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1. INTRODUCTION

The remote control modules permit remote wire line control of base station and repeater (RT) stations. The following modules are provided with the station dependent upon the type of station control and operation.

2. STANDARD MODULE DESCRIPTION

2.1 STATION CONTROL MODULE (DC and Tone Controlled Station)

This module provides the necessary integration of control functions from other modules in the remote chassis to key the station transmitter. Exciter audio amplification is also provided with amplitude adjustment by means of a potentiometer which is accessible through the front panel. Amplifiers are also provided to amplify the receiver discriminator output which is used externally.

2.2 LINE DRIVER MODULE (DC and Tone Controlled Stations)

The line driver module amplifies the receiver audio which is routed to the remote control point over wire line, and amplifies audio from the remote control point which is to be transmitted. Thus, it also provides monitoring of all repeater messages. For a repeater (RT) station that is *not* to be wire line controlled, this module can be omitted.

The line driver module is available in three models: 1-receiver, 2-wire (standard); 2-receiver, 2-wire (standard with 2-receiver base stations); and 4-wire (optional). The 4-wire line driver permits the transmit and receive audio to be carried on separate wire lines, or permits receive No. 2 audio to be carried on a separate wire line.

2.3 DC TRANSFER MODULE (DC Controlled Stations)

The dc transfer module converts dc line currents to control functions for use by a remote control console

operator via wire lines. Six dc transfer module versions are available and perform the functions shown in Table 1.

2.4 GUARD TONE DECODER (Tone Controlled Stations)

The guard tone decoder converts a 2175 Hz guard tone signal received from a remote control source to a line push-to-talk voltage. The decoder also amplifies and distributes received function tones to other function decoders.

2.5 F1-CS AND F1-PL CONTROL MODULES (Tone Controlled Stations)

Both modules convert a 1950 Hz tone signal from a remote control source to a switched ground to turn on the transmitter channel element. The F1-PL module also converts a 2050 Hz tone signal to a switched ground to disable the PL operation of the receiver for channel monitoring before transmitting. In carrier squelch stations, the PL disable function is not required and is therefore not used.

Table 1. DC Transfer Module Application

Module Version	Line Current (mA)	Function
F1-CS	+ 5.5	Keys transmitter on F1.
F1-PL	+ 5.5	Keys transmitter on F1.
	- 2.5	PL disables receiver.
C2-R2	+ 5.5	Keys transmitter on F1 and selects R1.
	+12.5	Keys transmitter on F2 and selects R2.
	- 2.5	PL disables receiver.
F2-R2 Mute	+ 5.5	Keys transmitter on F1.
	+12.5	Keys transmitter on F2 and unmutes R2.
	- 2.5	PL disables receiver.
Paging (Optional)	+ 5.5	Keys transmitter on F1 with PL tone.
	-12.5	Keys transmitter on F1 without PL tone.
	- 2.5	PL disables receiver.
Repeater Control (Optional) For Repeaters Only	+ 5.5	Keys transmitter on F1.
	+12.5	Repeater turn-on.
	- 2.5	PL disables receiver.
	- 5.5	Repeater turn-off.

REMOTE CONTROL MODULES

2.6 F2 TONE DECODER MODULES (Tone Controlled Stations)

The F2 tone decoder module is available in four versions which perform the functions shown in Table 2.

Table 2. F2 Tone Decoder Application

Module Version	Function Tone (Hz)	Function
F2 Control	1850	Keys transmitter on F2.
C2-R2	1850	Keys transmitter on F2.
	1750	Selects R1, inhibits R2.
F2-R2 Mute (Optional)	1650	Selects R2, inhibits R1.
	1850	Keys transmitter on F2.
F2-R2 Mute (Optional)	1750	Mutes R2.
	1650	Unmutes R2.
Paging (Optional)	1850	Keys transmitter on F1 without PL modulation.

2.7 SQUELCH GATE MODULE (Repeater Stations)

The squelch gate module is used in all repeater (RT) stations, dc or tone controlled, or non-wire line controlled. The squelch gate module produces an output to activate the transmitter when a carrier signal is received that has sufficiently high signal-to-noise ratio. *Private-Line* stations also require decoding of the proper PL code in addition to receiving a strong carrier signal.

2.8 TIME-OUT TIMER MODULE (Repeater Stations)

The time-out timer (T-O-T) module is standard in all repeater (RT) models and is an optional accessory for base station models. It limits the period of time the transmitter can be keyed. It can be set to limit the continuous transmission time from line controlled operation, and to limit the transmission time of individual users of the repeater. The time-out start of each is independent of the other. The unit can be preset for 1/2, 1, 2, 4 or 8 minutes by connecting jumpers to the corresponding time multiplier output.

3. OPTIONAL MODULE DESCRIPTION

3.1 SINGLE-TONE DECODER MODULE (DC and Tone Controlled Stations)

The single-tone decoder module provides a transistor switched output (logic low or high) or an optional relay closure upon receipt of the proper tone. The module responds only to a specific audio tone of at least 300 milliseconds duration. Nineteen different frequencies from 600 to 3300 Hz at 150 Hz intervals are available. The module can be jumpered so the output is latched on (must be reset by an external command), momentary on, or 5 seconds on. The single-tone decoder module can be used to control other functions as described in the following examples.

In repeater (RT) stations, the module may be used to inhibit repeater operation until the correct audio tone is received by the receiver. In this application, it is operated in the latched mode and is reset by the squelch gate upon loss of received carrier signal.

In base or repeater stations, the output of the module can be wired to inhibit (mute) receiver audio until the proper tone is received.

3.2 OPTION DECODERS

A tone controlled station may use *one* of the following decoders.

3.2.1 Four-Frequency Control Module (Tone Controlled Stations)

The four-frequency control module converts the proper function tones into frequency selection commands for selection of the station operating frequency. Refer to Table 3 for a listing of the necessary function tones. This control module also includes front chassis mounted switches which permit local frequency selection, when desired. The four-frequency control module operates with a F1-CS or F1-PL control module compatible with four-frequency operation. These F1 control modules provide biasing voltage for the four-frequency module and include the 2175 Hz notch filters.

Table 3. Four-Frequency Selection Tones

Function Tone	Frequency Selected
1930 Hz	F1: Transmitter keys on frequency T1. Receiver operates in standby mode on frequency R1.
1850 Hz	F2: Transmitter keys on frequency T2. Receiver operates in standby mode on frequency R2.
1350 Hz	F3: Transmitter keys on frequency T3. Receiver operates in standby mode on frequency R3.
1250 Hz	F4: Transmitter keys on frequency T4. Receiver operates in standby mode on frequency R4.

3.2.2 Squelch Control Module

This module converts the 1450 Hz and 1550 Hz function tone burst to two levels of squelch sensitivity in the carrier squelch mode of receiver operation.

3.2.3 *Private-Line* Control Module

This module converts the 1450 Hz and 1550 Hz function tone bursts to PL or carrier squelch mode of operation. It differs from the PL disable function of the F1-PL module in that the receiver does not revert to PL operations when the transmitter is keyed. When this module is operated in the PL mode, the PL disable function of the F1-PL module is unaffected to allow monitoring before transmitting.

3.2.4 Repeater Control Module

This module may be used in a repeater (RT) station only. It converts a 1450 Hz function tone to a repeater enable command (repeater "set-up") and a 1550 Hz function tone to repeater disable (repeater "knock-down"). In the repeater "knock-down" mode the station operates as a conventional base station only.

3.3 "WILD CARD" CONTROL MODULE

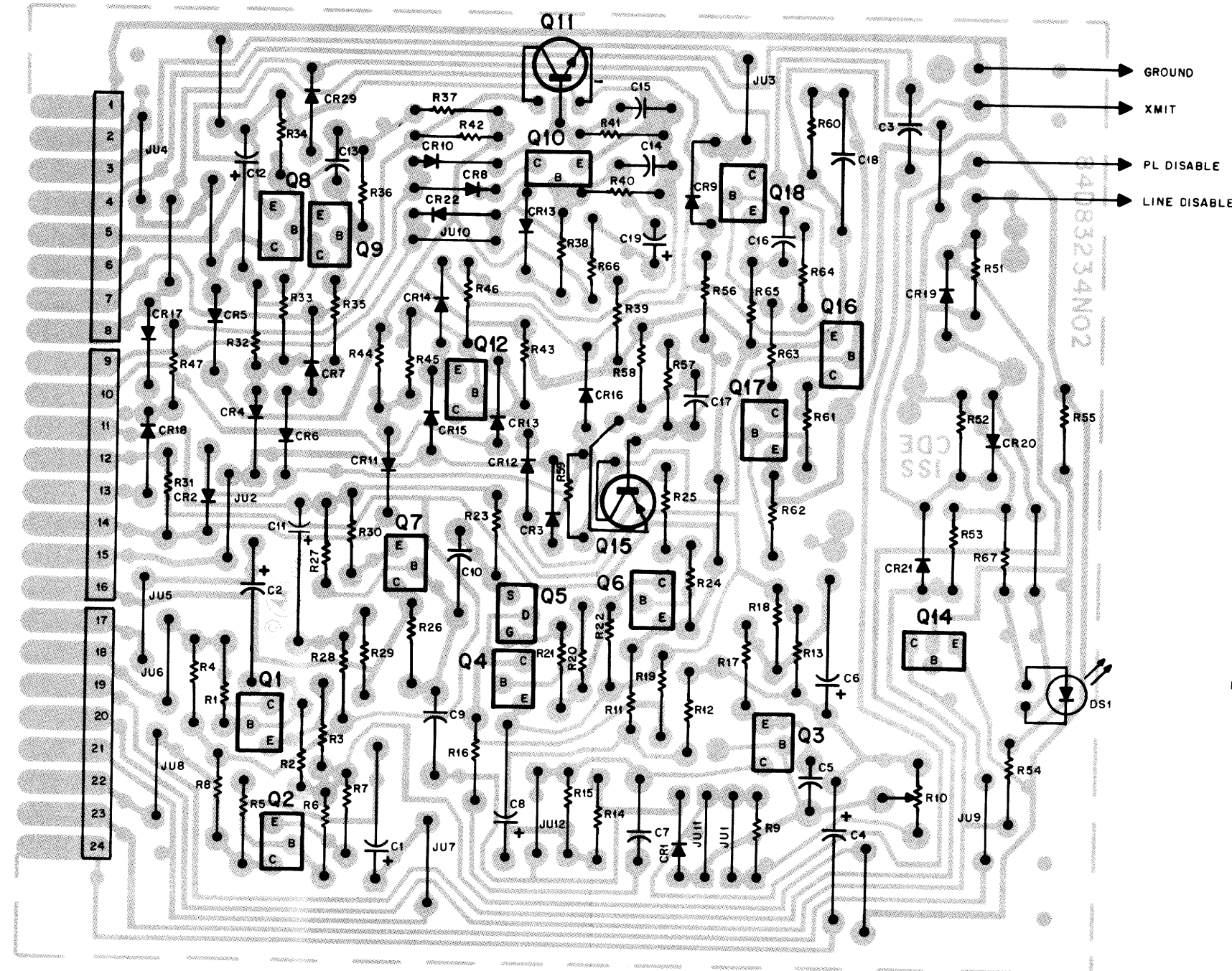
This module may be added to any model station. It provides four tone-activated transistor switched outputs which may be used to control the operation of four relays in response to function tone commands of 1350,

1250, 1150 and 1050 Hz. The circuits may be cross-connected to two on-off outputs if desired. The outputs may be used for any desired remotely controlled switching at the base station site such as on-off control of antenna tower lights, emergency power generating equipment, etc.

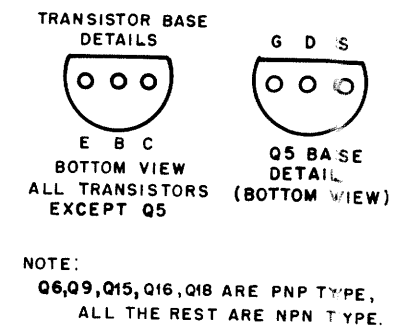
3.4 TLN4151A RELAY KITS

The Model TLN4151A Relay Kits are for use in the "Wild Card" module, single-tone decoder module, or squelch gate module. They provide a form "C" output circuit which is isolated from the module board circuitry, with higher voltage and current switching capability than provided by the normal transistor output.

MODEL TRN5321A STATION CONTROL MODULE



SOLDER SIDE ● BD-CEPS-34548-A
 ○ OL-CEPS-34549-A SHOWN FROM SOLDER SIDE



parts list

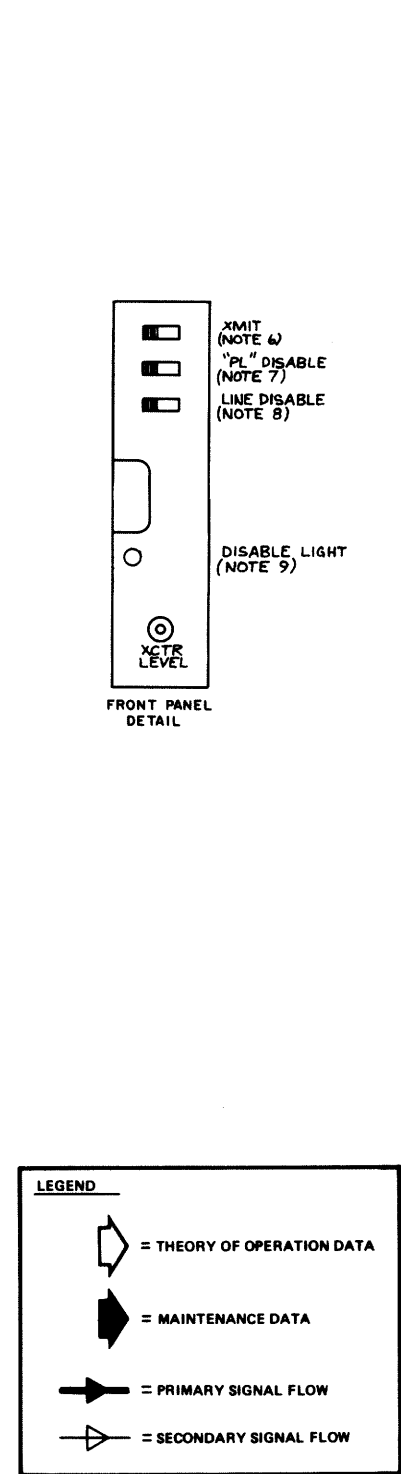
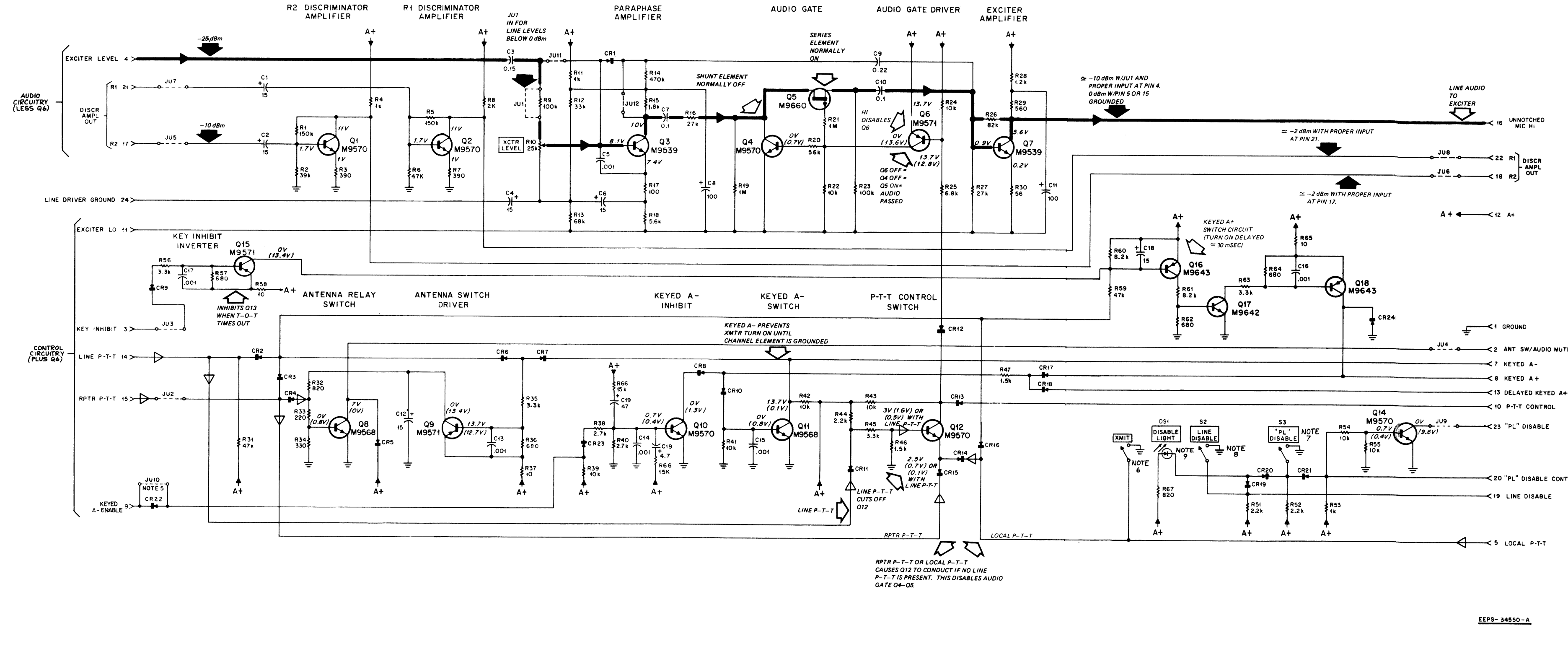
TRN5321A Station Control Module PL-7957-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1,2	23-865136	capacitor, fixed: $\mu F \pm 10\%$; 50 V; unless otherwise stated
C3	8-82905G05	15 $\pm 20\%$; 25 V
C4	23-865136	0.15
C5	21-82187B29	15 $\pm 20\%$; 25 V
C6	23-865136	0.01; 100 V
C7	8-82905G07	15 $\pm 20\%$; 25 V
C8	23-84665F03	0.10
C9	8-82905G11	0.22
C10	8-82905G07	0.10
C11	23-84665F03	100
C12	23-865136	15
C13 thru 17	21-82187B29	.001; 100 V
C18	23-82783B24	15 $\pm 10\%$; 25 V
C19	23-11019A40	47
CR1,2,3,4	48-83654H01	semiconductor device diode: (see note)
CR5	48-82466H13	silicon
CR6 thru 24	48-83654H01	silicon
DS1	48-88245C28	lamp, incandescent: LED
Q1,2	48-869642	transistor: (see note)
Q3	48-869539	NPN; type M9642
Q4	48-869642	NPN; type M9539
Q5	48-869642	NPN; type M9642
Q6	48-869643	FET, p-channel; type M9660
Q7	48-869539	PNP; type M9643
Q8	48-869568	NPN; type M9539
Q9	48-869643	PNP; type M9643
Q10	48-869642	NPN; type M9642
Q11	48-869568	NPN; type M9568
Q12	48-869642	NPN; type M9642
Q13		NOT USED
Q14	48-869642	NPN; type M9642
Q15, 16	48-869643	PNP; type M9643
Q17	48-869642	NPN; type M9642
Q18	48-869643	PNP; type M9643
R1	6-11009D02	resistor, fixed: $\pm 10\%$; 1/4 W; unless otherwise stated
R2	6-11009C87	150k
R3	6-11009C39	390
R4	6-11009C49	1k
R5	6-11009D02	150k
R6	6-11009C89	47k
R7	6-11009C39	390
R8	6-11009C56	2k
R9	6-11009C97	100k
R10	18-83083G03	var: 25k
R11	6-11009C49	1k
R12	6-11009C85	33k
R13	6-11009C93	68k
R14	6-11009D14	470k
R15	6-11009C55	1.8k
R16	6-11009C83	27k
R17	6-11009C25	100
R18	6-11009C67	5.6k
R19	6-11009D22	1 meg
R20	6-11009C91	56k
R21	6-11009D22	1 meg
R22	6-11009C73	10k
R23	6-11009C97	100k
R24	6-11009C73	10k
R25	6-11009C69	6.8k
R26	6-11009C95	82k
R27	6-11009C83	27k
R28	6-11009C51	1.2k
R29	6-11009C43	560
R30	6-11009C19	56
R31	6-11009C89	47k
R32	6-11009C47	820
R33	6-11009C33	220
R34	6-11009C37	330
R35	6-11009C61	3.3k
R36	6-11009C45	680
R37	6-11009C01	10
R38	6-11009C59	2.7k
R39	6-11009C73	10k
R40	6-11009C59	2.7k
R41	6-11009C73	10k
R42	6-11009C73	10k
R43	6-11009C73	10k
R44	6-11009C57	2.2k
R45	6-11009C61	3.3k
R46	6-11009C53	1.5k
R47	6-11009C53	1.5k
R48, 49, 50		NOT USED
R51, 52	6-11009C57	2.2k
R53	6-11009C49	1k
R54, 55	6-11009C73	10k
R56	6-11009C61	3.3k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R57	6-11009C45	680
R58	6-11009C01	10
R59	6-11009C89	47k
R60, 61	6-11009C71	8.2k
R62	6-11009C45	680
R63	6-11009C61	3.3k
R64	6-11009C45	680
R65	6-11009C01	10
R66	6-11009C77	15k
R67	6-11009C47	820 ohms
S1	40-83468E01	switch: xmtr.
S2,3	40-83204B01	slide; PL & line disable
mechanical parts		
	3-84256M01	SCREW, tapping; 2 used
	43-82721C01	BUSHING, snap
	5-84220B01	GROMMET, 2 used
	9-83497F01	RECEPTACLE, 8 contact; 3 used (PCB Edge Connector)
	39-10184A10	CONTACT, plug; 4 used
	64-83112L11	PANEL, screened

note: Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

MODEL TRN5321A STATION CONTROL MODULE



Maintenance & Troubleshooting

This module may be serviced either while connected to the unified chassis interconnect board or while connected to separate external test equipment. Refer to the unified chassis interconnect board servicing information in this manual for "setup" details.

Step 1. Check jumpers as applicable for the mode of operation of this module.

Step 2. Connect power and signal sources to the module as indicated in the following chart.

Pin No.	Connect
1, 11, 34	Ground
4	Audio Oscillator
12	+12 Volts dc
16	AC Voltmeter to Ground
2	10 Kilohms to 12 Volts dc
10	10 Kilohms to 12 Volts dc
23	10 Kilohms to 12 Volts dc

Note: Level adjust control should be full clockwise.

Step 3. Adjust audio oscillator output for -25 dBm at pin 4. Pin 16 should measure approximately -10 dBm with JU1 connected. If this level cannot be achieved, check stages Q3 and Q7. If the level is correct, ground pin 5 or pin 15 and note that the reading drops to 0. If this does not occur check stages Q4 and Q5 and their associated driver stages.

Step 4. Ground pins 14 and 9. Measure the dc voltage at pins 10 and 8. Each should read +12 volts. Pins 7 and 2 should read zero. If a voltage or ground does not appear at the prescribed location, check each stage associated with that location.

Step 5. Ground pin 15. Measure the dc voltage at pins 7 and 2. Each should read +12 volts. Pin 10 should read zero volts.

Step 6. With pin 15 still grounded, apply a ground to pin 14. Check for +12 volts dc at pin 10.

Step 7. Ground pin 20 and check the dc voltage at pin 23. The meter indication should be +12 volts. Remove the ground from pin 20 and the voltage should drop to zero.

Step 8. Apply a -10 dBm signal from the audio oscillator to pin 17 and measure the ac voltage at pin 18. The voltmeter should indicate approximately -2 dBm.

Step 9. Apply a -10 dBm signal from the audio oscillator to pin 21 and check the ac voltage on pin 22. The indication should be approximately -2 dBm.

Control Theory

When a PTT signal is applied to pin 5, 14, or 15 the following functions occur:

- A low is applied to the base of Q16. After a 30 millisecond delay, this provides a high output to pin 8 and to Q11 from Q17 and Q18.

- The drive to Q11 will be inhibited by Q10 until a low is applied to pin 9, indicating an oscillator channel element ground. This prevents A- from energizing the transmitter circuits until after the channel element has been grounded. Q11 can also be inhibited by a low entering on pin 3 from the time-out-timer module at the end of a pre-set time limit.

- The low is also applied to the base of Q9 where it is inverted and applied as a high to the base of Q8. If a low is applied as repeater PTT on pin 15, Q8 will be inhibited. However, if the low is applied to either pin 5 or 14, Q8 will saturate and provide a low to operate the antenna switch. Switch Q8 does not turn off the instant PTT low is removed. Instead it is kept on for the time required for C12 to discharge through R32 and R33. This allows the high level of energy to decay before the antenna switch reverts to the receive condition.

- If the PTT low is applied to the module on pin 5 or 15, a conduction path is provided for Q12. When Q12 conducts, a low is applied to pin 10. This control can be overridden by a line PTT signal applied to pin 14. This signal reaches the base of Q12 causing it to cut off and remove the low from pin 10.

When Xmit switch S1 is actuated, a ground is supplied to the emitter of Q12 with the same result as a low applied to pin 5 or 15. Actuating line disable switch S2 applies a ground output to pin 19. S2 also provides a ground to the disable light DS1, which causes it to illuminate. When PL disable switch S3 is actuated, DS1 also illuminates and a low is applied to the base of PL disable inverter Q14. This low causes Q14 (which is normally conducting) to cut off and removes the PL disable switched ground from pin 23. The station should not be left in the line or PL disable mode under normal operating conditions.

In Private-Line applications, keyed A- release is delayed at the end of a transmission by an input to pin 13 from the external Private-Line reverse burst circuitry. This input maintains transmitter keying for the duration of the reverse burst tone.

FUNCTION

- Integrates control functions from other modules to key the station transmitter.
- Adjusts exciter audio level.
- Amplifies receiver discriminator signals which are used externally.

NOTES:

- JU1 is in for line levels below 0 dBm and removed for line levels above 0 dBm.
- JU2 thru JU8 is in for all wire line control base stations and (RT) repeaters.
- JU9 is in for PL operation and removed for carrier squelch operation.
- Voltages shown in parentheses are normally measured when function is activated. Voltages not in parentheses are normally measured when function is deactivated.
- JU10 out for non-wire line repeaters.
- To key the transmitter, slide the Xmit switch to the right (closed) and hold in this position. To unkey the transmitter, release the switch.
- When the PL disable switch is in the (normal) position (to the left) the Private-Line function of the station is operational. In the actuated position (to the right), the receiver Private-Line tone-coded squelch circuit is disabled so that all on-frequency signals may be monitored.
- When the line disable switch is in the normal position (to the left, open), station operation can be initiated by remote control in the actuated position (to the right, closed), remote controls are disabled and the station can only be operated via local controls.
- The disable light is illuminated when either the PL or line disable switches are actuated.

MODELS TRN5235A, 36A, 37A LINE DRIVER MODULES

1. LINE DRIVER MAINTENANCE & TROUBLESHOOTING

This module may be serviced while connected to the control chassis via an extender card or by plugging it onto the rear of the backplane interconnect board. Refer to control chassis servicing information in this manual for additional "set-up" details.

1.1 TRN5235A LINE DRIVER/4-WIRE AUDIO MODULE SERVICING

1.1.1 General

When servicing in the chassis use the service extension or plug onto the rear of the backplane interconnect board.

1.1.2 Receive Audio (Line Amplifier No. 1)

Step 1. Inject a 1000 Hz tone at pin 3 and adjust the oscillator output for 150 mV.

Step 2. Adjust the LINE 1 LEVEL control for +11 dBm across the 600-ohm load at pins 19 and 20. If this level cannot be obtained, check preamplifier stages Q1 and Q2. Next check phase inverter Q4, amplifier Q5, line drivers Q6 and Q7, line 1 transformer T1, and line driver disable switch Q3. Check that the proper jumpers are installed.

Step 3. Connect the ac voltmeter between pin 23 and ground. The voltage should be approximately 0.7 V. If the level in Step 2 is satisfactory and this level is not correct, check exciter††speaker amplifier Q8, isolation amplifier Q9, and transformer T1.

Step 4. Apply a ground to pin 9. The outputs measured in Steps 2 and 3 should drop to zero. If they do not drop to zero, check diode CR1 and line driver disable switch Q3.

1.1.3 Receive Audio (Line Amplifier No. 2)

Step 1. Inject a 1000 Hz tone at pin 22 and adjust the oscillator output for 150 mV.

Step 2. Adjust the line 2 level control for +11 dBm across the 600-ohm load at pins 7 and 8. If +11 dBm cannot be obtained, check preamplifier stages Q17 and Q19. Next, check phase inverter Q20, amplifier Q21, line drivers Q22 and Q23, line 2 transformer T2, and line driver disable switch Q18. Check that the proper jumpers are connected.

NOTE

If the output is extremely low (70 dB below the +11 dBm level) check if jumper JU24 (first receiver priority) is in. If JU24 is in, apply ground to pin 18 to defeat the R1 priority.

Step 3. Connect an ac voltmeter between pin 23 and ground. The voltage should be approximately 0.7 V. If the level in Step 2 is satisfactory and this level is not correct, check isolation amplifier Q10 and transformer T2.

Step 4. Apply a ground to pin 5. The outputs measured in Steps 2 and 3 should drop to zero. If they do not drop to zero, check diode CR10 and line driver disable switch Q18.

1.1.4 Transmit Audio

Step 1. Inject a 1000 Hz tone between pins 19 and 20 and adjust the oscillator output to zero dBm.

Step 2. The voltage measured between pin 10 and ground should be at least 0.77 V ac. If this reading is incorrect, check transformer T1.

Step 3. The voltage between pin 24 and ground should be approximately 0.36 V ac. If the reading in Step 2 is correct and this reading is incorrect, check exciter/speaker amplifier Q8.

Step 4. The voltage measured between pin 23 and ground should be approximately 0.18 V ac. If the reading in Step 3 is correct and this reading is incorrect, check isolation amplifier Q9.

1.1.5 Receive Audio Mute Switches

Step 1. Inject a 1000 Hz tone between pin 13 and ground and adjust the oscillator output for 150 mV.

Step 2. The voltage measured between pin 6 and ground should be approximately 145 mV. However, if jumper JU18 is in (second receiver priority) the voltage reading should be zero. If jumper JU18 is in, apply a ground to pin 15. The voltage measured between pin 6 and ground should go to 145 mV. If the voltage between pin 6 and ground is considerably below 145 mV, check R1 mute switch Q12 and R1 mute switch driver Q11. The output between pin 6 and ground should also go to zero if a ground is applied to pins 9, 14, or 18. If the voltage does not go to zero, check OR gate diodes CR3 and CR5, R1 switch driver Q11, and R1 mute switch Q12.

Step 3. Inject a 1000 Hz tone between pin 22 and ground and adjust for 150 mV output.

Step 4. The voltage measured between pins 7 and 8 should be approximately +11 dBm. However, if this voltage is extremely low (such as -59 dBm) the R2 mute switch might be turned off due to receiver priority jumpering. If JU24 (first receiver priority) is in, connect pin 18 to ground and check that pins 15 and 17 are not grounded. If the priority jumpering and/or grounding connections are made to pass R2 audio and the output at pins 7 and 8 is still low, check R2 mute switch Q16, R2 mute switch driver Q15, and the R2 attenuator switch stage Q13 and Q14.

Step 5. Connect pin 15 to ground and check that the signal level at pins 7 and 8 decreases by approximately 70 dB.

1.2 TRN5236A LINE DRIVER/2-WIRE 1-RECEIVER AUDIO MODULE SERVICING

1.2.1 General

When servicing in the chassis, use the service extension or plug onto the rear of the backplane interconnect board.

1.2.2 Receive Audio (Line Amplifier No. 1)

Perform the Line Amplifier No. 1 procedure for the 4-wire audio module (paragraph 1.1.2), except that the level at pin 23 should be approximately 1.4 V.

1.2.3 Transmit Audio

Perform the Transmit Audio procedure described for the 4-wire audio module (paragraph 1.1.4).

1.2.4 Receive Audio Mute Switch

Step 1. Inject a 1000 Hz tone between pin 13 and ground and adjust the oscillator output for 150 mV.

Step 2. The voltage measured between pin 6 and ground should be approximately 145 mV. If the voltage is considerably below 145 mV, check R1 mute switch Q12 and R1 mute switch driver Q11. The output voltage between pin 6 and ground should drop to zero if a ground is applied to pins 9, 14, or 18. If it does not drop to zero, check OR gate diodes CR3 and CR5, R1 mute switch Q12, and R1 mute switch driver Q11.

1.3 TRN5237A LINE DRIVER/2-WIRE 2-RECEIVER AUDIO MODULE

1.3.1 General

When servicing in the chassis, use the service extension or plug onto the rear of the backplane interconnect board.

1.3.2 Receive Audio (Line Amplifier No. 1)

Perform the Line Amplifier No. 1 procedure described for the 4-wire audio module (paragraph 1.1.2), except that the level at pin 23 should be approximately 1.4 V.

1.3.3 Transmit Audio

Perform the Transmit Audio procedure described for the 4-wire audio module (paragraph 1.1.4).

1.3.4 Receiver Audio Mute Switches

Step 1. Inject a 1000 Hz tone between pin 13 and ground and adjust the oscillator output for 150 mV.

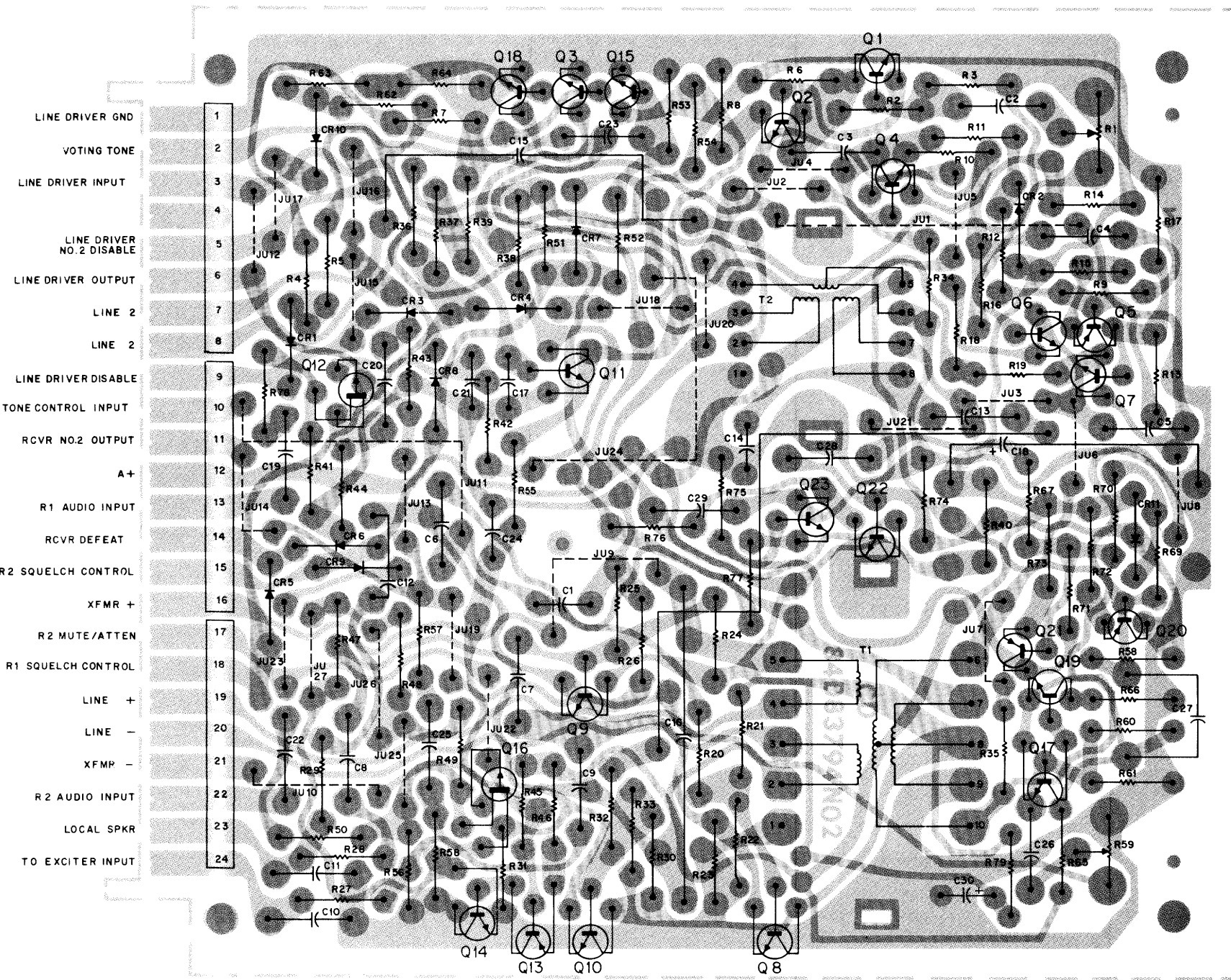
Step 2. The voltage measured between pin 6 and ground should be approximately 145 mV. However, if jumper JU18 is in (second receiver priority) the voltage reading should be zero. If jumper JU18 is in, apply a ground to pin 15. The voltage measured between pin 6 and ground should go to 145 mV. If the voltage between pin 6 and ground is considerably below 145 mV, check R1 mute switch Q12 and R1 mute switch driver Q11. The output between pin 6 and ground should also decrease by approximately 70 dB if a ground is applied to pins 9, 14, or 18. If the voltage does decrease by this amount, check OR gate diodes CR3 and CR5, R1 mute switch driver Q11, and R1 mute switch Q12.

Step 3. Inject a 1000 Hz tone between pin 22 and ground and adjust the oscillator for 150 mV output.

Step 4. The voltage measured between pin 6 and ground should be approximately 140 mV. However, if jumper JU24 (first receiver priority) is in, the voltage reading should be approximately 70 dB below this level. If jumper JU24 is in, apply a ground to pin 18. The voltage measured between pin 6 and ground should go to 140 mV. If the voltage between pin 6 and ground is considerably below 140 mV, check R2 mute switch Q16 and R2 mute switch driver Q12. With jumper JU15 in, the output pin 6 should also decrease by approximately 70 dB when a ground is applied to pins 5, 9, 14, or 15. With jumper JU23 in, the output at pin 6 should decrease by approximately 70 dB when a ground is applied to pin 17. If the output at pin 6 does not decrease by the 70 dB, check OR gate diodes CR6, CR7, CR8, and CR9, mute switch driver Q15 and mute switch Q16.

If a ground is present at pin 17 and jumper JU22 is in, the voltage at pin 6 will be attenuated. The amount of attenuation is determined by selection of jumpers JU25, JU26, and JU27. If the voltage is not attenuated check mute/attenuator switch Q13 and Q14.

MODELS TRN5235A, 36A, 37A LINE DRIVER MODULES



NOTE: THIS BOARD DETAIL IS APPLICABLE TO ALL THREE LINE DRIVER MODELS. PLATING RUNS ARE IDENTICAL TO ALL THREE. PART LOCATIONS ARE ALSO IDENTICAL EXCEPT FOR APPLICABLE DELETIONS AS INDICATED ON THE SCHEMATIC DIAGRAM (e.g., R20 IS LOCATED IN THE SAME PLACE FOR ALL MODELS).

SHOWN FROM SOLDER SIDE

SOLDER SIDE \bullet BD-DEPS-36692-0
COMPONENT SIDE \bullet BD-DEPS-36693-0
OL-DEPS-36694-0

parts list

reference symbol	suffix	application
No Suffix		All Models
A		TRN5236A
B		TRN5237A

This parts list covers 3 models of the line driver module. When differences exist, a letter code is added to the reference symbol to indicate the applicable unit.

TRN5235A Line Driver Module (4-Wire)
TRN5236A Line Driver Module (2-Wire, 1-RCVR)
TRN5237A Line Driver Module (2-Wire, 2-RCVR) PL-7963-C

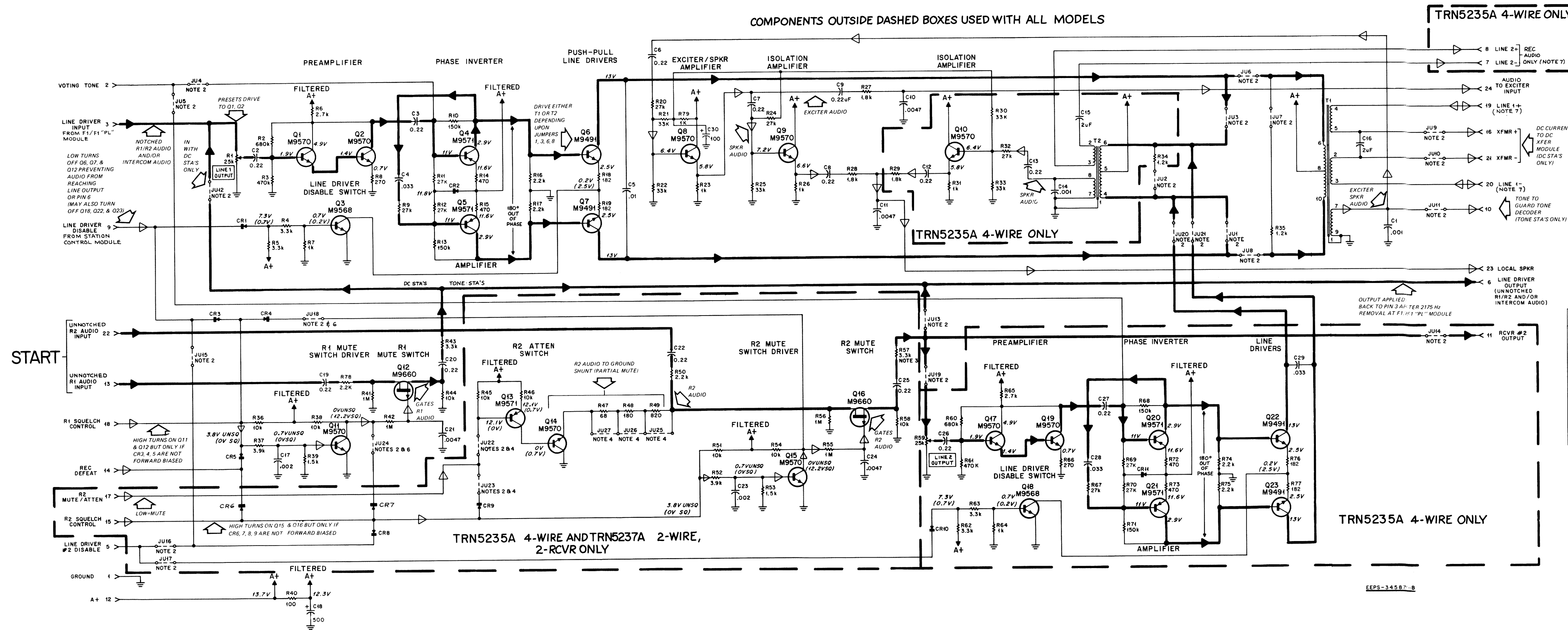
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1 (A,B)	21-82187B29	capacitor, fixed: uF $\pm 10\%$; 50 V; unless otherwise stated
C2,3 (A,B)	8-82905G11	.022
C4 (A,B)	8-82905G08	.033
C5 (A,B)	8-82905G01	.01
C6 thru 9 (A,B)	8-82905G11	.022
C10,11 (A,B)	8-82905G26	.0047; 100 V
C12,13	8-82905G11	.022
C14	21-82187B29	.001; 100 V
C15,16 (A,B)	8-82045E05	2; 350 V
C17 (A,B)	21-82428B25	.002 $\pm 20\%$; 500 V
C18 (A,B)	23-84669A23	500 V; 25 V
C19,20 (A,B)	8-82905G11	.022
C21 (A,B)	21-82428B27	.0047; 100 V
C22 (B)	8-82905G11	.022
C23 (B)	21-82428B47	.002 $\pm 20\%$; 500 V
C24 (B)	21-82428B27	.0047; 100 V
C25,26,27 (B)	8-82905G11	.022
C28,29	8-82905G08	.033
C30	23-11019A46	100 $\pm 20\%$; 25 V
CR1 thru 11	48-82392B03	semiconductor device, diode: (see note) silicon
Q1,2 (A,B)	48-869570	transistor: (see note) NPN; type M9570
Q3 (A,B)	48-869568	NPN; type M9568
Q4,5 (A,B)	48-869571	PNP; type M9571
Q6,7 (A,B)	48-869491	NPN; type M9491
Q8 thru 11 (A,B)	48-869570	NPN; type M9570
Q12 (A,B)	48-869660	FET, p-channel; type M9660
Q13 (B)	48-869571	PNP; type M9571
Q14,15 (B)	48-869570	NPN; type M9570
Q16 (B)	48-869660	FET, p-channel; type M9660
Q17	48-869570	NPN; type M9570
Q18	48-869568	NPN; type M9568
Q19	48-869570	NPN; type M9570
Q20,21	48-869571	PNP; type M9571
Q22,23	48-869491	NPN; type M9491
R1 (A,B)	18-83083G03	var; 25k
R2 (A,B)	6-11009D18	680k
R3 (A,B)	6-11009D14	470k
R4,5 (A,B)	6-11009C61	3.3k
R6 (A,B)	6-11009C59	2.7k
R7 (A,B)	6-11009C49	1k
R8 (A,B)	6-11009C35	27k
R9 (A,B)	6-11009C83	27k
R10 (A,B)	6-11009D02	150k
R11,12 (A,B)	6-11009C83	27k
R13 (A,B)	6-11009D02	150k
R14,15 (A,B)	6-11009C41	47k
R16,17 (A,B)	6-11009C57	2.2k
R18,19 (A,B)	6-10621B23	182 $\pm 1\%$
R20 (A,B)	6-11009C83	27k
R21,22 (A,B)	6-11009C85	33k
R23 (A,B)	6-11009C49	1k
R24 (A,B)	6-11009C83	27k
R25 (A,B)	6-11009C85	33k
R26 (A,B)	6-11009C49	1k
R27,28,29 (A,B)	6-11009C55	1.8k
R30	6-11009C85	33k
R31	6-11009C49	1k
R32	6-11009C83	27k
R33	6-11009C85	33k
R34,35	6-11009C51	1.2k
R36 (A,B)	6-11009C73	10k
R37 (A,B)	6-11009C63	3.9k
R38 (A,B)	6-11009C73	10k
R39 (A,B)	6-11009C53	1.5k
R40 (A,B)	6-11009C25	100
R41,42 (A,B)	6-11009D22	1 meg
R43 (A,B)	6-11009C61	3.3k
R44,45,46 (B)	6-11009C73	10k
R47 (B)	6-11009C21	68
R48 (B)	6-11009C31	180
R49 (B)	6-11009C47	820
R50 (B)	6-11009C57	2.2k
R51 (B)	6-11009C73	10k
R52 (B)	6-11009C63	3.9k
R53 (B)	6-11009C53	1.5k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R54 (B)	6-11009C73	10k
R55,56 (B)	6-11009D22	1 meg
R57 (B)	6-11009C61	3.3k
R58 (B)	6-11009C73	10k
R59 (B)	18-83083G03	var; 25k
R60	6-11009D18	680k
R61	6-11009D14	470k
R62,63	6-11009C61	3.3k
R64	6-11009C49	1k
R65	6-11009C59	2.7k
R66	6-11009C35	27k
R67	6-11009C83	27k
R68	6-11009D09	150k $\pm 5\%$
R69,70	6-11009C83	27k
R71	6-11009D02	150k $\pm 5\%$
R72,73	6-11009C41	47k
R74,75	6-11009C57	2.2k $\pm 5\%$
R76,77	6-10621B23	182 $\pm 1\%$
R78 (A,B)	6-11009C57	2.2k
R79	6-11019C49	1k

mechanical parts		
T1	25-83000H01	transformer: pri #1: pin 2 & 3 res 25 ohms; pri #2: pin 4 & 5 res 150 ohms; sec #1: pin 6 & 10 res 50 ohms; sec #2: pin 7 & 9 res 160 ohms
T2	25-84202A02	transformer: pri: pin 2 & 3 res 50 ohms; sec #1: pin 4 & 6 res 50 ohms; sec #2: pin 7 & 8 res 150 ohms

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

MODELS TRN5235A, 36A, 37A LINE DRIVER MODULES



TRN5235A 4-WIRE ONLY

TRN5235A 4-WIRE ONLY

TRN5235A 4-WIRE ONLY

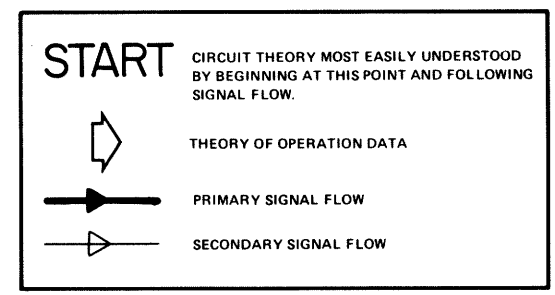
NOTES:

- Unless otherwise stated: resistor values are in ohms (K = 1000) capacitor values are in microfarads.
 - Exact audio routing and disabling in the line driver module is dependent on the jumper placements. Refer to jumper table.
 - At points showing two voltages, the voltage in parentheses is a result of a logic low at the control function input.
 - Partial or complete R2 audio muting is accomplished as follows:
- | R2 Audio Attenuator | Jumper Configuration (JU) |
|---------------------|-------------------------------|
| 10 dB | JU22 IN; JU23, 25, 26, 27 OUT |
| 20 dB | JU22, 25 IN; JU23, 26, 27 OUT |
| 30 dB | JU22, 25, 26 IN; JU23, 27 OUT |
| Complete | JU22 OUT; JU23 IN |
- R57 is removed in the 4-wire; 1 rec application.
 - Receiver priority is accomplished as follows:
- | Priority | Jumper Configuration |
|--------------------------|----------------------|
| Rcvr No. 1 | JU18 OUT; JU24 IN |
| Rcvr No. 2 | JU18 IN; JU24 OUT |
| First Come, First Served | JU18 & JU24 IN |
- Control current control tones and exciter (Xmit) audio functions are always carried on Line 1. Line 2, when used, only carries rec audio.

IMPORTANT
Refer to Function Table Maintenance Troubleshooting Information shown on facing page.

Line Driver	JU1	JU2	JU3	JU4	JU5	JU6	JU7	JU8	JU9	JU10	JU11	JU12	JU13	JU14	JU15	JU16	JU17	JU18	JU19	JU20	JU21	JU22	JU23	JU24	
TRN5235A 4-Wire	Out	In	Out	Out	Out	Out	In	Out	In	In	In	Out	In	Out	In	In	Out	In	In	In	In	Out	Out	Out	Out
TRN5237A 2-Wire; 2 Rcvr	Out	Out	Out	Out	Out	Out	In	In	In	In	In	*In	Out	In	Out	Out	Out	Out	Out	Out	Out	Out	Out	In	In
TRN5236A 2-Wire; 1 Rcvr	Out	Out	Out	Out	Out	Out	In	In	In	In	In	*In	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out	Out

*JU12 is cut in tone remote control applications.



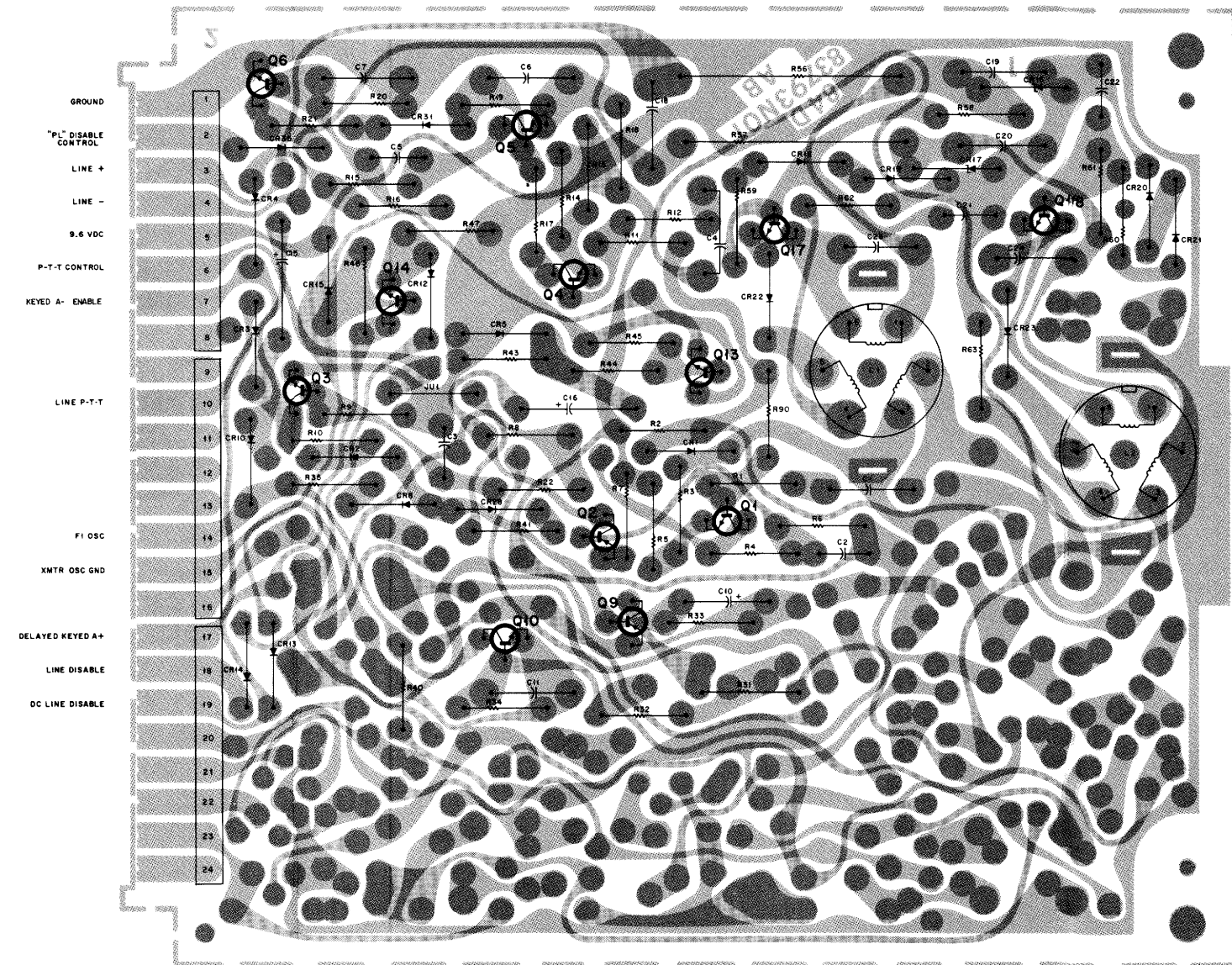
FUNCTION

• **TRN5235A 4-Wire Audio Module**
Accepts audio from up to two different receivers. Amplifies the audio and routes it out to either of two line outputs, or the local speaker; two transformers are provided. One is used for accepting the transmit audio and control signals, and the other is used to provide line audio to a remote point; gating circuits allow external control of R1 mute, R2 mute, and line driver disable functions.

• **TRN5236A 2-Wire 1-Receiver Audio Module**
Accepts audio from one receiver, amplifies the audio and routes it either through an amplifier section or as a direct output; a single transformer is used to accept the transmit audio and control signals and also provide line audio to a remote point; gating circuits allow external control of R1 mute and line driver disable functions.

• **TRN5237A 2-Wire 2-Receiver Audio Module**
Accepts audio from up to two different receivers, and routes it either through an amplifier section or as a direct output. A single transformer is used to accept the transmit audio and control signals and also provide line audio to a remote point; gating circuits allow external control of R1 mute, R2 mute, and line driver disable functions.

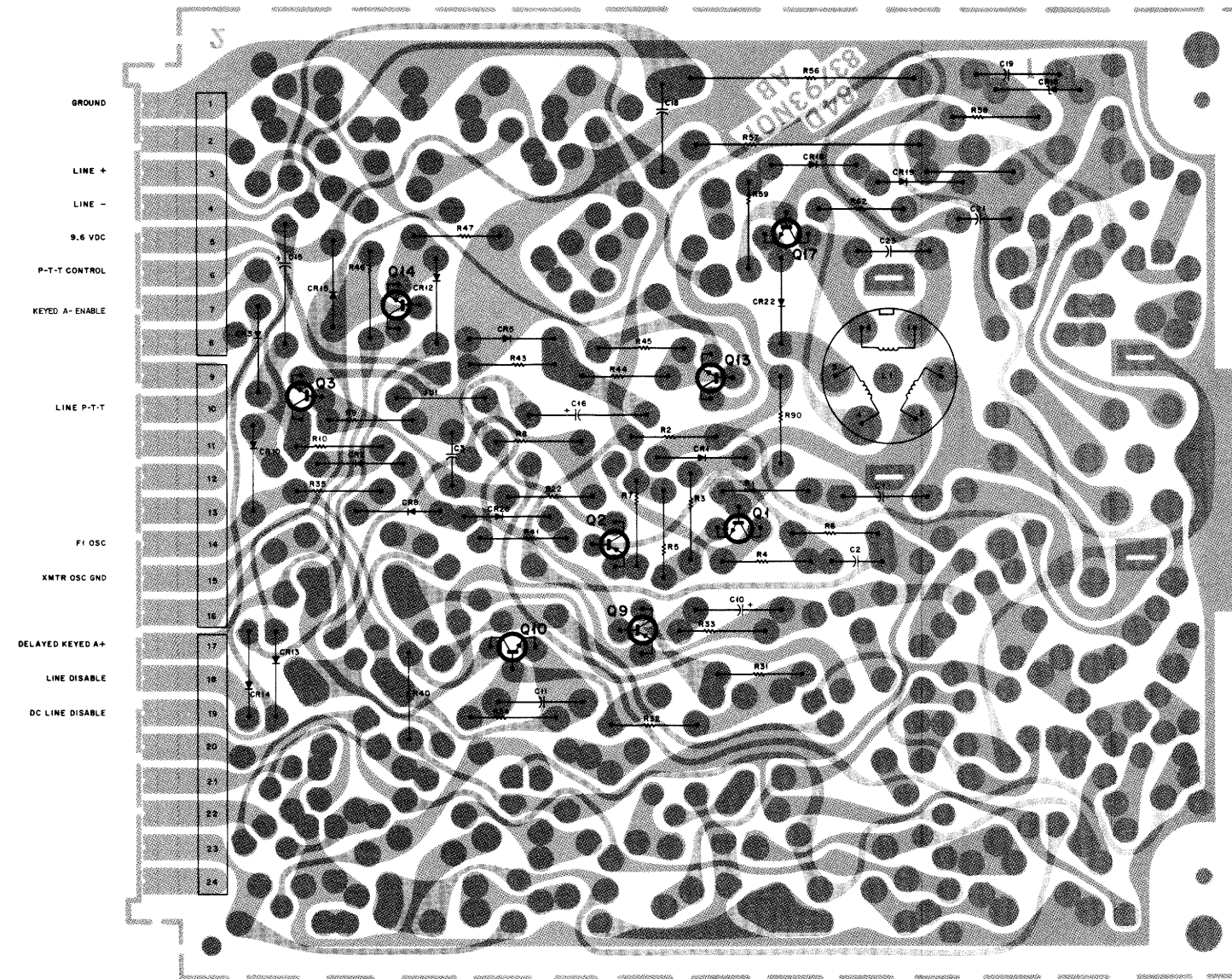
TRN5240A F1-PL DISABLE



SHOWN FROM SOLDER SIDE

SOLDER SIDE: 80-DEPS-34554-0
 COMPONENT SIDE: 80-DEPS-34555-0
 CL-DEPS-34556-0

TRN5254A F1 CONTROL

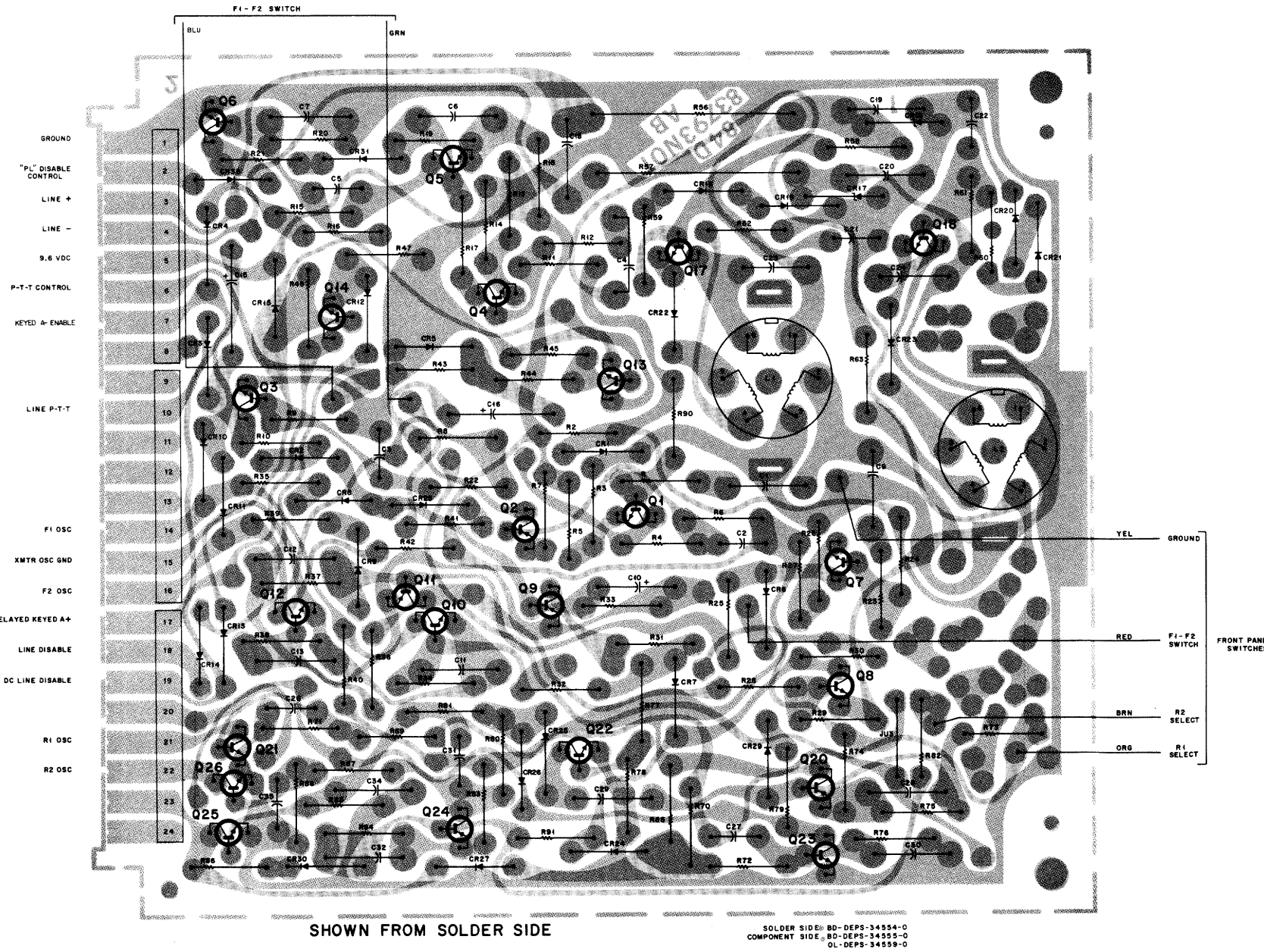


SHOWN FROM SOLDER SIDE

SOLDER SIDE: 80-DEPS-34554-0
 COMPONENT SIDE: 80-DEPS-34555-0
 CL-DEPS-34557-0

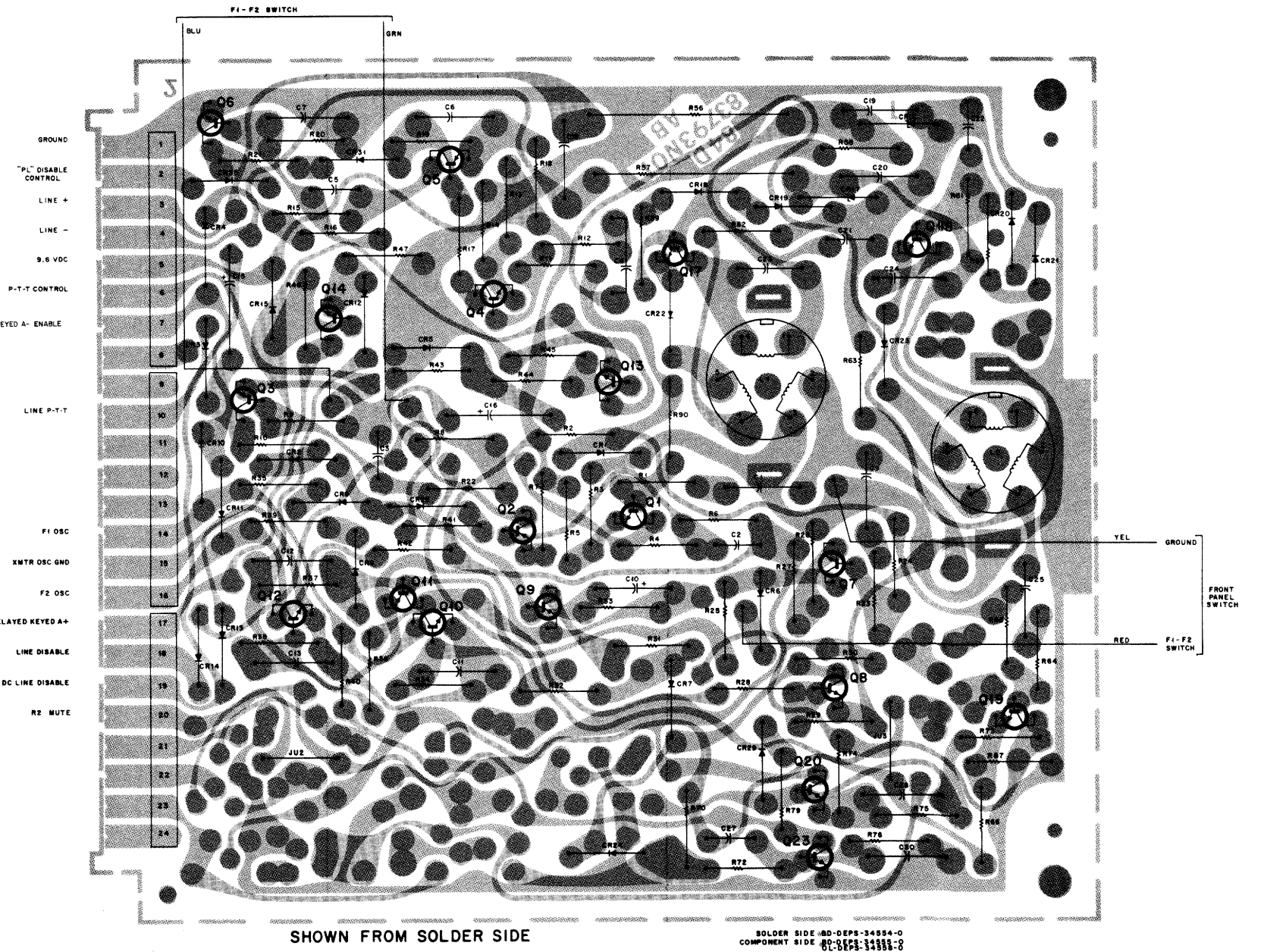
DC TRANSFER MODULES
 MODELS TRN5240A, 54A, 55A, 56A

TRN5255A C2-R2 CONTROL



SHOWN FROM SOLDER SIDE

TRN5256A F2-R2 MUTE



SHOWN FROM SOLDER SIDE

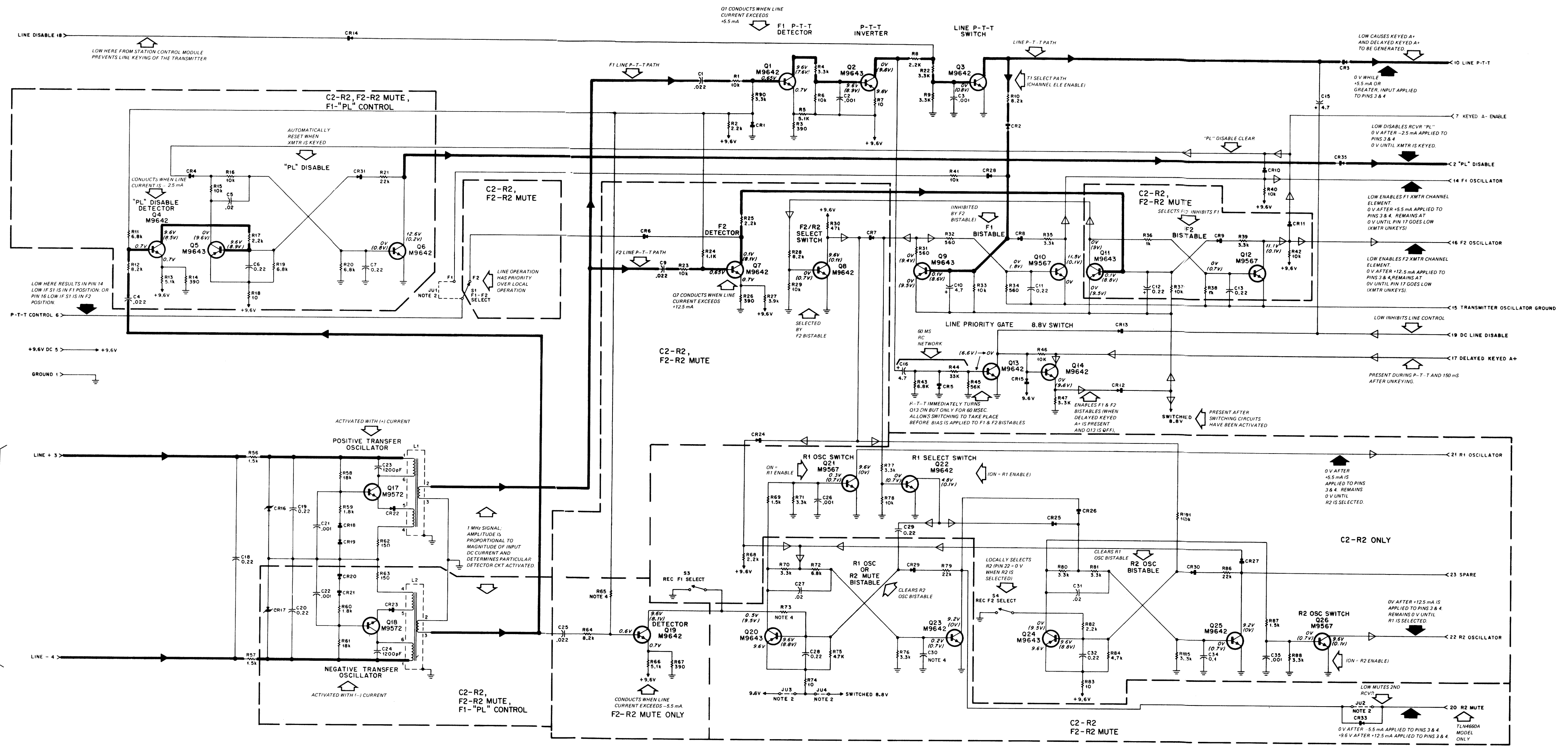
parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: $\mu F \pm 10\%$; 50 V; unless otherwise stated
C1	8-82905G02	.022
C2,3	21-82187B29	.001; 100 V
C4 (A,B,D)	8-82905G02	.022
C5 (A,B,D)	21-82428B26	.02 + 80-20%; 200 V
C6,7 (A,B,D)	8-82905G02	.022
C9 (B,D)	8-82905G02	.022
C10	23-865137	4.7 $\pm 20\%$; 25 V
C11	8-82905G11	.022
C12 (B,D)	8-82905G11	.022
C13 (B,D)	8-82905G11	.022
C15,16	23-865137	4.7 $\pm 20\%$; 25 V
C18 (A,C,D)	8-82905G11	.022
C19 (A,C,D)	8-82905G11	.022
C20 (A,C,D)	8-82905G11	.022
C21,22	21-82187B29	.001; 100 V
C23,24	21-874352	1200 pF $\pm 5\%$; 300 V
C25	8-82905G11	.022
C26 (D)	21-82187B29	.001; 100 V
C27 (B,D)	21-82428B26	.02 + 80-20%; 200 V
C28 (B,D)	8-82905G11	.022
C29 (D)	8-82905G11	.022
C30 (B,D)	8-83813H09	.033; 100 V
C31 (D)	21-82428B26	.02 + 80-20%; 200 V
C32 (D)	8-82905G11	.022
C34 (D)	8-83813H09	.033; 100 V
C35 (D)	21-82187B29	.001; 100 V
		semiconductor device, diode: (see note)
CR1, 2, 3	48-83654H01	silicon
CR4 (A,B,D)	48-83654H01	silicon
CR5	48-83654H01	silicon
CR6 (B,D)	48-83654H01	silicon
CR7 (B,D)	48-83654H01	silicon
CR8	48-83654H01	silicon
CR9 (B,D)	48-83654H01	silicon
CR10	48-83654H01	silicon
CR11 (B,D)	48-83654H01	silicon
CR12 thru 15	48-83654H01	silicon
CR18 thru 24	48-83654H01	silicon
CR25 (D)	48-83654H01	silicon
CR26 (D)	48-83654H01	silicon
CR27 (D)	48-83654H01	silicon
CR28, 29	48-83654H01	silicon
CR30 (D)	48-83654H01	silicon
CR31 (A,B,D)	48-83654H01	silicon
CR33	48-83654H01	silicon
		coil; rf; oscillator
L1,2	24-83008H01	
		transistor: (see note)
Q1	48-869642	PNP; type M9642
Q2	48-869643	PNP; type M9643
Q3	48-869642	PNP; type M9642
Q4 (A,B,D)	48-869642	PNP; type M9642
Q5 (A,B,D)	48-869643	PNP; type M9643
Q6 (A,B,D)	48-869642	PNP; type M9642
Q7 (B,D)	48-869642	PNP; type M9642
Q8 (B,D)	48-869642	PNP; type M9642
Q9	48-869643	PNP; type M9643
Q10	48-869567	NPN; type M9567
Q11 (B,D)	48-869643	PNP; type M9643
Q12 (B,D)	48-869567	NPN; type M9567
Q13, 14	48-869642	PNP; type M9642
Q17	48-869572	NPN; type M9572
Q18 (A,D)	48-869572	NPN; type M9572
Q19 (B)	48-869642	PNP; type M9642
Q20 (B,D)	48-869643	PNP; type M9643
Q21 (D)	48-869567	NPN; type M9567
Q22 (D)	48-869642	PNP; type M9642
Q23 (B,D)	48-869642	PNP; type M9642
Q24 (D)	48-869643	PNP; type M9643
Q25 (D)	48-869642	PNP; type M9642
Q26 (D)	48-869567	NPN; type M9567
		resistor, fixed: $\pm 5\%$; 1/4 W; unless otherwise stated
R1	6-11009C73	10k
R2	6-11009C57	2.2k
		switch:
S1	40-83204B01	slide
S3,4	40-83468E01	slide
		voltage regulator: (see note)
VR1	48-83461E12	Zener, 27 V
VR2 (A,B,D)	48-83461E12	Zener, 27 V
		non-referenced items
9-83497F01	RECEPTACLE, female: 8-contact; 3 used (PCB Edge Connector)	
14-84436N01	CAN, insulated coil	
64-83120L02	PANEL, screened (TRN5240A, TRN5254A)	
64-83121L02	PANEL, screened (TRN5255A)	
64-83122L02	PANEL, screened (TRN5256A)	
26-82072G03	SHIELD, coil; 2 req'd.	
76-83960B07	CORE, 6 req'd.	

Note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

DC TRANSFER MODULES

MODELS TRN5240A, 54A, 55A, 56A



Module Description	Line Current	Function
F1-PL	+5.5 mA	Key Transmitter on F1.
F2-R2 Mute	-2.5 mA	PL Disable Receiver
	+5.5 mA	Key Transmitter on F1
	+12.5 mA	Key Transmitter on F2, Unmute R2
	-2.5 mA	PL Disable Receiver
	-5.5 mA	Mute R2
F1-CS	+5.5 mA	Transmit on F1
C2-R2	+5.5 mA	Transmit on F1, Select R1
	+12.5 mA	Transmit on F2, Select R2
	-2.5 mA	PL Disable Receiver

BENCH TESTING SET-UP	
Pin No.	Connect
1, 15	Ground
10, 2	10k ohms to 9.6 volts dc
3	Through 0 to 15 dc millimeter to 70 to 100 volts dc current source
4	To negative (-) of current source
5	9.6 volts
17	12 volts dc

- NOTES:
- Unless otherwise stated: resistor values are in ohms (k = 1000); capacitor values are in microfarads.
 - Jumper chart.

	Model	JU1	JU2	JU3	JU4
F1-PL	TRN5240A	IN	OUT	OUT	OUT
F2-R2 Mute	TRN5256A	OUT	IN	OUT	OUT
F1 CONT	TRN5254A	IN	OUT	OUT	OUT
C2-R2	TRN5255A	OUT	OUT	IN	OUT

- Voltsages shown in parentheses are normally measured when function is activated. Voltages not in parentheses are normally measured when function is deactivated.
- See parts list for component values.
- All bistables are complementary. Therefore, both bistable transistors are on or off simultaneously.
- NA.
- While either pins 18 or 19 are grounded, line currents will not activate the module.

LEGEND

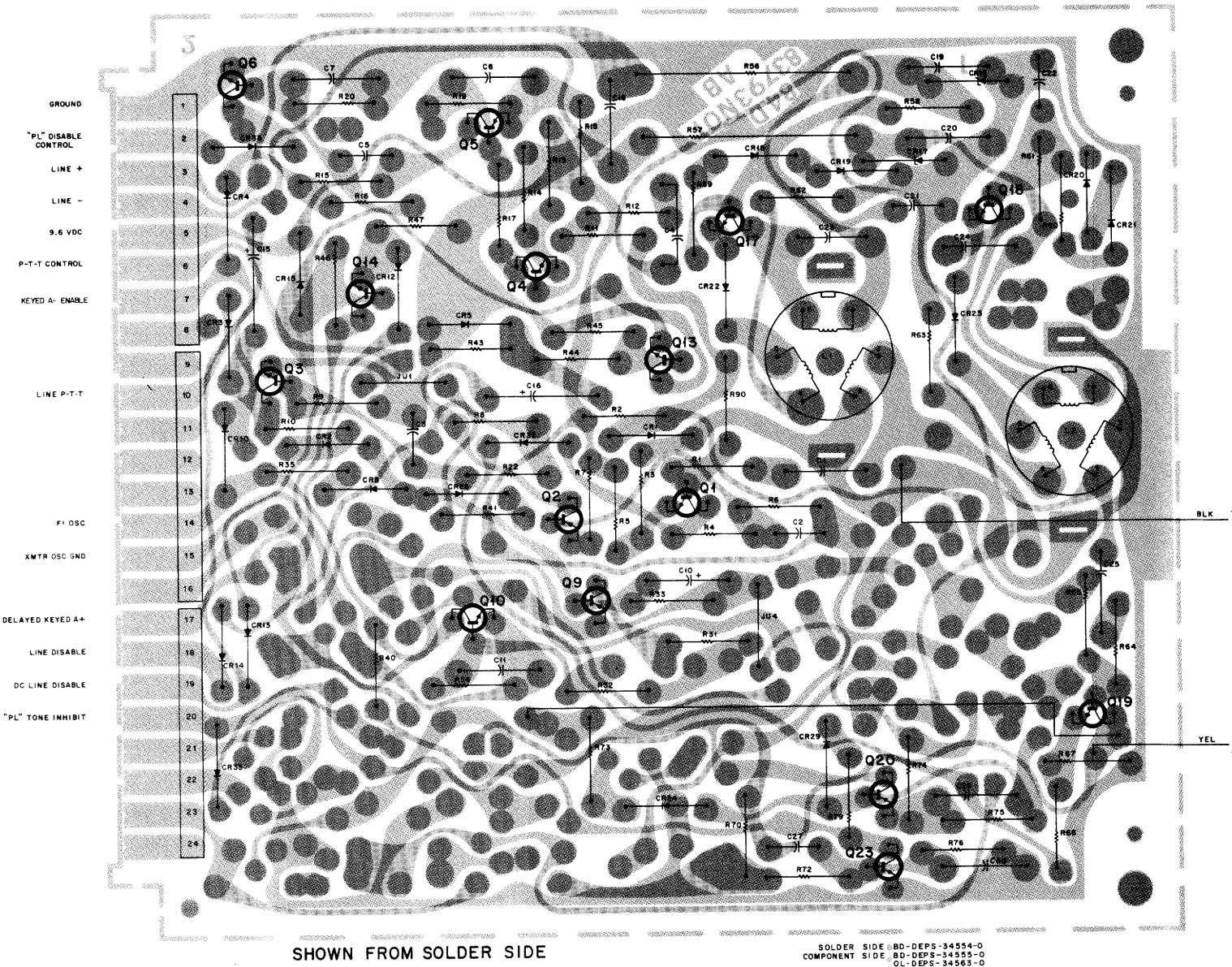
START - CIRCUIT THEORY MOST EASILY UNDERSTOOD BY BEGINNING AT THIS POINT AND FOLLOWING SIGNAL FLOW

- ◇ - THEORY OF OPERATION DATA
- ◀ - MAINTENANCE DATA
- - PRIMARY SIGNAL FLOW
- ⇨ - SECONDARY SIGNAL FLOW

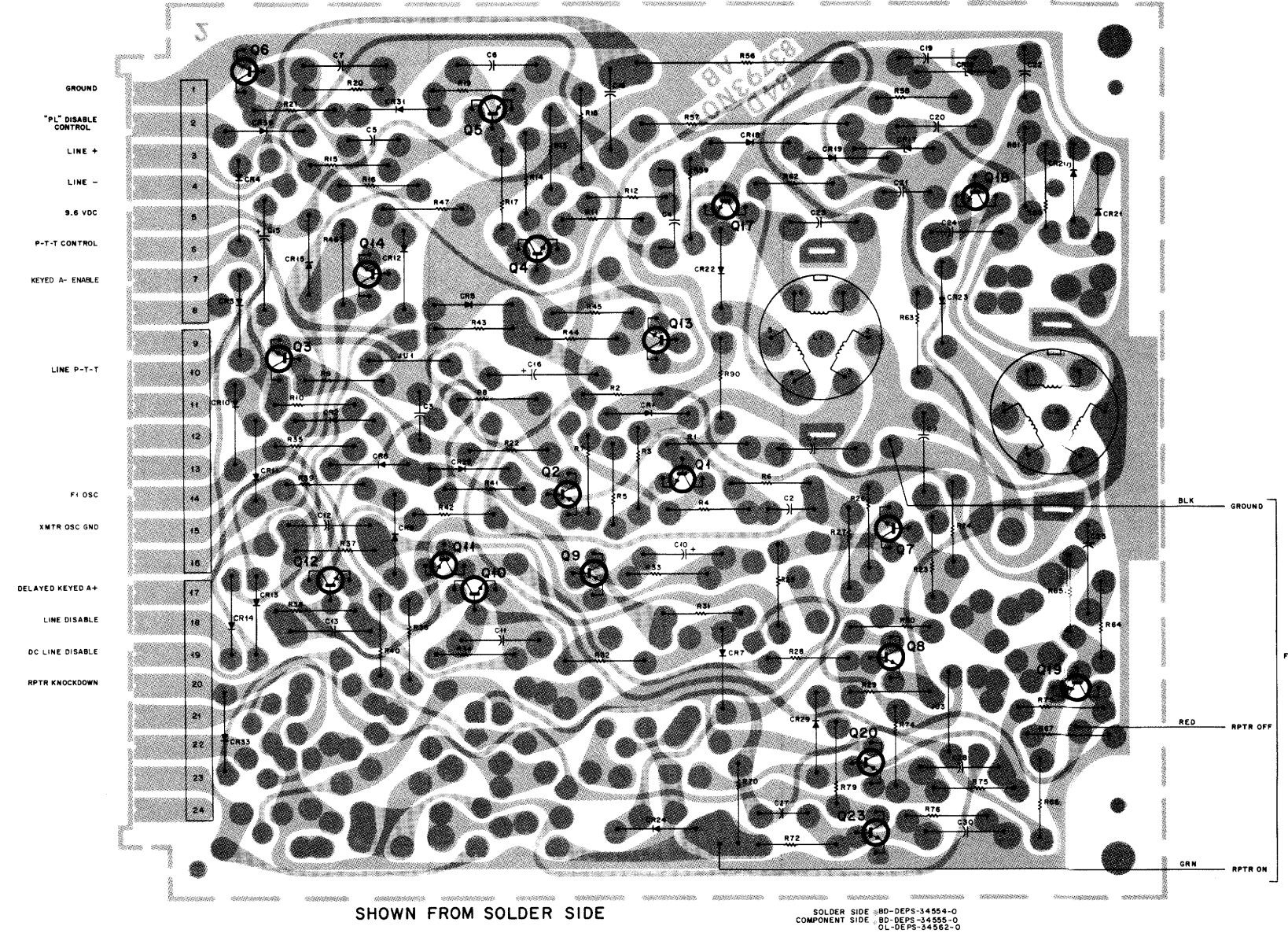
CIRCUITRY OUTSIDE DASHED BOXES USED WITH ALL MODELS

DC TRANSFER (OPTION) MODULE
 MODELS TRN5239A, 57A

TRN5239A PAGING CONTROL



TRN5257A REPEATER CONTROL



parts list

reference symbol	suffix	application
No Suffix		All models
A		TRN5239A
B		TRN5257A

This parts list covers 2 models of the DC Transfer module. Where differences exist, a letter code is added to the reference symbol to indicate the applicable unit.

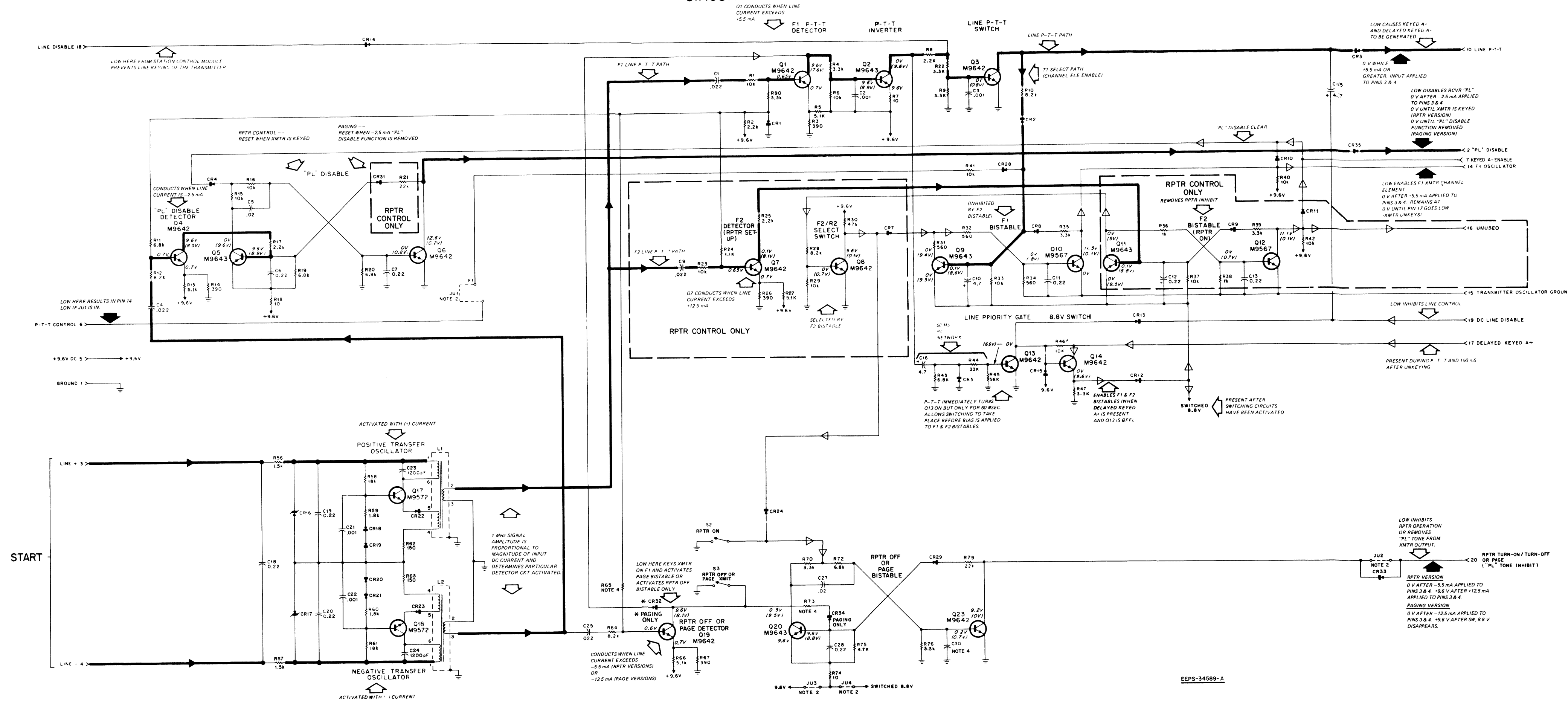
TRN5239A Paging Control DC Transfer Module
 TRN5257A Repeater Control DC Transfer Module

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF ± 10%; 50 V; unless otherwise stated
C1	8-82905G02	.022
C2,3	21-52187B29	.001; 100 V
C4	8-82905G02	.022
C5	21-82428B26	.02 ± 80-20%; 200 V
C6,7	8-82905G02	.022
C9 (B)	8-82905G02	.022
C10	23-865137	4.7 ± 20%; 25 V
C11	8-82905G11	0.22
C12 (B)	8-82905G11	0.22
C13 (B)	8-82905G11	0.22
C15,16	23-865137	4.7 ± 20%; 25 V
C18,19,20	8-82905G11	0.22
C21,22	21-52187B29	.001; 100 V
C23,24	21-874352	1200 pF ± 5%; 300 V
C25	8-82905G11	0.22
C26		NOT USED
C27	21-82428B26	.02 ± 80-20%; 200 V
C28	8-82905G11	0.22
C29		NOT USED
C30	8-83813H09	.033; 100 V
		diode: (see note)
CR1 thru 6	48-83654H01	silicon
CR7 (B)	48-83654H01	silicon
CR8	48-83654H01	silicon
CR9 (B)	48-83654H01	silicon
CR10	48-83654H01	silicon
CR11 (B)	48-83654H01	silicon
CR12 thru 15	48-83654H01	silicon
CR18 thru 24	48-83654H01	silicon
CR28, 29	48-83654H01	silicon
CR31 (B)	48-83654H01	silicon
CR32 (A)	48-83654H01	silicon
CR33 (A)	48-84616A01	silicon, hot carrier
CR33 (B)	48-83654H01	silicon
CR34 (A)	48-83654H01	silicon
		coil; rf oscillator
L1,2	24-83008H01	
		transistor: (see note)
Q1	48-869642	NPN; type M9642
Q2	48-869643	PNP; type M9643
Q3	48-869642	NPN; type M9642
Q4	48-869642	NPN; type M9642
Q5	48-869643	PNP; type M9643
Q6	48-869642	NPN; type M9642
Q7 (B)	48-869642	NPN; type M9642
Q8 (B)	48-869642	NPN; type M9642
Q9	48-869643	PNP; type M9643
Q10	48-869643	PNP; type M9643
Q11	48-869643	PNP; type M9643
Q12	48-869642	NPN; type M9642
Q13, 14	48-869642	NPN; type M9642
Q17, 18	48-869572	NPN; type M9572
Q19	48-869642	NPN; type M9642
Q20	48-869643	PNP; type M9643
Q23	48-869642	NPN; type M9642
		resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R1	6-11009C73	10k
R2	6-11009C57	2.2k
R3	6-11009C39	390
R4	6-11009C61	3.3k
R5	6-11009C66	5.1k
R6	6-11009C73	10k
R7	6-11009C01	10
R8	6-11009C57	2.2k
R9	6-11009C61	3.3k
R10	6-11009C71	8.2k
R11	6-11009C69	6.8k
R12	6-11009C71	8.2k
R13	6-11009C66	5.1k
R14	6-11009C39	390
R15	6-11009C73	10k
R16	6-11009C73	10k
R17	6-11009C57	2.2k
R18	6-11009C01	10
R19	6-11009C69	6.8k
R20	6-11009C69	6.8k
R21(B)	6-11009C81	22k
R22	6-11009C61	3.3k
		switch:
S1	40-83204B01	slide
S2 (B)	40-83468E01	slide
S3,4	40-83468E01	slide
		voltage regulator: (see note)
VR1,2	48-83461E12	Zener, 27 V
		non-referenced items
9-83497F01	RECEPTACLE, female: 8-contact; 3 used (PCB Edge Connector)	
64-83123L02	PANEL, screened (TRN5239A)	
64-83124L03	PANEL, screened (TRN5257A)	
26-858660	SHIELD, coil; 2 req'd.	
76-83960B07	CORE, 6 req'd.	

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R23 (B)	6-11009C73	10k
R24 (B)	6-11009C50	1.1k
R25 (B)	6-11009C57	2.2k
R26 (B)	6-11009C39	390
R27 (B)	6-11009C66	5.1k
R28 (B)	6-11009C71	8.2k
R29 (B)	6-11009C73	10k
R30 (B)	6-11009C89	47k
R31	6-11009C43	560
R32	6-11009C43	560
R33	6-11009C73	10k
R34	6-11009C43	560
R35	6-11009C61	3.3k
R36 (B)	6-11009C49	1k
R37 (B)	6-11009C73	10k
R38 (B)	6-11009C49	1k
R39 (B)	6-11009C61	3.3k
R40	6-11009C73	10k
R41	6-11009C73	10k
R42 (B)	6-11009C73	10k
R43	6-11009C69	6.8k
R44	6-11009C85	33k
R45	6-11009C91	56k
R46	6-11009C73	10k
R47	6-11009C61	3.3k
R56	17-83027H03	1.5k; 3 W
R57	17-83027H03	1.5k; 3 W
R58	6-11009C79	18k
R59	6-11009C55	1.8k
R60	6-11009C55	1.8k
R61	6-11009C79	18k
R62	6-11009C29	150
R63	6-11009C29	150
R64	6-11009C71	8.2k
R65 (A)	6-11009C53	1.5k
R65 (B)	6-11009C57	2.2k
R66	6-11009C66	5.1k
R67	6-11009C39	390
R70	6-11009C61	3.3k
R72	6-11009C69	6.8k
R73 (A)	6-11009C57	2.2k
R73 (B)	6-11009C49	1k
R74	6-11009C01	10
R75	6-11009C85	4.7k
R76	6-11009C61	3.3k
R79	6-11009C81	22k
R90	6-11009C61	3.3k

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

CIRCUITRY OUTSIDE DASHED BOXES USED WITH BOTH MODELS



Module Description	Line Current	Function
Paging (Optional)	+5.5mA	Key transmitter on F1 with PL modulation.
	-2.5mA	PL disable receiver
	-12.5mA	Key transmitter on F1 without PL modulation.
RPTR Control (optional for repeater)	+5.5 mA	Transmit on F1 Repeater turn-on
	-2.5 mA	PL disable receiver
	-5.5 mA	Repeater turn-off

Bench Testing Set Up

Pin No.	Connect
1, 15	Ground
10, 2, 20	10K ohms to 96 volts dc
3	Through 0 to 15 dc milliammeter to 70 to 100 volts dc current source
4	To negative (-) of current source
5	9.6 volts
17	12 volts dc

- NOTES:**
- Unless otherwise stated; resistor values are in ohms (k = 1000) and capacitor values are in microfarads.
 - Jumper Chart.
- | | Model | JU1 | JU2 | JU3 | JU4 |
|------------|----------|-----|-----|-----|-----|
| Paging | TRN5239A | IN | OUT | IN | IN |
| RPTR Cont. | TRN5257A | IN | OUT | IN | OUT |

3. Voltages shown in parenthesis are normally measured when function is activated. Voltages not in parentheses are normally measured when function is deactivated.
4. See parts list for component values.
5. All bistables are complementary. Therefore both bistable transistors are on or off simultaneously.
6. N/A.
7. While either pins 18 or 19 are grounded, line currents will not activate the module.

LEGEND:

START - CIRCUIT THEORY MOST EASILY UNDERSTOOD BY BEGINNING AT THIS POINT AND FOLLOWING SIGNAL FLOW.

- THEORY OF OPERATION DATA
- MAINTENANCE DATA
- PRIMARY SIGNAL FLOW
- SECONDARY SIGNAL FLOW

DC TRANSFER (OPTION) MODULE

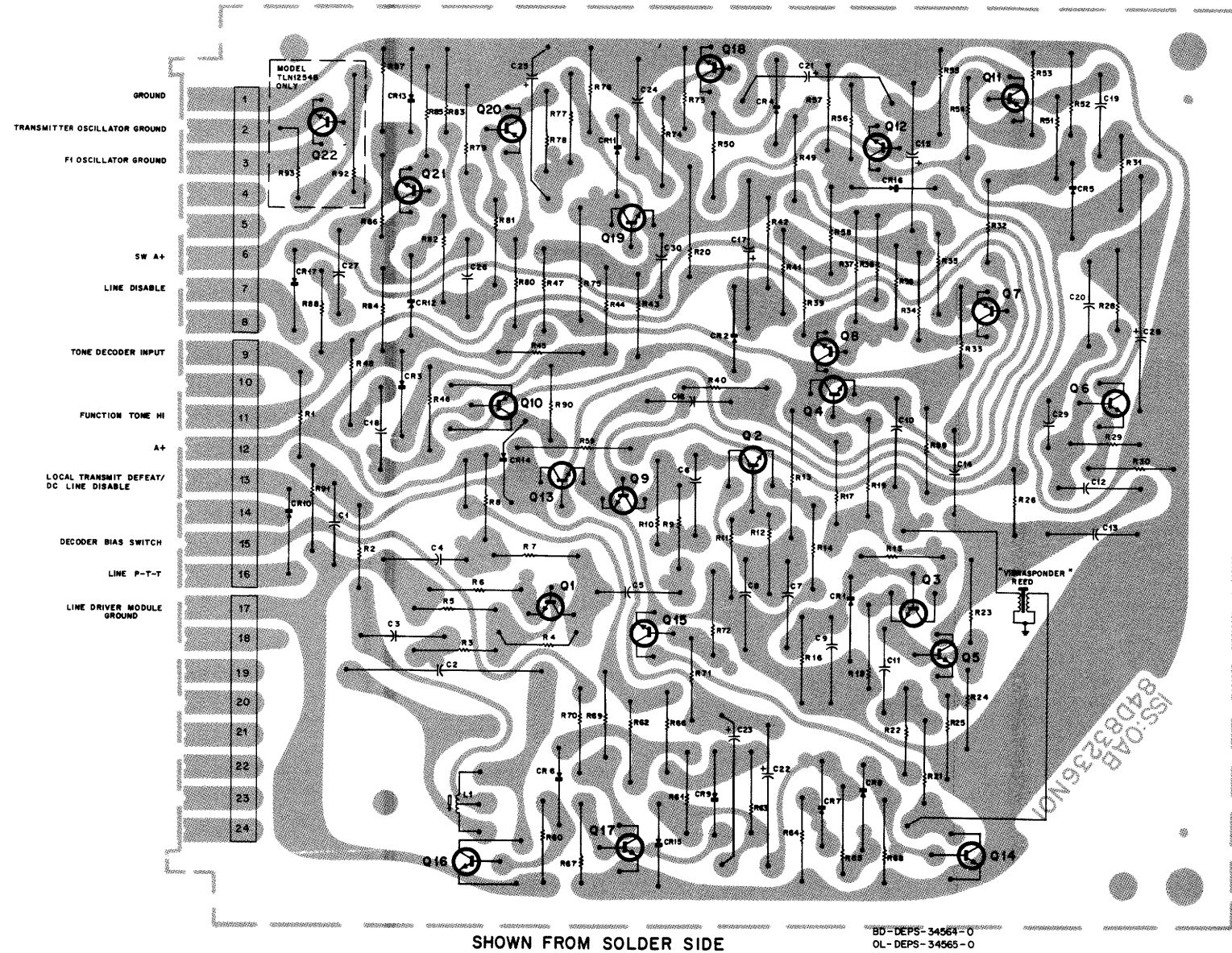
MODELS TRN5239A, 57A

FUNCTION

Converts dc line currents to station control functions.

GUARD TONE DECODER MODULES

MODELS TLN2443A, 50A



Circuit Board Detail & Parts List
 Motorola No. 68P81062E18-A
 (Sheet 1 of 2)
 11/1/85- UP

parts list

reference symbol	suffix	application
No Suffix		All Models
A		TRN5307A Decoder without GND switch circuit
B		TRN5319A Decoder with GND switch circuit

This parts list covers 2 models of the Guard Tone Decoder Module. Where differences exist, a letter code is added to the reference symbol to indicate the applicable model.

TRN5307A Guard Tone Decoder Board
 TRN5319A Guard Tone Decoder Board
 PL-7959-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1	8-82905G26	capacitor, fixed: uF ± 5%; 50 V; unless otherwise stated
C2	8-84326A29	.0047
C3	8-82905G07	.01
C4	8-82905G11	0.22
C5, 6, 7	8-82905G02	.022
C8	8-82905G25	.0033
C9	8-82905G01	.01
C10	8-82905G11	0.22
C11 thru 14	8-82905G04	.068
C15	23-865136	15 ± 20%; 25 V
C16	8-82905G03	.047
C17	23-865136	15 ± 20%; 25 V
C18, 19, 20	8-82905G04	.068
C21	23-865137	4.7 ± 20%; 25 V
C22	23-82763B08	1.0 ± 20%; 35 V
C23	23-865136	15 ± 20%; 25 V
C24	8-82905G11	0.22
C25	23-865136	15 ± 20%; 25 V
C26	8-82905G07	0.1
C27	8-82905G11	0.22
C28	23-82601A25	100 + 150-10%; 20 V
C29, 30	21-82187B14	.001; 100 V
CR1 thru 17	48-83654H01	semiconductor device, diode: (see note) silicon
L1	1-80702B11	coil assembly, inductor: 1 H; incl. ground clip
Q1	48-869539	transistor: (see note) NPN; type M9539
Q2	48-869594	NPN; type M9594
Q3, 4	48-869570	NPN; type M9570
Q5	48-869594	NPN; type M9594
Q6	48-869570	NPN; type M9570
Q7	48-869571	PNP; type M9571
Q8	48-869570	NPN; type M9570
Q9	48-869594	NPN; type M9594
Q10, 11	48-869571	PNP; type M9571
Q12 thru 14	48-869570	NPN; type M9570
Q15	48-869648	NPN; type M9648
Q16 thru 19	48-869570	NPN; type M9570
Q20	48-869571	PNP; type M9571
Q21	48-869570	NPN; type M9570
Q22 (B)	48-869567	NPN; type M9567
R1	6-11009C73	resistor, fixed: ± 10%; 1/4 W; unless otherwise stated
R2	6-11009C69	10k
R3	6-11009C81	6.8k
R4	6-11009D06	22k
R5	6-11009C97	100k
R6	6-11009C49	1k
R7	6-11009C73	10k
R8	6-11009C81	22k
R9	6-11009C77	15k
R10	6-11009C61	3.3k
R11	6-11009D02	150k
R12	6-11009D18	680k
R13	6-125A73	10k; 1/2 W
R14	6-11009C45	680
R15	6-11009D18	680k
R16	6-11009D08	270k
R17	6-11009C73	10k
R18	6-11009C41	470
R19	6-11009C45	680
R20	6-125C37	330; 1/2 W
R21	6-11009C53	1.5k
R22	6-11009C13	33
R23	6-11009C93	68k
R24	6-11009C83	27k
R25	6-11009C01	10
R26	6-11009C49	1k
R28	6-11009C93	68k
R29	6-11009C83	27k
R30	6-11009C11	27

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R31	6-11009C49	1k
R32	6-11009C75	12k
R33	6-11009C33	220
R34	6-11009C89	47k
R35	6-11009C57	2.2k
R36	6-11009C99	120k
R37	6-125C97	100k
R38	6-11009C81	22k
R39	6-11009C93	68k
R40	6-11009C73	10k
R41	6-11009C89	47k
R42	6-11009C95	82k
R43, 44	6-11009C57	2.2k
R45	6-11009C37	330
R46	6-11009C75	12k
R47	6-11009C61	3.3k
R48	6-11009C51	1.2k
R49, 50	6-11009C13	33
R51	6-11009C75	12k
R52	6-11009C61	3.3k
R53	6-11009C57	2.2k
R54	6-11009C35	270
R55	6-11009C89	47k
R56	6-11009C65	4.7k
R57	6-11009C57	2.2k
R58	6-11009C25	100
R59	6-125C49	1k; 1/2 W
R60	6-11009C89	47k
R61	6-11009C81	22k
R62	6-11009C93	68k
R63	6-11009C81	22k
R64	6-11009C75	12k
R65	6-11009C61	3.3k
R66	6-11009C33	68k
R67, 68	6-11009C89	47k
R69, 70	6-11009C57	2.2k
R71	6-11009C73	10k
R72	6-11009C89	47k
R73	6-11009C49	1k
R74	6-11009C61	3.3k
R75	6-125C49	1k; 1/2 W
R76	6-11009C49	1k
R77	6-11009C63	3.9k
R78	6-11009C49	1k
R79	6-11009C57	2.2k
R80	6-11009C25	100
R81	6-11009C57	2.2k
R82	6-11009C73	10k
R83	6-11009C57	2.2k
R84	6-11009C49	1k
R85	6-11009C09	22
R86	6-11009C93	68k
R87	6-11009C81	27k
R88	6-11009C37	330
R89	6-11009C01	10
R90	6-11009C49	1k
R91	6-11009C57	2.2k
R92	6-11009C49	1k
R93	6-11009C61	3.3k

mechanical parts		
3-84256M01	SCREW, tapping; 2 used	
64-83128L02	PANEL, screened	
5-84220B01	GROMMET; 2 used	
9-83497F01	RECEPTACLE, 8; contact; 3 used (PCB Edge Connector)	
1-80702B13	ASSEMBLY SOCKET and BRACKET	
9-83697M01	RECEPTACLE, female; 13 used	

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

GUARD TONE DECODER MODULES

MAINTENANCE & TROUBLESHOOTING

1. CONNECTIONS

This module may be serviced either while connected to the control chassis or while connected to separate external test equipment. Refer to control chassis servicing information in the manual for additional set-up details.

Make the following connections to the module.

Pin Number	Connection
1, 17	Ground
9	Audio oscillator through 0.1 uF
11	AC Voltmeter
12	A+ (13.9 V dc)

2. NORMAL CONDITIONS

Excessive deviations from these values indicate abnormal conditions.

Function	Typical Value
Pull-In Line Level @ 2175 Hz	-31 dBm
Drop-Out Line Level @ 2175 Hz	-51 dBm
PTT Turn-On Time	Less than 100 Milliseconds
PTT Turn-Off Time	Less than 100 Milliseconds
Prefilter Switch Time	375 Milliseconds
Gated AGC Threshold	-45 dBm
Line AGC Threshold	-18 dBm
Prefilter Frequency	2160 Hz
Vibrasponder Frequency	2175 Hz

3. MODULE MALFUNCTION LOCATION TECHNIQUES

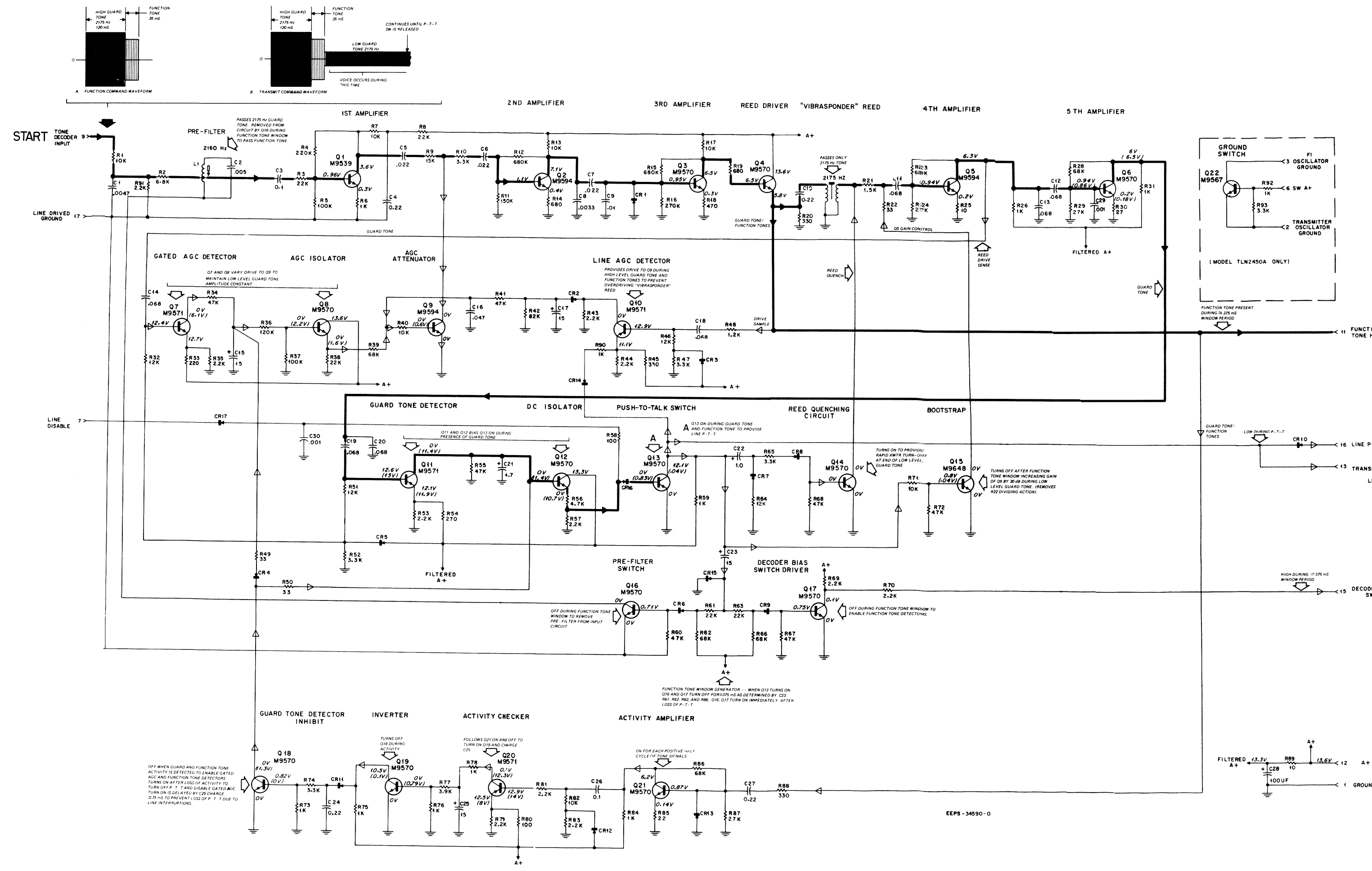
Step 1. Inject a 15 millivolt, 2175 Hz audio tone into pin 9.

Step 2. Measure the dc voltage from pin 13 to ground as the tone input voltage reaches 15 millivolts, pin 13 should go to ground if the ground does not occur. Check voltages on transistors Q1 through Q6, Q11, Q12 and Q13.

Step 3. Connect an ac voltmeter across pin 11 and ground, and a dc voltmeter to pin 13 and ground. With an accurate 2175 Hz tone injected at pin 9, pin 13 should go to ground and remain. When pin 13 is at ground the output level at pin 11 should remain constant at 180 millivolts \pm 3 dB when the input level is slowly varied from 3 millivolts to 80 millivolts. If this does not occur, check Q1 through Q5, Q7, Q8, and Q9.

Step 4. Ground the base of the Q16 prefilter switch. With the ac voltmeter connected to pin 11, inject a 2000 Hz tone into pin 9. As the input level is raised to 40 millivolts \pm 3 dB. The level measured at pin 11 should reach approximately 3 volts ac and then level off with proper operation, increasing the signal amplitude at pin 9 to 4 volts ac should cause only a 3 dB increase in the level at pin 11 from that with 40 millivolt input. If Step 3 was ok and Step 4 did not operate, check Q10.

Step 5. Repeat Steps 1 and 2 with an accurate 2175 Hz tone. To check the drop-out level, slowly reduce the signal amplitude at pin 9 until the voltage at pin 13 goes to the A+ level. Measure the ac voltage at pin 9. Extra attenuation may be required between the audio oscillator and pin 9, since the drop-out level is typically less than -60 dBm (1 mV).



Model Complement			
Model	Module	Reed (2175 Hz)	Application
TLN2443A	TRN5307A	TLN6709BH	Remote control base and repeater stations
TLN2450A	TRN5319A	TLN6709BH	Guard tone relay control stations.

FUNCTION

- Converts 2175 Hz guard tone signal to line PTT signal.
- Amplifies and distributes received function tones to other function decoders.
- Provides security against remote control chassis falsing from function tone signals outside predetermined time frame.
- Turns transmitter off at end of PTT.
- Transmitter channel element ground provided with TLN2450A Module. (A guard tone relay control station does not include this circuitry on any other module.)

F1-CS & F1-PL TONE CONTROL MODULES

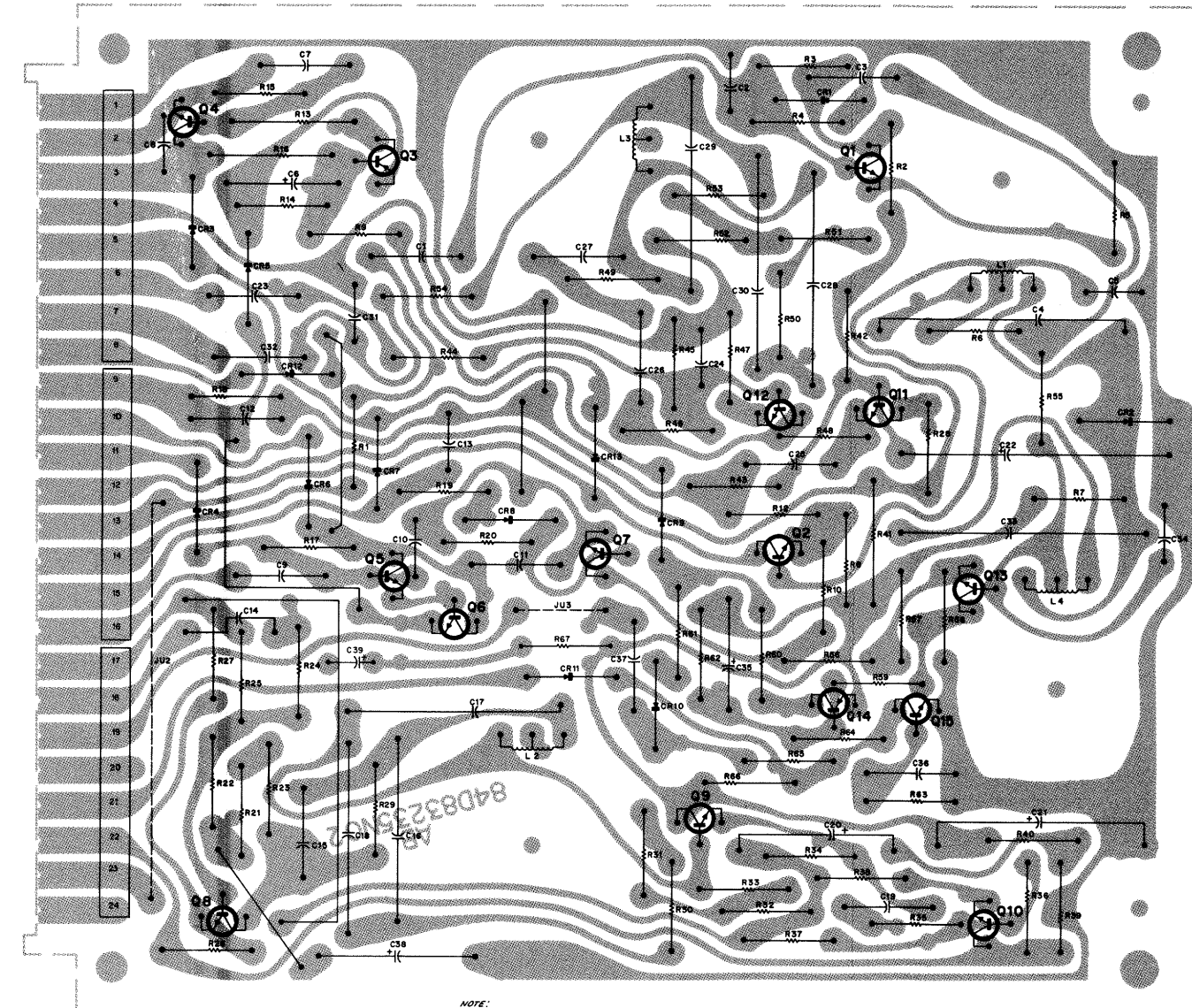
parts list

reference symbol	suffix	application
No Suffix		All Models
A		TRN5322A
B		TRN5327A
C		TRN5327A

This parts list covers 4 models of the F1 Tone Decoder Modules. Where differences exist, a letter code is added to the reference symbol to indicate the applicable unit.

TRN5320A F1-PL Control, F1 Tone Control Module
 TRN5322A F1-CS Control, F1 Tone Control Module
 TRN5327A 4-Frequency F1-CS Control, F1 Tone Control Module
 TRN5328A 4-Frequency F1-PL Control, F1 Tone Control Module

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1 (A)	8-82905G07	capacitor, fixed: $\mu\text{F} \pm 10\%$; 50 V; unless otherwise stated
C2 (A)	21-82187B29	0.1
C3 (A)	8-82905G07	0.01; 100 V
C4 (A)	8-84326A14	.0062 $\pm 2\%$
C5 (A)	21-82187B29	.001; 100 V
C6 (A)	23-82783B08	1 $\pm 20\%$; 35 V
C7 (A)	8-82905G02	.022
C8 (A)	21-82187B29	.001; 100 V
C9 (A, B, C)	8-82905G11	0.22
C10 (A, B, C)	21-82187B29	.001; 100 V
C11, 12 (A, B, C)	8-82905G07	0.1
C13 (A, B, C)	21-82187B29	.001; 100 V
C14 (A, B, C)	8-82905G11	0.22
C15 (A, B, C)	8-82905G25	.0033
C16 (A, B, C)	8-82284C01	.001
C17 (A, B, C)	8-84326A30	.0045 $\pm 1\%$
C18 (A, B, C)	8-82284C01	.001
C19 (A, B, C)	8-82905G11	0.22
C20 (A, B, C)	23-865136	15 $\pm 20\%$; 25 V
C21 (A, B, C)	23-84669A19	100 $\pm 150-10\%$; 20 V
C22 (A, B, C)	23-82601A25	100 $\pm 150-10\%$; 20 V
C23 (A, B, C)	8-82905G07	0.1
C24 (A, B, C)	21-82187B27	.002; 100 V
C25 (A, B, C)	8-82905G03	.047
C26 (A, B, C)	8-82905G11	0.22
C27 (A, B, C)	8-82905G25	.0033
C28 (A, B, C)	8-82284C01	.001
C29 (A, B, C)	8-84326A30	.0045 $\pm 1\%$
C30 (A, B, C)	8-82284C01	.001
C31 (A, B, C)	21-82187B22	270 pF; 200 V
C32 (A, B, C)	8-82905G07	0.1
C33 (B)	8-84326A13	.0056 $\pm 2\%$
C34 (B)	21-82187B29	.001; 100 V
C35 (B)	23-82783B08	1 $\pm 20\%$; 35 V
C36 (B)	8-82905G02	.022
C37 (B)	8-82905G11	0.22
C38 (B, C)	23-865136	15 $\pm 20\%$; 25 V
C39	23-11019A46	100 $\pm 20\%$; 25 V
CR1 (A, B)	48-83654H01	diode; (see note)
CR2 (A, B)	48-83654H01	silicon
CR3 (A, B)	48-83654H01	silicon
CR4 thru 8	48-83654H01	silicon
CR9 (A, C)	48-83654H01	silicon
CR10 (A, C)	48-83654H01	silicon
CR11 (A, C)	48-83654H01	silicon
CR12	48-83654H01	silicon
CR13 (A, B, C)	48-83654H01	silicon
L1 (A, B, C)	1-80702B11	coil, air; 1 H; includes ground clip
L2, 3	1-80702B11	1 H; includes ground clip
L4 (A)	1-80702B11	1 H; includes ground clip
Q1, 2 (A)	48-869642	NPN; type M9642
Q3 (A)	48-869643	PNP; type M9643
Q4 (A)	48-869567	NPN; type M9567
Q5 (A, B, C)	48-869642	NPN; type M9642
Q6 (A, B, C)	48-869491	NPN; type M9491
Q7 thru 12 (A, B, C)	48-869642	NPN; type M9642
Q13 (B)	48-869642	NPN; type M9642
Q14 (B)	48-869643	PNP; type M9643
Q15 (B)	48-869642	NPN; type M9642
R1 (A)	6-11009C43	560
R2 (A)	6-11009C49	1k
R3 (A)	6-11009C93	68k
R4 (A)	6-11009C83	27k
R5 (A)	6-11009C09	22k
R6 (A)	6-11009C81	22
R7, 8 (A)	6-11009C57	2.2k
R9 (A)	6-11009C49	1k
R10 (A)	6-11009C33	220
R11		NOT USED
R12 (A)	6-11009C49	1k



NOTE: NOT ALL COMPONENTS SHOWN ARE USED FOR EACH MODULE. REFER TO SCHEMATIC DIAGRAM FOR COMPONENT-MODULE IDENTIFICATION.

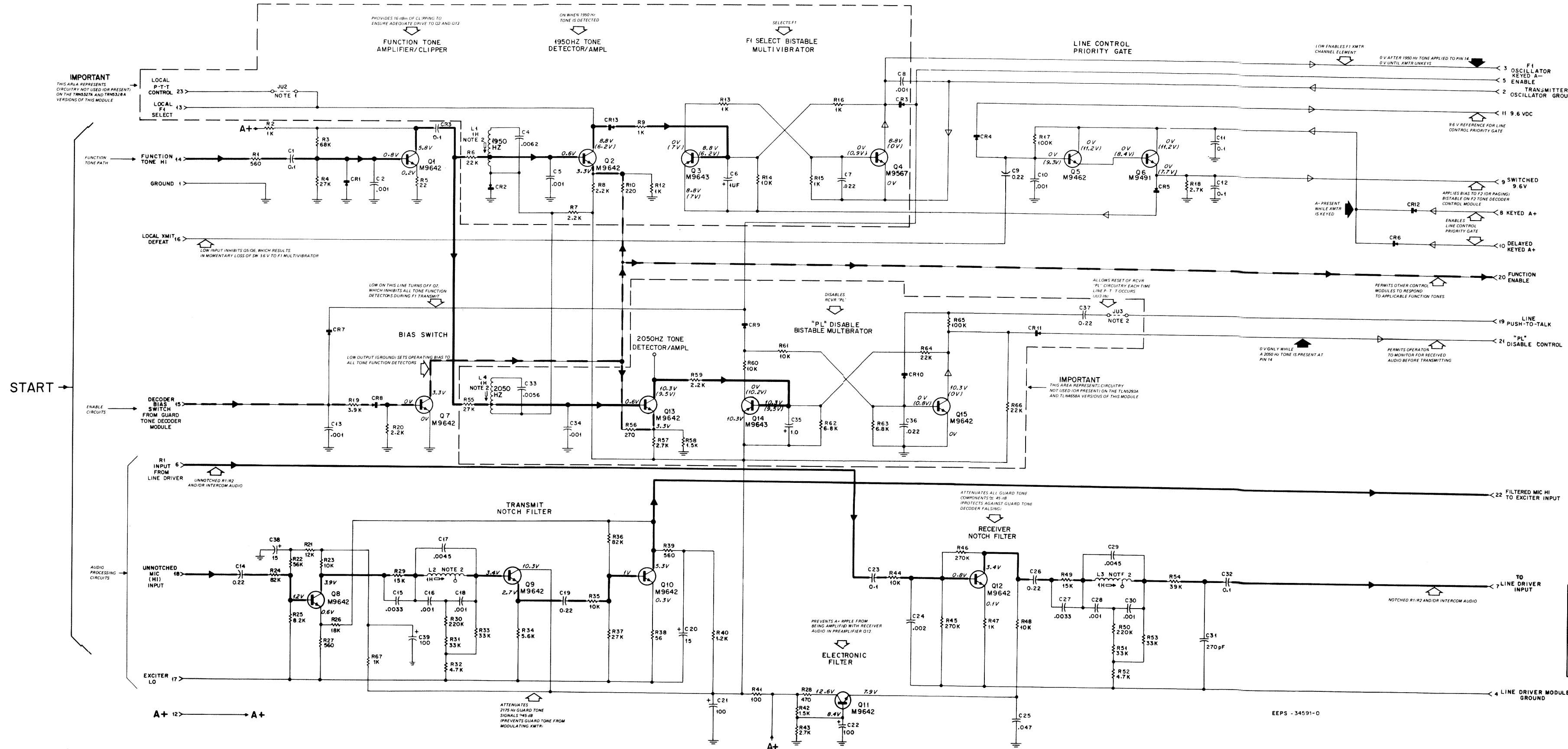
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R13 (A)	6-125C49	1k; 1/2 W
R14 (A)	6-11009C73	10k
R15 (A)	6-11009C49	1k
R16 (A, B, C)	6-125C49	1k; 1/2 W
R17 (A, B, C)	6-11009C97	100k
R18 (A, B, C)	6-11009C59	2.7k
R19 (A, B, C)	6-11009C63	3.9k
R20 (A, B, C)	6-11009C57	2.2k
R21 (A, B, C)	6-11009C79	18k
R22 (A, B, C)	6-11009C91	56k
R23 (A, B, C)	6-11009C73	10k
R24 (A, B, C)	6-11009C95	82k
R25 (A, B, C)	6-11009C71	8.2k
R26 (A, B, C)	6-11009C79	18k
R27 (A, B, C)	6-11009C43	560
R28 (A, B, C)	6-11009C41	470
R29 (A, B, C)	6-11009C77	15k
R30 (A, B, C)	6-11009D06	220k
R31 (A, B, C)	6-11009C88	33k
R32 (A, B, C)	6-11009C55	5.6k
R33 (A, B, C)	6-11009C85	4.7k
R34 (A, B, C)	6-11009C67	33k
R35 (A, B, C)	6-11009C73	10k
R36 (A, B, C)	6-11009C95	82k
R37 (A, B, C)	6-11009C83	27k
R38 (A, B, C)	6-11009C19	56
R39 (A, B, C)	6-11009C43	560
R40 (A, B, C)	6-11009C51	1.2k
R41 (A, B, C)	6-125A25	100; 1/2 W
R42 (A, B, C)	6-11009C53	1.5k
R43 (A, B, C)	6-11009C59	2.7k
R44 (A, B, C)	6-11009C73	10k
R45, 46 (A, B, C)	6-11009D08	270k
R47 (A, B, C)	6-11009C49	1k
R48	6-11009C73	10k
R49 (A, B, C)	6-11009C77	15k
R50 (A, B, C)	6-11009D06	220k
R51 (A, B, C)	6-11009C85	4.7k
R52 (A, B, C)	6-11009C65	33k
R53 (A, B, C)	6-11009C85	33k
R54 (A, B, C)	6-11009C87	39k
R55	6-11009C83	27k
R56	6-11009C35	270
R57	6-11009C59	2.7k
R58	6-11009C53	1.5k
R59	6-11009C57	2.2k
R60, 61	6-11009C73	10k
R62, 63	6-11009C69	6.8k
R64	6-11009C81	22k
R65	6-11009C97	100k
R66	6-11009C81	22k
R67	6-11009C49	1k

mechanical parts

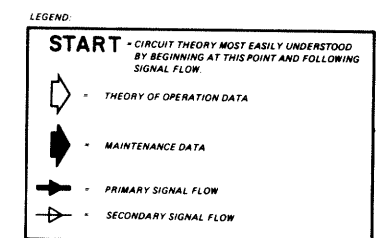
3-84256M01	SCREW, tapping; 2 used
5-84220B01	GROMMET; 2 used
64-83127L02	PANEL, screened (TRN5320A)
64-83126L02	PANEL, screened (TRN5322A)
64-84317A02	PANEL, screened (TRN5328A)
64-84394A02	PANEL, screened (TRN5327A)
9-83497F01	RECEPTACLE, connector; 8-contact; 3 used (PCB Edge)

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

F1-CS & F1-PL TONE CONTROL MODULES



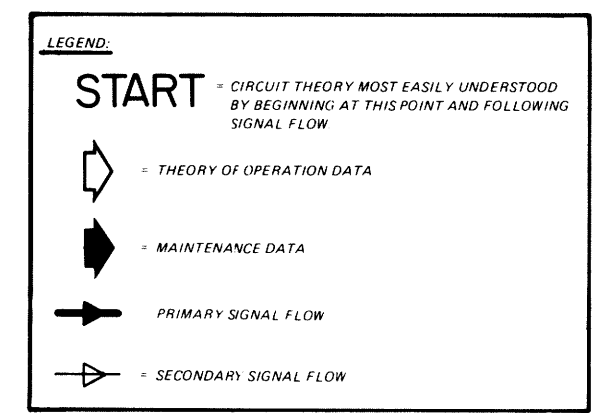
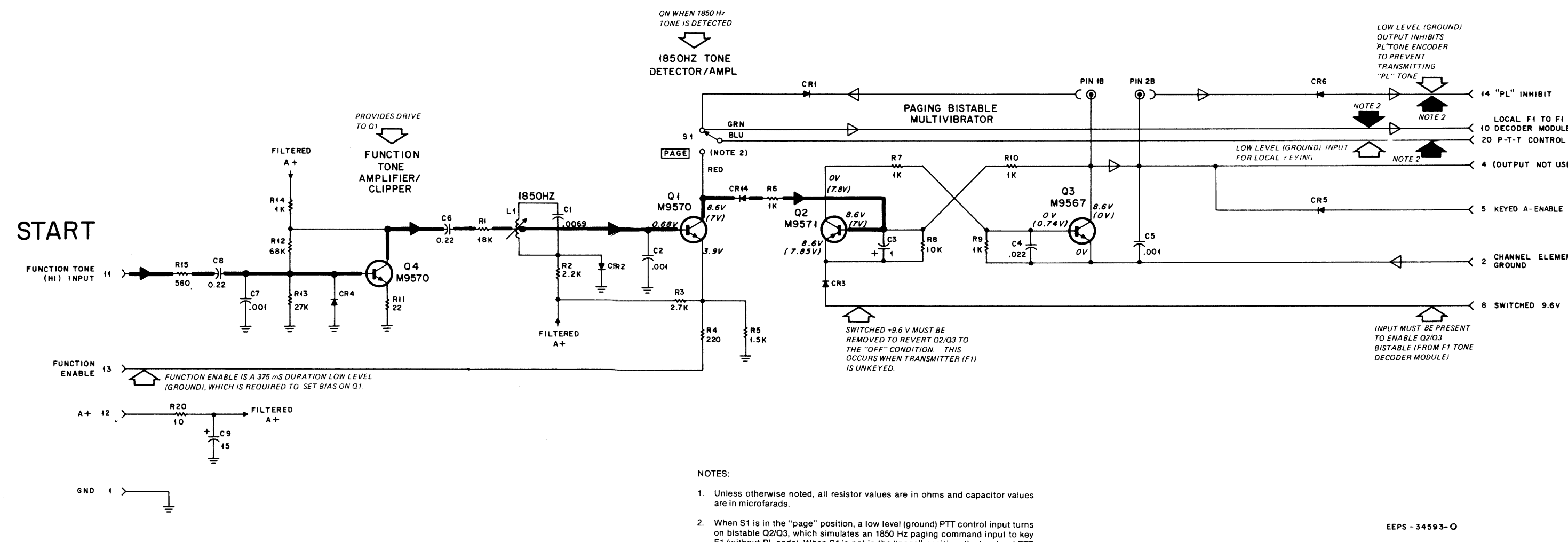
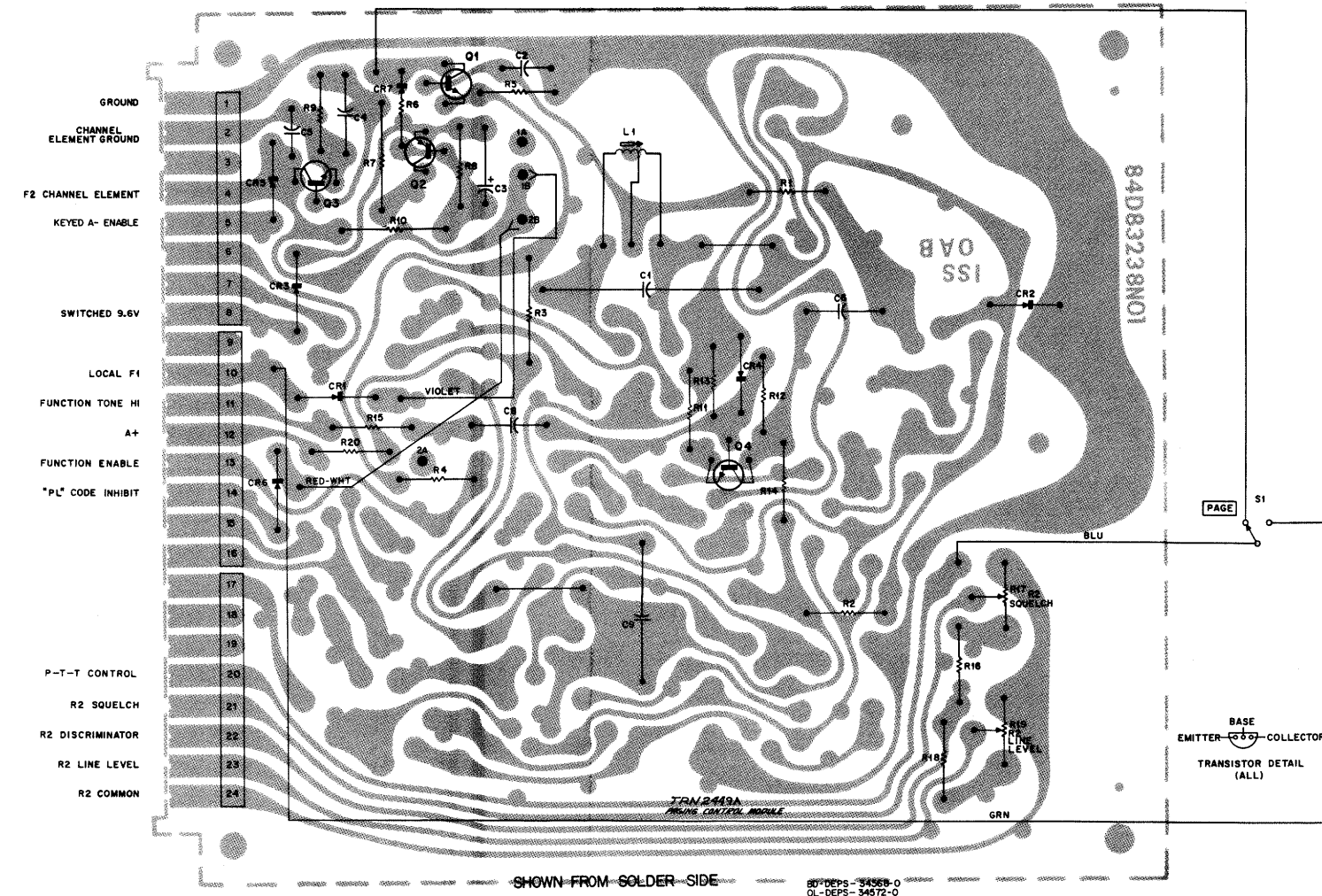
- NOTES:
1. JU2 is removed when multi-frequency and paging transmitters are used.
 2. Tuned circuits containing L1, L4, L2 and L3 are factory adjusted to the required frequency.
 3. Voltages shown in parentheses are normally measured when function is activated.
 4. Unless otherwise stated: resistor values are in ohms (k = 1000), capacitor values are in microfarads.



FUNCTION	
TRN5322A F1-CS Control	Keys XMTR on F1.
TRN5320A F1-PL Control	Keys XMTR on F1 and PL disables RCVR.
TRN5327A F1-CS Control (4-Freq. Carrier Squelch Station)	Provides receive and transmit notch filters. Frequency selected on separate TRN5296A 4-Frequency Control Module.
TRN5328A F1-PL Control (4-Freq. PL Squelch Station)	Provides receive and transmit notch filters and PL disables RCVR. Frequency selected on separate TRN5296A 4-Frequency Control Module.

Schematic Diagram
 Motorola No. 68P81062E19-B
 (Sheet 2 of 2)
 11/1/85-UP

TRN5317A PAGING TONE CONTROL



- NOTES:**
- Unless otherwise noted, all resistor values are in ohms and capacitor values are in microfarads.
 - When S1 is in the "page" position, a low level (ground) PTT control input turns on bistable Q2/Q3, which simulates an 1850 Hz paging command input to key F1 (without PL code). When S1 is not in the "page" position, the low level PTT control signal is routed direct to the F1 tone decoder module to key F1 (with PL tone).
 - This module is "grouped" with F2 tone modules because its circuitry is similar. However, this paging application module is applicable only to stations with 1-freq. transmitters.

FUNCTION

Received 1850 Hz function tone keys transmitter on F1 and disables PL encoder (allows transmitter to transmit without a PL code).

EEPS - 34593 - O

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

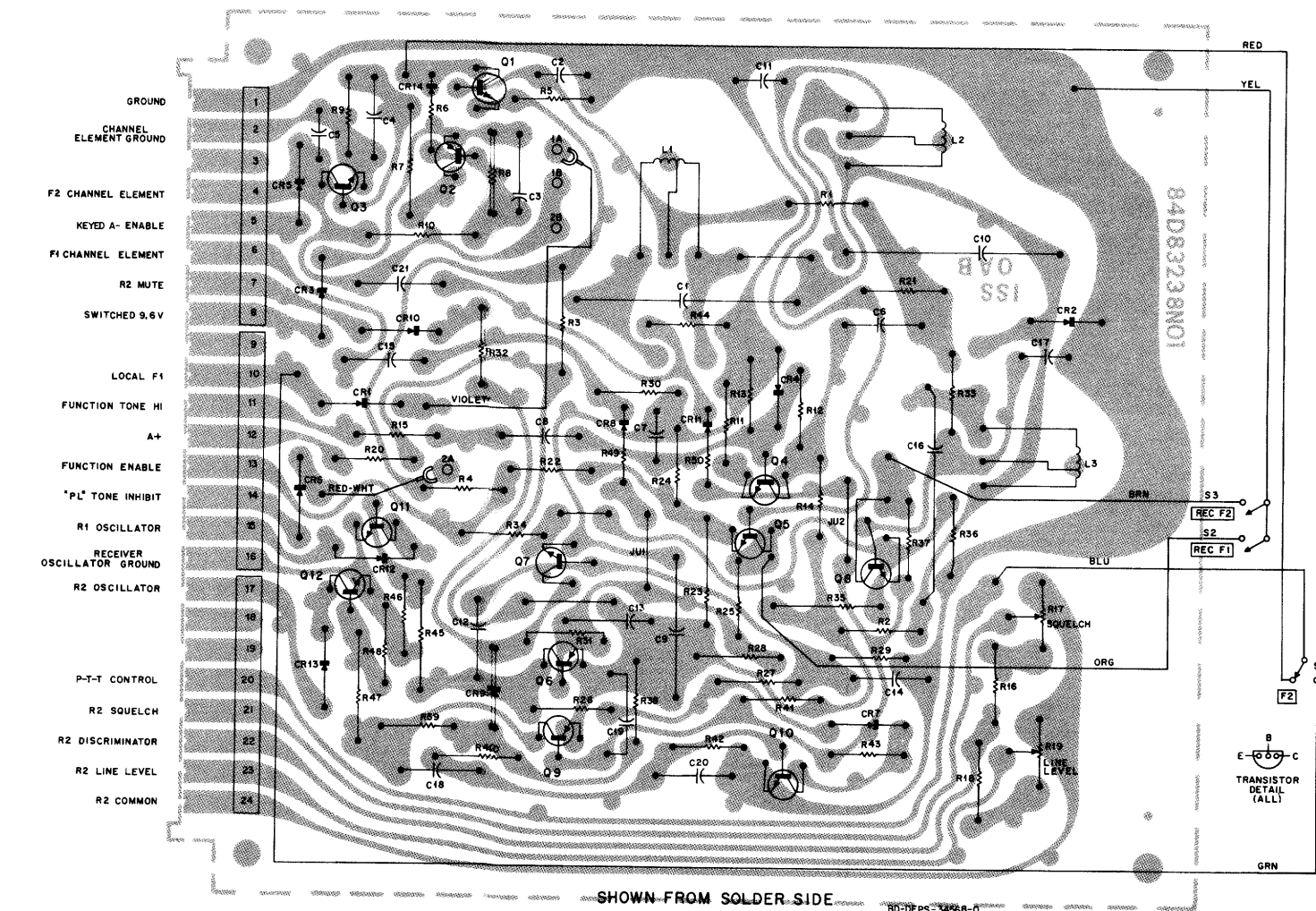
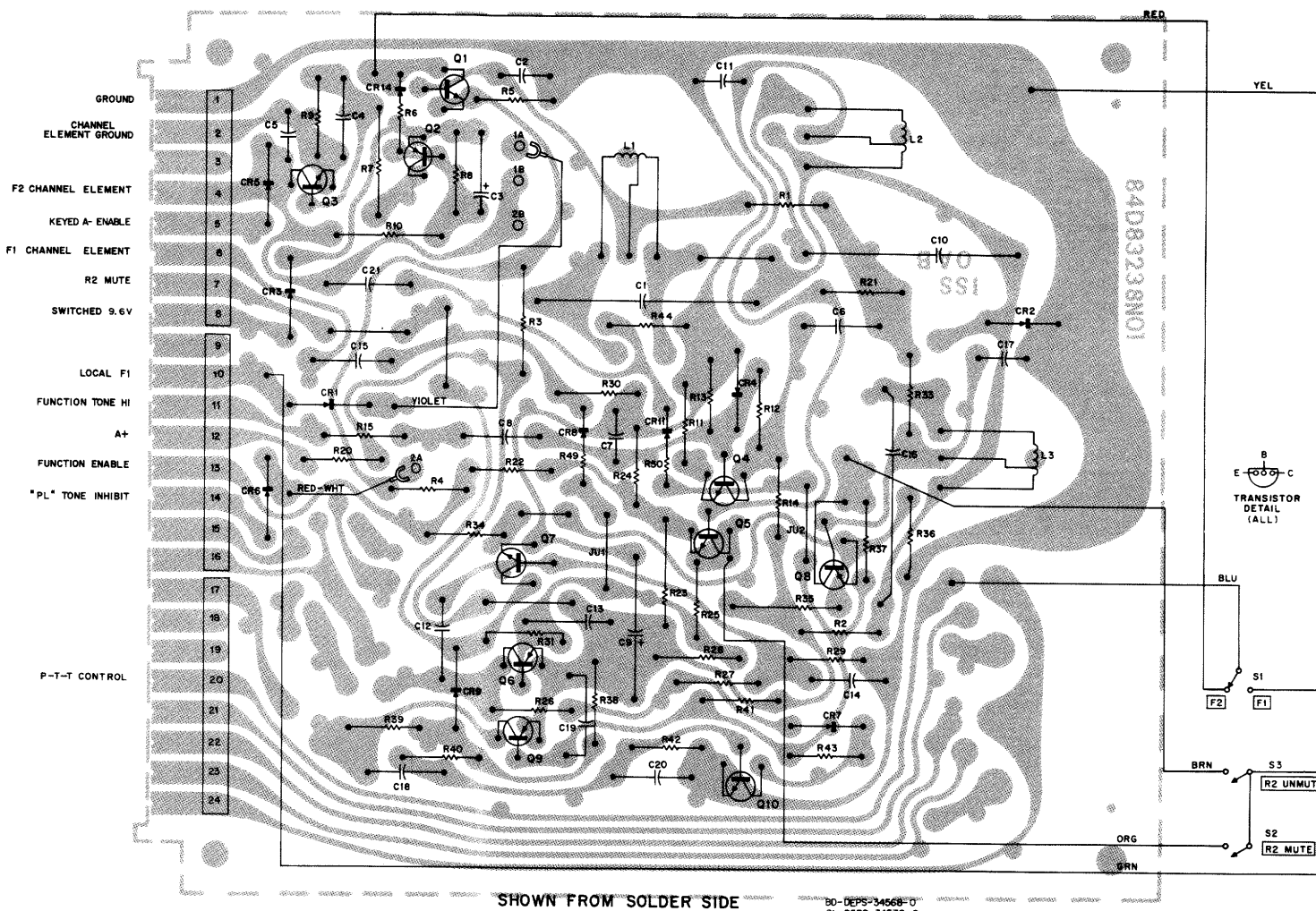
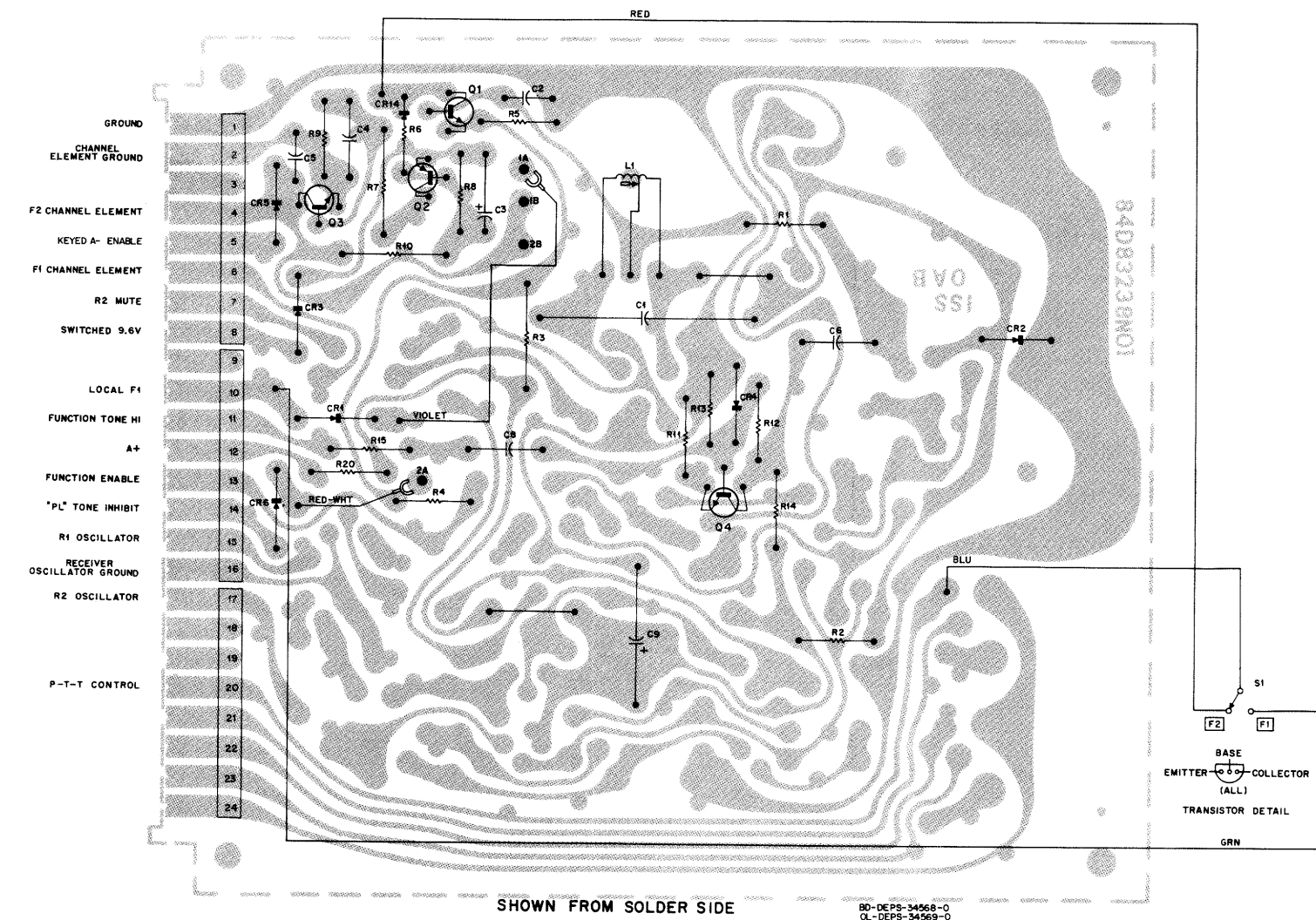
Circuit Board Detail & Schematic Diagram
 Motorola No. **68P81062E21-A**
 (Sheet 1 of 3)
 11/1/85-UP

F2 TONE CONTROL MODULE
 MODEL TRN5325A
F2-R2 MUTE TONE CONTROL MODULE
 MODEL TRN5326A
C2-R2 TONE CONTROL MODULE
 MODEL TLN5308A

TRN5325A F2 TONE CONTROL

TRN5326A F2-R2 MUTE TONE CONTROL

TLN5308A C2-R2 TONE CONTROL



parts list

reference symbol	suffix	application
No Suffix		All Models
A		TRN5325A
B		TRN5326A
C		TRN5317A

This parts list covers 4 models of the Mode Mute & Decoder Bd. modes. Where differences exist a code is added to the reference symbol to indicate the applicable unit.

TRN5325A Tone Decoder Module, F2 Control
 TRN5326A Tone Decoder Module, F2 R2 Mute Control
 TRN5317A Tone Decoder Board, Paging Control
 TRN5308A Tone Decoder Board, C2-R2 Control
 PL-7981-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1 (A, B, C)	8-84326A15	capacitor, fixed: uF ± 10%; 50 V; unless otherwise stated
C2 (A, B, C)	21-82187B29	0069 ± 2%
C3 (A, B, C)	23-82783B08	001; 100 V
C4 (A, B, C)	8-82905G02	1 ± 20%; 35 V
C5 (A, B, C)	21-82187B29	022
C6 (A, B, C)	8-82905G11	001; 100 V
C7 (A, B, C)	21-82187B29	001; 100 V
C8 (A, B, C)	8-82905G11	0.22
C9 (A, B, C)	23-865136	15 ± 20%; 25 V
C10 (B)	8-84326A16	0077 ± 2%
C11 (B)	21-82187B29	001; 100 V
C12 thru 15 (B)	8-82905G11	0.22
C16 (B)	8-84326A17	00085 ± 2%
C17 (B)	21-82187B29	001; 100 V
C18 thru 21 (B)	8-82905G11	0.22
CR1 thru 5 (A, B, C)	48-83654H01	diode (see note) silicon
CR6 thru 9 (B)	48-83654H01	silicon
CR10 thru 13 (B)	48-83654H01	silicon
CR14 (B)	48-83654H01	silicon
CR15 (A, B)	48-83654H01 or 48-84616A01	silicon hot carrier
L1 (A, B, C)	1-80702B11	coil, air; 1 H; includes ground clip
L2, 3 (B)	1-80702B11	1 H; includes ground clip
Q1 (A, B, C)	48-869570	transistor (see note) NPN; type M9570
Q2 (A, B, C)	48-869571	PNP; type M9571
Q3 (A, B, C)	48-869567	NPN; type M9567
Q4 (A, B, C)	48-869570	NPN; type M9570
Q5 (B)	48-869570	NPN; type M9570
Q6 (B)	48-869571	PNP; type M9571
Q7, 8 (B)	48-869570	NPN; type M9570
Q9 (B)	48-869571	PNP; type M9571
Q10 (B)	48-869570	NPN; type M9570
Q11, 12	48-869567	NPN; type M9567
R1 (A, B, C)	6-11009C79	resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R2 (A, B, C)	6-11009C57	18k
R3 (A, B, C)	6-125A59	2.2k
R4 (A, B, C)	6-11009C33	2.7k; 1/2 W
R5 (A, B, C)	6-11009C43	1.5k
R6 (A, B, C)	6-11009C49	2k
R7 (A, B, C)	6-125C49	1k; 1/2 W
R8 (A, B, C)	6-11009C73	10k
R9 (A, B, C)	6-11009C49	1k
R10 (A, B, C)	6-125C49	1k; 1/2 W
R11 (A, B, C)	6-11009C09	22
R12 (A, B, C)	6-11009C93	68k
R13 (A, B, C)	6-11009C63	27k
R14 (A, B, C)	6-11009C49	1k
R15 (A, B, C)	6-11009C43	560
R16 (C)	6-11009C61	3.3k
R17 (C)	18-83083G03	variable; 25k
R18 (C)	6-11009C61	3.3k
R19 (C)	18-83083G03	variable; 25k
R20 (A, B, C)	6-11009C01	10
R21 (B)	6-11009C81	22k
R22 (B)	6-84444A07	221 ± 1%
R23 (B)	6-84444A09	2.43 ± 1%
R24 (B)	6-11009C49	1k
R25 (B)	6-11009C57	2.2k
R26, 27 (B)	6-11009C43	560
R28 (B)	6-11009C65	4.7k
R29 (B)	6-11009C43	560
R30 (B)	6-11009D10	330k
R31 (B)	6-11009C65	4.7k
R32 (C)	6-11009C61	3.3k
R33 (B)	6-11009C79	18k
R34 (B)	6-84444A07	221 ± 1%
R35 (B)	6-84444A08	2.21k ± 1%
R36 (B)	6-11009C49	1k
R37, 38 (B)	6-11009C57	2.2k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R39, 40	6-11009C43	560
R41 (B)	6-11009C65	4.7k
R42 (B)	6-11009C43	560
R43 (B)	6-11009C65	4.7k
R44 (B)	6-11009D10	330k
R45 (C)	6-125C53	1.5k; 1/2 W
R46 (C)	6-11009C61	3.3k
R47 (C)	6-125C53	1.5k; 1/2 W
R48 (C)	6-11009C61	3.3k
R49, 50 (B)	6-11009C55	1.8k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
S1 (A, B)	40-83204B01	switch; slide; dpdt
S2, 3 (B)	40-83468E01	slide; spdt

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1-80702B15	ASSEMBLY, wire and terminal; includes: CONTACT, receptacle	
39-10184A24	CONTACT, receptacle	
37-82603D01	SLEEVING, coded #1	
1-80702B16	ASSEMBLY, wire and terminal; includes: CONTACT, receptacle	
39-10184A24	CONTACT, receptacle	
37-82603D02	SLEEVING, coded #2	
1-80754D50	ASSEMBLY, circuit board; includes: CONTACT, plug	
39-10184A30	CONTACT, plug	
1-80757D84	ASSEMBLY PANEL; includes: (TRN5325A) refer part S1	
64-83130L02	PANEL, screened	
1-80757D85	ASSEMBLY PANEL; includes: (TRN5326A) refer parts S1, S2, S3	
64-83131L02	PANEL, screened	
9-83497F01	RECEPTACLE, female; 8-contact; 3 used (PCB Edge)	
5-84220B01	GROMMET; 2 used (TRN5325A, 5326A)	
3-84256M01	SCREW, tapping; 2 used (TRN5325A, 5326A)	
42-10217A02	STRAP, tie; .019 x 3.62" WHT	

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

reference symbol	suffix	application
No Suffix		All Models
A		TRN5309A

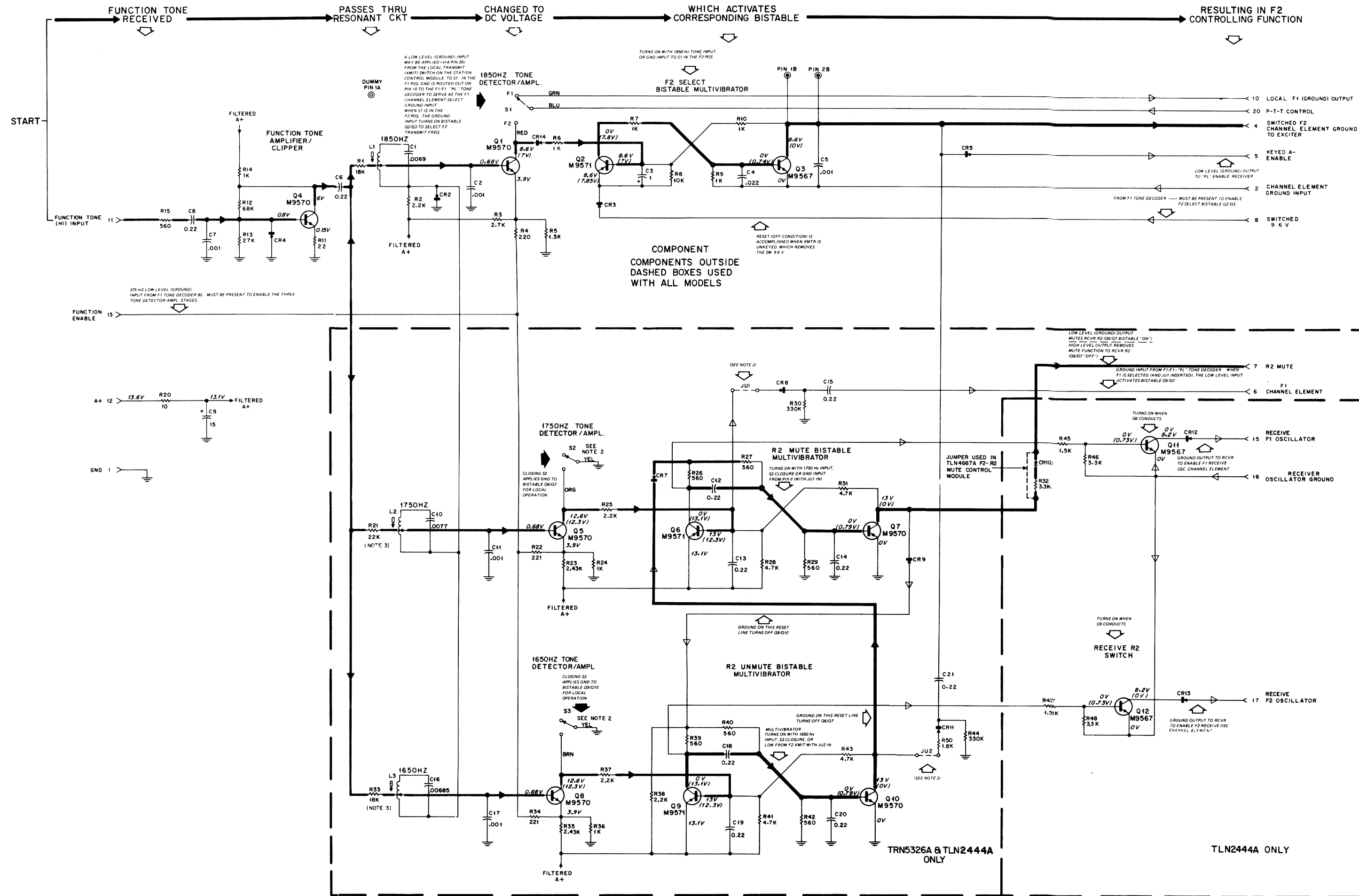
This parts list covers 2 models of the Panel Decoder modes. Where differences exist a code is added to the reference symbol to indicate the applicable unit.

TRN5309A C2-R2 Control Module Panel
 TRN5318A Paging Control Module Panel
 PL-7982-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
S1	40-83204B01	switch, slide; dpdt
S2 (A)	40-83468E01	spdt
S3	40-83468E01	spdt

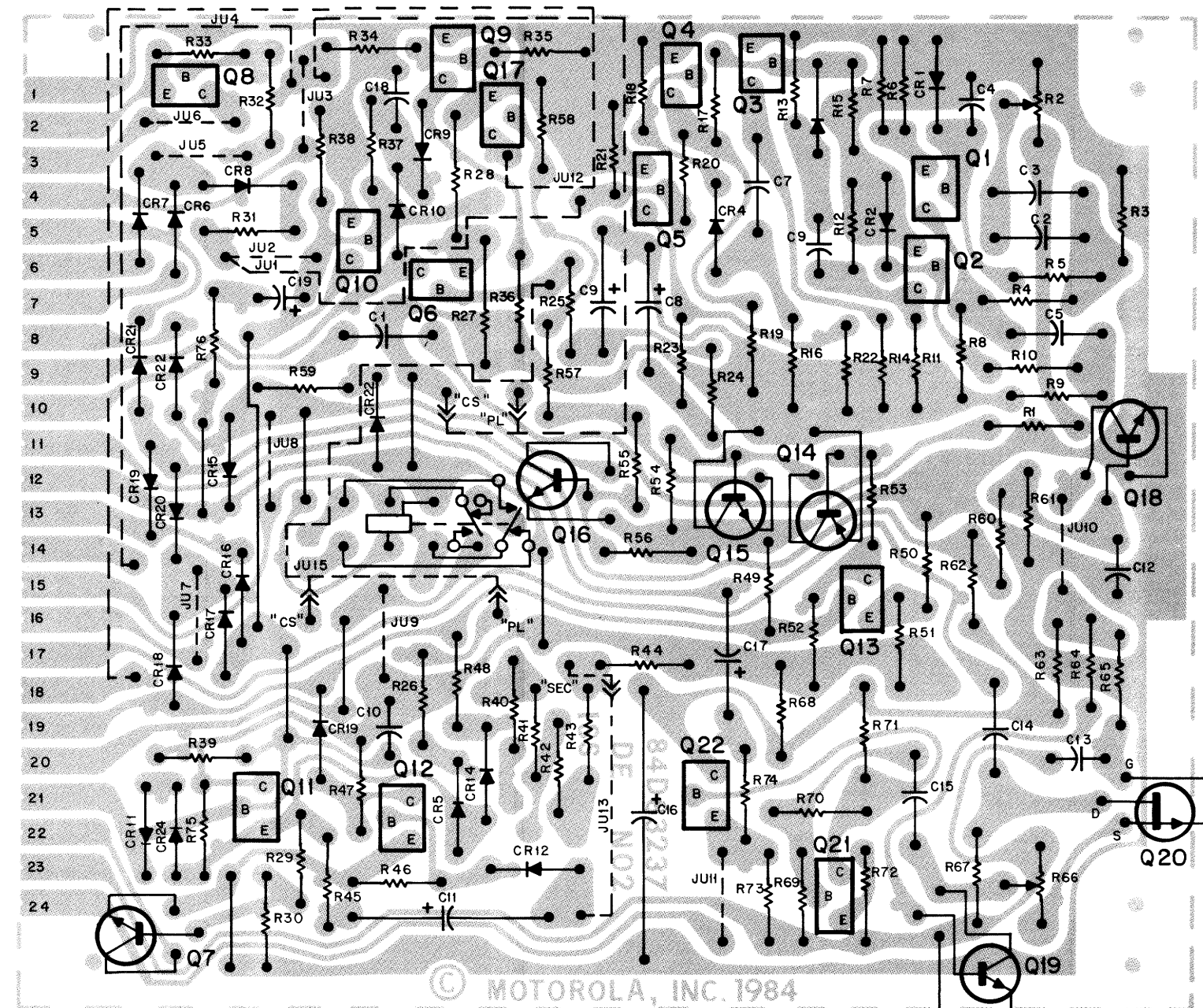
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
3-84256M01	SCREW, tapping; 2 used	
64-83121L02	PANEL, screened (TRN5309A)	
64-83132L02	PANEL, screened (TRN5318A)	

F2 TONE CONTROL MODULE
MODEL TRN5325A
F2-R2 MUTE TONE CONTROL MODULE
MODEL TRN5326A
C2-R2 TONE CONTROL MODULE
MODEL TLN2444A



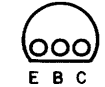
SQUELCH GATE MODULE

MODEL TRN5324A



SOLDER SIDE ● BD-CEPS-34576-A SHOWN FROM SOLDER SIDE
 ○ OL-CEPS-34577-B

TRANSISTOR BASE DETAILS



BOTTOM VIEW
 ALL TRANSISTORS
 EXCEPT Q20



BOTTOM VIEW
 OF Q20

NOTE:
 Q6, AND Q14 ARE PNP TYPE,
 ALL THE REST ARE NPN TYPE
 EXCEPT Q20 WHICH IS A FET

parts list

TRN5324A Squelch Gate Module

PL-7961-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1	8-82905G11	capacitor, fixed: pF ± 10%; 50 V;
C2	8-82905G01	0.22 uF
C3		0.1 uF
C4	21-859943	NOT USED
C5	8-82905G02	250 ± 5%; 500 V
C6	21-850510	0.22 uF
C7	21-850994	470; 300 V
C8,9	23-82783B25	3000 ± 5%; 500 V
C10	21-82187B29	4.7 uF; 25 V
C11	23-865594	.001 uF; 100 V
C12	21-82428B25	68 uF; 15 V
C13	21-83596E23	.002 uF ± 20%; 500 V
C14,15	8-82905G11	0.047 uF; 200 V
C16	23-82783B04	0.22 uF
C17	23-82783B25	100 uF ± 20%; 25 V
C18	21-82428B62	4.7 uF; 25 V
C19	23-11019A40	.01 uF
CR1 thru 23	48-83654H01	semiconductor device, diode: (see note)
CR24	48-83654H01	silicon
Q1	48-869594	silicon
Q2 thru 5	48-869642	transistor: (see note)
Q6	48-869643	NPN; type M9594
Q7	48-869642	PNP; type M9642
Q8	48-869642	NPN; type M9642
Q9 thru 13	48-869642	NPN; type M9567
Q14	48-869643	PNP; type M9642
Q15	48-869642	NPN; type M9642
Q16,17	48-869568	NPN; type M9568
Q18,19	48-869642	NPN; type M9642
Q20	48-869660	FET, p-channel; type M9660
Q21,22	48-869642	NPN; type M9642
R1	6-11009C61	resistor, fixed: ± 10%; 1/4 W;
R2	18-83083G03	unless otherwise stated
R3	6-11009C83	3.3k
R4	6-11009D06	variable; 25k ± 30%
R5	6-11009C11	27k
R6	6-11009C13	150k
R7		27
R8	6-11009C49	33 ± 5%
R9	6-11009C89	1k ± 5%
R10	6-11009C65	47k
R11	6-11009C57	4.7k
R12	6-11009C69	2.2k
R13	6-11009C85	6.8k
R14	6-11009C53	33k
R15	6-11009C81	1.5k
R16	6-11009C85	22k
R17,18	6-11009C81	33k ± 5%
R19	6-11009C81	22k
R20	6-11009C73	2.7k
R21	6-11009C81	10k
R22,23	6-11009C61	22k
R24	6-11009C81	3.3k
R25,26	6-11009C73	22k
R27	6-125A37	10k
R28	6-125A42	330; 1/2 W
R29	6-11009C79	510 ± 5%; 1/2 W
R30	6-11009C63	18k
R31	6-11009C71	3.9k
R32	6-11009C53	8.2k
R33	6-11009C61	1.5k
R34	6-11009C73	3.3k
R35	6-11009C83	10k
R36	6-11009C73	27k
R37	6-11009C71	10k
R38	6-11009C75	8.2k
R39	6-11009C65	12k
R40	6-11009C95	4.7k
R41	6-11009C87	82k
R42	6-11009C79	39k
R43	6-11009C71	18k
R44	6-11009C73	8.2k
R45	6-11009C37	10k
R46	6-11009C89	330
R47,48	6-11009C73	47k
R49	6-11009C89	10k
R50	6-11009C49	47k
R51	6-11009C63	1k
R52,53	6-11009C81	3.9k
R54	6-11009C89	22k
R55	6-11009C53	47k
R56	6-11009C73	82k
R57	6-11009C53	39k
R58	6-11009C73	1.5k
R59	6-11009C67	10k
R60	6-11009C63	5.6k
R61	6-11009C53	3.9k
R62	6-11009C73	1.5k
R63	6-11009C65	10k
		4.7k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R64	6-11009C91	56k
R65	6-11009D22	1 m
R66	18-83083G02	variable; 500k ± 30%
R67	6-11009D22	1 m
R68	6-11009C25	100
R69	6-11009D06	220k
R70	6-11009D18	680k
R71	6-11009C83	27k
R72	6-11009C47	820
R73	6-11009C49	1k
R74	6-11009C45	680
R75, 76	6-11009C89	47k

mechanical parts

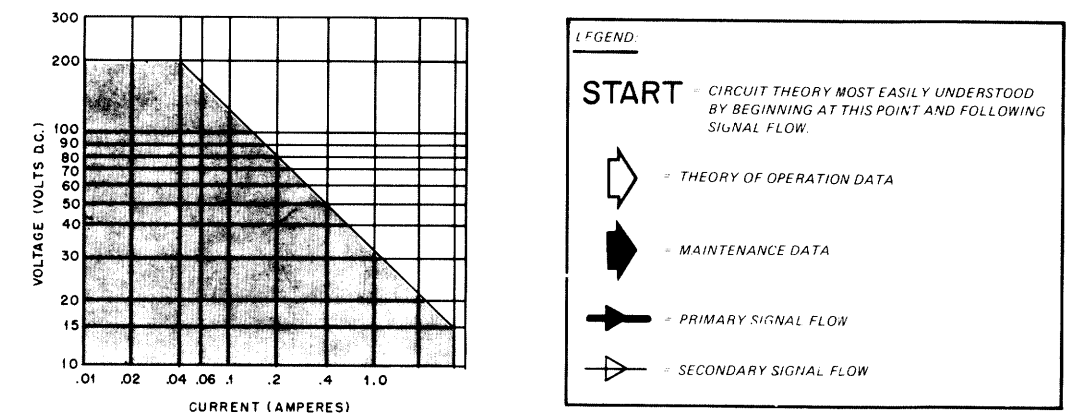
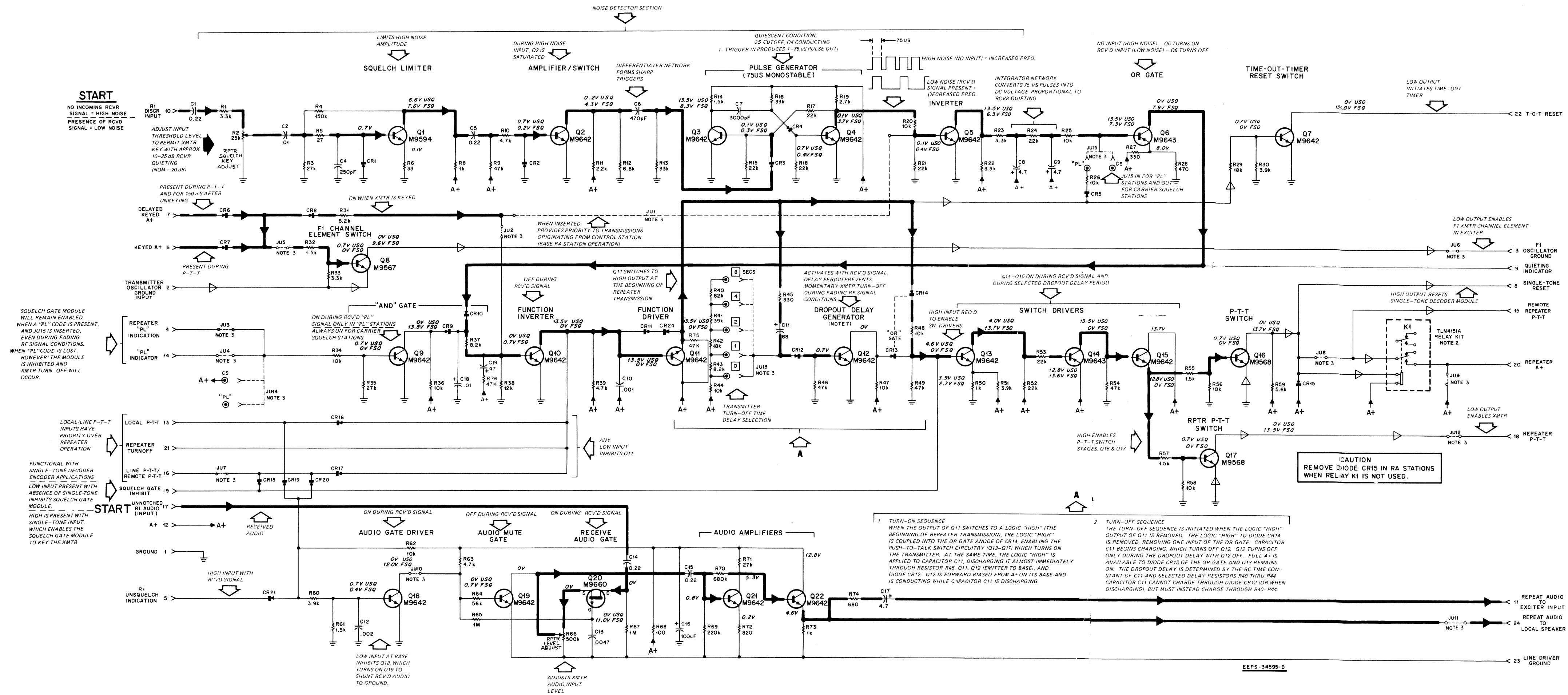
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-84256M01	SCREW, tapping; 2 used
	43-82721C01	BUSHING, snap; 2 used
	64-83129L02	PANEL, screened
	5-84220B01	GROMMET; 2 used
	9-83497F01	RECEPTACLE, 8 contact; 3 used (PCB Edge Connector)
	39-10184A24	RECEPTACLE, contact; 3 used
	39-10184A10	CONTACT, plug; 9 used

note: Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.

TLN4151A Relay Kit PL-455-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
See Schematic	48-82392B03	silicon (reverse voltage protection)
K1	80-84201A01	relay, armature: 2 form "C", coil res. 200 ohms
	43-84920H01	SPACER, relay

SQUELCH GATE MODULE MODEL TRN5324A



LOAD MUST BE IN SHADED AREA
TLN4151A RELAY KIT
RELAY CONTACT RATING

- NOTES:
- Unless otherwise stated: resistor values are in ohms (k = 1000). Capacitor values are in microfarads.
 - Relay kit is an optional accessory item. Refer to relay application chart for CR15, JU8 and JU9 usage with relay.
 - Refer to jumper table.
 - Voltage readings shown are for two conditions:
USQ = Unsquelled
FSQ = Fully Squelched
 - Jumpers JU5 and JU6 are OUT for tone controlled stations and IN for dc controlled stations.

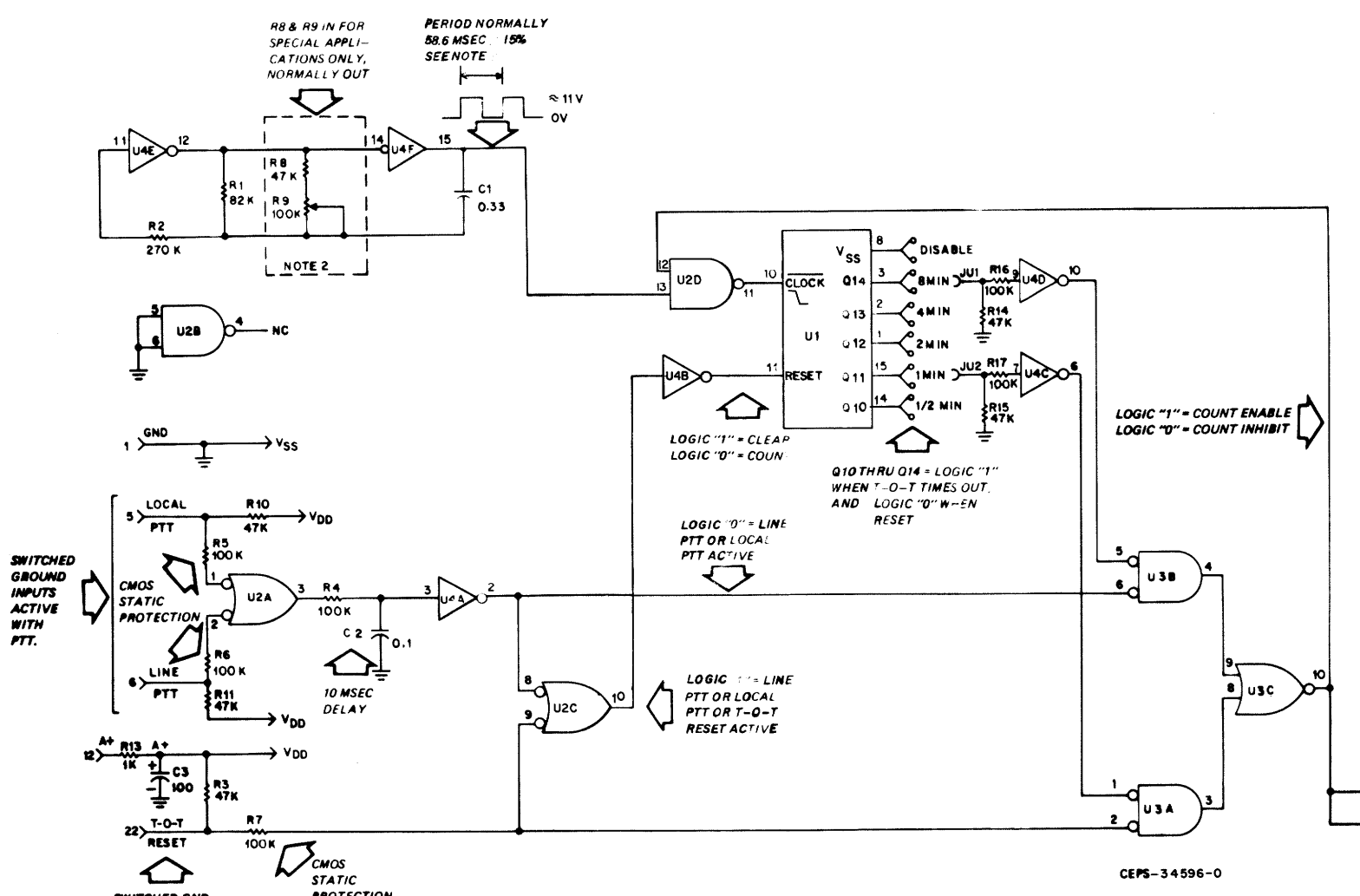
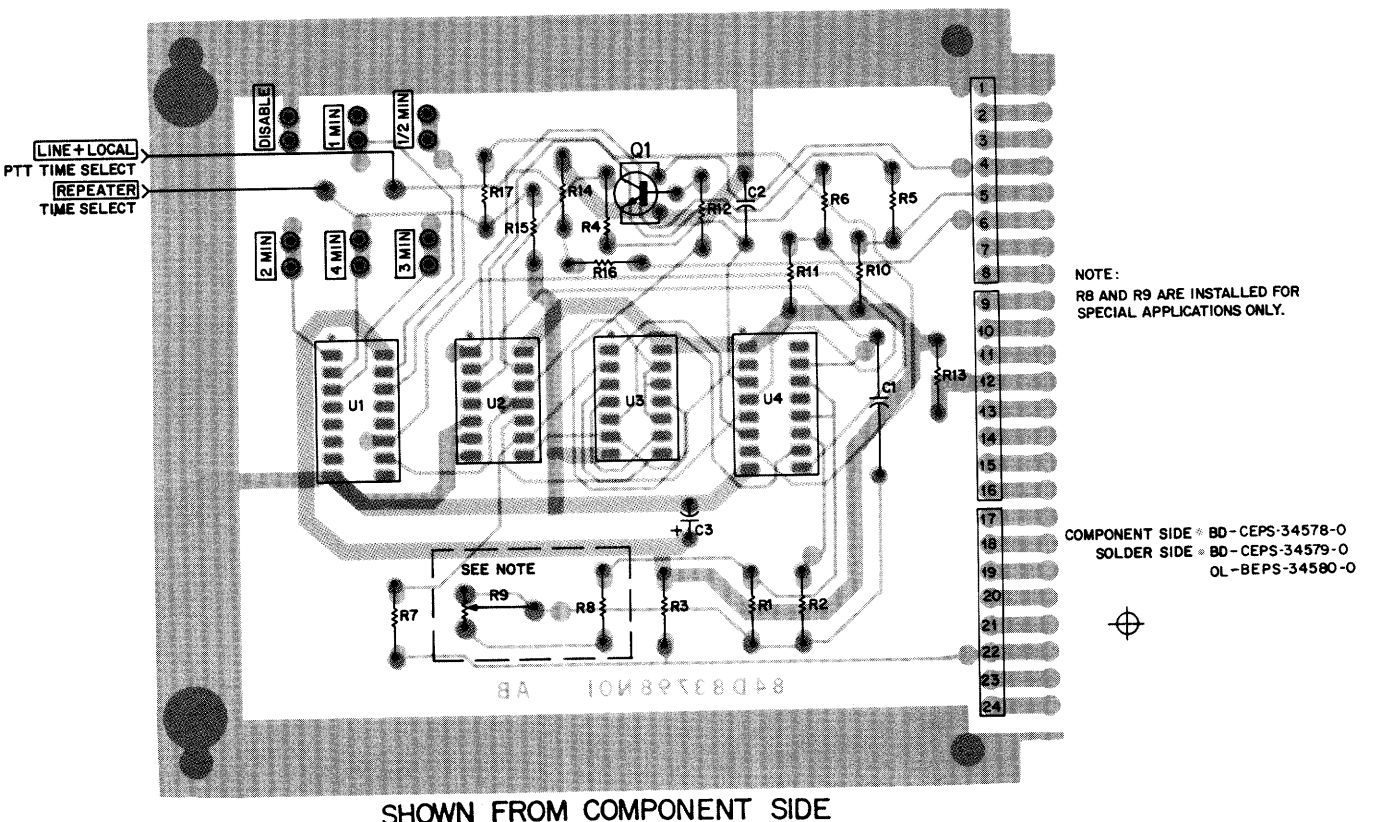
Jumper Table

Application	JU1	JU2	JU3	JU4	JU5	JU6	JU7	JU8	JU9	JU10	JU11	JU12	JU13	JU14	JU15
Line Control Base	OUT	OUT	IN	OUT	OUT	OUT	IN	IN	IN	OUT	OUT	OUT	Selected delay	IN	
Repeater (RT) Station Without Wire Line Control	OUT	OUT	IN	IN PL	IN	IN	IN	IN	IN	IN	IN	IN	Selected Delay	IN CS	IN PL
Repeater (RT) Station with Wire Line Control	OUT	OUT	IN	IN PL	OUT	OUT	IN	IN	IN	IN	OUT	IN	Selected Delay	IN CS	IN PL
Base (RA) Station	IN	OUT	IN	IN PL	NOTE 5	NOTE 5	IN	*	*	OUT	OUT	OUT	Selected Delay	IN CS	IN PL
Repeater (RA) Station	OUT	OUT	IN	IN	NOTE 5	NOTE 5	OUT	*	*	OUT	OUT	OUT	Selected Delay	IN CS	IN PL
Community Repeater (RT) Station	OUT	OUT	IN	IN	IN	IN	IN	IN	IN	IN	IN	IN	Selected Delay	OUT	IN

***Relay Application Chart**

TLN4151A Relay Kit	Diode CR15	JU8	JU9
Not Used	OUT	IN	IN
Used	IN	OUT	OUT

TIME-OUT TIMER MODULE MODEL TRN5295A

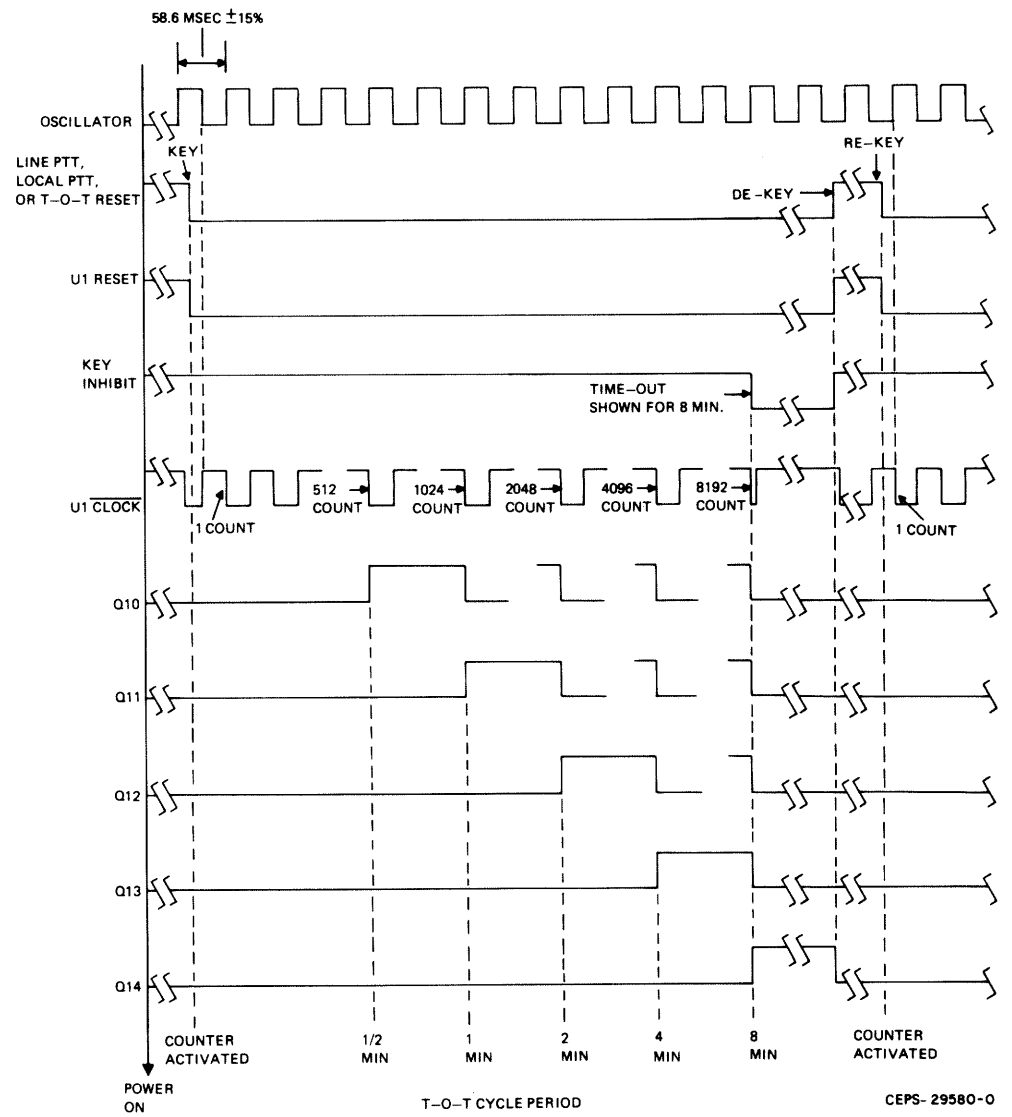
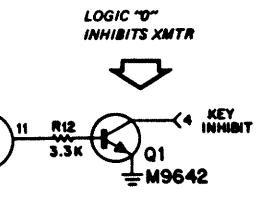


NOTES:

- Unless otherwise stated: resistor values are in ohms, capacitor values are in microfarads.
- For special applications only, R8 and R9 are installed to provide variable frequency (see chart). R1 must be removed in these applications.
- In special applications only: period can be varied, from approximately 36 msec to approximately 100 msec.
- This is a functional positive logic diagram. Refer to basic logic circuit guide, 68P81106E88.

Symbol	Description	Supply (VDD) Pin No.	Ground (VSS) Pin No.
U1	14-bit binary counter	16	8
U2	Quad 2-input nand gate	14	7
U3	Quad 2-input nor gate	14	7
U4	Hex inverter/buffer	1	8

Jumper	Description
JU1	Line & local PTT time select
JU2	Repeater time select



GENERAL

The time-out timer (T-O-T) module is standard in all repeater (RT) models and is an optional accessory for base station models. It limits the period of time the transmitter can be keyed. It can be set to limit transmission time from line controlled operation, and to limit the transmission time of individual repeater users. The timing period of each is independent of the other. The unit can be preset for 1/2, 1, 2, 4, or 8 minutes or unlimited continuous keying by jumper selection.

CIRCUIT DESCRIPTION

The initial condition of the time-out-timer module is: local PTT, line PTT and T-O-T reset at a high (logic "1") level, with A+ applied to the module.

The high local and line PTT inputs to U2A cause its output to be low. This low is inverted by U4A producing a high input to U2C-8. This high input, plus the high T-O-T reset input to U2C-9, forces the output at U2C-10 low. This low is inverted by U4B, producing a high at counter U1 reset input. The high reset input clears the counter by forcing and holding all of the outputs low.

Jumpers JU1 and JU2 connect two low outputs of U1 to the inputs of U4D and U4C, respectively. A local or line PTT input (base station) executes the T-O-T timing function via JU1. A T-O-T reset input (repeater PTT) executes the T-O-T timing function via JU2.

The low outputs of U1 are inverted by U4D and U4C, producing high inputs at U3B-5 and U3A-1, respectively. These high inputs, plus the highs from the T-O-T reset input and U4A-2, cause the outputs of U3B and U3A to be low. These low inputs are applied to U3C and cause its output to be high. This high is applied to U2D, enabling it, and to U3D, resulting in a high at the key inhibit output of the module. This high output allows the station transmitter to operate if keyed.

The timing function is started by a low line PTT, a low local PTT, or a low T-O-T reset signal from the squelch gate module. A low on the local PTT or the line PTT input causes the output of U2A to be high. This high is delayed by R4, C2 and is inverted by U4A producing a low input to U2C-8. This low input, or a low T-O-T reset input to U2C-9, causes the output of U2C to be high which is inverted by U4B. The resulting low enables counter U1. The oscillator output passes through U2D to the "CLOCK" input of U1. For every negative-going transition at the "CLOCK" input of counter U1, the counter is advanced by one count.

Due to the period of the oscillator: 512 counts corresponds to 30 seconds (Q10 output); 1024 counts corresponds to 1 minute (Q11 output); 2048 counts corresponds to 2 minutes (Q12 output); 4096 counts corresponds to 4 minutes (Q13 output); and 8192 counts corresponds to 8 minutes (Q14 output). (See timing diagram.)

Assume that both time select jumpers are connected to the Q10 outputs of U1. The Q10 output goes high at the end of the 30 second timing period. This high is inverted by U4D and U4C, producing low inputs at U3B-5 and U3A-1, respectively. These low inputs, plus either the low from the T-O-T reset input or the low output of U4A-2, cause the output of U3A or U3B, respectively, to go high. The high output of either U3A or U3B causes the output of U3C to go low. This low is applied to U2D, which disables it and prevents any further transitions from reaching the "CLOCK" input of U1.

The low U3C output is also applied to U3D, which functions as an inverter and causes Q1 to turn on. This results in a low at the key inhibit output of the module which inhibits the station transmitter.

The transmitter will remain inhibited until the switched ground start signal is removed from the module input. At that time, the module returns to its initial condition,

which results in the counter being held in reset (all outputs low) and the station transmitter being uninhibited. When a start signal is again applied, another timing cycle begins.

If line and local PTT time select jumper JU1 is connected to the 30 second output, and repeater time select jumper JU2 is connected to the 2 minute output; then a start signal (switched ground) on either the line PTT or the local PTT input will inhibit the transmitter after 30 seconds, or a start signal on the T-O-T reset input will inhibit the transmitter after 2 minutes.

If either or both of the time select jumpers are connected to the DISABLE (ground) output of U1, the corresponding start signal input(s) will not inhibit the transmitter and unlimited continuous transmission is possible.

In special applications, it may be desirable to obtain a T-O-T cycle period other than those normally available. To vary the oscillator period, remove R1 and insert R8 and R9. Connect a +13.8 V dc power supply between pin 12 and ground, pin 1. Monitor the oscillator output at U4F-15, with respect to ground.

Then, using the variable timing chart, choose an appropriate output and connect both time select jumpers

to that output. Adjust R9 for the desired (calculated) period. An audio frequency counter or an oscilloscope may be used to monitor the oscillator output.

MAINTENANCE & TROUBLESHOOTING

This module may be serviced either while connected to the station or while connected to external test equipment as described in the RF-Control Chassis section of this manual. The following check-out procedure is intended for out-of-station servicing but is functionally applicable to in-station servicing also.

CAUTION

This module uses CMOS integrated circuits which can be damaged by excessive static charges. Handle module by edges only.

Step 1. Remove the module from the chassis.

Step 2. Connect a 13.5 V dc power supply to the module so ground (-) is connected to pin 1 and the positive (+) terminal is connected to pin 12. Turn the power supply on.

Step 3. Connect a 5k ohm resistor between module pins 4 and 12.

Step 4. Connect time selection jumpers JU1 & JU2 to the "DISABLE" output (ground).

Step 5. Check the oscillator frequency with a counter connected between pin 15 of U4 and ground. The frequency should be 17.1 Hz ± 2.5 Hz. An oscilloscope may be used in place of the audio frequency counter. The oscillator period should be 58.6 msec, ± 9 msec.

Step 6. Connect a temporary jumper between module pins 5 and 1.

Step 7. Refer to the schematic and timing diagram and note the desired timing cycle for different outputs of the module. Use a stop-watch to compare the desired timing of highs and lows on a VTVM. Timing should be accurate to within ± 15%.

Step 8. Move the temporary jumper to pins 6 and 1 and repeat Step 7.

Step 9. Move the temporary jumper to pins 22 and 1 and repeat Step 7.

Step 10. Connect both time selection jumpers to "1/2

MIN" output. Module pin 4 should go low after 1/2 minute (± 4.5 sec.).

Step 11. If a defective output is not located, check connections and continuity of plating for opens and shorts.

FACTORY FIXED (±15%)	58.6 MSEC OR 17.1 HZ	Q10	Q11	Q12	Q13	Q14	DISABLE
		1/2 MIN.	1 MIN.	2 MIN.	4 MIN.	8 MIN.	INFINITY
V L A I R M I I A T B S L E	MAXIMUM 99.6 MSEC OR 10.0 HZ MINIMUM 35.2 MSEC OR 28.4 HZ	51 SEC OR 0.85 MIN	102 SEC OR 1.7 MIN	204 SEC OR 3.4 MIN	408 SEC OR 6.8 MIN	816 SEC OR 13.6 MIN	INFINITY
		18 SEC OR 0.3 MIN	36 SEC OR 0.6 MIN	72 SEC OR 1.2 MIN	144 SEC OR 2.4 MIN	288 SEC OR 4.8 MIN	INFINITY

GENERAL FORMULA: $F = (1/12)2^{(N-1)}$; WHERE 1 IS THE DESIRED TIME-OUT TIME IN SECONDS, N IS THE CHOSEN Q OUTPUT NUMBER, AND F IS THE REQUIRED OSCILLATOR FREQUENCY IN HERTZ.

FOR EXAMPLE, TO CALCULATE THE OSCILLATOR FREQUENCY NEEDED TO PRODUCE A 3 MINUTE T-O-T PERIOD, FIRST DETERMINE FROM THE ABOVE CHART WHICH OUTPUT MUST BE USED - Q12. SECOND, INSERT THE KNOWN INTO THE GENERAL FORMULA, AND CALCULATE THE REQUIRED FREQUENCY:

$$F = (1/12) \times (2^{12-1}) = (1/12) \times (60) \times (2^{12-1}) = (1/120) \times (2048) = 11.4 \text{ HZ}$$

$$\text{FOR A 5 MINUTE T.O.T. PERIOD, } F = (1/12) \times (2^{15-1}) = (1/15) \times (60) \times (2^{13-1}) = 13.7 \text{ HZ}$$

BEPS-27258-A

FUNCTION

Limits the period of time the transmitter may be keyed.

parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1	8-83813H29	capacitor, fixed: 0.33 uF ± 10%; 50 V
C2	21-82372C01	0.1 uF + 80-20%; 25 V
C3	23-84685F03	100 uF + 100-10%; 25 V
Q1	48-869642	transistor: (see note) NPN; silicon
R1	6-11009C95	resistor, fixed: ± 5%; 1/4 W; unless otherwise stated
R2	6-11009D08	82k
R3	6-11009C89	270k
R4-7	6-11009C97	47k
R8	6-11009C89	100k
R9	18-8494C07	47k (used for special applications only) var. 100k ± 20%; 0.1 W (used for special applications only)
R10,11	6-11009C89	47k
R12	6-11009C61	3.3k
R13	6-11009C49	1k
R14,15	6-11009C89	47k
R16,17	6-11009C97	100k
U1	51-82884L42	integrated circuit: (see note) 14-bit binary counter
U2	51-82884L05	Quad, 2-input NAND gate
U3	51-82884L04	Quad, 2-input NOR gate
U4	51-82884L02	HEX inverter/buffer

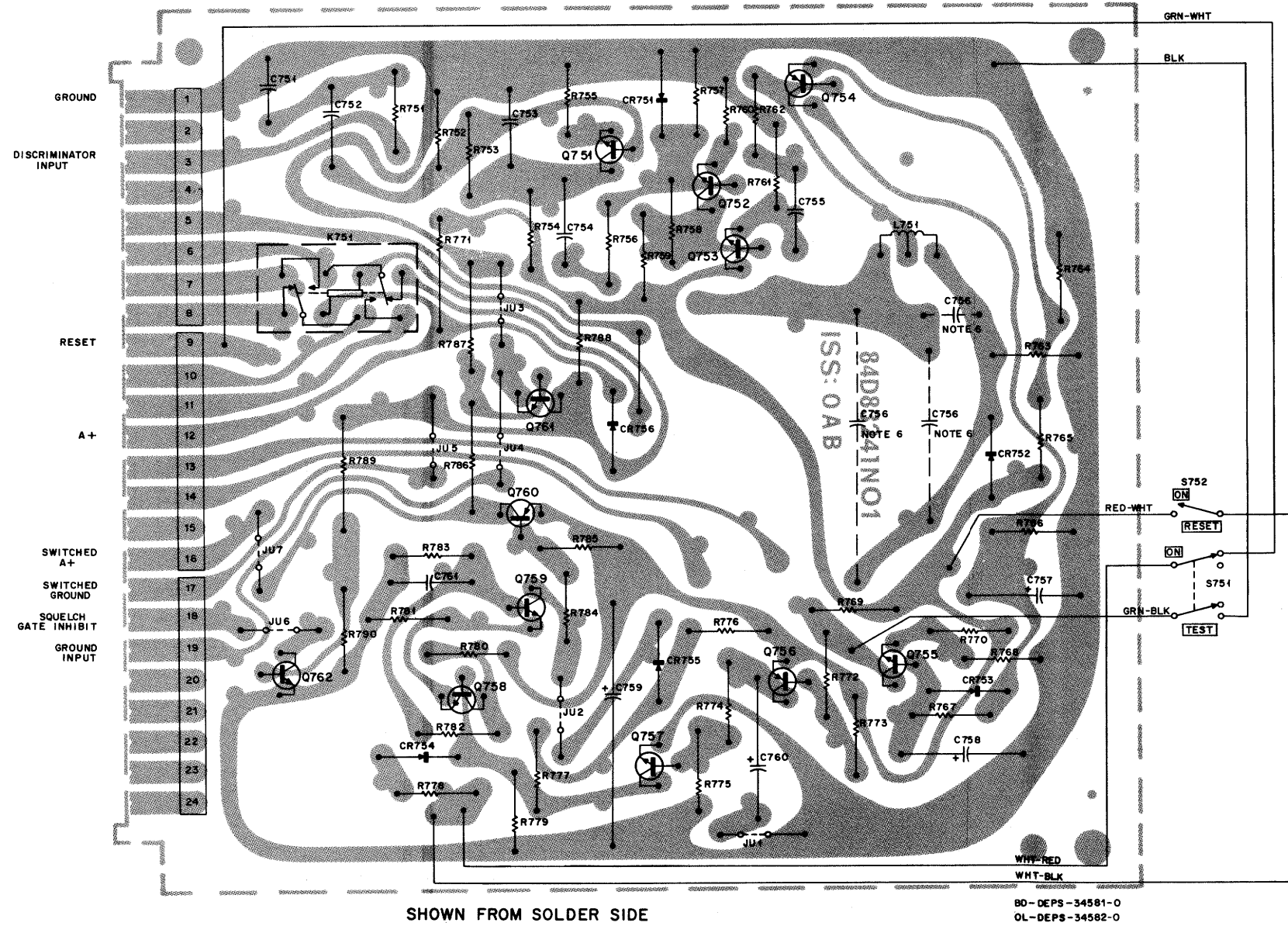
non-referenced items	
29-83167C01	TERMINAL, strain relief; 2 used
39-10184A24	CONTACT, receptacle; 2 used
9-83011H01	RECEPTACLE, board mounting; 9 used
39-10184A10	CONTACT, plug; 12 used
43-865080	BUSHING, threaded; 2 used
3-84256M01	SCREW, tapping; 2 used
5-94220B01	GROMMET; 2 used
9-83497F01	RECEPTACLE, 8 contact; 3 used (PCB Edge Connector)
64-83125L02	PANEL, screened

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

Schematic Diagram, Circuit Board Detail, Maintenance, and Parts List
Motorola No. 68P8106E24-A
11/1/85-UP

SINGLE-TONE DECODER MODULE

MODEL TLN2442A



parts list

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C751	21-82187B29	capacitor, fixed: $\mu\text{F} \pm 10\%$; 50 V; unless otherwise stated
C752	8-82905G11	.001; 100 V
C753	8-82905G01	0.22
C754	8-82905G02	.01
C755	8-82905G07	.022
C756		0.1
C757	23-82783B08	(see: FREQUENCY DETERMINING COMPONENTS)
C758	23-83214C02	$1 \pm 20\%$; 35 V
C759	23-82601A25	$15 \pm 20\%$; 25 V
C760	23-83214C02	$100 + 150-10\%$; 20 V
C761	8-82905G07	$15 \pm 20\%$; 25 V
CR751 thru 756	48-83654H01	diode: (see note) silicon
L751	1-80702B11	coil, air; assembly, inductor and ground clip (1 H)
Q751, 752, 753	48-869570	transistor: (see note) NPN; type M9570
Q754	48-869571	PNP; type M9571
Q755	48-869570	NPN; type M9570
Q756	48-869571	PNP; type M9571
Q757, 758, 759	48-869570	NPN; type M9570
Q760	48-869571	PNP; type M9571
Q761	48-869568	NPN; type M9568
R751	6-11009D06	resistor, fixed: $\pm 5\%$; 1/4 W; unless otherwise stated
R752	6-11009D08	100k
R753	6-11009D14	270k
R754	6-11009C73	470k
R755	6-11009C37	10k
R756	6-11009C81	330
R757	6-11009D08	22k
R758	6-11009D10	270k
R759	6-11009C73	330k
R760	6-11009C37	10k
R761	6-11009C37	330
R762	6-11009C57	2.2k
R763	6-11009C55	1.8k
R764	6-11009C57	2.2k
R765	6-11009C27	120
R766	6-11009C65	4.7k
R767	6-11009C89	47k
R768	6-11009C51	1.2k
R769	6-11009C89	47k
R770	6-11009C63	3.9k
R771	6-125C01	10; 1/2 W
R772	6-11009C89	47k
R773	6-11009C73	10k
R774	6-11009D06	220k
R775	6-11009C89	47k
R776	6-11009C73	10k
R777	6-11009C81	22k
R778	6-11009C77	15k
R779	6-11009C65	4.7k
R780	6-11009C57	2.2k
R781	6-11009C27	120
R782	6-11009C81	22k
R783, 784	6-11009C69	6.8k
R785	6-11009C57	2.2k
R786	6-125C49	1k; 1/2 W
R787	6-125C37	330; 1/2 W
R788	6-11009C57	2.2k
R789	6-125C81	22k; 1/2 W
R790	6-11009C73	10k

frequency determining components
The frequency-determining components of this decoder are C756 and R762. In some cases, C756 consists of two capacitors connected in parallel. Refer to the following table.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C756	8-84326A27 & 8-84326A06	600 Hz: .0057 $\mu\text{F} + 20\%$; 50 V .0095 $\mu\text{F} \pm 3\%$; 50 V 1.5k $\pm 10\%$; 1/4 W
R762	6-124C57	
C756	8-84326A26	750 Hz: .0420 $\mu\text{F} \pm 2\%$; 50 V 1.5k $\pm 10\%$; 1/4 W
R762	6-124C57	
C756	8-84326A24 & 8-84326A02	900 Hz: .0261 $\mu\text{F} \pm 2\%$; 50 V .0030 $\mu\text{F} \pm 3\%$; 50 V 2.2k
R762	6-124C57	
C756	8-84326A23	1050 Hz: .0213 $\mu\text{F} \pm 2\%$; 50 V 3.3k
R762	6-124C61	
C756	8-84326A08 & 21-859947	1200 Hz: .0158 $\mu\text{F} \pm 3\%$; 50 V 510 pF $\pm 5\%$; 500 V 3.3k
R762	6-124C61	

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C756	8-84326A20	1350 Hz: .0129 $\mu\text{F} \pm 2\%$; 50 V 4.7k
R762	6-124C65	
C756	8-84326A18 & 21-848236	1500 Hz: .0098 $\mu\text{F} \pm 2\%$; 50 V 650 pF $\pm 5\%$; 300 V 6.8k
R762	6-124C69	
C756	8-84326A17	1650 Hz: .00865 $\mu\text{F} \pm 2\%$; 50 V 6.8k
R762	6-124C69	
C756	8-84326A05	1800 Hz: .0073 $\mu\text{F} \pm 3\%$; 50 V 10k
R762	6-124C73	
C756	8-84326A14	1950 Hz: .0062 $\mu\text{F} \pm 2\%$; 50 V 10k
R762	6-124C73	
C756	8-84326A30	2100 Hz: .0045 $\mu\text{F} \pm 1\%$; 50 V 820 pF $\pm 2\%$; 300 V 15k
R762	8-21-873269 & 6-124C77	
C756	8-84326A30 & 21-840047	2250 Hz: .0045 $\mu\text{F} \pm 1\%$; 50 V 150 pF $\pm 5\%$; 500 V 15k
R762	6-124C77	
C756	8-84326A03	2400 Hz: .0042 $\mu\text{F} \pm 3\%$; 50 V 18k
R762	6-124C79	
C756	8-84326A02	2550 Hz: .0030 $\mu\text{F} \pm 3\%$; 50 V 650 pF $\pm 5\%$; 300 V 22k
R762	6-124C81	
C756	8-84326A02 & 21-859942	2700 Hz: .0030 $\mu\text{F} \pm 3\%$; 50 V 220 pF $\pm 5\%$; 500 V 22k
R762	6-124C81	
C756	8-84326A02	2850 Hz: .0030 $\mu\text{F} \pm 3\%$; 50 V 22k
R762	6-124C81	
C756	8-84326A01 & 21-859947	3000 Hz: .0021 $\mu\text{F} \pm 5\%$; 500 V 510 pF $\pm 5\%$; 500 V 27k
R762	6-124C83	
C756	8-84326A01 & 21-859178	3150 Hz: .0021 $\mu\text{F} \pm 5\%$; 50 V 270 pF $\pm 5\%$; 300 V 33k
R762	6-124C85	
C756	8-84326A01	3300 Hz: .0021 $\mu\text{F} \pm 5\%$; 500 V 33k
R762	6-124C85	
mechanical parts		
	42-10217A02	STRAP, tie; 2 used
	5-84220B01	GROMMET; 2 used
	9-83497F01	RECEPTACLE, female; 8-contact; 3 used (PCB Edge)

TRN5306A Single-Tone Decoder Module Panel PL-7980-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
S751	40-83204B01	switch, slide: dpdt
S752	40-83468E01	spdt
mechanical parts		
	3-84256M01	SCREW, tapping; 2 used
	1-80757D80	ASSEMBLY, panel includes ref. items S751, 752, and: PANEL, screened
	64-83136L02	

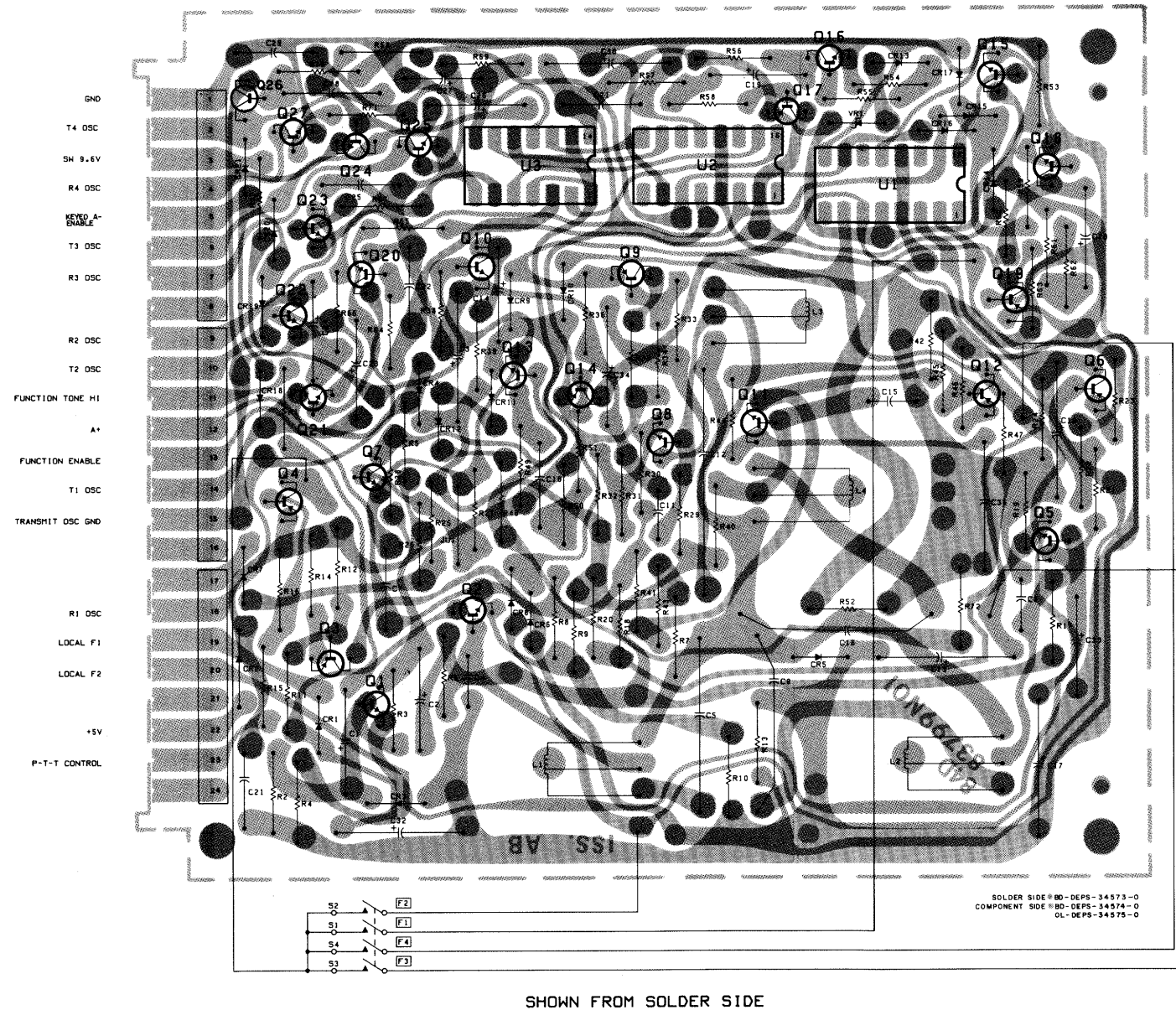
TLN4151A Relay Kit PL-455-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
See Schematic	48-82392B03	diode: silicon (reverse voltage protection)
K1	80-84201A01	relay, armature: 2 form "C," coil res. 200 ohms
non-referenced item		
	43-84920H01	SPACER, relay

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

4-FREQUENCY CONTROL OPTION DECODER MODULE

MODEL TRN5296A



parts list

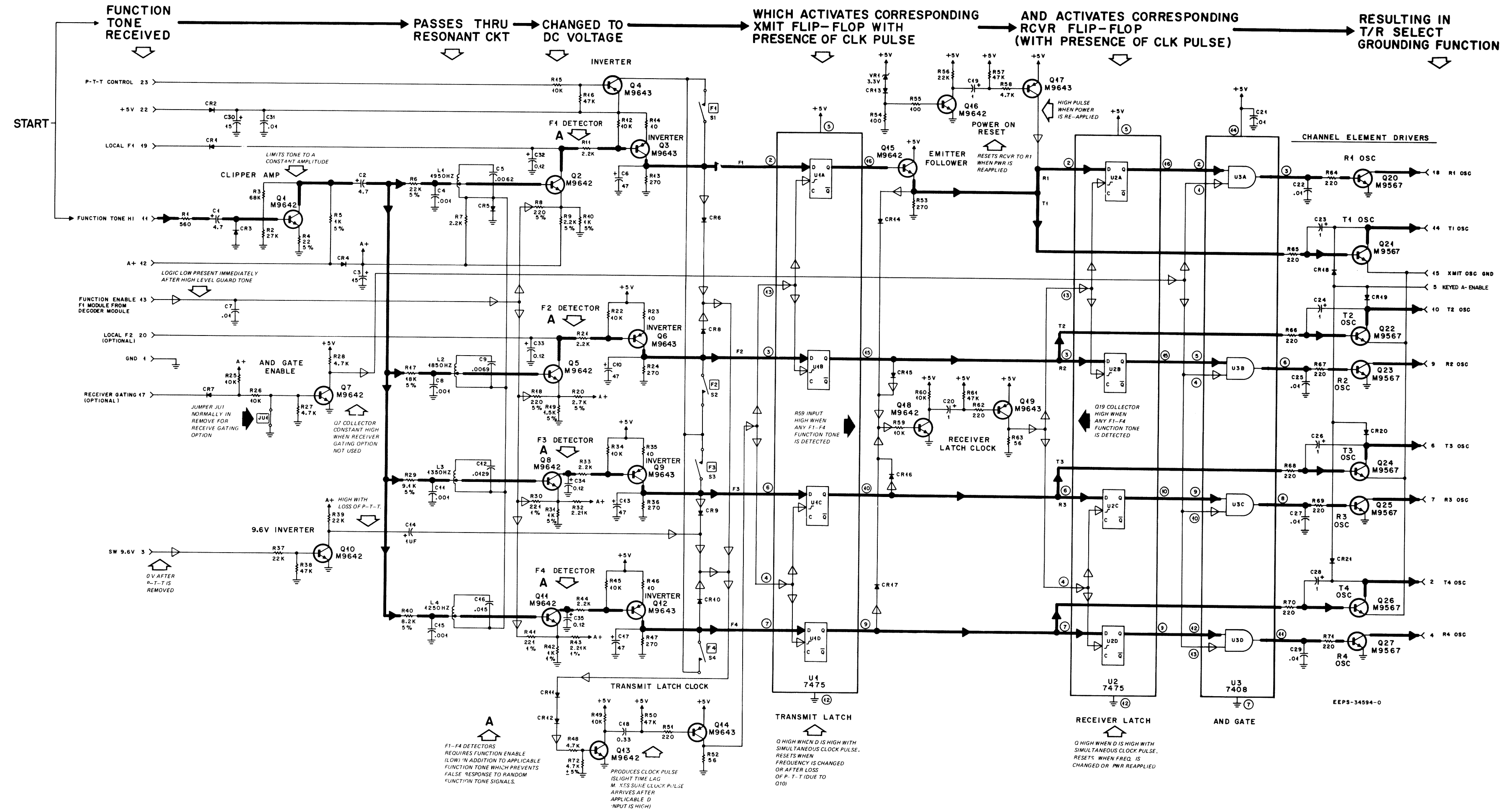
TRN5296A 4-Frequency Control Module PL-7967-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1,2	23-865137	capacitor, fixed: uF ± 20%; 50 V;
C3	23-865136	4.7; 25 V
C4	21-82187B29	15; 25 V
C5	8-84326A14	.001 ± 10%; 100 V
C6	23-868446	.0062 ± 2%
C7	8-82905G01	47; 6 V
C8	21-82187B29	.01 ± 10%; 50 V
C9	8-84326A15	.001, 100 V
C10	23-868446	.0069 ± 2%; 50 V
C11	21-82187B29	47; 6 V
C12	8-84326A20	.001 ± 10%; 100 V
C13	23-868446	.0129 ± 2%
C14	23-82783B08	47; 6 V
C15	21-82187B29	1; 35 V
C16	8-84326A21	.001 ± 10%; 100 V
C17	23-868446	.015 ± 2%
C18	8-82905G42	47; 6 V
C19,20	23-82783B08	0.33 ± 10%
C21,22	8-82905G01	1; 35 V
C23,24	23-82783B08	.01 ± 10%
C25	8-82905G01	1; 35 V
C26	23-82783B08	.01 ± 10%
C27	8-82905G01	1; 35 V
C28	23-82783B08	.01 ± 10%
C29	8-82905G01	1; 35 V
C30	23-865136	.01 ± 10%
C31	8-82905G01	.12; 20 V
C32 thru 35	23-83214C23	
CR1	48-83654H01	semiconductor device, diode: (see note)
CR2	48-82466H13	silicon
CR3 thru 21	48-83654H01	silicon
L1 thru 4	1-80702B11	coil, audio freq.: assembly inductor and grommet clip
Q1,2	48-869642	transistor: (see note)
Q3,4	48-869643	NPN; type M9642
Q5	48-869642	PNP; type M9643
Q6	48-869643	NPN; type M9642
Q7,8	48-869642	PNP; type M9643
Q9	48-869643	NPN; type M9642
Q10,11	48-869642	PNP; type M9643
Q12	48-869643	NPN; type M9642
Q13	48-869642	PNP; type M9643
Q14	48-869643	NPN; type M9642
Q15,16	48-869642	PNP; type M9643
Q17	48-869643	NPN; type M9642
Q18	48-869642	PNP; type M9643
Q19	48-869643	NPN; type M9642
Q20 thru 27	48-869567	NPN; type M9567
R1	6-11009C43	resistor, fixed: ± 5%; 1/4 W;
R2	6-11009C83	560
R3	6-11009C83	27k
R4	6-11009C09	68k
R5	6-11009C49	22
R6	6-11009C81	1k
R7	6-11009C57	22k
R8	6-11009C33	2.2k
R9	6-11009C57	220
R10	6-11009C49	2.2k
R11	6-11009C57	1k
R12	6-11009C73	2.2k
R13	6-11009C35	10k
R14	6-11009C01	270
R15	6-11009C73	10
R16	6-11009C89	10k
R17	6-11009C79	47k
R18	6-11009C33	18k
R19	6-11009C53	220
R20	6-11009C59	1.5
R21	6-11009C57	2.7k
R22	6-11009C57	2.7k
R23	6-11009C73	2.2k
R24	6-11009C35	10k
R25,26	6-11009C73	2.2k
R27,28	6-11009C65	2.2k
R29	6-11009C72	9.1k
R30	6-84444A07	221 ± 1%
R31	6-11009C49	1k
R32	6-84444A08	2.21k ± 1%
R33	6-11009C57	2.2k
R34	6-11009C73	2.2k
R35	6-11009C01	10k
R36	6-11009C35	270
R37	6-11009C81	22k
R38	6-11009C89	47k
R39	6-11009C81	22k
R40	6-11009C71	8.2k
R41	6-84444A07	221 ± 1%
R42	6-11009C49	1k

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
R43	6-84444A08	2.21k ± 1%
R44	6-11009C57	2.2k
R45	6-11009C73	10k
R46	6-11009C01	10
R47	6-11009C35	270
R48	6-11009C65	4.7k
R49	6-11009C73	10k
R50	6-11009C89	47k
R51	6-11009C33	220
R52	6-11009C19	56
R53	6-11009C35	270
R54,55	6-11009C25	100
R56	6-11009C81	22k
R57	6-11009C89	47k
R58	6-11009C65	4.7k
R59,60	6-11009C73	10k
R61	6-11009C89	47k
R62	6-11009C33	220
R63	6-11009C19	56
R64 thru 71	6-11009C33	220
R72	6-11009C65	4.7
S1 thru 4	40-83468E01	switch, slide: spdt
U1,2	51-84371K25	integrated circuit: (see note)
U3	51-84371K09	quad bistable latch
V/R1	48-82256C26	semiconductor device, diode: (see note)
		Zener
non-referenced items		
	3-84256M01	SCREW, tapping; 2 used
	5-84220B01	GROMMET; 2 used
	9-83497F01	RECEPTACLE, 8 contact; 3 used
	64-83133L02	PANEL, screened

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

4-FREQUENCY CONTROL OPTION DECODER MODULE MODEL TRN5296A



SQUELCH CONTROL OPTION DECODER MODULE

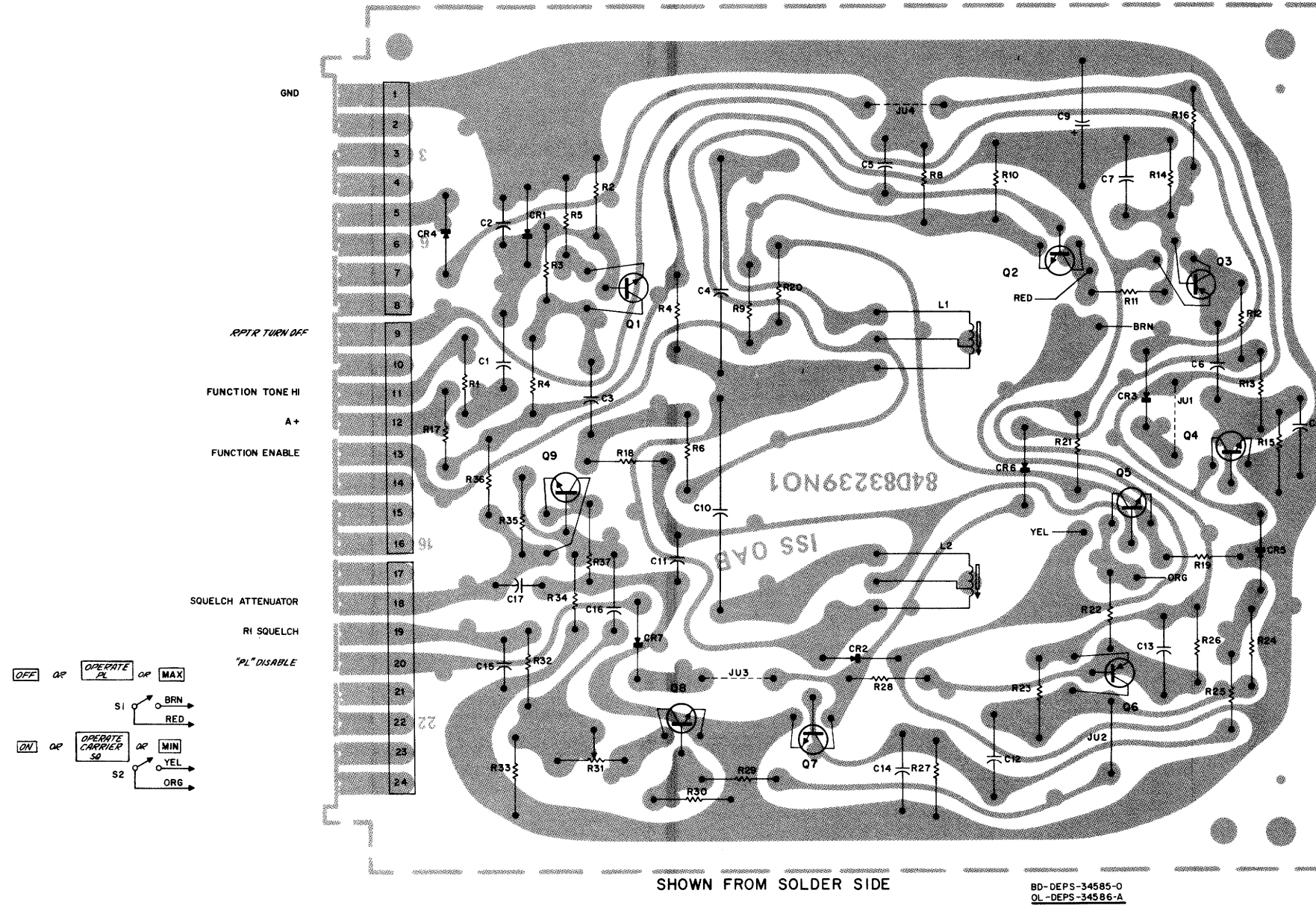
MODEL TLN2445A

REPEATER CONTROL OPTION DECODER MODULE

MODEL TLN2446A

PRIVATE-LINE CONTROL OPTION DECODER MODUE

MODEL TLN2447A



NOTE:

Wire colors shown on switches S1 & S2 are for TLN2445A and TLN2447A. Wire colors for TLN2446A are the same except on S1 the BRN wire is YEL and on S2 the YEL wire is BRN.

parts list

TRN5311A Squelch Control Module Panel
TRN5312A Repeater Control Module Panel
TRN5313A Private-Line Control Module Panel
PL-7998-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
S1, 2	40-83468E01	switch, slide: spdt; spring return
mechanical parts		
1-80757D81		ASSEMBLY, panel (TRN5311A); includes ref. items S1, S2, and PANEL, screened
64-83124L05		PANEL, screened
1-80757D73		ASSEMBLY, panel (TRN5312A); includes ref. items S1, S2, and PANEL, screened
64-83124L04		PANEL, screened
1-80757D82		ASSEMBLY, panel (TRN5313A); includes ref. items S1, S2, and PANEL, screened
64-83124L06		PANEL, screened
3-84256M01		SCREW, tapping; 2 used

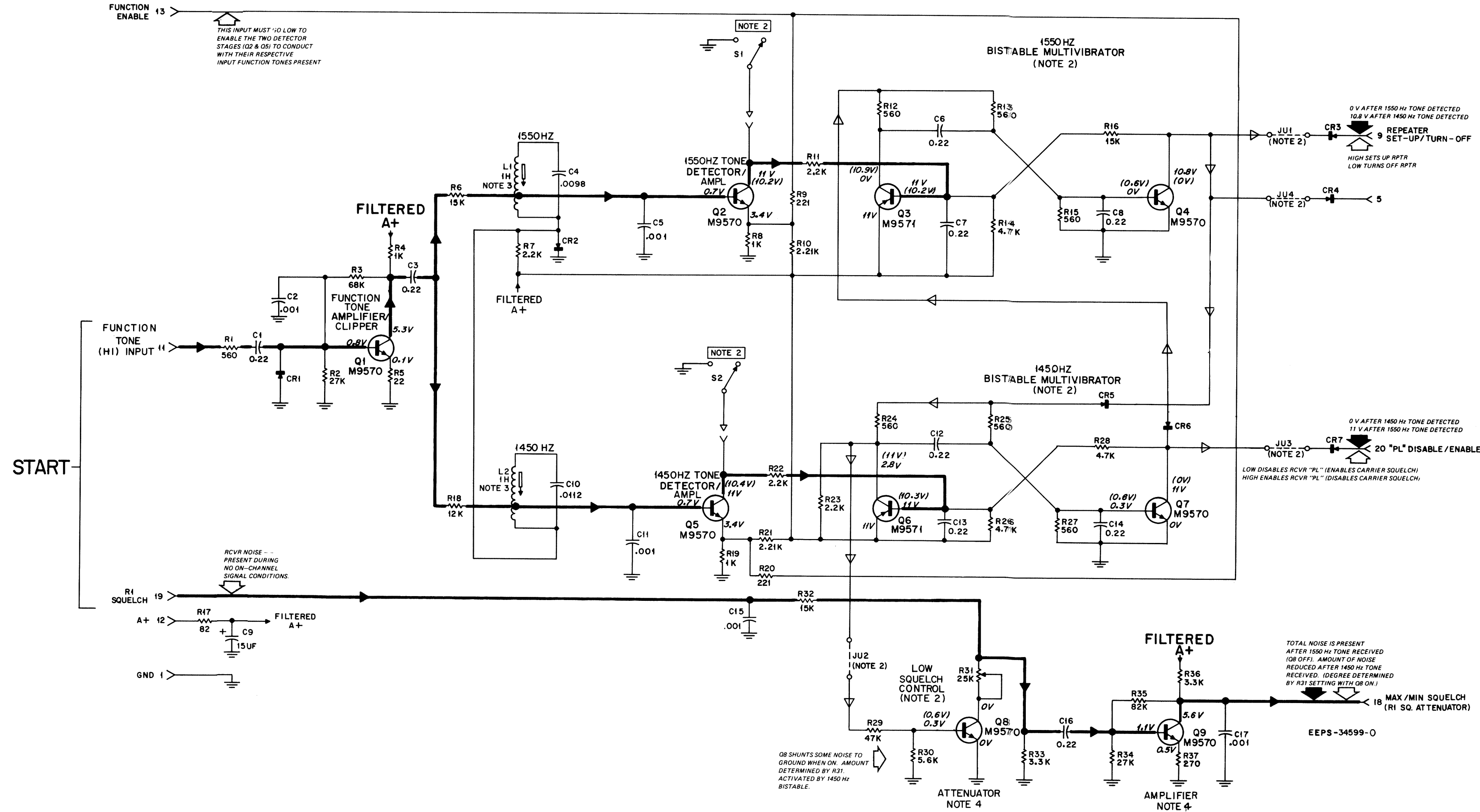
TRN5310A Tone Decoder Board
TRN5464A Tone Decoder Board
TRN5465A Tone Decoder Board
PL-7997-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1	8-82905G11	capacitor, fixed: $\mu F \pm 10\%$; 50 V; 0.22
C2	21-82187B29	0.01; 100 V
C3	8-82905G11	0.22
C4	8-84326A18	0.098 $\pm 2\%$
C5	21-82187B29	0.01; 100 V
C6, 7, 8	8-82905G11	0.22
C9	23-865136	15 $\pm 20\%$; 25 V
C10	8-84326A19	0.112 $\pm 2\%$
C11	21-82187B29	0.01; 100 V
C12, 13, 14	8-82905G11	0.22
C15	21-82187B29	0.01; 100 V
C16	8-82905G11	0.22
C17	21-82187B29	0.01; 100 V
CR1 thru 7	48-83654H01	diode: (see note) silicon
L1, 2	1-80702B11	coil, af: assembly, inductor and ground clip (1 H)
Q1, 2	48-869570	transistor: (see note) NPN; type M9570
Q3	48-869571	PNP; type M9571
Q4, 5	48-869570	NPN; type M9570
Q6	48-869571	PNP; type M9571
Q7, 8, 9	48-869570	NPN; type M9570
R1	6-11009C43	resistor, fixed: $\pm 5\%$; 1/4 W; 560
R2	6-11009C83	27k
R3	6-11009C93	68k
R4	6-11009C49	1k
R5	6-11009C09	22
R6	6-11009C77	15k
R7	6-11009C57	2.2k
R8	6-11009C49	1k
R9	6-8444A07	221 $\pm 1\%$
R10	6-8444A08	2.21k $\pm 1\%$
R11	6-11009C57	2.2k
R12, 13	6-11009C43	560
R14	6-11009C65	4.7k
R15	6-11009C43	560
R16	6-11009C77	15k
R17	6-11009C23	82
R18	6-11009C75	12k
R19	6-11009C49	1k
R20	6-8444A07	221 $\pm 1\%$
R21	6-8444A08	2.21k $\pm 1\%$
R22, 23	6-11009C57	2.2k
R24, 25	6-11009C43	560
R26	6-11009C65	4.7k
R27	6-11009C43	560
R28	6-11009C65	4.7k
R29	6-11009C89	47k
R30	6-11009C67	5.6k
R31	18-83083G03	variable; 25k $\pm 30\%$
R32	6-11009C77	15k
R33	6-11009C61	3.3k
R34	6-11009C83	27k
R35	6-11009C95	82k
R36	6-11009C61	3.3k
R37	6-11009C35	270
mechanical parts		
5-84220B01		GROMMET; 2 used
9-83497F01		RECEPTACLE, 8-contact; 3 used (PCB Edge)

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

SQUELCH CONTROL OPTION DECODER MODULE
REPEATER CONTROL OPTION DECODER MODULE
PRIVATE-LINE CONTROL OPTION DECODER MODULE

MODEL TLN2445A
MODEL TLN2446A
MODEL TLN2447A



FUNCTION

Selects one of two modes of operation in response to 1450 Hz and 1550 Hz function tones.

Model/Function Table

Function Tone Frequency	TLN2445A Squelch Control	TLN2446A Repeater Control	TLN2447A Private-Line Control
1500 Hz	Maximum Squelch Operation	Repeater Turn Off Operation	Private-Line Tone-Coded Squelch Operation
1450 Hz	Threshold Squelch Operation	Repeater Setup Operation	Carrier Squelch Operation

Function — Selects desired mode of operation by decoding remote generated 1450 and 1550 Hz function tones.

Application Table

	Squelch Control Module	Private-Line Control Module	Repeater Control Module
S1	Max. Sq.	Operate PL	RPTR Knockdown
S2	Min. Sq.	Operate Carrier Squelch	RPTR Setup
Q3/Q4	Operate Maximum Squelch	Operate PL	Repeater Turn Off
Q6/Q7	Operate Threshold Squelch	Operate Carrier Squelch	Repeater Set Up
R31	Low Squelch Control	(Not Used)	(Not Used)
JU1	OUT	OUT	IN
JU2	IN	OUT	OUT
JU3	OUT	IN	OUT
JU4	OUT	OUT	OUT

- NOTES:
- Voltages in parentheses are for active state.
 - Refer to table for application and/or description.
 - Factors adjusted to required frequency.
 - Used in squelch control models only.

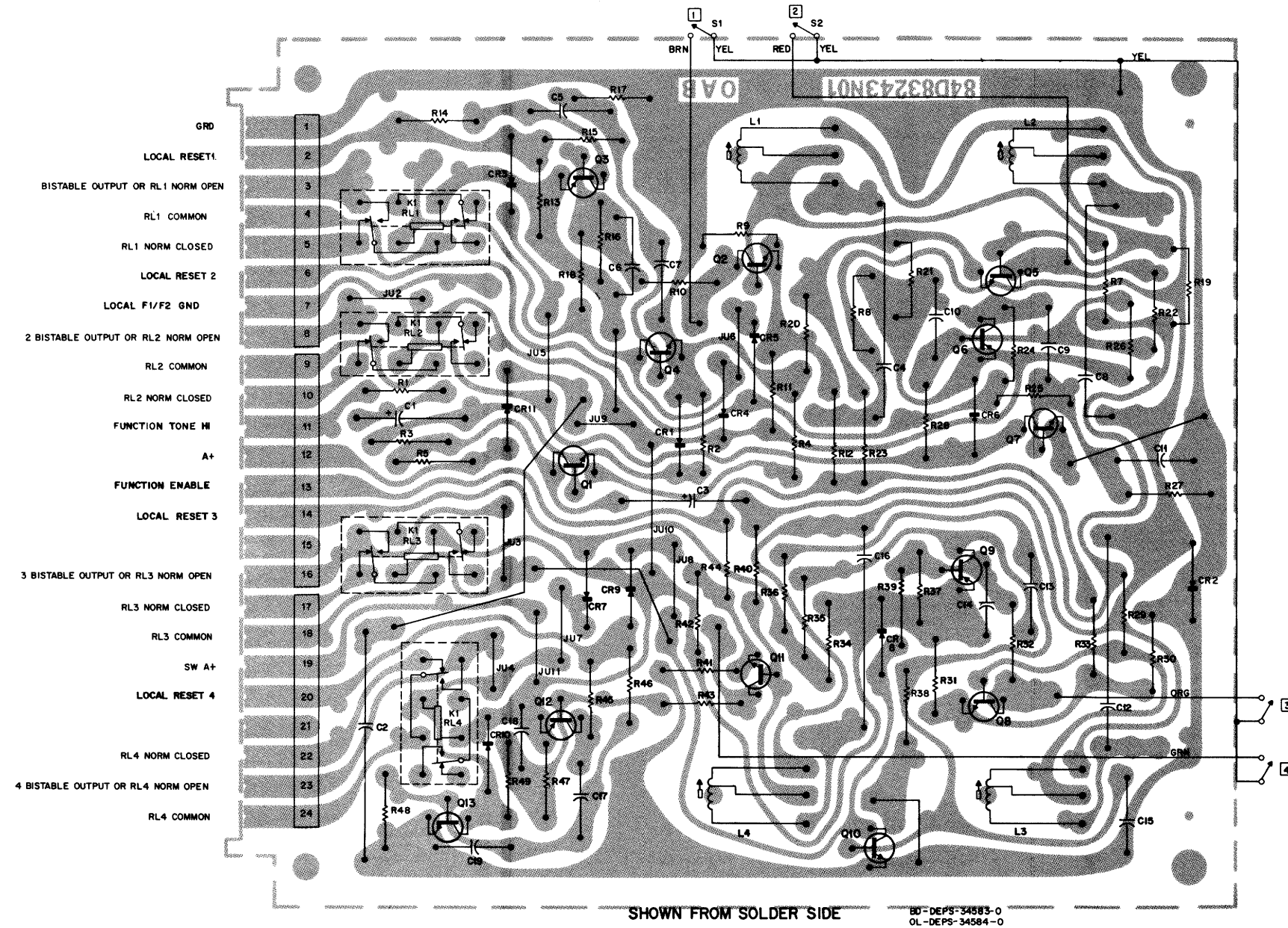
LEGEND:

START CIRCUT THEORY MOST EASILY UNDERSTOOD BY BEGINNING AT THIS POINT AND FOLLOWING SIGNAL FLOW.

- ◁ THEORY OF OPERATION DATA
- ▶ MAINTENANCE DATA
- PRIMARY SIGNAL FLOW
- ⇨ SECONDARY SIGNAL FLOW

"WILD CARD" CONTROL MODULE

MODEL TLN2448A



SHOWN FROM SOLDER SIDE
 80-DEPS-34583-0
 01-DEPS-34584-0

Circuit Board Detail and Parts Lists
 Motorola No. 68P81062E27-A
 (Sheet 1 of 2)
 11/1/85- UP

parts list

TRN5315A "Wild Card" Control Module Board PL-8000-O

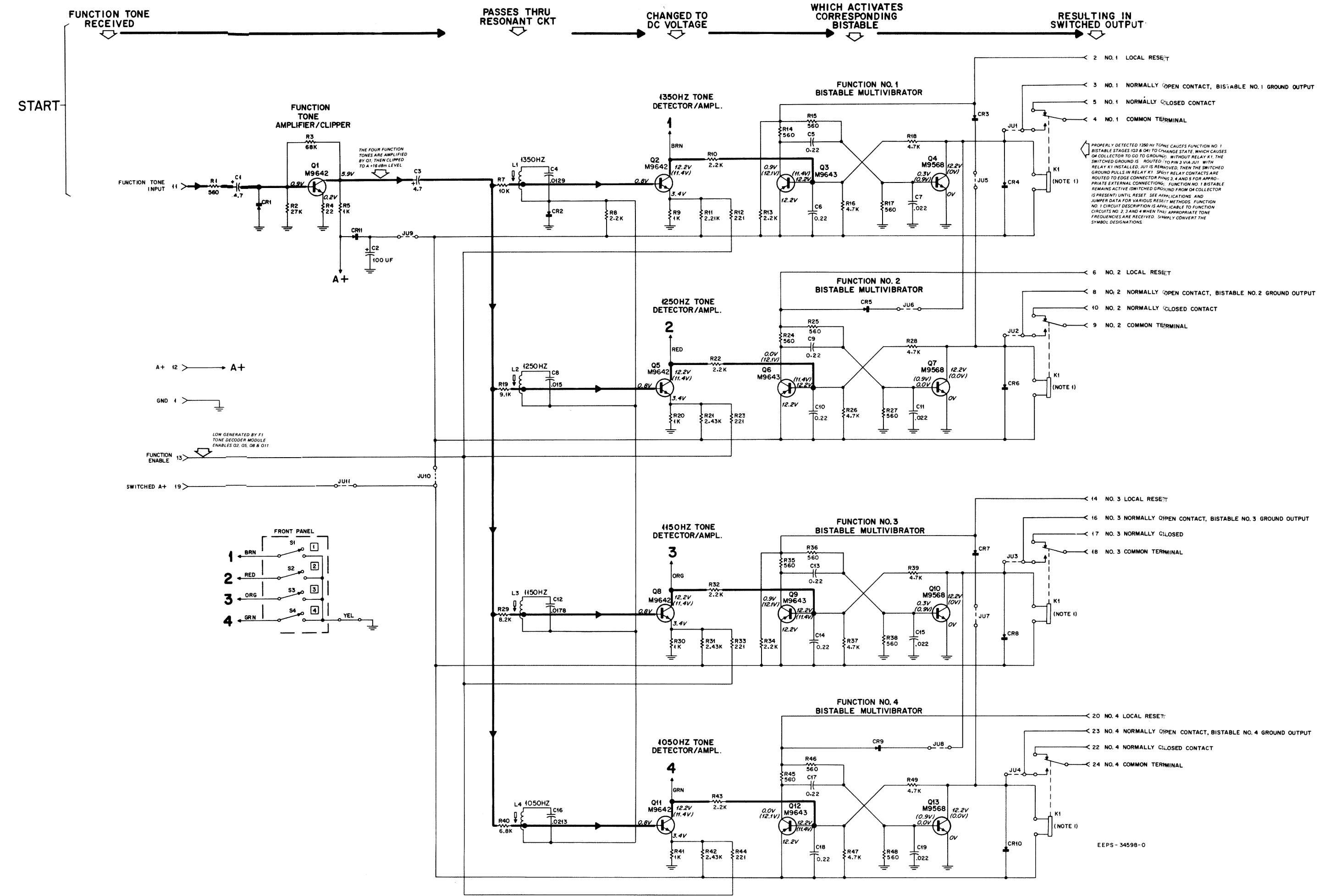
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1	23-865137	capacitor, fixed: uF ± 10%; 50 V; unless otherwise stated
C2	23-82601A25	4.7 ± 20%; 25 V
C3	23-865137	100 + 150-10%; 20 V
C4	8-84326A20	4.7 ± 20%; 25 V
C5, 6	8-82905G11	.0129 ± 2%
C7	8-82905G02	.022
C8	8-84326A21	.015 ± 2%
C9, 10	8-82905G11	.022
C11	8-82905G02	.022
C12	8-84326A22	.0178 ± 2%
C13, 14	8-82905G11	.022
C15	8-82905G02	.022
C16	8-84326A23	.0213 ± 2%
C17, 18	8-81905G11	.022
C19	8-82905G02	.022
CR1 thru 11	48-83654H01	semiconductor device, diode: (see note) silicon
L1 thru 4	1-80702B11	coil assembly, inductor: 1 H; incl. ground clip 42-84315A01
Q1, 2	48-869642	transistor: (see note) NPN; type M9642
Q3	48-869643	PNP; type M9643
Q4	48-869568	NPN; type M9568
Q5	48-869642	NPN; type M9642
Q6	48-869643	PNP; type M9643
Q7	48-869568	NPN; type M9568
Q8	48-869642	NPN; type M9642
Q9	48-869643	PNP; type M9643
Q10	48-869568	NPN; type M9568
Q11	48-869642	PNP; type M9643
Q12	48-869643	NPN; type M9643
Q13	48-869568	NPN; type M9568
R1	6-11009C43	resistor, fixed: ± 10%; 1/4 W; unless otherwise stated
R2	6-11009C83	560
R3	6-11009C93	27k
R4	6-11009C09	68k
R5	6-11009C49	22 ± 5%
R7	6-11009C73	1k ± 5%
R8	6-11009C57	10k ± 5%
R9	6-11009C49	2.2k
R10	6-11009C57	1k ± 5%
R11	6-84444A08	2.2k
R12	6-84444A07	2.21 ± 1%
R13	6-11009C57	2.2k
R14, 15	6-11009C43	560
R16	6-11009C65	4.7k
R17	6-11009C43	560
R18	6-11009C65	4.7k
R19	6-11009C72	9.1k ± 5%
R20	6-11009C49	1k ± 5%
R21	6-84444A09	2.43k ± 1%
R22	6-11009C57	2.2k
R23	6-84444A07	2.21 ± 1%
R24, 25	6-11009C43	560
R26	6-11009C65	4.7k
R27	6-11009C43	560
R28	6-11009C65	4.7k
R29	6-11009C71	8.2k ± 5%
R30	6-11009C49	1k ± 5%
R31	6-84444A09	2.43k ± 1%
R32	6-11009C57	2.2k
R33	6-84444A07	2.21 ± 1%
R34	6-11009C57	2.2k
R35, 36	6-11009C43	560
R37	6-11009C65	4.7k
R38	6-11009C43	560
R39	6-11009C65	4.7k
R40	6-11009C09	6.8k ± 5%
R41	6-11009C49	1k ± 5%
R42	6-84444A09	2.43k ± 1%
R43	6-11009C57	2.2k
R44	6-84444A07	2.21 ± 1%
R45, 46	6-11009C43	560
R47	6-11009C65	4.7k
R58	6-11009C43	560
R49	6-11009C05	4.7k
mechanical parts		
5-84220B01	GROMMET: 2 used	
9-83497F01	RECEPTACLE, female: 8-contact; 3 used (PCB Edge Connector)	

TRN5316A "Wildcard" Control Module Panel PL-7999-A

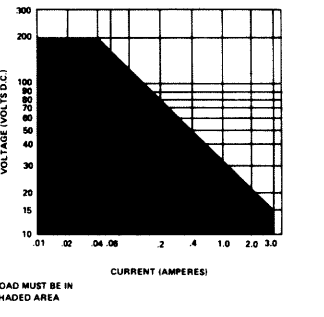
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
S1 thru 4	40-83468E01	switch, slide: spdt
non-referenced items		
	1-80757D83	PANEL ASSEMBLY, include:
	64-83134L02	PANEL SWITCHES S1 thru S4
	3-84256M01	SCREW, tapping; 2 used
TLN4151A Relay Kit PL-455-B		
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
See Schematic	48-82392B03	diode: silicon (reverse voltage protection)
K1	80-84201A01	relay, armature: 2 form "C," coil res. 200 ohms
non-referenced item:		
	43-84920H01	SPACER, relay

note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

"WILD CARD" CONTROL MODULE MODEL TLN2448A



PROPERLY DETECTED 1050 HZ TONE CAUSES FUNCTION NO. 1 BISTABLE STAGES (Q3 & Q4) TO CHANGE STATE, WHICH CAUSES Q4 COLLECTOR TO GO TO GROUND. WITHOUT RELAY K1, THE SWITCHED GROUND IS ROUTED TO PIN 3 VIA JU1. WITH RELAY K1 INSTALLED, JU1 IS REMOVED, THEN THE SWITCHED GROUND PULLS IN RELAY K1. Q4 RELAY CONTACTS ARE ROUTED TO EDGE CONNECTOR PINS 3, 4 AND 5 FOR APPROPRIATE EXTERNAL CONNECTIONS. FUNCTION NO. 1 BISTABLE REMAINS ACTIVE (SWITCHED GROUND FROM Q4 COLLECTOR IS PRESENT UNTIL RESET. SEE APPLICATIONS AND JUMPER DATA FOR VARIOUS RESET METHODS. FUNCTION NO. 1 CIRCUIT DESCRIPTION IS APPLICABLE TO FUNCTION CIRCUITS NO. 2, 3 AND 4 WHEN THE APPROPRIATE TONE FREQUENCIES ARE RECEIVED. SIMPLY CONVERT THE SYMBOL DESIGNATIONS.



NOTES:

- TLN4151A relay is an optional accessory. Refer to graph for relay contact rating.
- Unless otherwise noted, all resistor values are in ohms and capacitor values are in microfarads.

Applications & jumper data

- A. Operation without relays (jumpers JU1-JU4 must be connected)

Function Tone (Hz)	Bistable Operated	Output Pin
1350	No. 1	3
1250	No. 2	8
1150	No. 3	16
1050	No. 4	23

- B. Operation with relays

Function Tone (Hz)	Bistable & Relay Operated	N.O.	C	N.C.	Remove Jumper
1350	No. 1	3	4	5	JU1
1250	No. 2	8	9	10	JU2
1150	No. 3	16	18	17	JU3
1050	No. 4	23	24	22	JU4

- C. Mixture of relay and non-relay operation is permissible.

- D. Paired reset operation.

With this type of operation, 1350 Hz function tone latches bistable No. 1 on and resets bistable No. 2. A 1250 Hz function tone latches bistable No. 2 and resets bistable No. 1.

To Operate Bistables as Pairs	Connect Jumpers	Remove Jumpers
No. 1 & No. 2	JU5, JU6, JU9	JU11
No. 3 & No. 4	JU7, JU8, JU9, JU10	JU11

- E. Independent bistable operation.

With this type of operation, each bistable can be activated independently by its function tone. Bistables can be reset only as a group by interruption or switched A+ at pin 19 (reset when transmitter unkeys). For independent bistable operation, connect jumpers JU10 and JU11, and remove jumpers JU5 thru JU9.

- F. Mixture of paired reset operation for bistable No. 1 & 2, and independent bistable operation for bistable No. 3 & 4 is permissible. Connect jumpers JU5, JU6, JU9 and JU11. Remove jumpers JU7, JU8 and JU10.

- G. Local reset operation

Independent, external reset of each bistable is available by applying a switched ground to the associated local reset pin. This operation may be the only method of bistable resetting, or may be in addition to paired reset or independent bistable operation. If it is to be the only method of bistable resetting, connect jumper JU9 and JU10 and remove jumpers JU5-JU8 and JU11.

Model Complement

Model	Board	Panel
TLN2448A	TRN5315A	TRN5316A
TLN4151A Relay (Optional)	—	—

FUNCTION

Converts function tones of 1050 Hz, 1150 Hz, 1250 Hz and 1350 Hz into transistor closures; relay closures optional. Allows remote control point to operate up to four universal on-off switches at the station site.