



MOTOROLA INC.
Communications
Sector

DC REMOTE CONTROL BOARDS

MODEL TRN5191A (2-WIRE)
MODEL TRN5192A (4-WIRE)

1. INTRODUCTION

This section describes the features and capabilities of the 2-wire and 4-wire dc remote control boards. The front panel controls and indicators associated with this board are shown on Figure 1. The dc remote control board performs four main functions as follows:

- Translates dc line currents into logic levels which are used to control station operation.
- Provides amplification for transmit audio inbound from the wireline before it is applied to the station control board.
- Provides filtering and amplification for received audio before it is routed outbound to the remote control console via the wireline.

- Allows local channel selection in servicing or repair situations.

One other feature associated with this module is the INTERCOM switch S902. This switch allows intercom capability between a service technician at the station and the remote control console operator. The use of the intercom is described in the Operation section of this manual.

2. DESCRIPTION

2.1 GENERAL

The dc remote board is available in two models. The first is a 1-receiver, 2-wire version (standard) and the other is a 1-receiver, 4-wire version (optional). The 4-wire option permits full duplex operation with the

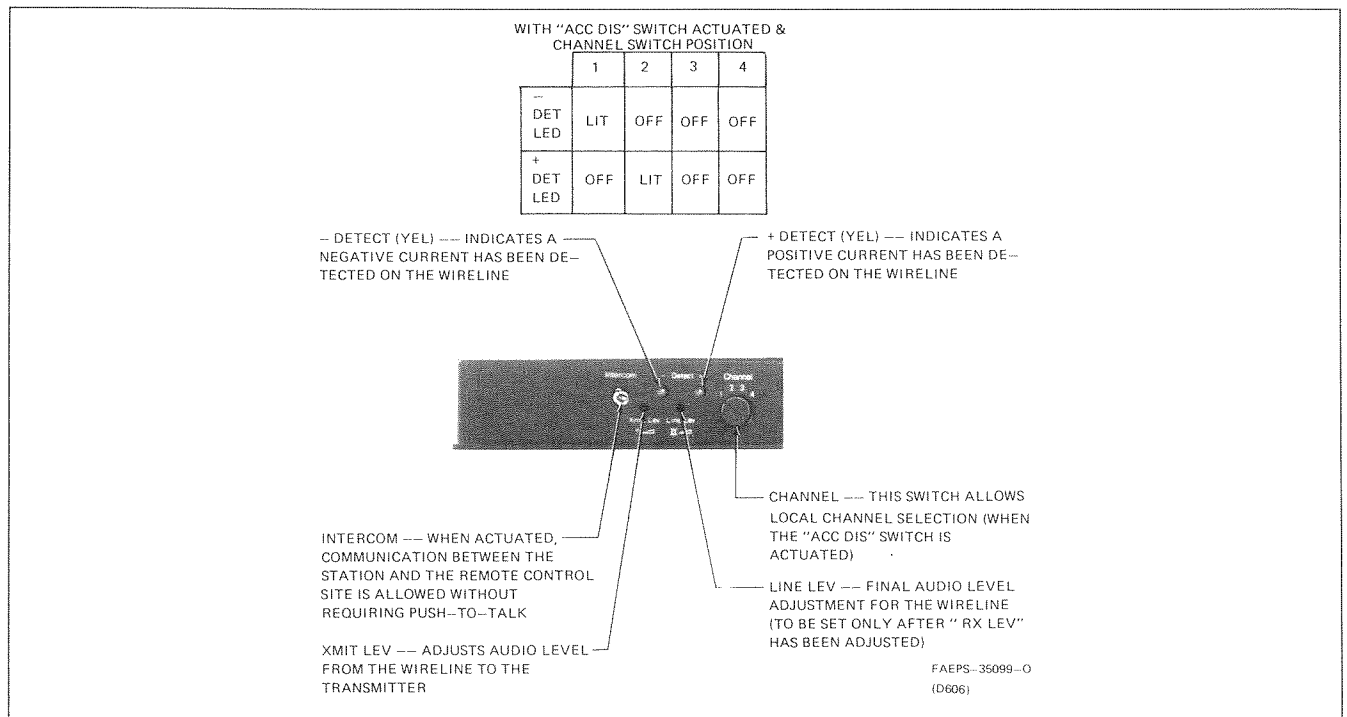


Figure 1. DC Remote Control Board, Controls and Indicators

technical writing services

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console. For a repeater (RT) station that is not to be wireline controlled, this board can be omitted.

2.2 FUNCTIONS

2.2.1 Line Current Detection

The polarity and magnitude of the control currents on the wireline are detected by opto-isolators U901-U904 as shown on the schematic diagram located at the end of this section. The optimum values of these control currents are plus and minus 2.5, 5.5 and 12.5 mA, but the detectors are capable of detecting currents as low as 2 mA, 4.5 mA, and 10 mA respectively. The function initiated by each current is defined by software associated with the station control board rather than by hardware. This affords greater system flexibility by allowing choices to be made in the definition (or definitions) for each current. Table 1 can be used as an aid in understanding the operation of the command (CMD) lines which the dc remote board uses to communicate with the station control board. A "HI" indicates that the particular bit is active (+5 V).

Table 1. DC Line Current Truth Table

Current (mA)	P804-6 CMD 3	P804-7 CMD 2	P804-8 CMD 1	P804-9 CMD 0
+12.5	H	H	H	L
+5.5	L	H	H	L
+2.5	L	L	H	L
0 (null)	L	L	L	L
-2.5	L	L	L	H
-5.5	L	H	L	H
-12.5	H	H	L	H

NOTES:

1. H = +5 V; L = 0 V
2. Current Detectors Enabled (ADIS = H)

2.2.2 Transmit Audio Amplification

As shown on the schematic diagram, incoming line audio is coupled through transformer T901 and is

then applied to the first of two op-amp stages. The amplified output is routed to the station control board via W401 and P804-5.

2.2.3 Receive Audio Amplification and Filtering

Received audio enters the board at P804-4 and is routed to the line amplifier chain which consists of U906B, U907B, U907C, Q906, and Q907 (see the schematic diagram). The first amplifier also provides filtering which causes the audio response to roll off at approximately 40 dB per decade at frequencies above 3400 Hz. The audio is then routed to the wireline either via T901 in 2-wire systems or via T902 in 4-wire systems.

2.2.4 Local Control

When the ACC DIS (access disable) switch S801 on the station control module front panel is actuated, the ADIS line at P804-10 goes low. This disables the current detectors to prevent the remote control console from accessing the station. When this occurs, the CHANNEL switch (S901) on the dc remote board is allowed to control the command lines leading to the station control board as shown on the schematic diagram. This switch can be very useful as a diagnostic tool. Each switch position 1 through 4 (as shown in Table 2) has the effect of changing the station to the corresponding channel (1 through 4) as defined by the program in the station control board personality prom.

Table 2. Channel Switch Truth Table

S901 Position	P804-6 CMD 3	P804-7 CMD 2	P804-8 CMD 1	P804-9 CMD 0
1	L	L	L	H
2	L	L	H	L
3	L	H	L	L
4	H	L	L	L

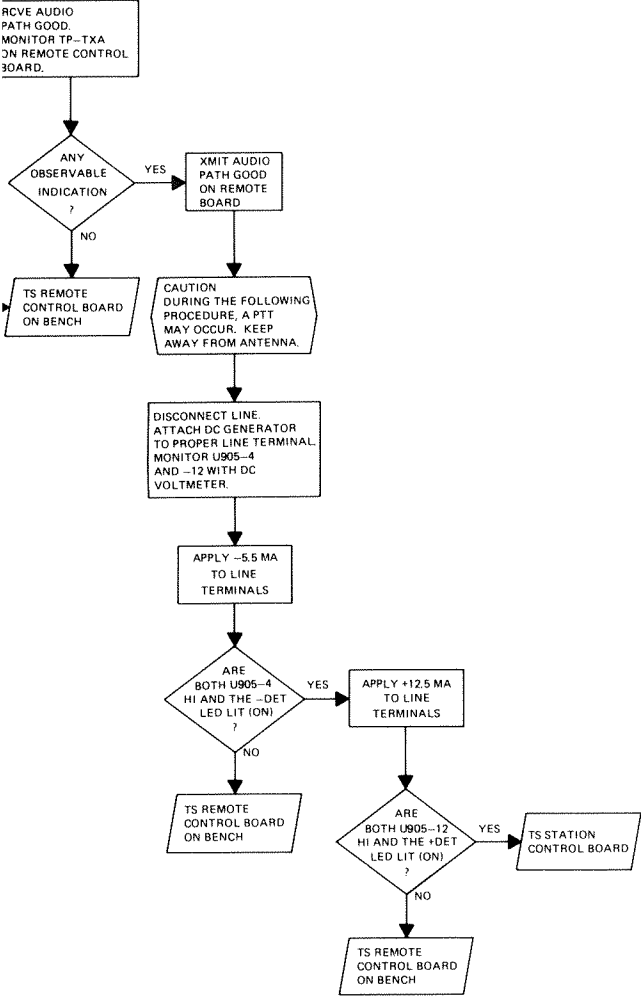
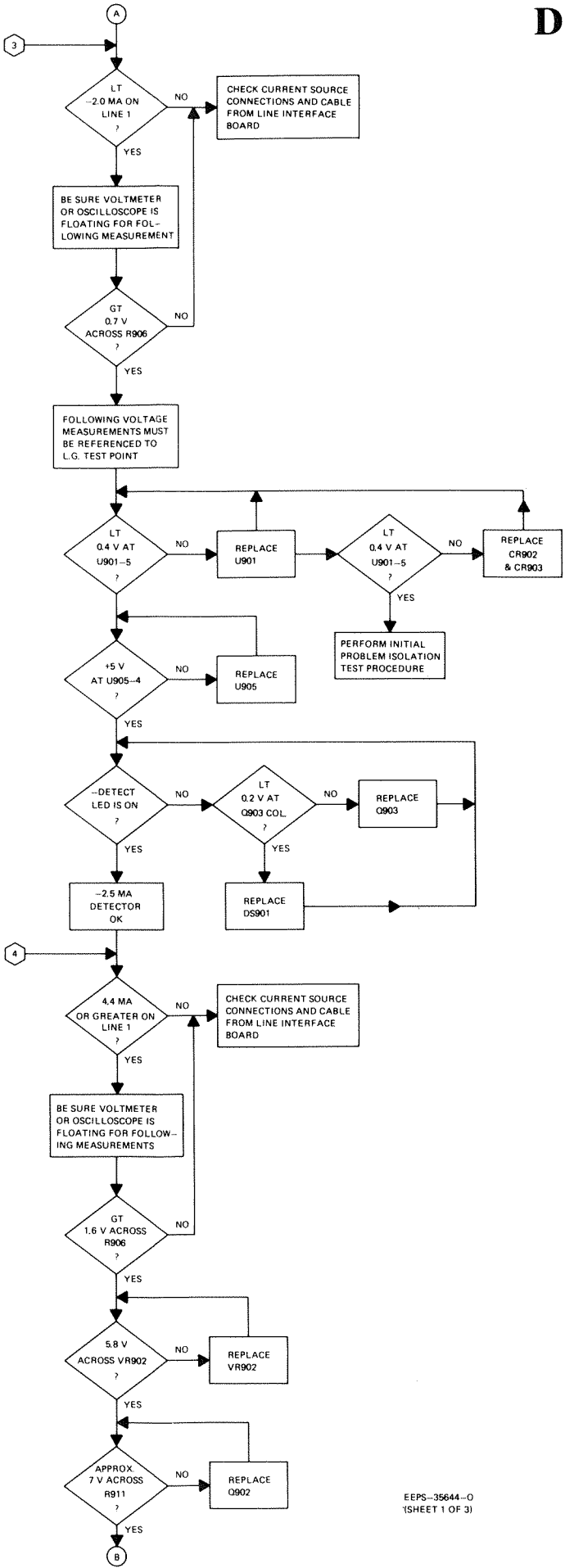
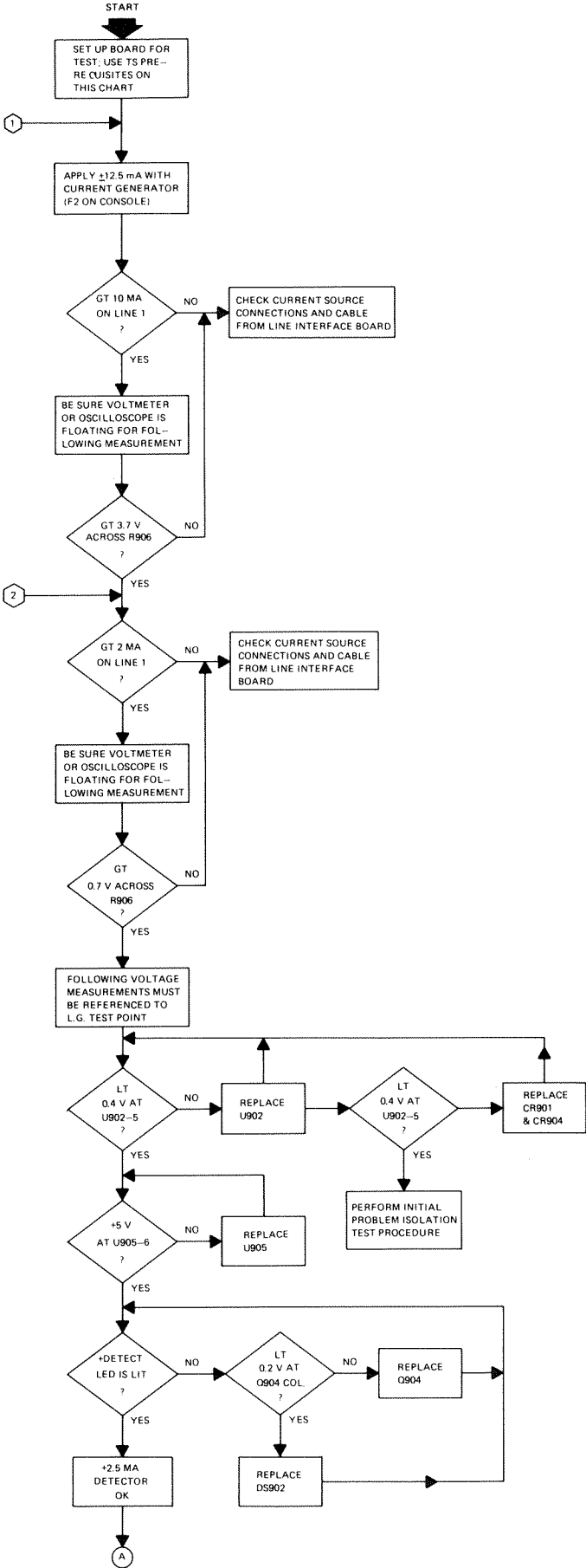
NOTES:

1. H = +5 V; L = 0 V
2. Current Detectors Disabled (ADIS = L)

DC REMOTE CONTROL BOARD
TROUBLESHOOTING CHART

2. BENCH TEST OF DC REMOTE CONTROL BOARD.
- A) TEST EQUIPMENT REQUIRED FOR BENCH TESTING:
- DC CURRENT GENERATOR OR REMOTE CONTROL CONSOLE
 - AUDIO OSCILLATOR
 - AC & DC VOLTMETER
 - OHM METER
 - MODEL TRN5471A WIRELINE INTERFACE BOARD
 - MODEL TKN8305A WIRELINE INTERFACE CABLE
 - +13.8 V SUPPLY
 - +9.6 V SUPPLY
 - +5 V SUPPLY
- B) TESTING SET UP:
- CONNECT THE +13.8 V SUPPLY TO P804-1 AND CONNECT ITS GROUND TO P804-2 (OR TO TEST PINS SCREENED A+ & A.G., RESPECTIVELY).
 - CONNECT THE +9.6 V SUPPLY TO P804-3 AND ITS GROUND TO P804-2 (OR TO TEST PINS SCREENED +9.6 V & A.G., RESPECTIVELY).
 - CONNECT ONE END OF LINE INTERFACE CABLE TO P804 ON DC REMOTE BOARD AND CONNECT OTHER END TO J1602 ON LINE INTERFACE BOARD.

- CONNECT DC CURRENT GENERATOR OR REMOTE CONTROL CONSOLE TO LINE 1 ON LINE INTERFACE BOARD. OBSERVE PROPER POLARITY.
- CONNECT THE +5 V SUPPLY TO TEST PIN SCREENED +5 V. ATTACH GROUND LEAD TO TEST PIN SCREENED L.G. (LOGIC GROUND).
- CONNECT JUMPER WIRE FROM +5 V TEST PIN TO P804-10 TO PROVIDE AN ACCESSIBLE SIGNAL TO THE DC REMOTE CONTROL BOARD UNDER TEST.
- PERFORM THE FOLLOWING TS PROCEDURE TO DETERMINE TS CHART STARTING POINTS.



ABBREVIATIONS USED IN THE CHART

MEASUREMENTS ARE DC, UNLESS OTHERWISE STATED.

SIGNAL PATH	TS	= TROUBLESHOOTING
	LT	= LESS THAN
	GT	= GREATER THAN
	EGT	= EQUAL TO OR GREATER THAN
	ELT	= EQUAL TO OR LESS THAN
	U901-5	= PIN 5 OF U901
	COL	= COLLECTOR (OF TRANSISTOR)
	LG	= LOGIC GND
	AG	= AUDIO GND
	TP	= TEST POINT (ON THE BOARD)

TROUBLESHOOTING PREREQUISITES:

2. BENCH TEST OF DC REMOTE CONTROL BOARD

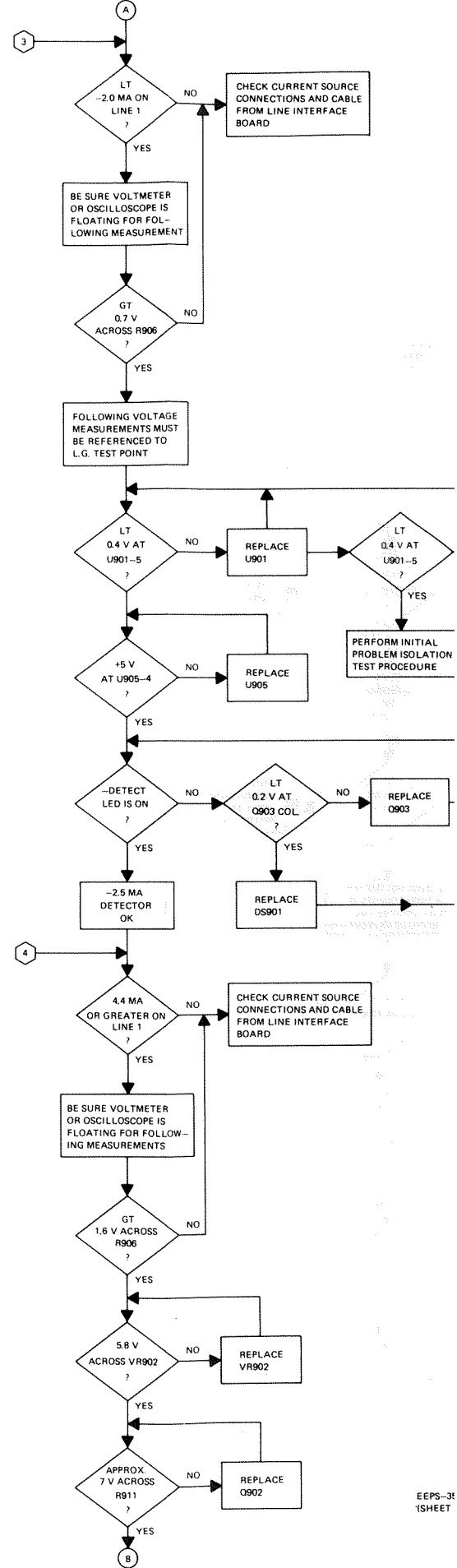
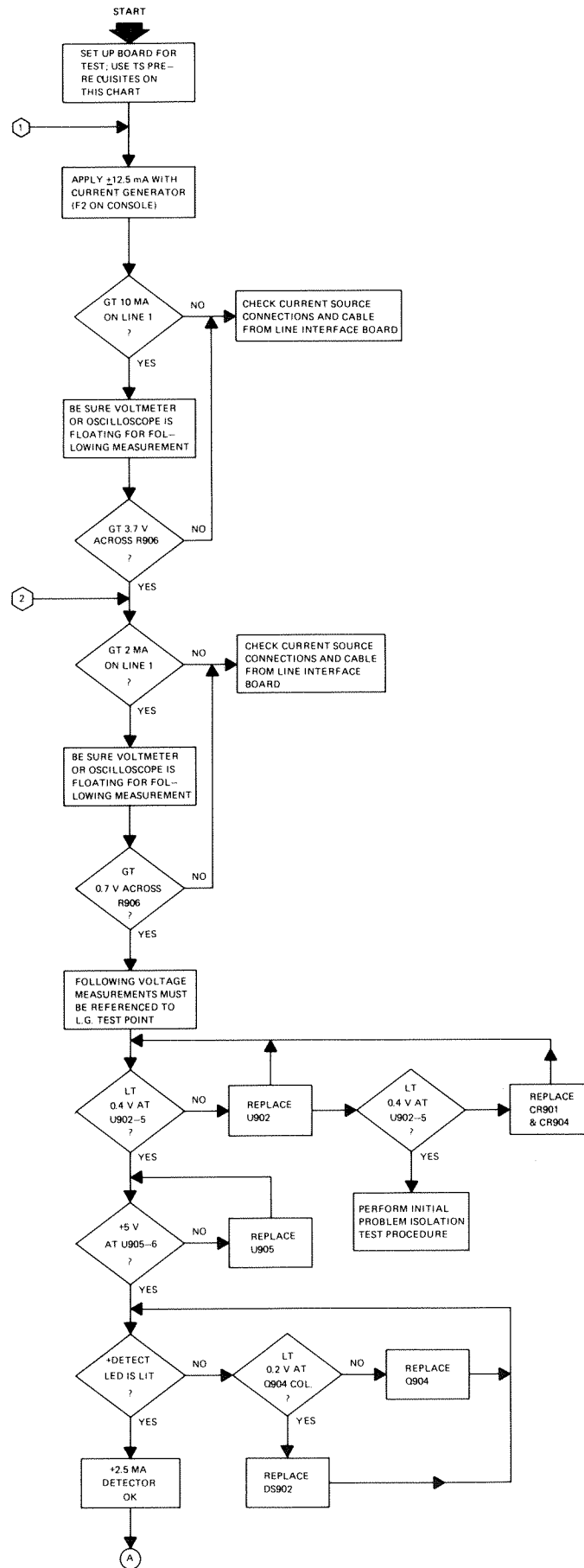
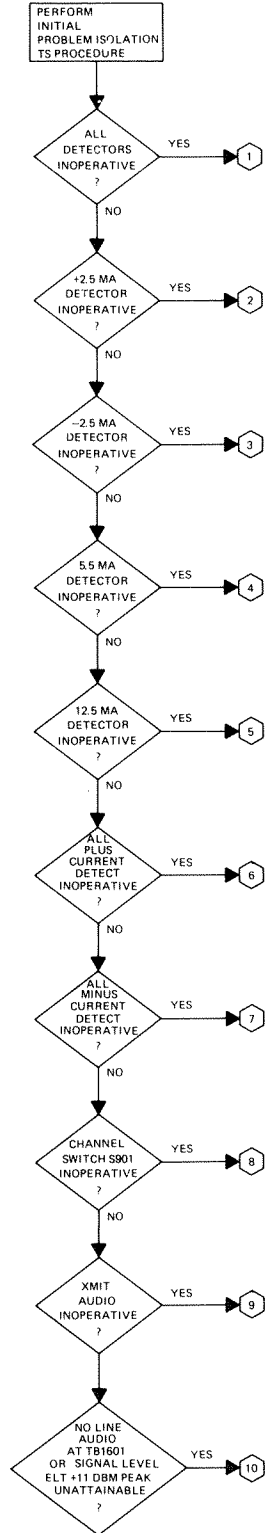
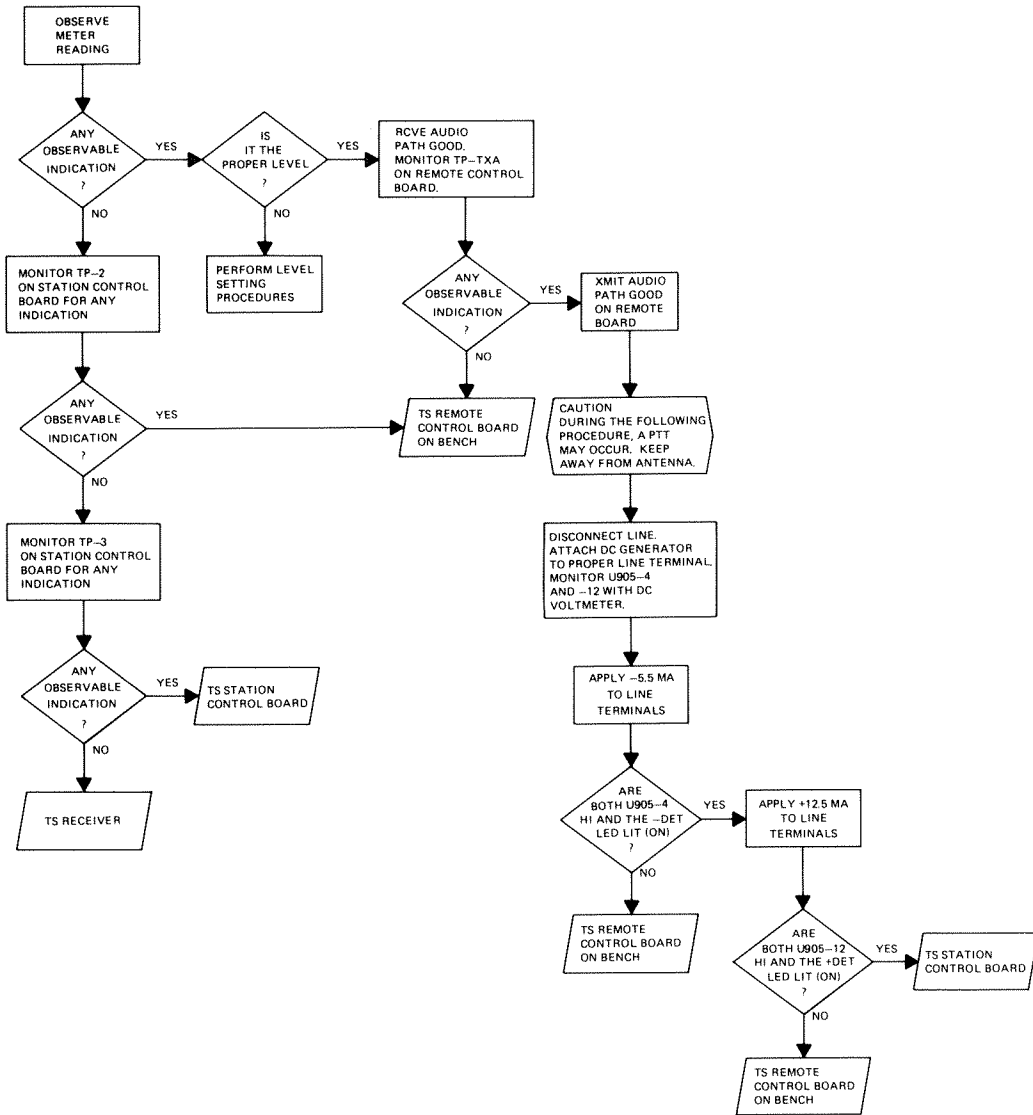
- A) TEST EQUIPMENT REQUIRED FOR BENCH TESTING:
- DC CURRENT GENERATOR OR REMOTE CONTROL CONSOLE
 - AUDIO OSCILLATOR
 - AC & DC VOLT METER
 - OHM METER
 - MODEL TRN5471A WIRELINE INTERFACE BOARD
 - MODEL TXN8305A WIRELINE INTERFACE CABLE
 - +13.8 V SUPPLY
 - +9.6 V SUPPLY
 - +5 V SUPPLY
- B) TESTING SET UP:
1. CONNECT THE +13.8 V SUPPLY TO PB04-1 AND CONNECT ITS GROUND TO PB04-2 (OR TO TEST PINS SCREENED & A. G., RESPECTIVELY).
 2. CONNECT THE +9.6 V SUPPLY TO PB04-3 AND ITS GROUND TO PB04-2 (OR TO TEST PINS SCREENED +9.6 V & A. G., RESPECTIVELY).
 3. CONNECT ONE END OF LINE INTERFACE CABLE TO PB04 ON DC REMOTE BOARD AND CONNECT OTHER END TO J1602 ON LINE INTERFACE BOARD.

4. CONNECT DC CURRENT GENERATOR OR REMOTE CONTROL CONSOLE TO LINE 1 ON LINE INTERFACE BOARD. OBSERVE PROPER POLARITY.
5. CONNECT THE +5 V SUPPLY TO TEST PIN SCREENED +5 V. ATTACH GROUND LEAD TO TEST PIN SCREENED L.G. (LOGIC GROUND).
6. CONNECT JUMPER WIRE FROM +5 V TEST PIN TO P804-10 TO PROVIDE AN ACCESS ENABLE SIGNAL TO THE DC REMOTE CONTROL BOARD UNDER TEST.
7. PERFORM THE FOLLOWING TS PROCEDURE TO DETERMINE TS CHART STARTING POINTS.

NOTES:

1. INITIAL PROBLEM ISOLATION:

- A) TEST EQUIPMENT REQUIRED FOR IN-STATION TESTING:
 - DC CURRENT GENERATOR OR REMOTE CONTROL CONSOLE
 - RF SIGNAL GENERATOR
 - DC VOLT METER
 - AC VOLT METER
- B) ACTIVATE S801 TO "ACC DIS" POSITION.
- C) ATTACH AC VOLT METER ACROSS LINE 1 (FOR 2-WIRE STATIONS) OR LINE 2 (FOR 4-WIRE STATIONS).
- D) RADIATE RF, AT THE STATION RECEIVE FREQUENCY, MODULATED WITH A 1 KHZ TONE, WITH ± 3 KHZ DEVIATION.
- E) ACTIVATE S802 TO "PL DIS" POSITION.
- F) PERFORM THE FOLLOWING PROCEDURE.



ALL VOLTAGE MEASUREMENTS ARE DC, UNLESS OTHERWISE STATED.

• ALTERNATE SIGNAL PATH

• TEST TO BE DONE

■ DECISION

* SOURCE OF FAULT

TS = TROUBLESHOOTING

LT \leq LESS THAN

GT = GREATER THAN

EGT = EQUAL TO OR GREATER

TABLE 5
RANGE OF U901

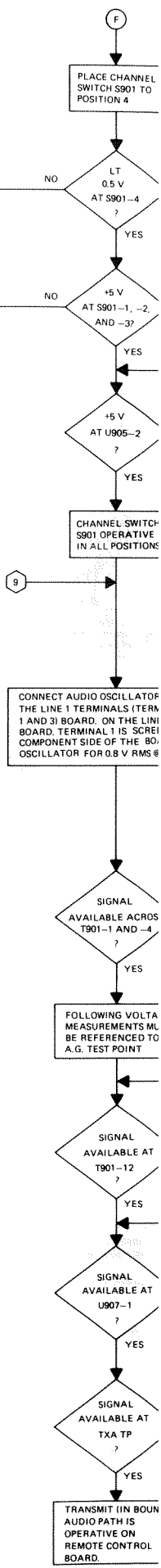
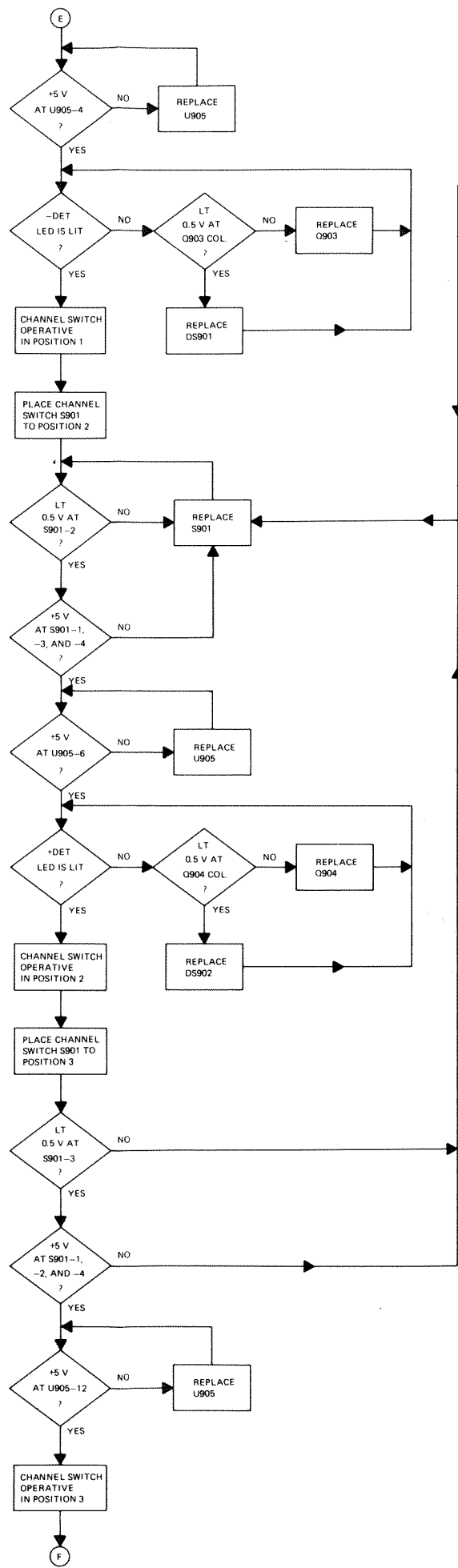
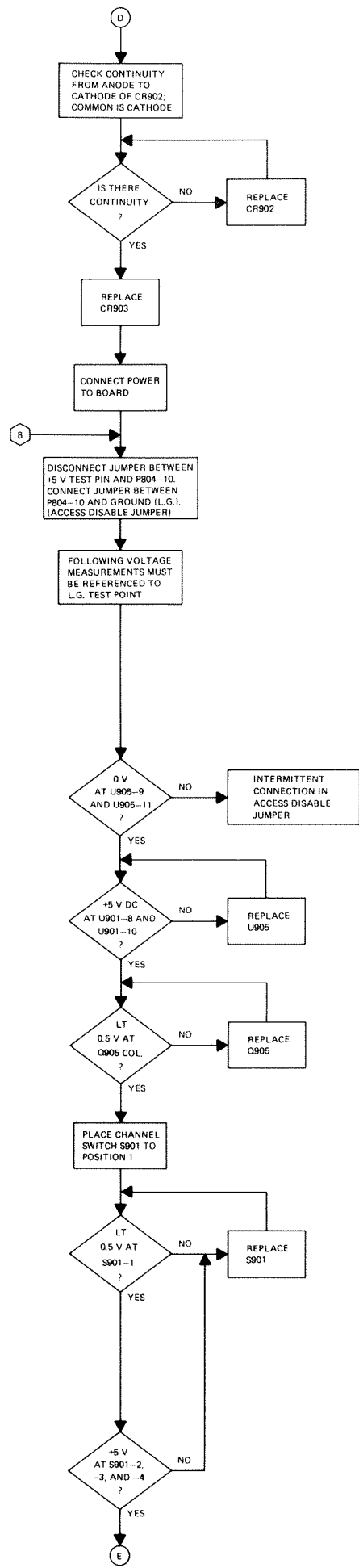
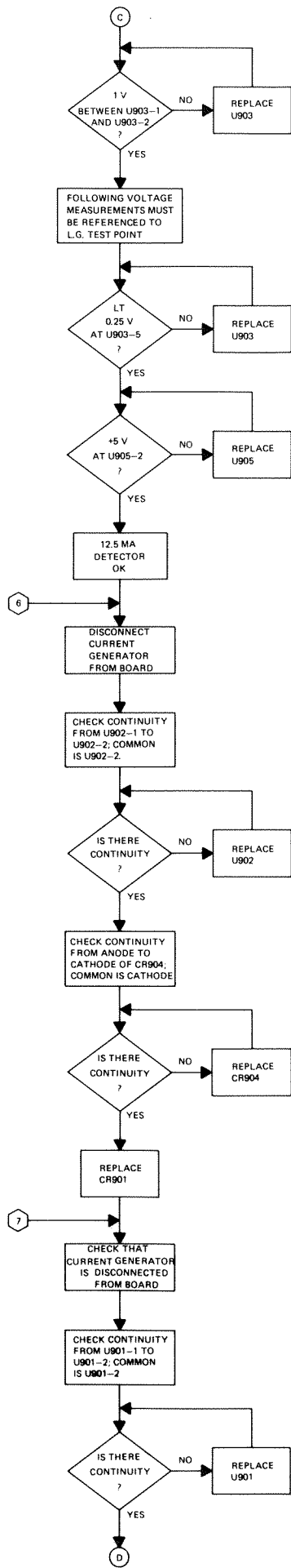
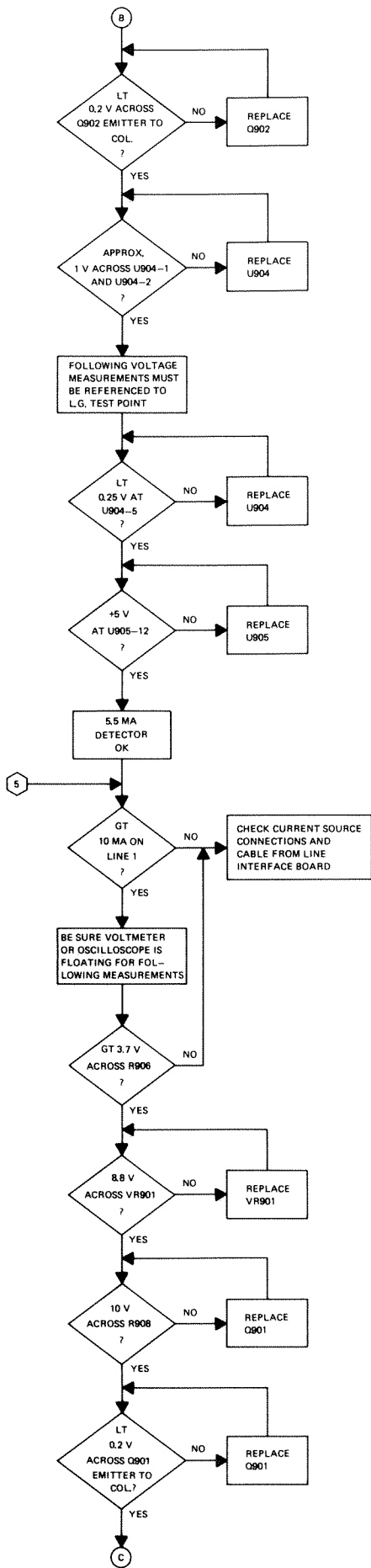
COL = COLLECTOR (OF T

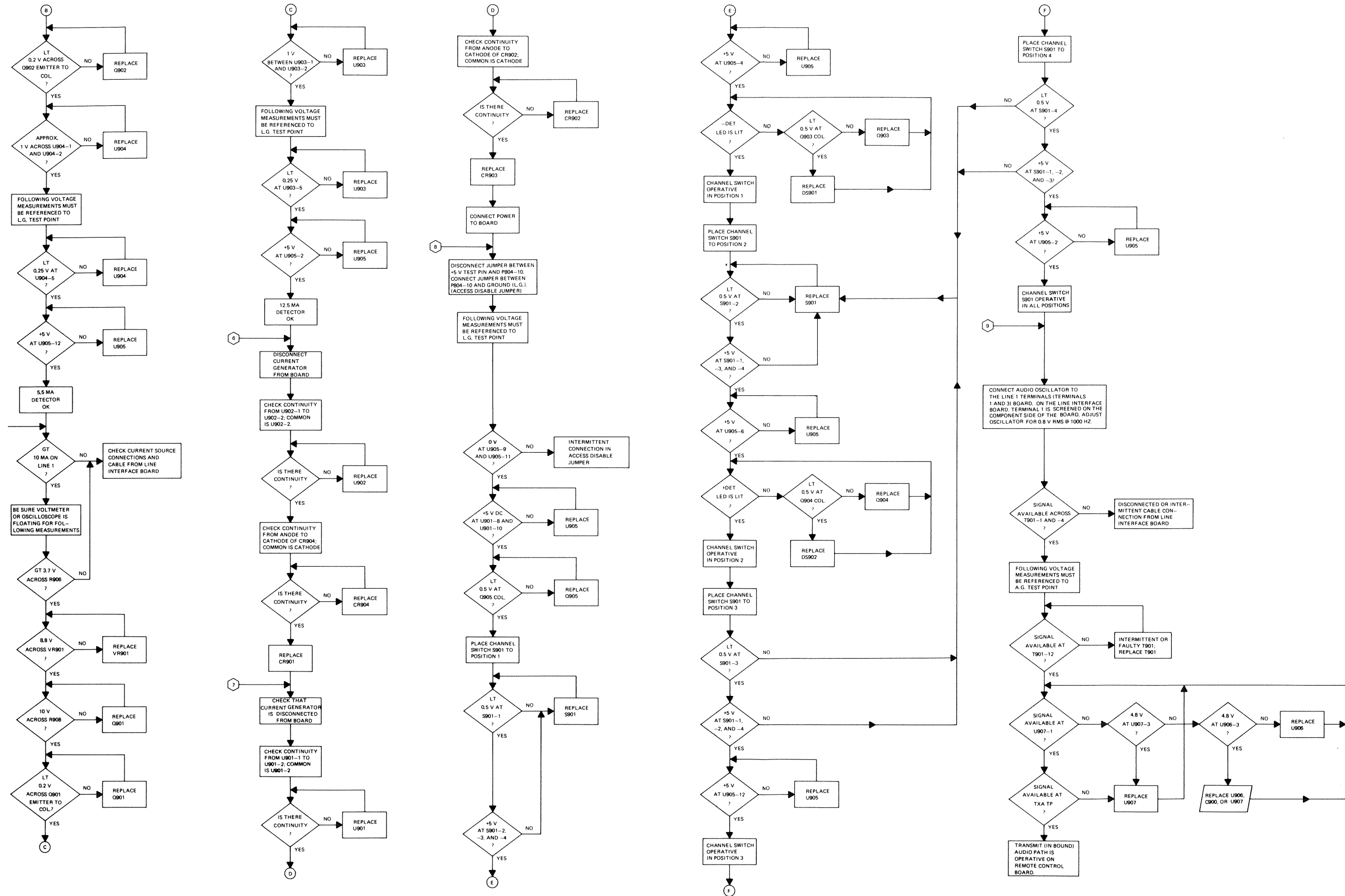
LG \equiv LOGIC GND

AG \Rightarrow AUDIO GND

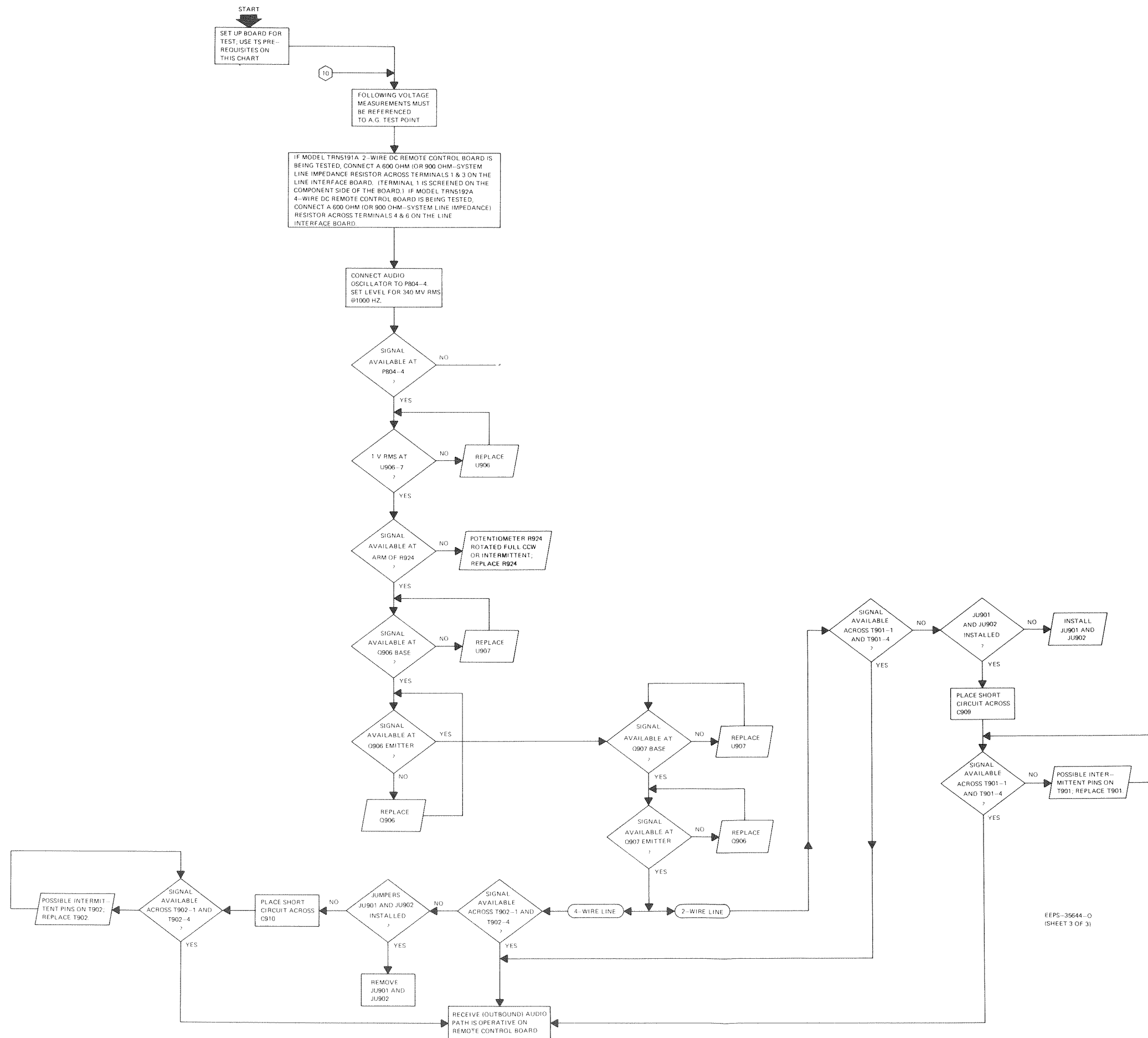
TP = TEST POINT (ON THE

DC REMOTE CONTROL BOARD
TROUBLESHOOTING CHART

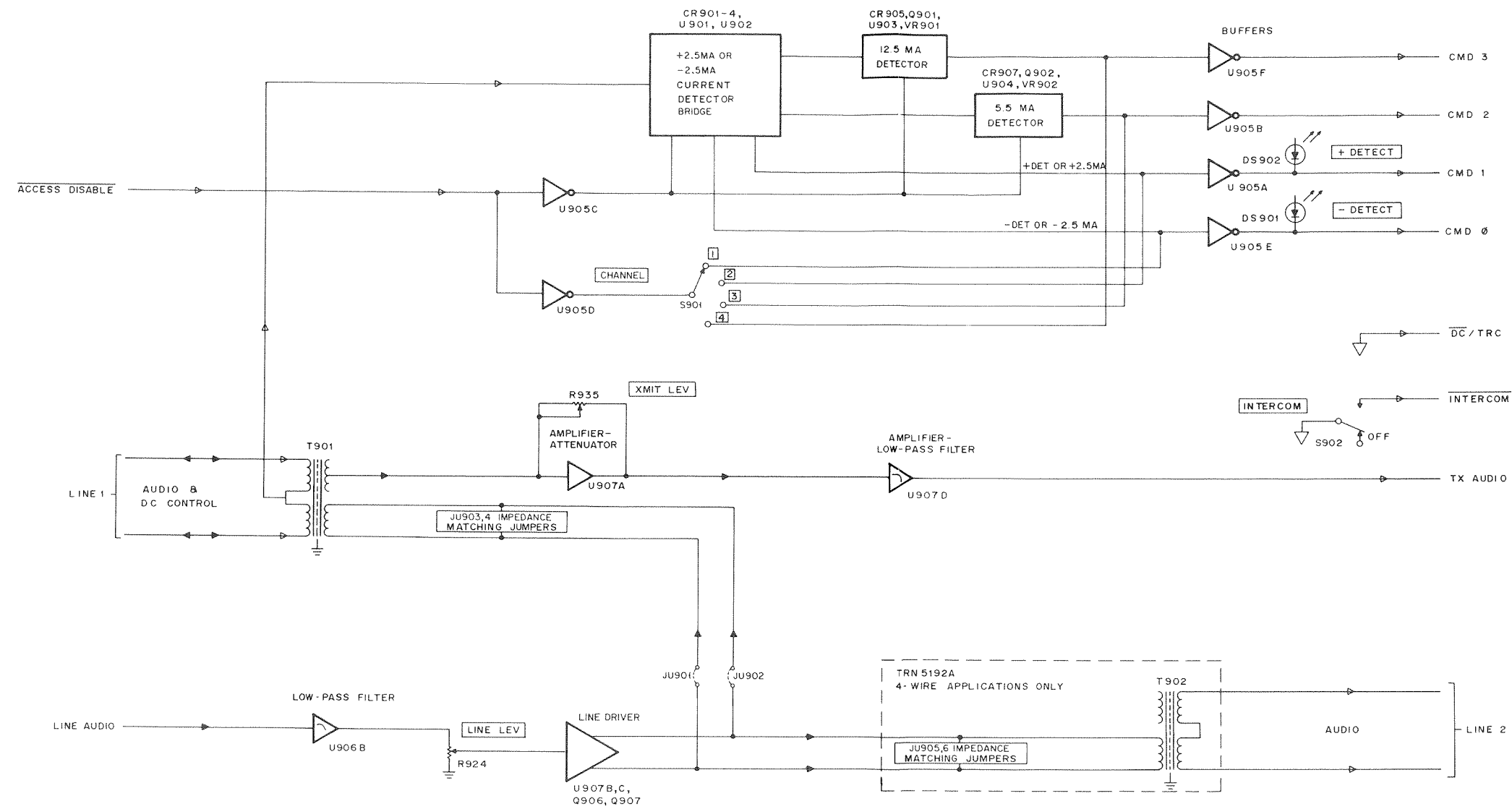




DC REMOTE CONTROL BOARD TROUBLESHOOTING CHART



DC REMOTE CONTROL BOARDS
BLOCK DIAGRAM



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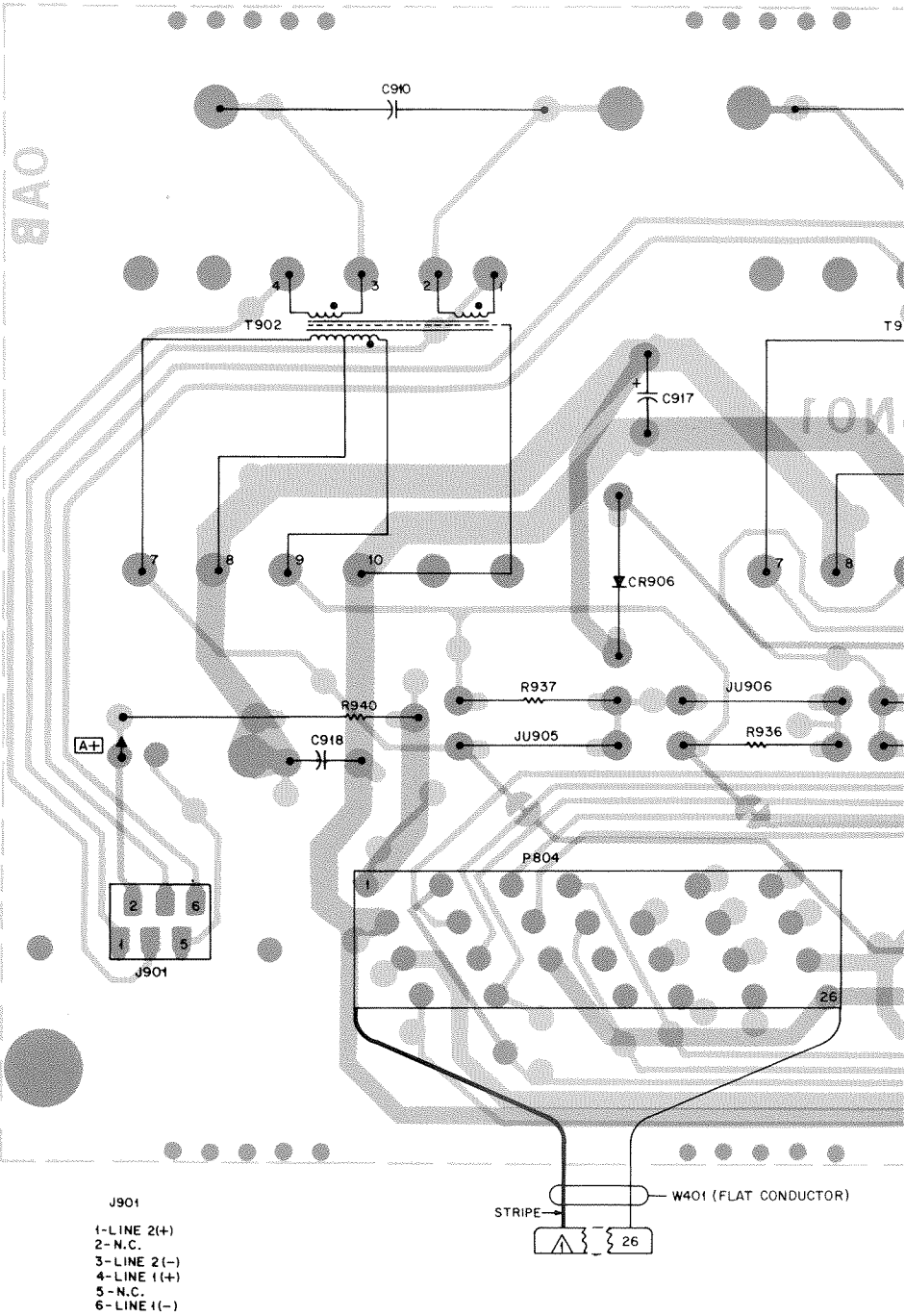
DC REMOTE CONTROL BOARDS

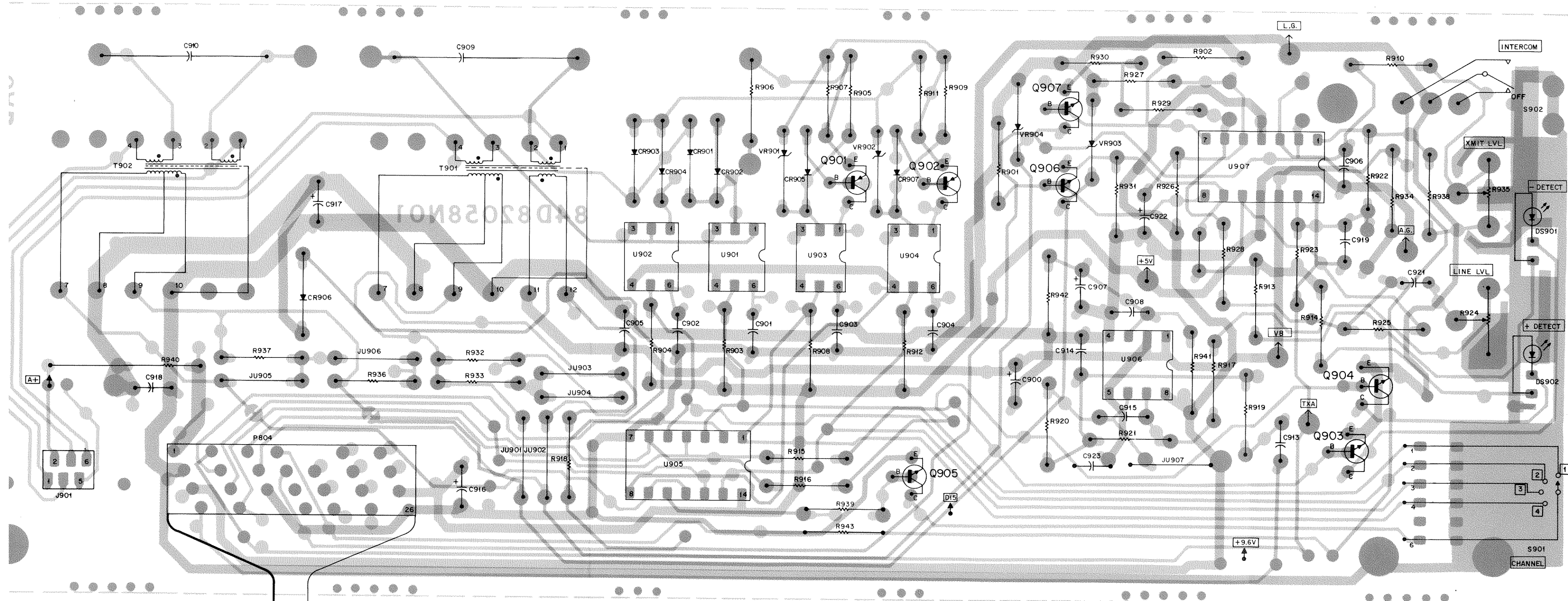
CIRCUIT BOARD DETAILS AND PARTS LISTS

parts list

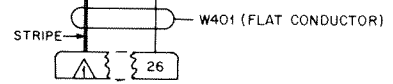
TRN5191A 2-Wire DC Remote Control Board		
TRN5192A 4-Wire DC Remote Control Board		PL-8145-A
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		capacitor, fixed: uF ± 5%; 50 V: unless otherwise stated
C900	23-11019A20	10 ± 20%; 25 V
C901, 902	8-11017A17	0.1
C903	8-11017A15	.056
C904	8-11017A08	.01
C905, 906	21-11014H32	20 pF; 100 V
C907	23-11019A20	10 ± 20%; 25 V
C908	21-11021G07	.01 + 100-0%
C909	8-82045F09	2.2 ± 10%; 250 V
C910	8-82045F09	2.2 ± 10%; 250 V (TRN5192A)
C913	8-11017A17	0.1
C914	7-11017A11	.022
C915	21-11022F58	470 pF
C916	23-11019A20	10; 100 V
C917	23-11019A46	100 ± 20%; 25 V
C918	21-11021G07	.01 + 100-0%
C919	21-11021E05	220 pF ± 10%
C921	8-11017A17	0.1
C922	23-11019A20	10 ± 20%; 25 V
C923	21-11014A48	91 pF
		diode: (see note) silicon
CR901 thru 904	48-82466H18	silicon
CR905, 906, 907	48-11034A01	silicon
		light emitting diode: (see note) yellow
DS901, 902	48-82445C30	
		connector, receptacle: 6-contact; female
J901	9-84206N01	
		connector, plug: 26-contact; p/o W401
P804	—	
		transistor: (see note) PNP; type M9643
Q901, 902	48-869643	PNP; type M9643
Q903, 904, 905	48-869642	NPN; type M9642
Q906, 907	48-869787	NPN; type M9787
		resistor, fixed: ± 5%; 1/4 W: unless otherwise stated
R901, 902	6-11009A65	4.7k
R903, 904	6-11009A79	18k
R905	6-11009A89	47k
R906	6-124C41	470 ± 10; carbon composition
R907	6-10621C03	1210 ± 1%; 1/8 W
R908	6-11009A93	68k
R909	6-11009A89	47k
R910	6-11009A41	470
R911	6-83175C98	2.2k ± 1%
R912	6-11009A93	68k
R913, 914	6-11009A31	180
R915, 916	6-11009A77	15k
R917	6-11009A49	1k
R918	6-11009A89	47k
R919	6-11009A84	30k
R920	6-11009A52	1.3k
R921	6-11009A96	91k
R922	6-11009A71	8.2k
R923	6-11009A89	20k
R924	18-83686N05	variable; 5k (line level)
R925	6-11009A49	1k
R926	6-11009A85	33k
R927	6-11009A73	10k
R928, 929	6-11009A89	47k
R930, 931	6-11009A23	82
R932	6-11009A62	3.6k
R933	6-11009A55	1.8k
R934	6-11009A88	43k
R935	18-83686N06	variable; 250k (transmit level)
R936	6-11009A62	3.6k (TRN5192A)
R937	6-11009A55	1.8k (TRN5192A)
R938	6-11009A49	1k
R939	6-11009A77	15k
R940	6-11009A01	10
R941	6-11009A76	13k
R942	6-11009A73	10k
R943	6-11009A89	47k
		switch: 2-pole, 4-position spdt
S901	40-83658N01	
S902	40-83685N07	
		transformer: pri: leads 1 to 2 & 3 to 4; res. 25 ohms
T901	25-83036L01	sec: leads 7 to 9 & 11 to 12; res. 250 ohms
		pri: leads 1 to 2 & 3 to 4; res. 25 ohms
T902	25-83036L01	sec: leads 7 to 9 & 11 to 12; res. 250 ohms (TRN5192A)
		integrated circuit: (see note) opto-isolator
U901 thru 904	51-83629M75	opto-isolator
U905	51-83627M92	hex Schmitt inverter
U906	51-82848M17	dual opamplifier

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
voltage regulator: (see note)		
VR901	48-82256C56	Zener; 8.8 V
VR902	48-82256C61	Zener; 5.8 V
VR903, 904	48-82022N05	suppressor, transient
W401	30-83139N02	cable, assembly: 26-conductor; flat; 1.5" used (Remote Control); includes ref. item P804 and PCB header
note: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.		
TRN5193A DC Remote Escutcheon		
TRN5200A Blank Escutcheon		PL-8238-O
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		13-83115N01
		13-83115N02
		36-83144N01
		BEZEL, dc remote (TRN5193A)
		BEZEL, blank (TRN5200A)
		KNOB, channel; dc remote (TRN5193A)

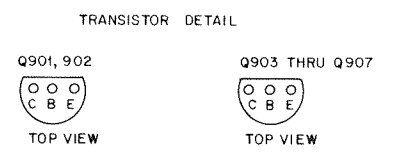




- J901
1-LINE 2(+)
2-N.C.
3-LINE 2(-)
4-LINE 1(+)
5-N.C.
6-LINE 1(-)

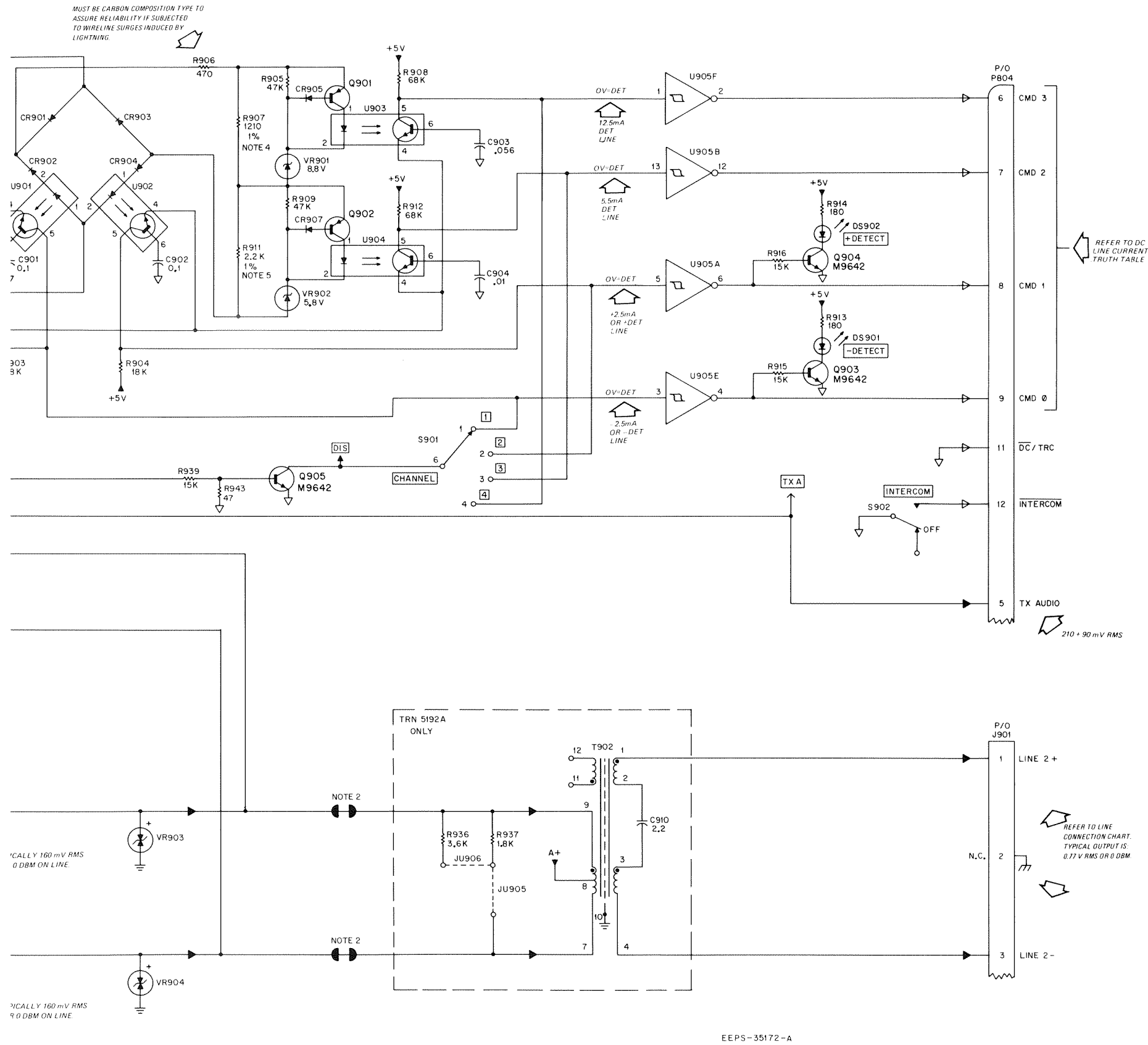


SHOWN FROM COMPONENT SIDE



- COMPONENT SIDE BD-EEPS-37427-0
SOLDER SIDE BD-EEPS-37428-0
OL-EEPS-37429-0

DC REMOTE CONTROL BOARDS
SCHEMATIC DIAGRAM



NOTES:

- Unless otherwise specified, resistor values are in ohms and capacitor values are in microfarads.
- Foil jumpers (see LEGEND and Circuit Board Detail) are located adjacent to the P804 header on the component side of the pc board. These jumpers are cut to field-convert to 4-Wire DC Remote Control Board to a 2-Wire board. Refer to JUMPERTABLE for additional conversion requirements.
- Transformers (T901 and T902) and opto-isolators (U901-U904) provide an isolating "barrier" between the remote control line(s) and the station, as shown by the white line on the component side legend of the PCB.
- Voltage drop across R907 is approximately 10 V dc during 12.5 mA detect.
- Voltage drop across R911 is 7 V during 5.5 mA detect.

Line Connection Chart		
Application	Line 1 J901-4(+), -6(-)	Line 2 J901-1(+), -3(-)
2-Wire	Inbound Tx Audio, DC Control Currents, & Outbound Line Audio	Not Used
4-Wire	Inbound Tx Audio, & DC Control Current	Outbound Line Audio

Jumper Table						
Remote Wire Line Options	Jumper Designation					
	JU901	JU902	JU903	JU904	JU905	JU906
2-Wire (600 ohms)	In	In	In	In	Out	Out
2-Wire (900 ohms)	In	In	In	Out	Out	Out
4-Wire* (600 ohms)	Out	Out	In	In	In	In
4-Wire* (900 ohms)	Out	Out	In	Out	In	Out

* SEE NOTE 2

Integrated Circuit Data Chart					
Ref. Desig.	+ 5. V (Pin)	+ 9.6 V (Pin)	Logic Gnd (Pin)	Audio Gnd (Pin)	Description
U901	Refer to the schematic diagram for connections				opto-isolator
U902	Refer to the schematic diagram for connections				opto-isolator
U903	Refer to the schematic diagram for connections				opto-isolator
U904	Refer to the schematic diagram for connections				opto-isolator
U905	14	-	7	-	hex schmitt (inv)
U906	-	8	-	4	dual op amp
U907	-	4	-	11	quad op amp

DC Line Current Truth Table				
Current (mA)	P804-6 CMD 3	P804-7 CMD 2	P804-8 CMD 1	P804-9 CMD 0
+ 12.5	H	H	H	L
+ 5.5	L	H	H	L
+ 2.5	L	L	H	L
0(NULL)	L	L	L	L
- 2.5	L	L	L	H
- 5.5	L	H	L	H
- 12.5	H	H	L	H

Notes:

- H = + 5 V; L = 0 V
- Current detectors Enabled (ADIS⁻ = H)

Channel Switch Truth Table				
S901 Position	P804-6 CMD 3	P804-7 CMD 2	P804-8 CMD 1	P804-9 CMD 0
1	L	L	L	H
2	L	L	H	L
3	L	H	L	L
4	H	L	L	L

Notes:

- H = + 5 V; L = 0 V
- Current detectors Disabled (ADIS⁻ = L)

