MAINTENANCE MANUAL
FOR
MULTIPLE TRANSMITTER STATIONS
(OPITIONS 7427, 7428, 7437, 7438)

TABLE OF CONTENTS

DESCRIPTION

The MASTR Progress Line stations used in multiple transmitter systems are single-frequency, remote control base stations operating in the 150.8-174 MHz or 450-470 MHz range. The application of the different option numbers is shown in the following chart.

Option Number	Transmitter Type Number		Power Output	Station Receiver
	150.8-174 MHz	450-470 MHz		
7427	ET-58-M	ET-60-K	90 Watts 70 Watts	No
7428	ET-70-F	ET-71-E	330 Watts 250 Watts	No
7437	ET-58-M	ET-60-K	90 Watts 70 Watts	Yes
7438	ET-70-F	ET-71-E	330 Watts 250 Watts	Yes

Up to 10 stations can be controlled by a centrally-located Multi-Transmitter Control Panel. The Control Panel is keyed by the operator of a remote control unit (Deskon, TCC, etc.), which, in turn, keys all of the transmitters in the system simultaneously.

The transmitters are located so that their RF output saturates a specified operating area. This assures that a receiver anywhere in the area will receive a strong, readable signal.

MODIFICATION

Modifications to the station includes the following:

- Installation of a stable oscillator panel,
- Installation of RF Level Detector,
- Modifying the transmitter exciter board for operation with the stable oscillator,
- Connecting the transmitter RF sniffer output to the RF Level.
- Detector (medium Power stations only).

Complete instructions for each modification are contained in the applicable Modification Diagram provided in this manual.

ADJUSTMENT

STABLE OSCILLATOR

The stability of the oscillator is better than the measurement capability of most field measuring instruments. Therefore, it is recommended that the oscillator be adjusted only as directed in the Transmitter Adjustment Procedure contained in the Maintenance Manual for the Multi-Transmitter Control Panel (LBI-4334).

REMOTE CONTROL PANEL

Modulation Input

Adjust the remote control panel as directed in Maintenance Manual LBI-4155 except for the Modulation Input Adjustment. Adjust the MODULATION INPUT control (R27) on the Intercom-Compressor board for 3.3 kHz deviation for the transmitter.

Transmit Fail

The Remote Control Panel is equipped with a RF failure detector circuit. When the transmitter output power drops 50% or more, a relay on the KC-16-A de-energizes. De-energizing the relay inserts a resistance in the telephone loop. This change in current is detected at the Multi-Transmitter Control Panel, lighting the Transmit Fail light and activating the external alarm. To set the transmit fail circuit:

1. Connect a milliammeter in series with the control line.
2. Key the transmitter from the Multi-Transmitter Control Panel and reduce the transmitter RF output by approximatley 50%.
3. With the transmitter keyed, adjust the RF level control (R1) on the RF Level detector until its relay just energizes.

NOTE

On medium power stations, remove the test set metering plug for this adjustment. Also, the plug must be removed during normal operations.

4. Reduce the transmitter power output and additional 5 to 10 Watts until the RF Level Detector relay de-energizes. Then adjust the 6 milliampere current control (R6) for a line current of 6 milliamperes.
5. Re-align the transmitter for the proper power output.
6. Repeat this procedure for each transmitter in the system.

CIRCUIT ANALYSIS

STABLE OSCILLATOR

The stable oscillator mounts on a two-rack unit panel below the KC-16-A remote control panel. The oscillator operates on 12.6 Volts from station power supply type EP-38-A, and provides a sinewave output of one Volt RMS into 50 ohms. The output is connected by RF cables to a phono jack on the bottom cover of the transmitter, and then to the transmitter exciter modulator circuit. The exciter is modified so that it can be changed back to the original circuit, if desired.

Frequency stability of the oscillator is ±5 parts-per-hundred million (±.000005%) from -30°C to +60°C (+25°C reference). The aging stability is ±1 part-per-billion per day after a 30-day burn-in period.

This stability provides a maximum difference of only ±144 Hz per year between two 150.8-174 MHz transmitters, and a maximum of difference of only 384 Hz between two 450-470 MHz transmitters.

RF LEVEL DETECTOR

Two different RF level detector circuits are available. One is used in medium power stations, and the other in high power stations. The circuit is mounted on the station remote control panel (KC-16-A). Power and RF sniffer connections are shown on the applicable Modification and Schematic Diagram (see Table of Contents).

Each time the transmitter is keyed, the RF level detector circuit monitors the output power. If the RF level drops below 50%, a potentiometer is switched into the line control circuit, causing the control current to drop to 6 milliamperes. This change in current is detected as a failure at the Multi-Transmitter Control Panel.

References to symbol numbers mentioned in the following text can be found on the applicable Schematic Diagram, Outline Diagram or Parts List (see Table of Contents).

Medium Power Level Detector

The medium power RF level detector operates on the negative voltage from the transmitter RF sniffer circuit. Keying the transmitter applies the negative RF sniffer voltage to the emitter of Q1 through RF Level potentiometer R1. If the transmitter output is over 50% of rated output, the "sniffer" voltage turns on transistor Q1. Turning on Q1 causes Q2 and Q3 to conduct, energizing relay K1. Energizing K1 connects the line control current through contacts 6 and 7, bypassing the 6-milliampere current adjust potentiometer (R6). Bypassing R6 keeps the control current at approximately 20 milliamperes, which keeps the 15 milliampere Line Fail relays at the Multi-Transmitter Control Panel energized. Capacitor C2 keeps the Line Fail relays energized until the RF power builds up enough to operate the detector circuitry.

When the power output drops below 50%, the RF sniffer voltage at the emitter of Q1 is not sufficient to turn the transistor on. Relay K1 does not energize and the control current is coupled through potentiometer R6, which is set for 6 milliamperes. Reducing the line current to 6 milliamperes causes the Line Fail relays at the Multi-Transmitter Control Panel to de-energize, turning on the FAIL lights and activating the external fail circuits.

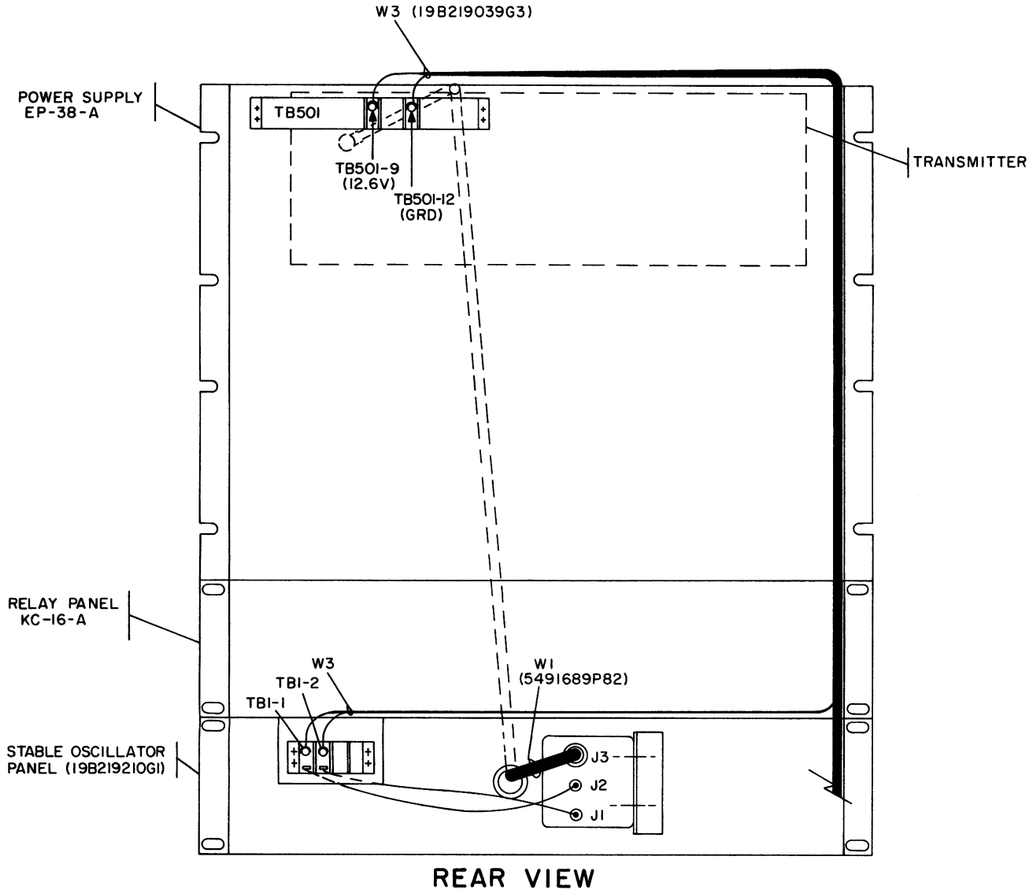
Instructions for setting R1 and R6 are contained in the Adjustment Procedure.

High Power Level Detector

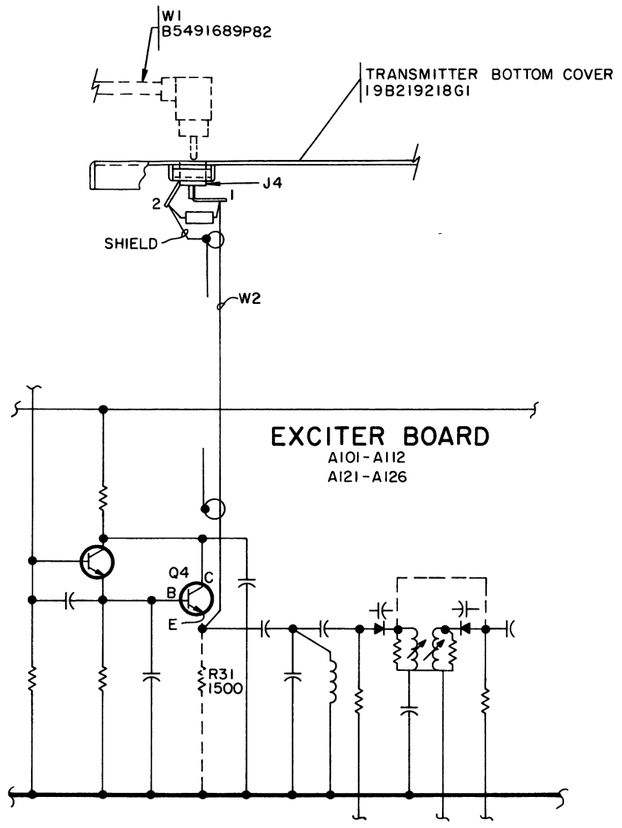
The high power RF Level Detector operates on the positive voltage from the reflectometer on the station Power Amplifier. Keying the transmitter applies the positive reflectometer voltage to the cathode of CR1. When the transmitter output is over 50% of rated output, the reflectometer voltage keeps Q4 turned off. This causes Q5 to turn on, turning on Q3 and Q2. Turning on Q2 energizes relay K1, connecting the line control current through contacts 6 and 7 which bypasses the 6-milliampere current adjust potentiometer. Bypassing R6 keeps the control current at approximately 20 milliamperes, keeping the 15 milliampere Line Fail relays energized at the Multi-Transmitter Control Panel. Capacitor C2 keeps the Line Fail relays energized until the transmitter power builds up enough to operate the detector circuitry.

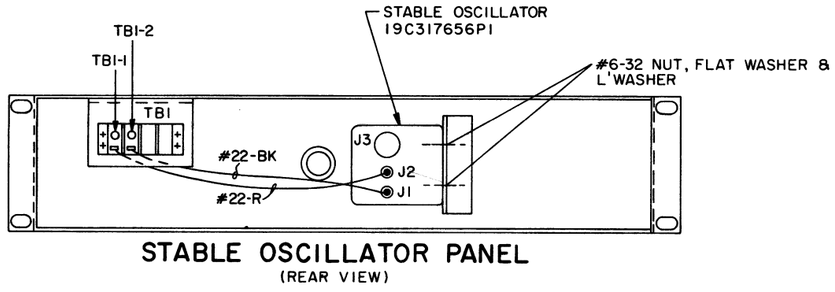
When the power output drops below 50%, the reflectometer voltage drops enough to allow Q4 to turn on. Turning on Q4 keeps Q5, Q3 and Q2 turned off so that K1 does not energize. With K1 not energized, the control current is coupled through potentiometer R6. R6 is set for 6 milliamperes, which reduces the line current and causes the Line Fail relays at the Multi-Transmitter Control Panel to de-energize. De-energizing the relays turns on the transmit FAIL lights and activates the external fail circuits.

Instructions for setting R6 and R6 and R10 are contained in the Adjustment Procedure.

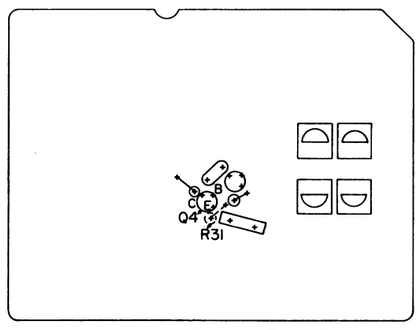


REAR VIEW





STABLE OSCILLATOR PANEL
(REAR VIEW)



EXCITER BOARD

(19D413924, Rev. 1)

THESE INSTRUCTIONS COVER THE INSTALLATION OF STABLE OSCILLATOR KIT (PL19A128138G1). & MODIFICATION TO STATION TRANSMITTER & POWER SUPPLY (4EP38)

INSTALLATION INSTRUCTIONS;

STABLE OSCILLATOR PANEL

1. MOUNT OSCILLATOR (19C317656P1) TO PANEL (PL19B219210G1) WITH #6-32 NUT, L WASHER & FLAT WASHER PROVIDED. PUSH OSCILLATOR AGAINST FRONT OF PANEL BEFORE SECURING.
2. SOLDER BLACK #22 WIRE PROVIDED BETWEEN TB1-2 & OSCILLATOR J1. SOLDER RED #22 WIRE PROVIDED BETWEEN TB1-1 & OSCILLATOR J2.
3. INSTALL OSCILLATOR PANEL IMMEDIATELY BELOW LAST PANEL IN STATION WITH #12-24 HARDWARE SUPPLIED.
4. CONNECT CABLE W3 BETWEEN OSCILLATOR PANEL & POWER SUPPLY (4EP38) AS SHOWN WITH WIRE MARKED #1 GOING FROM TB1-1 (OSC. PANEL) TO TB501-9 (12.6V) (POWER SUPPLY) & WIRE MARKED #2 GOING FROM TB1-2 (OSC. PANEL) TO TB501-12 (GRD) (POWER SUPPLY).

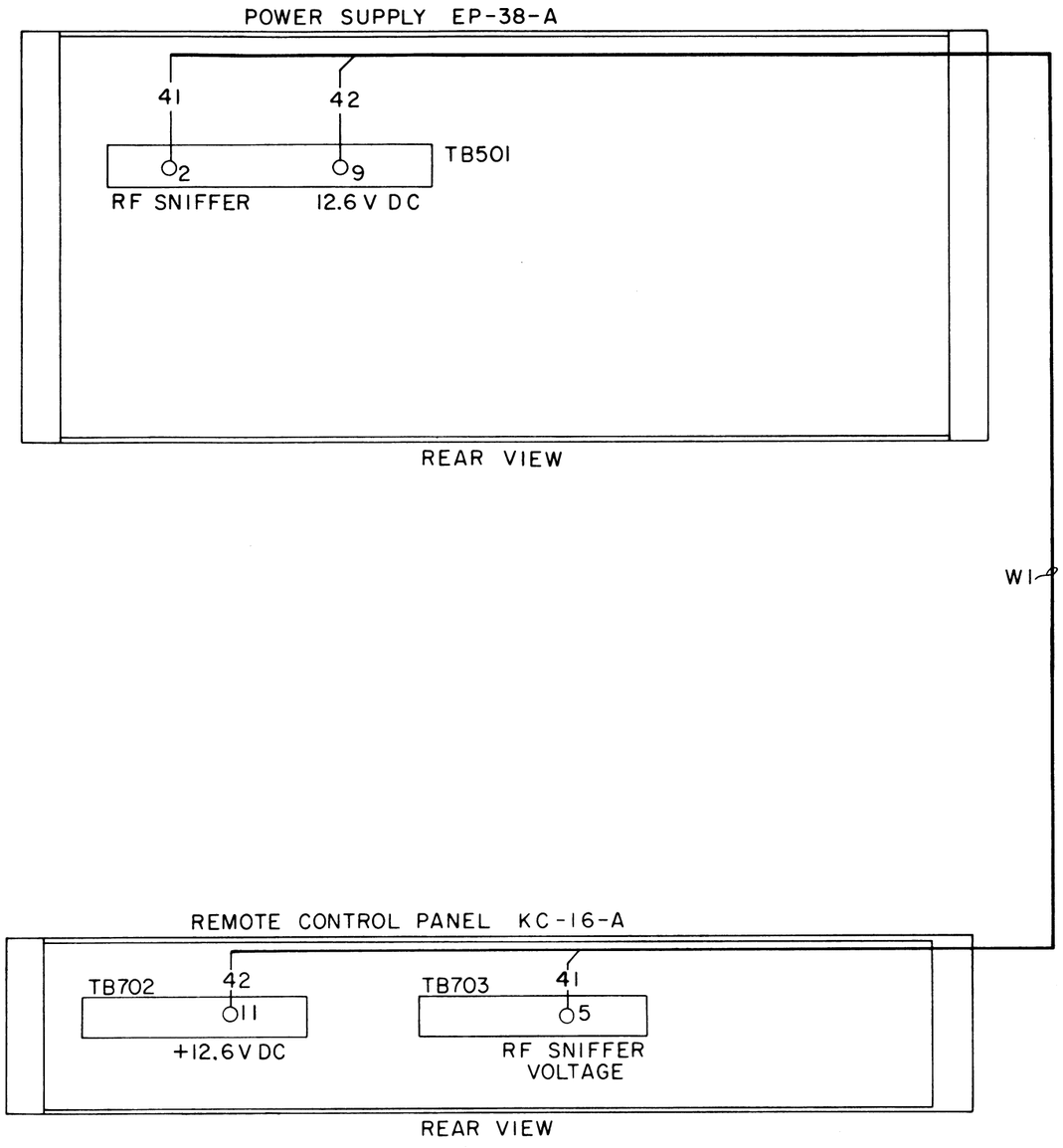
TRANSMITTER MODIFICATION

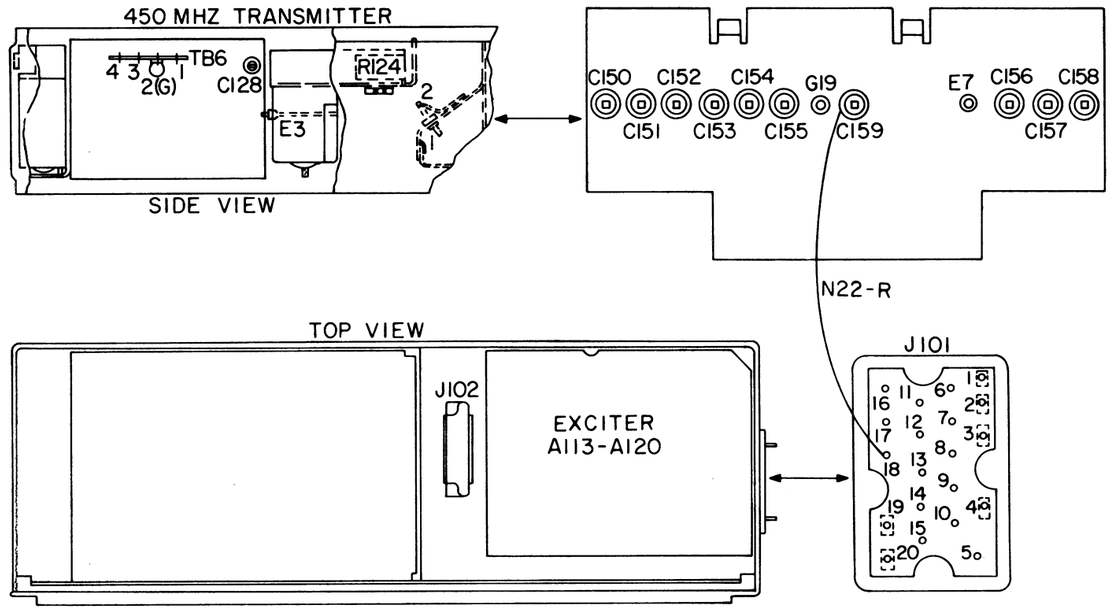
1. REMOVE 2 SCREWS SECURING BOTTOM COVER OF TRANSMITTER & SAVE.
2. REMOVE BOTTOM COVER & RETURN TO STOCK.
3. REMOVE MOUNTING SCREWS OF CHANNEL GUARD OR LOW PASS FILTER BOARD & SAVE IF PRESENT. REMOVE BOARD SO AS TO HAVE EASY ACCESS TO EXCITER BOARD.
4. ON EXCITER BOARD (19C303483) REMOVE EMITTER LEAD OF Q4 & REMOVE R31 FROM BOARD.
5. CONNECT CENTER CONDUCTOR OF CABLE W2 (PART OF NEW TRANSMITTER BOTTOM COVER) IN HOLE LEFT BY REMOVAL OF Q4 EMITTER LEAD. THIS CONNECTION TO BE MADE FROM BACK SIDE OF EXCITER BOARD.
6. REPLACE CHANNEL GUARD OR LOW PASS FILTER BOARD.
7. ASSEMBLE NEW TRANSMITTER BOTTOM COVER (PL19B219218G1) ON TRANSMITTER & SECURE WITH TWO SCREWS. (INSTRUCTION 1, TRANSMITTER MODIFICATIONS).
8. CONNECT CABLE W1 (B5491689P82) BETWEEN TRANSMITTER BOTTOM COVER & STABLE OSCILLATOR PANEL AS SHOWN. ROUTE CABLE W1 ACROSS TOP OF TRANSMITTER IN MOST CONVENIENT MANNER.

MODIFICATION DIAGRAM

STABLE OSCILLATOR

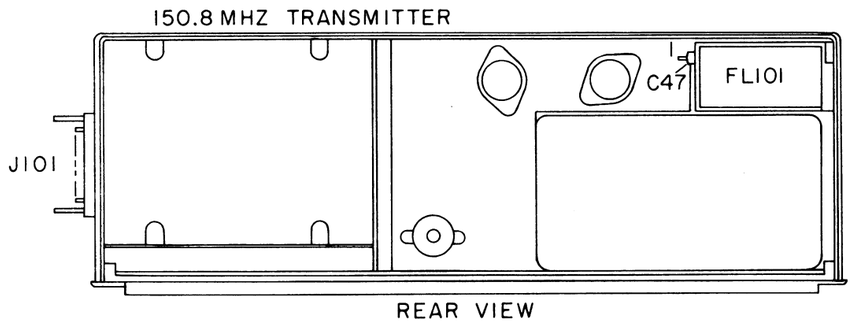
Issue 1





INSTALLATION INSTRUCTIONS:

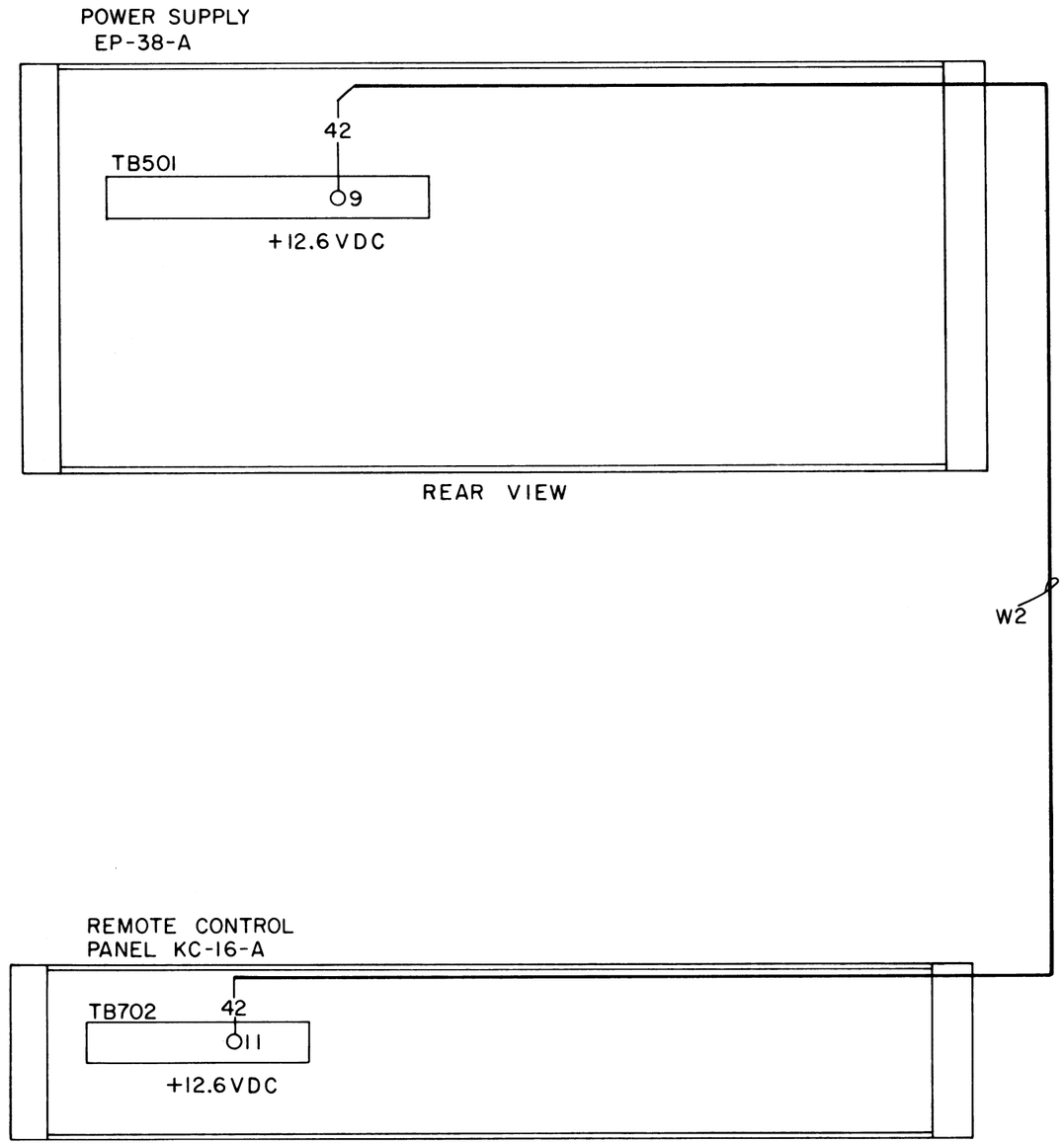
1. CONNECT W1 AS SHOWN.
2. CONNECT RED WIRE (SUPPLIED) BETWEEN C159-1 AND J101-18 IN 450 TRANSMITTERS OR BETWEEN C47 OF FL101 AND J101-18 IN HIGH BAND TRANSMITTERS.

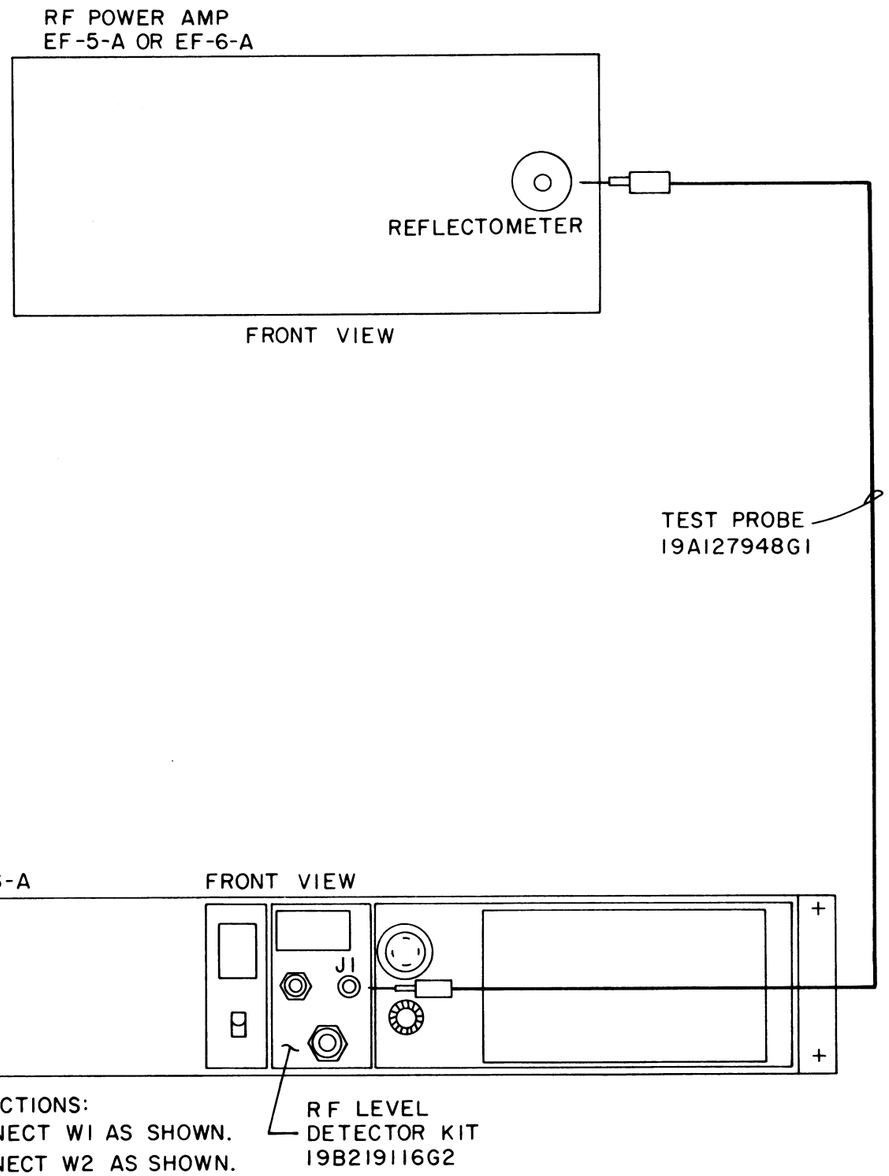


MODIFICATION DIAGRAM

(19C317734, Rev. 1)

RF LEVEL DETECTOR
MEDIUM POWER

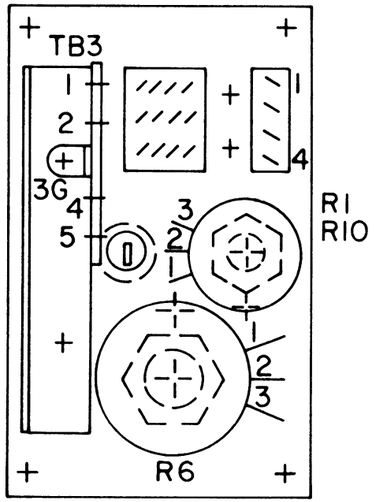


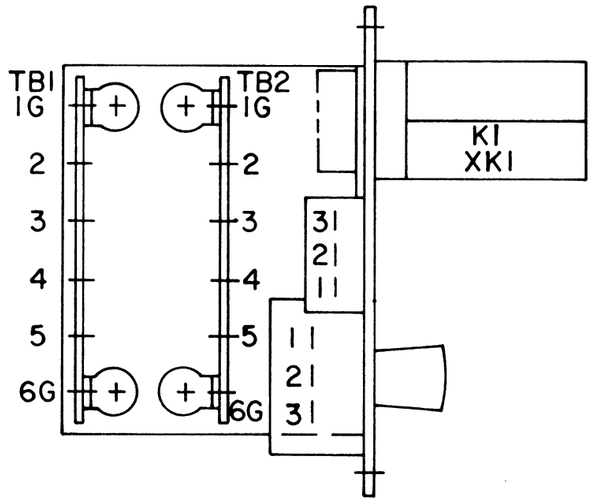


(19C317736, Rev. 1)

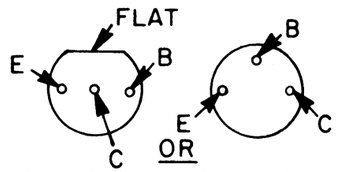
MODIFICATION DIAGRAM

RF LEVEL DETECTOR
HIGH POWER





LEAD IDENTIFICATION
FOR Q1-Q5



IN-LINE TRIANGULAR
VIEW FROM LEAD END

NOTE: LEAD ARRANGEMENT, AND NOT CASE SHAPE, IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

(19B219620, Rev. 0)

OUTLINE DIAGRAM

RF LEVEL DETECTOR

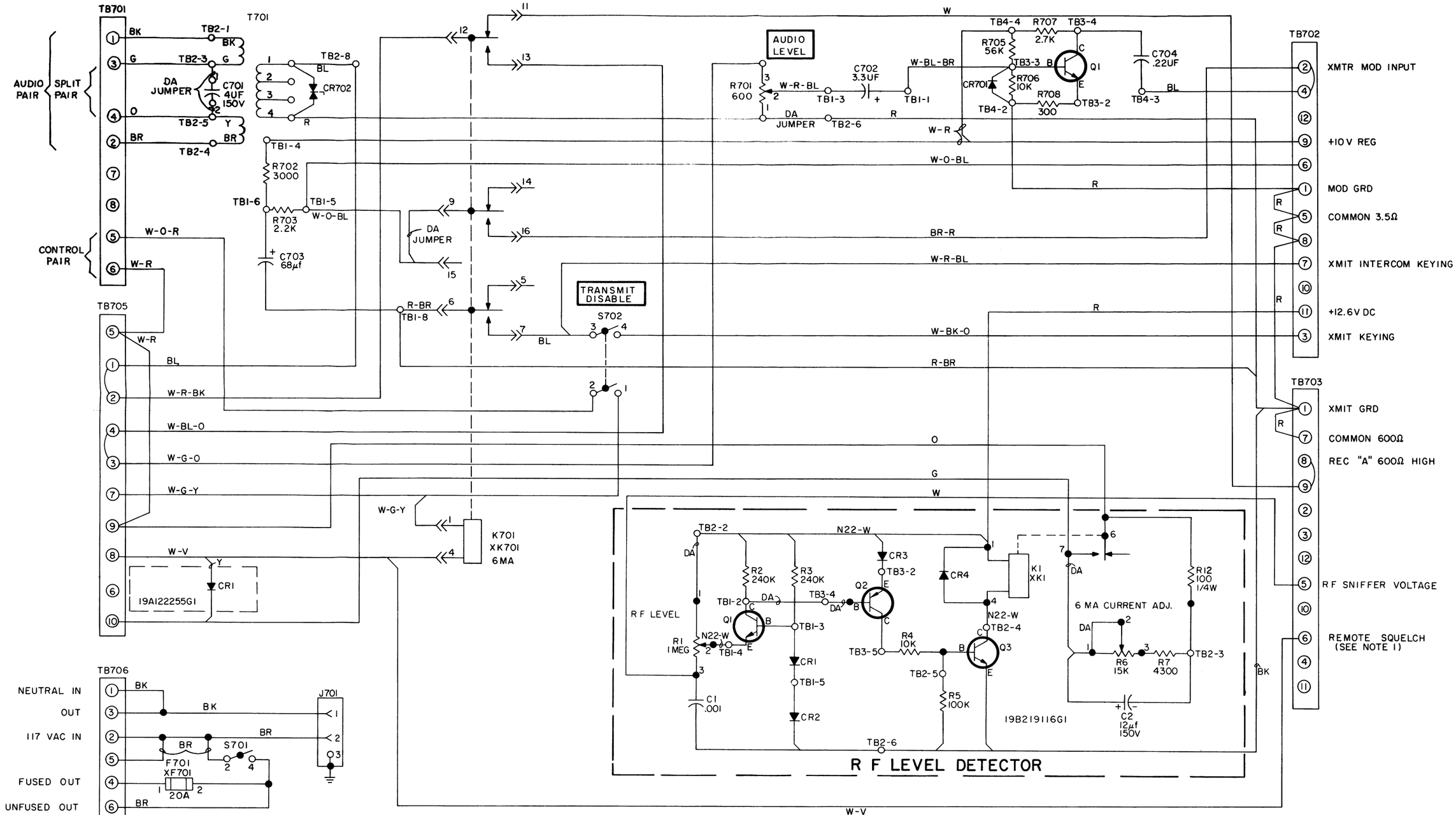
8 Issue 1

PARTS LIST

RF LEVEL DETECTOR
19B219116G1 MEDIUM POWER
19B219116G2 HIGH POWER

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1	5494481P11	Ceramic disc: 1000 pf ±20%, 1000 VDCW; sim to RMC Type JF Discap.
C2	19A115680P15	Electrolytic: 12 µf +150% -10%, 150 VDCW; sim to Mallory Type TT.
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR1 thru CR3	19A115250P1	Silicon.
CR4	4037822P1	Silicon.
		- - - - - - - - JACKS AND RECEPTACLES - - - - - -
J1	7150763P2	Jack, tip, stake-in: red nylon body, sim to Alden Products 110BC1.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	5491595P14	Armature: 1.5 w operating, 520 ohms ±15% coil res, 4 form C contacts; sim to Allied Control T154-X-131.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q2	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q3	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q4 and Q5	19A115768P1	Silicon, PNP; sim to Type 2N3702.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	5494774P110	Variable, carbon film: 1 megohm ±20%, 0.2 w; sim to CTS Series 70 Control.
R2 and R3	3R77P244J	Composition: 0.24 megohm ±5%, 1/2 w.
R4	3R77P103J	Composition: 10,000 ohms ±5%, 1/2 w.
R5	3R77P104J	Composition: 0.10 megohm ±5%, 1/2 w.
R6	5496870P1	Variable, carbon film: 15,000 ohms ±20%; sim to Mallory LC(15K).
R7	3R77P432J	Composition: 4300 ohms ±5%, 1/2 w.
R8	3R77P303J	Composition: 30,000 ohms ±5%, 1/2 w.
R9	3R77P474J	Composition: 0.47 megohm ±5%, 1/2 w.
R10	5494774P103	Variable, carbon film: 5000 ohms ±20%, 0.3 w; sim to CTS Series 70 Control.
R11	3R77P104J	Composition: 0.10 megohm ±5%, 1/2 w.
R12	3R152P101J	Composition: 100 ohms ±5%, 1/4 w.
		- - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1 and TB2	7775500P16	Phen: 6 terminals.
TB3	7487424P7	Miniature, phen: 4 terminals.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XK1	5491595P5	Relay: 16 contacts; sim to Allied Control 30054-2.
		- - - - - - - - - MISCELLANEOUS - - - - - - -
	5491595P9	Retainer: spring; sim to Allied Control 30040-2. (Used with K1).
	19A115308P1	Knob. (Used with R1 and R10).

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES



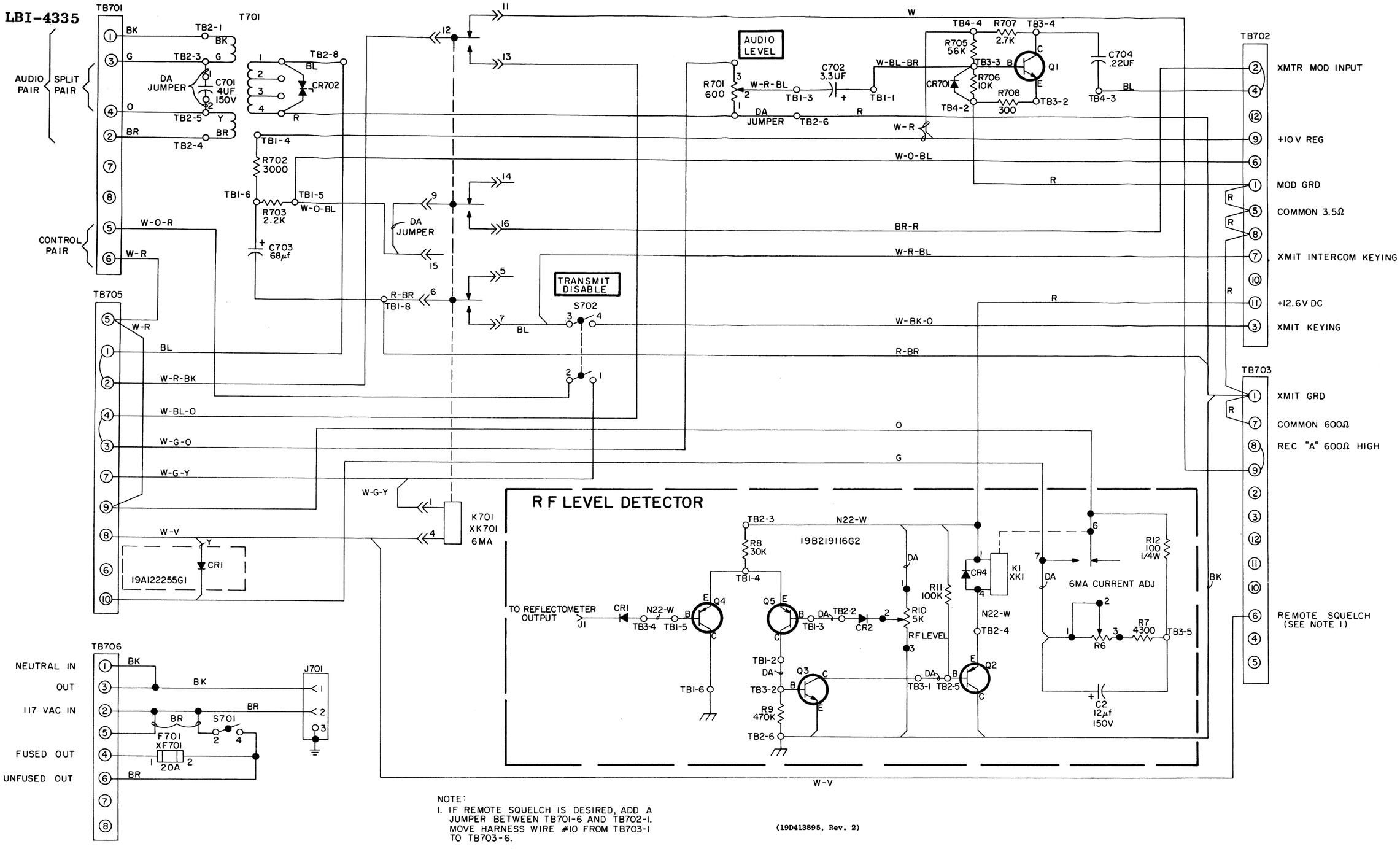
NOTE:
1. IF REMOTE SQUELCH IS DESIRED, ADD A JUMPER BETWEEN TB701-6 AND TB702-1. MOVE HARNESS WIRE #10 FROM TB703-1 TO TB703-6.

(19D413886, Rev. 2)

SCHEMATIC DIAGRAM

RF LEVEL DETECTOR MEDIUM POWER

Issue 1



NOTE:
1. IF REMOTE SQUELCH IS DESIRED, ADD A JUMPER BETWEEN TB701-6 AND TB702-1. MOVE HARNESS WIRE #10 FROM TB703-1 TO TB703-6.

(19D413895, Rev. 2)

SCHEMATIC DIAGRAM

RF LEVEL DETECTOR
HIGH POWER

10 Issue 1

DF-9028

MOBILE RADIO DEPARTMENT
GENERAL ELECTRIC COMPANY • LYNCHBURG, VIRGINIA 24502

GENERAL ELECTRIC

Printed in U.S.A.