MOBILE RADIO

MASTR® Progress Line

REMOTE CONTROL PANEL MODEL 4KC16A10

(and Options 7620, 7621, 7650, 7651, 7659 & 7660)

Maintenance Manual LBI3726F
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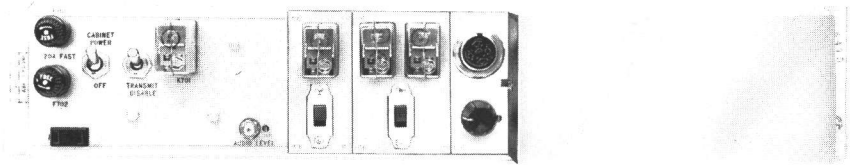

SPECIFICATIONS *

Minimum signal for 70% Modulation	-12 dBm (without compressor)
Input Impedance	600 ohms
Audio Line Output	+18 dBm into 600 ohms
Temperature Range	-30°C to +60°C (-22°F to +140°F)
Frequency Response	±2 dB from 300 to 3,000 Hz
Distortion	Less than 3%
Dimensions (HxWxD)	3 1/2" x 19" x 3 1/4" (Less Options)

4KC16A10

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

GENERAL ELECTRIC

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ILLUSTRATIONS

WARNING

No one should be permitted to handle any portion of the equipment that is supplied with high voltage; or to connect any external apparatus to the units while the units are supplied with power. KEEP AWAY FROM LIVE CIRCUITS.

DESCRIPTION

General Electric Remote Control Panel Model 4KC16A10 was designed for use with the Transistorized Control Console in MASTR Progress Line remote, local/remote, and remote/repeater station applications. The Control Panel is also compatible with systems using Remote Control Unit EC-28-4 and Remote Control Panel KC-7-C.

The Remote Control Panel uses silicon diodes and sensitive relays to provide a maximum of five functions by the application of different levels and polarities of control current from the Remote Control Console.

Accessory kits and options are available for multi-frequency operations, Channel Guard, Intercom-Compressor, Compressor-Amplifier or Repeater-Disable functions. Refer to the Service Sheets on pages 15 through 24 for schematic diagrams of available accessories and options.

CONTROL METHODS

Three types of telephone line connections are commonly used in remote control applications (see Figure 1). Before choosing one of these methods, consider both the cost and the performance of each, as one method may be available at a considerably lower rate. In addition, some local telephone companies offer no choice, but will provide an audio pair and a control pair. The chart at the bottom of this page contains information to assist in selecting the Control Method and type of telephone line to be leased.

TELEPHONE LINE CONNECTIONS

Because different control current polarities are used to select different functions at the Remote Control Panel, the lines carrying the control current must be connected to corresponding terminals at the Control Console and the Control Panel. To identify each end of one of the wires, temporarily connect one of the wires at the Remote Control Panel to a good earth ground, and measure the resistance of each wire to ground at the Remote Control Console. The grounded wire will show a resistance to ground. The other wire will show an open circuit.

Connect the telephone lines by one of the following methods (see Fig. 1):

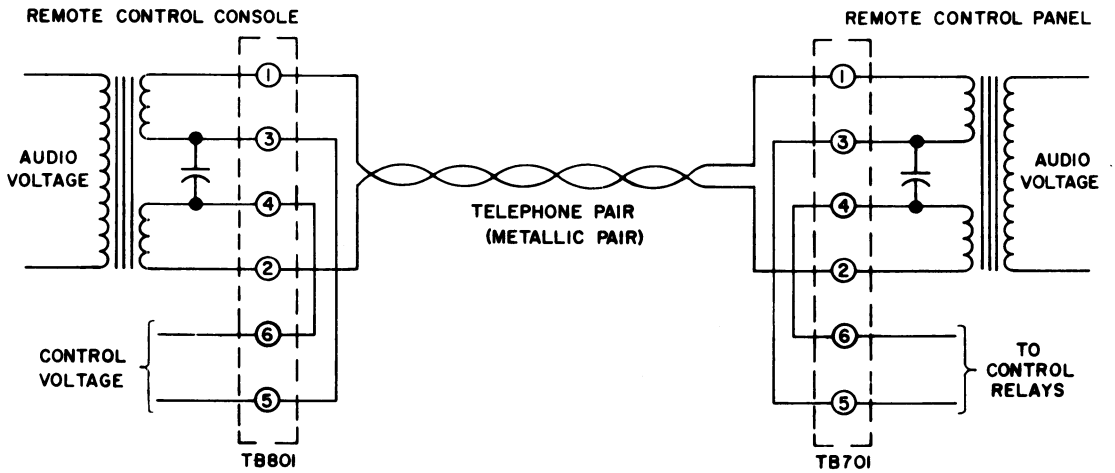
Method 1 - Single Telephone Pair (Control Voltage Simplexed Line to Line

a. Connect telephone pair to TB701-1 and TB701-2.
b. Connect jumper between TB701-3 and TB701-5.
c. Connect jumper between TB701-4 and TB701-6.

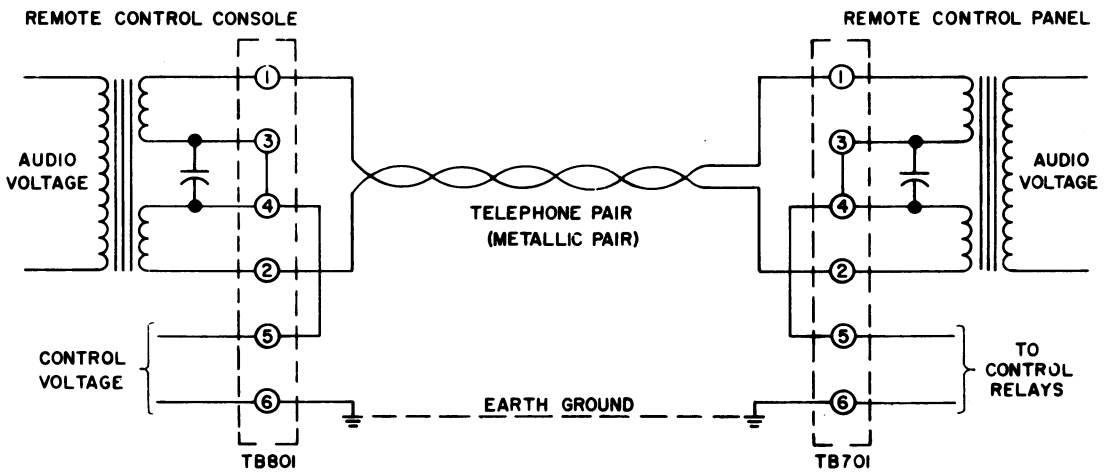
Method 2 - Single Telephone Pair (Control Voltage Simplexed Line to Ground)

a. Connect telephone pair to TB701-1 and TB701-2.
b. Connect jumper between TB701-3 and TB701-4.
c. Connect jumper between TB701-4 and TB701-5.
d. Connect TB701-6 to a good earth ground.

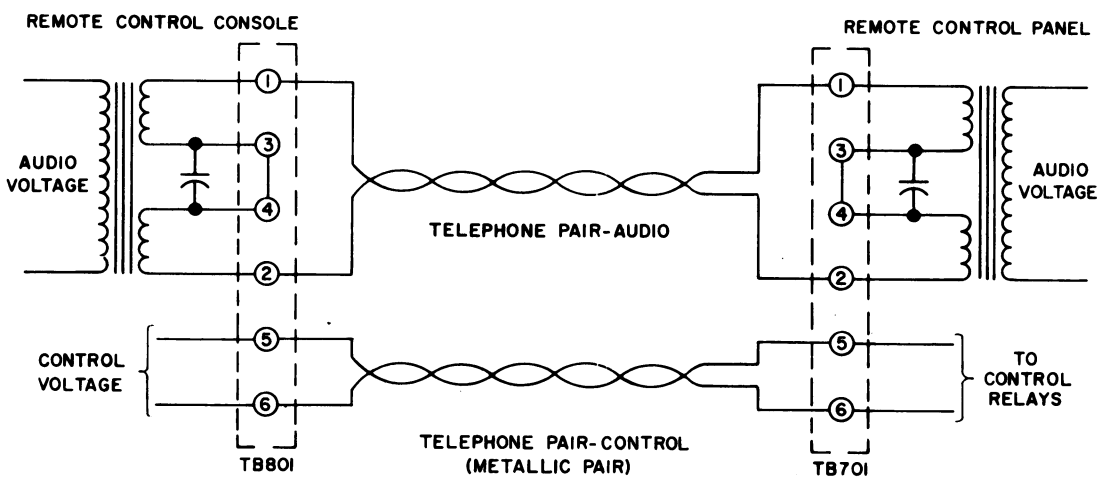
Method	Description	Advantages or Disadvantages
1	One metallic pair: for both audio and control voltages with control voltage simplexed from line to line.	Economical; dependable where earth currents may be large, or where a good earth ground cannot be obtained; keying clicks will be heard in paralleled Remote Control Units.
2	One metallic pair: for both audio and control voltages with control voltage simplexed from line to ground.	Economical; earth ground currents (encountered near power company sub-stations) may interfere with control functions; keying clicks minimized.
3	Two telephone pairs: one for audio voltage and one for control voltage (metallic pair).	Provides best performance; keying clicks will not be heard; least susceptible to earth ground currents which may interfere with control functions.



METHOD 1 - SINGLE TELEPHONE PAIR WITH CONTROL SIMPLEXED LINE TO LINE



METHOD 2 - SINGLE TELEPHONE PAIR WITH CONTROL SIMPLEXED BETWEEN CENTER TAP AND GROUND



METHOD 3 - SEPARATE CONTROL AND AUDIO PAIRS

RC-1348A

Figure 1 - Telephone Line Connections

Method 3 - Separate Control and Audio Pairs

a. Connect audio pair to TB701-1 and TB701-2.
b. Connect control pair to TB701-5 and TB701-6.
c. Connect jumper between TB701-3 and TB701-4.

After the telephone lines have been connected, a few adjustments may be required before placing the station in service. Refer to the ADJUSTMENT PROCEDURE on page 11.

CIRCUIT ANALYSIS

Remote Control Panel Model 4KC1610 contains the components for remotely switching a single-frequency station from receive to transmit. The panel is normally mounted in the station cabinet below the Transmitter-Receiver Power Supply Model 4EP38A10.

The standard panel consists of the following components:

- Line matching transformer T701.
- 6-milliamp transmit relay K701.
- AUDIO LEVEL control R701.
- TRANSMIT-DISABLE switch S702.
- AC power switch S701, fuses and convenience outlet.
- Terminal boards for telephone line, power line and station interconnection.

POWER CIRCUITS

Power applied to terminals TB706-1 and TB706-2 supplies all units in the MASTR station, and is controlled by CABINET POWER switch S701. One section of the switch opens and closes the 117 volt AC line, and the (other) section is used in the regulated line (when the voltage regulator option is used). Each line contains a 20-ampere fuse for circuit protection. A convenience outlet (J701) is connected across the unregulated input, and can be used even with the CABINET POWER switch off.

AUDIO & CONTROL CIRCUITS

Through the use of accessory relay kits and options, the Remote Control Panel can provide up to five different control functions. This is accomplished by the application of two different levels and polarities of control current from a Remote Control Console to activate up to four relays

ACCESSORY or OPTION	FUNCTION SELECTED AND RELAY ENERGIZED BY CONTROL CURRENT (Current at TB701-5 relative to TB701-6)				
	0	+6	+15 mA	-6 mA	-15 mA
One-Frequency Transmit and 1-Frequency Receive	Receive	Transmit K701			
Two-Frequency Transmit and 1-Frequency Receive	Receive	Transmit-F1 K701	Transmit-F2 K1		
One-Frequency Transmit and 2-Frequency Receive	Receive-F1	Transmit K701		Receive-F2 K2	
Two-Frequency Transmit and 2-Frequency Receive	Receive-F1	Transmit-F1 K701	Transmit-F2 K1	Receive-F2 K2	
One-Frequency Transmit and PSLM or 2 separate receivers	Receive-F1 & F2	Transmit K701		Receive-F1 K2	Receive-F2 K3
Two-Frequency Transmit and PSLM or 2 separate receivers	Receive-F1 & F2	Transmit-F1 K701	Transmit-F2 K1	Receive-F1 K2	Receive-F2 K3
One-Frequency Transmit and receive with Channel Guard	Channel Guard Receive	Monitor (noise squelch) K1	Transmit K701		
Repeater Disable (Option 7651)	Receive	Transmit K701		Repeater Disable K2	
Remote/Repeat with Channel Guard (Option 7659)	Channel Guard Receive	Monitor (noise squelch K1)	Transmit (K701)		
Remote/Repeat with Channel Guard & Repeat Disable (Option 7660)	Channel Guard Receive	Monitor (noise squelch K1)	Transmit (K701)	Repeat Disable (K2)	Repeat Disable & Channel Guard Mon (K2 & K3)

Figure 2 - Control Current and Function Chart

on the control panel. The control current required to select each function and the relay energized is listed in Figure 2 on Page 3.

ONE-FREQUENCY TRANSMIT & RECEIVE

In the standard Remote Control Panel, relay K701 is used to switch a single-frequency station from receive to transmit.

With no control current applied to the Control Panel, the output of the station receiver is fed from TB703-9 through normally-closed contacts K701-11 and 12 and through audio transformer T701 to the telephone pair.

Keying the microphone at the Remote Control Console applies 6 milliamps to the control pair, energizing relay K701 on the Control Panel. Resistor R704 simulates the coil resistance of an optional 15-mA relay. K701 switches the telephone line audio pair to the transmitter input, applies +10 volts DC with the audio to open the diode gating circuit on Power Supply EP-38-A, and switches the transmitter keying lead to ground. A simplified diagram of the transmitter keying circuit is shown in Figure 3.

MULTI-FREQUENCY TRANSMIT & RECEIVE

For multi-frequency switching, two different polarities and levels of control current are applied to the telephone pair by the Remote Control Console. On the Remote Control Panel, 6-mA and 15-mA relays are connected in series for the two levels of control current, and relay-polarizing diodes are added in series with the relays for the different polarities. Figure 4 shows how the relays and diodes are connected for remotely selecting five functions.

When a positive control current is applied to TB701-5 (with respect to TB701-6), current will flow only through relay coils K701 and K1. With TB701-5 negative (with respect to TB701-6), current will flow only through K2 and K3.

If the current flowing through series pair K701-K1 or pair K2-K3 is 15 milliamps or more, both relays in the series pair will be energized. A control current of 6 milliamp will energize only the 6-milliamp relay in either series pair.

With no control current at the control pair, none of the relays are energized and audio from the station receiver is fed to the Remote Control Console.

CHANNEL GUARD

In Channel Guard Applications, two different levels of control current are used. A 6 mA control current is required for disabling the Channel Guard (see Figure 2), and a 15 mA control current is required for keying the transmitter. The 6 mA and 15 mA relays, are interchanged on the Remote Control Panel so that the 6 mA relay is mounted on Channel Guard relay assembly 19A122231-G8, and the 15 mA relay is mounted on the chassis next to XMIT-DISABLE switch S702.

Pressing the MONITOR button on the Remote Control Console microphone applies 6 milliamps to the control pair, energizing relay K1. This opens up the Channel Guard ground return, disabling the receiver Channel Guard. The station receiver now operates only on noise squelch, so that all transmissions on the receiver frequency can be heard.

Pressing the TRANSMIT button on the

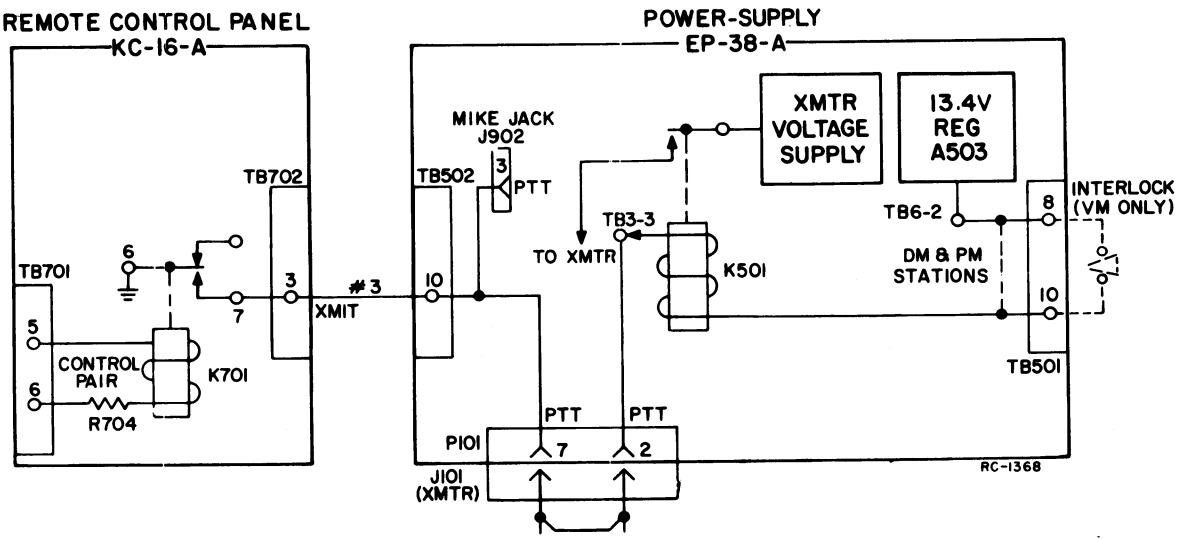


Figure 3 - Transmitter Keying Circuit

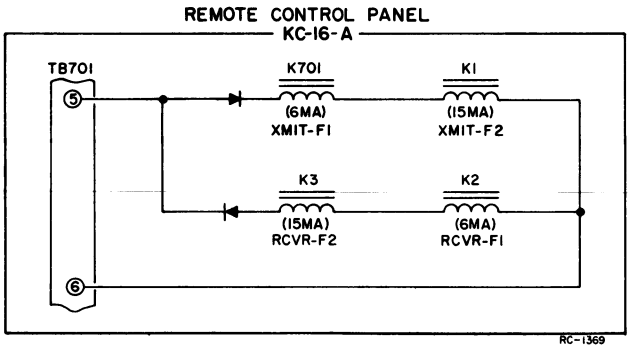


Figure 4
Control Current Connections to Control Relays

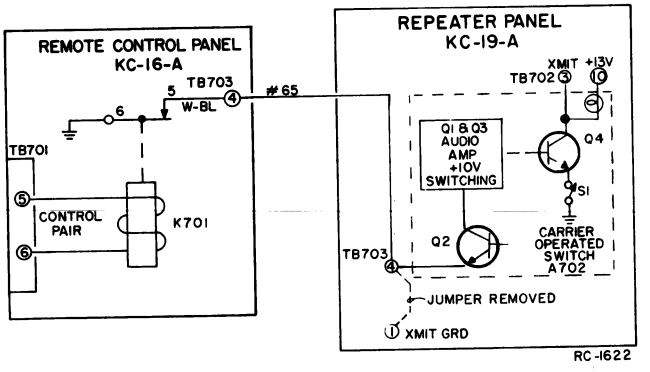


Figure 5
Remote/Repeater Control Option 7650

console microphone applies 15 milliamps to the control pair. This energizes relay K701, keying the station transmitter.

Channel Guard Disable switch S1 on the control panel is used to disable the Channel Guard for test purposes.

REMOTE/REPEATER CONTROL

In Remote/Repeater applications, the station transmitter may be keyed by either an incoming RF signal (repeater operation), or by a control current from the Remote Control Console (remote operation). One of the following options is ued to give the dispatcher (at the Remote Control Console) priority over all repeater operations. Options 7650 and 7651 are for stations without Channel Guard while Options 7659 and 7660 are for stations with Channel Guard.

Option 7650

Keying the Control Console microphone applies +6 milliamps to the control pair. This energizes transmit relay K701 on the Remote Control Panel, which opens the ground return of the Carrier-Operated switch on the repeater panel (Fig. 5). This disables the repeater keying, and the station will operate as a remote only as long as the microphone at the Control Console is keyed.

Option 7651

Pushing in the Repeater-Disable pushbutton (marked SUPV) at the Remote Control Console applied -6 milliamps to the control pair. This energizes optional relay K2 on the Remote Control Panel, which opens the ground return to the Carrier-Operated switch on the repeater panel (Fig. 6). This disables the repeater keying, and the station will operate as a remote as long as the Remote-Disable pushbutton at the Control Console is pushed in.

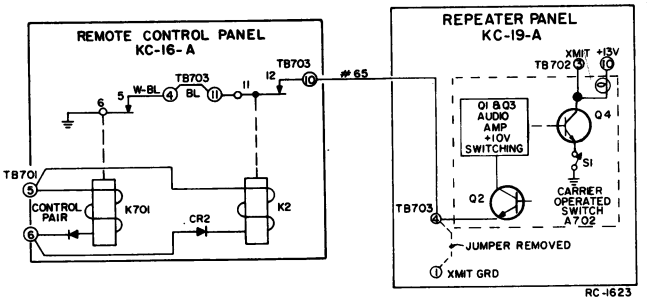


Figure 6
Remote/Repeater Control
With Repeater-Disable Option 7651

Option 7659

Option 7659 provides Remote/Repeater control of stations equipped with Channel Guard. The option adds a 19C303972-G6 Circuit Board to the KC-16-A Remote Control Panel and changes the Channel Guard and Carrier-Operated Switch (COS) circuits. Normally, the output of the receiver Channel Guard decoder connects directly to the DC amplifier on the IF/Audio & Squelch Board, but for this application the output is applied through circuits of the KC-16-A panel.

Stations with 2-Watt Receivers

When stations contain 2-watt receivers, the 19C303972-G6 Circuit Board is modified as indicated on the Service Sheet for Option 7659. The output from the Channel Guard decoder connects through normally-closed (NC) contacts of K1 to the DC amplifier to provide Channel Guard operation (see Figure 7).

Pressing the Channel Guard monitor switch at the remote control console applies +6 mA to the control pair, energizing K1. Contacts 14 and 15 of K1 disconnect the Channel Guard output from the DC amplifier.

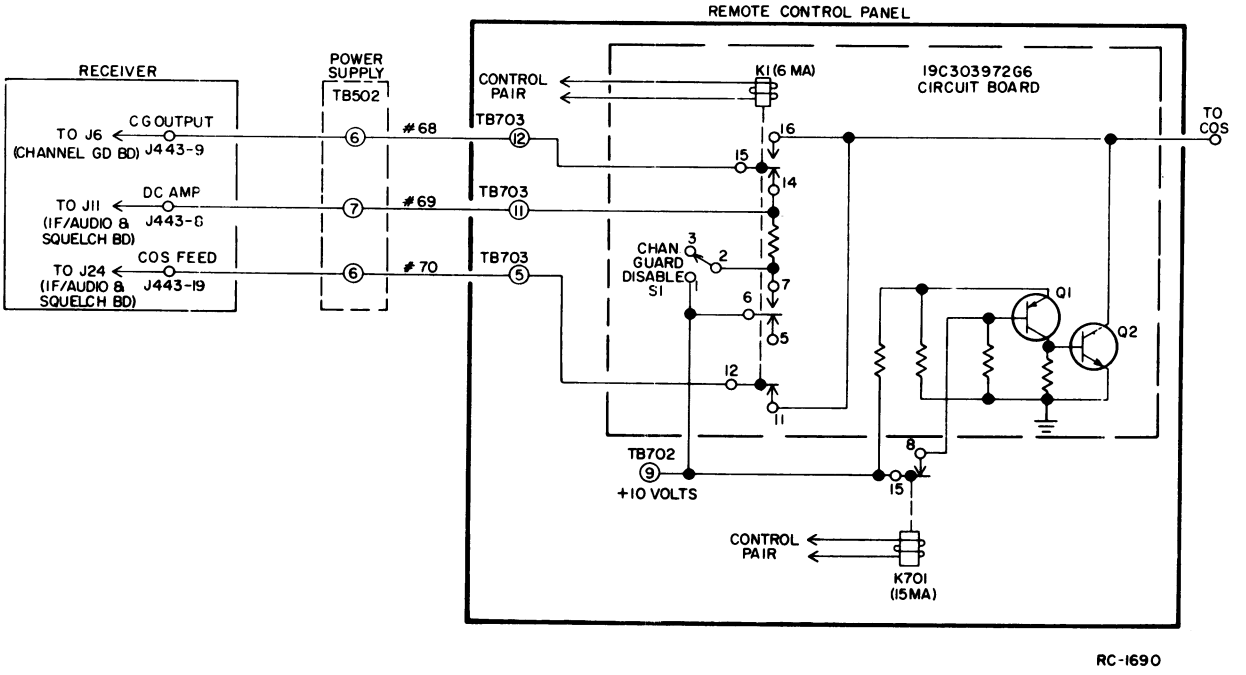


Figure 7 - Remote/Repeater Control with Channel Guard (Option 7659 with 2-Watt Receiver)

Contacts 6 and 7 close, applying a positive voltage to the DC amplifier. This disables the Channel Guard so that all signals on the receiver frequency are monitored at the remote control console. Contacts 11 and 12 of K1 open the normal COS feed circuit to prevent signals without Channel Guard from operating the station transmitter, however, signals with Channel Guard are repeated. When Channel Guard tone is present, the positive voltage from the Channel Guard decoder is fed through contacts 15 and 16 of K1 to the COS feed circuit. This voltage operates the COS to key the station transmitter.

The remote control console has priority over the repeater function. Keying the transmitter from the remote control console applies +15 mA to the control pair, energizing K701. Contacts of K701 open, removing the voltage connected to the base of Q1 and turning Q1 on. This turns on Q2 and shorts the COS feed circuit to ground. The COS turns off, disabling the repeater function and giving the remote control console complete control of the station.

Stations with 5-Watt Receivers.

When stations contain 5-watt receivers, the output from the Channel Guard decoder is connected to the base of Q3 on the 19D303972-G6 Circuit Board (see Figure 8). Normally, with no incoming call, the output is positive and Q3 conducts. While Q3 is conducting, Q4 is turned off and the resultant positive voltage at the collector of Q4 is connected to the DC amplifier to squelch the receiver.

When the incoming signal contains the Channel Guard tone, no output is provided by the Channel Guard decoder and Q3 turns off. This permits Q4 to conduct, removing the positive voltage from the DC amplifier to unsquelch the receiver. While the receiver is unsquelched, COS feed voltage connects through normally closed (NC) contacts 11 and 12 of K1 to operate the COS and key the station transmitter.

Pressing the Channel Guard monitor switch at the remote control console applies +6 mA to the control pair, energizing K1. Contacts 6 and 7 of K1 connect a positive voltage to the base of Q4, turning Q4 on and removing the positive voltage from the DC amplifier. This disables the Channel Guard function so that all signals on the receiver frequency are monitored at the remote control console. Contacts 11 and 12 of K1 open the normal COS feed circuit to prevent signals without Channel Guard from operating the transmitter, however, signals with Channel Guard are repeated. When the Channel Guard tone is present, Q3 turns off and the positive voltage at its collector is connected through contacts 15 and 16 of K1 to the COS feed circuit. This voltage operates the COS to key the station transmitter.

The remote control console has priority over the repeater function. Keying the transmitter from the remote control console applies +15 mA to the control pair, energizing K701. Contacts of K701 open, removing the voltage connected to the base of Q1 and turning Q1 on. This turns on Q2 and shorts the COS feed circuit to ground. The COS turns off, disabling the repeater function and giving the remote control console complete control of the station.

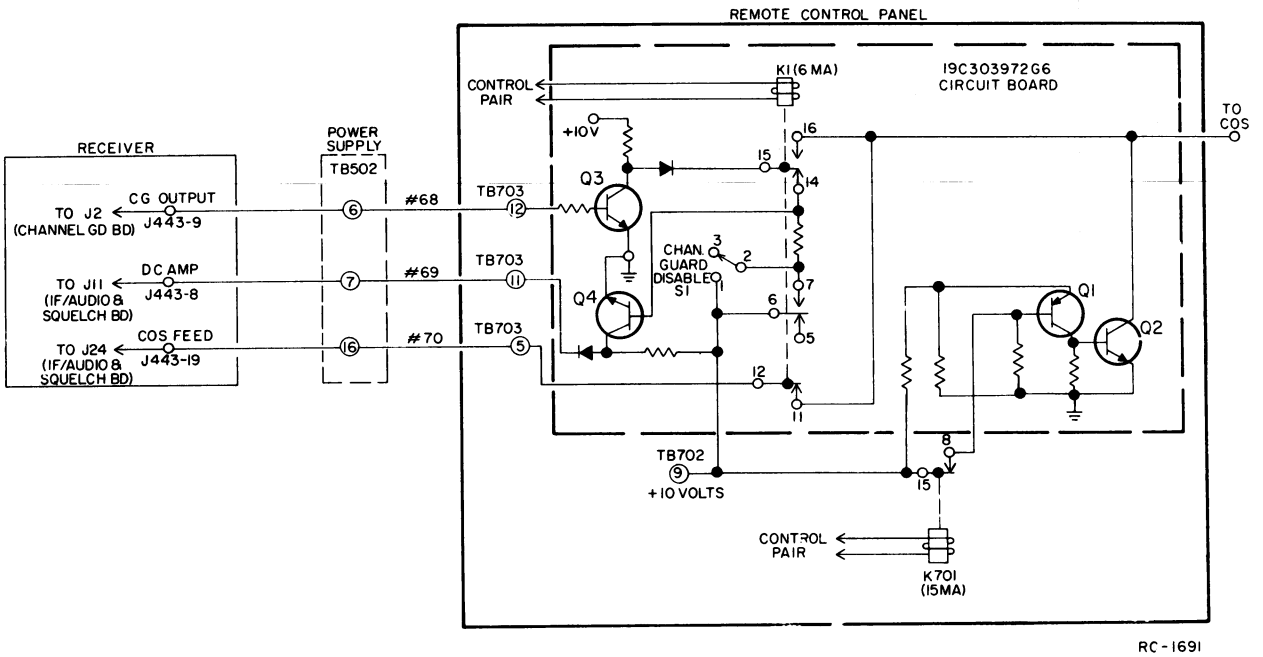


Figure 8 - Remote/Repeater Control with Channel Guard (Option 7659 with 5-Watt Receiver)

Option 7660

Option 7660 utilizes a 19C303972-G6 Circuit Board to provide the functions described for Option 7659. In addition, a 19C303972-G7 Circuit Board containing relays K2 (for Repeater Disable) and K3 (for Channel Guard Disable) is provided. When -6 mA is applied from the control pair, relay K2 energizes to disable the Carrier Operated Switch. When -15 mA is applied from the control pair, relay K3 also energizes and disables Channel Guard.

OTHER OPTIONS & ACCESSORIES

INTERCOM-COMPRESSOR (Option 7620)

The Intercom-Compressor option is used to equalize audio output levels over a wide range of microphone or line input levels. The board operates as a mike-to-line Compression-Amplifier in the transmit or intercom mode. This simplifies or eliminates line level settings in paralleled Remote Control Consoles.

For this option, the station microphone and speaker are connected to the Remote Control Panel as shown in the simplified switching diagram (see Fig. 9).

Transmit/Intercom Mode

Keying the microphone at the control panel energizes relay K1, which mutes the loud-speaker and applies audio from the common-emitter preamp (Q1) through Mike Gain control R5 to the compressor-amplifier connected by the relay through Line Output control R28 to compound-connected audio PA transistors Q8 and Q1. Following the audio PA state audio voltage is coupled through line-matching transformer T701 to the telephone pair and then to the Remote Control Console.

The other portion is coupled through Mod Input control R27 to the transmitter modulation input (TB702-2). Energizing K1 applies +10 volts along with the audio to open the diode-gating circuit on the EP-38-A, and grounds the transmitter keying lead.

Placing the TRANSMIT-DISABLE switch (S702) in the disable position opens the ground lead so that the transmitter cannot be keyed, and the Intercom-Compressor operates as an intercom only.

Receive Mode

Audio from a Remote Control Console or station receiver is coupled through line-matching transformer T701 to Intercom-Compressor board A1. The audio input (from J17) is connected through the normally-closed relay contact to Line Input control R7, and then to the Compressor-Amplifier. Following the Compressor-Amplifier, the audio voltage is connected by the relay through VOLUME control R1 to the audio PA, and then through the secondary of audio transformer T1 to the speaker. The 600 ohm receiver output is applied directly to the line through T701.

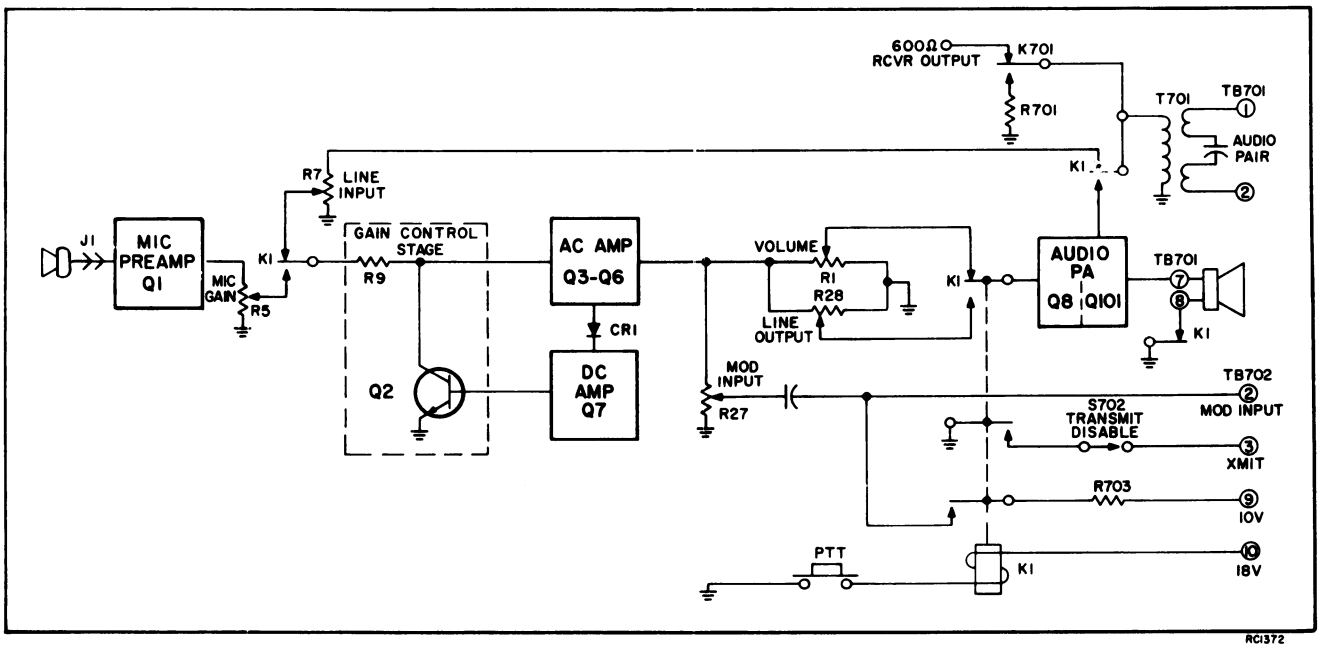


Figure 9 - Block Diagram of Intercom-Compressor Option

Compressor-Amplifier

The Compressor-Amplifier circuit consists of gain control stage Q2, high gain audio amplifier Q3 through Q6, and DC amplifier Q7.

When audio is applied to the Compressor-Amplifier, resistor R9 and the AC impedance of transistor Q2 act as a voltage divider for the AC input signal. The output of Q2 is amplified by a four stage, direct-coupled amplifier (Q3 through Q6). Both AC and DC feedback in the amplifier circuit provides for extremely stable operation.

One portion of the amplified output is fed through Line Output control R28 to the Audio PA stage. The remaining portion is rectified by detector CR1, filtered by C8 and amplified by DC current amplifier Q7. This DC output is fed back to the base of gain control transistor Q2.

The amount of DC feedback to the gain control stage determines the AC impedance of Q2. When the input level rises, the AC amplifier output starts to increase. The output is detected, amplified, and fed back to the base of Q2. This increase in feedback reduces the AC impedance of Q2 and decreases the audio voltage to the AC amplifier, keeping the amplifier output constant.

When the audio decreases, the output of the AC amplifier starts to decrease, reducing the feedback to Q2. This raises the AC impedance of Q2 and increases the audio voltage to the AC amplifier, keeping the amplifier output constant.

COMPRESSOR-AMPLIFIER (Option 7621)

Compressor-Amplifier board A2 consists of gain control stage Q2, high gain audio amplifiers Q3 through Q6, and DC amplifier Q7.

When audio from a Remote Control Console is applied to the Compressor-Amplifier, resistor R9 and the AC impedance of transistor Q2 act as a voltage divider for the AC input signal. The output of Q2 is amplified by a four-stage, direct-coupled amplifier (Q3 through Q6). Both AC and DC feedback in the amplifier circuit provides for extremely stable operation.

One portion of the amplified output is fed through Modulation Input control R27 to the transmitter modulation input (TB702-2). The remaining portion is rectified by detector CR1, filtered by C8 and amplified by DC current amplifier Q7. This DC output is fed back to the base of gain control transistor Q2.

The amount of DC feedback to the gain control stage determines the AC impedance of Q2. When the input level rises, the AC amplifier output starts to increase. The output is detected, amplified, and fed back to the base of Q2. This increase in feedback reduces the AC impedance of Q2 which decreases the audio voltage to the AC amplifier, keeping the amplifier output constant.

When the audio input decreases, the output of the AC amplifier starts to decrease, reducing the feedback to Q2. This raises the AC impedance of Q2 and increases the audio voltage to the AC amplifier, keeping the amplifier output constant.

LOCAL/REMOTE CONTROL

In Local/Remote stations, an Audio Limiter is used to prevent a strong audio signal from the receiver from driving the Intercom-Compressor into deep compression.

Unsquelching the station receiver applies a positive voltage to TB703-5 (COR Feed), and then to the base of Q1 on the Audio Limiter. This positive voltage turns on Q1, which turns on Q2 and Q3.

Q3 is connected across the input of the compression circuitry. When turned on, Q3 acts as a shunt for any signal from the receiver that exceeds the threshold of compression (0.4 volt DC measured at A1-J19). The Audio Limiter is set for threshold of compression by potentiometer R4 in the emitter circuit of Q3.

The Audio Limiter does not operate when the station is in the transmit or intercom mode.

MAINTENANCE

RELEASE TIME ADJUSTMENT

The release time of the compressor-amplifier circuit (on intercom-Compressor Board A1 or Compressor-Amplifier A2) is the time required for the unit to restore full gain after an input signal that has driven the unit into compression is removed.

The release time is determined by the value of R25 which was selected at the factory for average operating conditions. When overall system requirements indicate that a shorter release time is needed, R25 may be replaced with a different value resistor as shown in the table.

Value of R25	Release Time
100K-ohms (standard)	2 seconds
27K-ohms	1 second
16K-ohms	0.5 second

Reducing the release time, however, will result in an increase in background noise picked up during pauses in transmissions.

TROUBLESHOOTING

The Remote Control Panel will require a minimum of maintenance. Should service be required on the Intercom-Compressor or Compressor-Amplifier options, use the DC voltage readings included on the Schematic Diagrams and the step-by-step Troubleshooting Chart included on the Outline Diagrams.

WARNING

When servicing the control panel or station, always place toggle switch S702 in the TRANSMIT-DISABLE position. This opens the transmitter keying circuit and prevents the application of high voltage to the transmitter (keying the transmitter) from a remote point.

After servicing the unit, always place TRANSMIT-DISABLE switch back in the Operate position.

ADJUSTMENT PROCEDURE

Before adjusting the Remote Control Panel, make sure that all power line, phone line and ground connections have been completed at the Control Console and the base station. Also, the base station and Control Console should have been properly aligned, and the station VOLUME control (R511 on Power Supply EP-38-A) set for not more than 6 volts RMS at the audio pair with maximum system deviation at 1000 Hz applied to the base station receiver antenna jack.

To adjust the Control Panel, refer to one of the three following procedures, as applicable:

I. STANDARD CONTROL PANEL

AUDIO LEVEL ADJUSTMENT (For panels without Intercom or Compressor options)

1. Feed a 1000-Hz tone into the microphone jack on the Transistorized Control Console.
2. Key the microphone at the Control Console and adjust the 1000-Hz source to obtain a +18 dBm output (or desired level) from the Control Console. Do not change any adjustments on the Control Console.
3. Connect an AC-VTVM across pins 1 and 2 of Mike Jack J902 on Power Supply EP-38-A. Adjust the AUDIO LEVEL control (R701) on the Control Panel for a meter reading of 200 millivolts RMS.

NOTE

For paralleled Remote Control Consoles and Remote Control Panel KC-16-A without Intercom-Compressor or Compressor-Amp option, apply the tone on the console having the largest line loss and adjust the AUDIO LEVEL control according to the above instructions. It will then be necessary to adjust the Line Output Control on the remaining Control Console(s) to produce the same level at the transmitter.

II. CONTROL PANEL WITH INTERCOM-COMPRESSOR

LINE INPUT ADJUSTMENT

The Line Input has been adjusted at the factory for an input of 180 millivolts RMS (-12 dBm) for threshold of compression. Use of excessive compression will accent background and line noise during pauses in transmission.

Procedure:

1. Feed a 1000-Hz signal onto the audio pair from the Transistorized Control Console having the largest line loss. Adjust the audio generator to produce +18 dBm on the audio pair. However, if the source has been adjusted for less than +18 dBm on the line, set the generator to this lower level.
2. Adjust the Line Input control (R7) for threshold of compression as indicated by a reading of 0.4 volt DC on a 20,000 ohm-per-volt meter connected from A1-J19 to ground.

MIC GAIN ADJUSTMENT

The MIC GAIN control (R5) was set at the factory according to the type microphone ordered with the Console. Setting this control for excessive compression will accent background noise during pauses in transmission.

PROCEDURE A:

1. Key the microphone and talk into the mike from a normal distance (12 to 15 inches for the Desk or Boom mike, or across the face of the Military mike).
2. Adjust MIC GAIN control R5 for the threshold of compression as indicated by the line between the red and green areas on the Compression Meter, or by a reading of 0.4 volt DC on a 20,000 ohm-per-volt meter connected from J19 to ground on Intercom-Compressor board A1

PROCEDURE B:

1. Apply a 1000 Hz signal to pins 1 (GRD) and 2 of Mike Jack J801 at the level indicated in the following chart.

For Microphone Type:	Set Input Level For:
EM-28-A (Desk Mike)	12 millivolts
EM-25-A (Military Mike) or EM-26-A (Handset)	60 millivolts
EM-13-A (Boom Mike)	6 millivolts

2. Adjust MIC GAIN control R5 for threshold of compression as indicated by the Compression Meter, or by a reading of 0.4 volt DC on a 20,000 ohm-per-volt meter connected from J19 to ground on Intercom-Compressor board A1.

LINE OUTPUT AND MODULATION INPUT ADJUSTMENT

The Intercom-Compressor option has been set at the factory for a line output of 6 volts RMS (+18 dBm). To minimize cross-talk, always reduce this level whenever line losses and noise pickup permit an adequate signal-to-noise ratio.

Procedure:

1. Feed a 1000-Hz, 30-millivolt signal into pins 1 and 2 of mike jack J1.
2. Connect an AC-VTVM across the audio pair. Use a 0.5-mF capacitor in series with the meter if DC is being simplexed line-to-line.
3. Adjust Line Output control R28 on the Intercom-Compressor for 6 volts RMS (or less when possible).
4. Connect an AC-VTVM across pins 1 and 2 of Mike Jack J902 on Power Supply EP-38-A. Adjust the Modulation Input Control (R27) on the Intercom board for a meter reading of 200 millivolts RMS.

AUDIO LIMITER ADJUSTMENT (Local/Remote Only)

In Local/Remote stations, it is necessary to adjust R4 on the Audio Limiter board after all adjustments to the Intercom-Compressor board have been completed.

Procedure:

1. Feed a 1000 Hz tone at maximum system deviation to the station receiver antenna jack.
2. Connect a 20,000 ohm-per-volt meter from J19 to ground on the Intercom-Compressor board.
3. Adjust R4 on the Audio Limiter board for 0.4 volt DC.

NOTE

If the receiver output is less than 500 millivolts RMS measured at TB701-1 and -2, disconnect the Audio Limiter circuit by unplugging the brown lead connected to J5 on the Intercom-Compressor board A1.

III. CONTROL PANEL WITH COMPRESSOR-AMPLIFIER

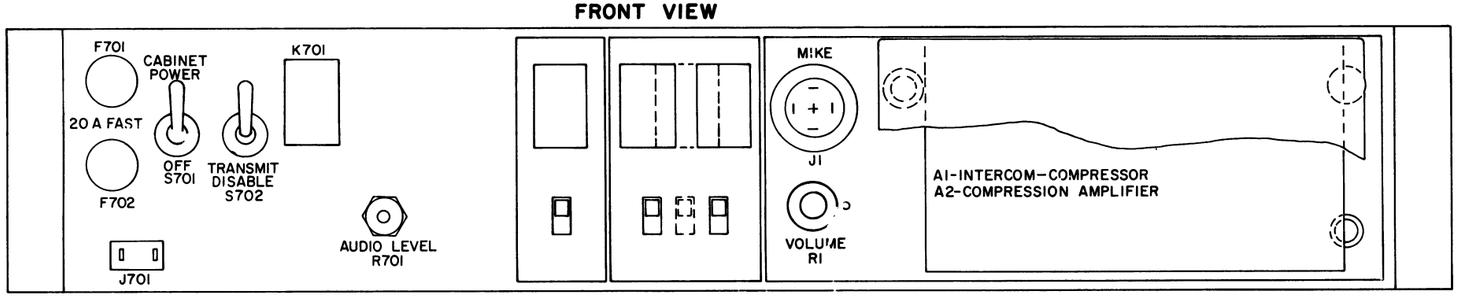
AUDIO LEVEL AND MODULATION INPUT ADJUSTMENT

AUDIO LEVEL control R701 on the Remote Control Panel has been adjusted at the factory for an input of 180 millivolts RMS (-12 dBm) for threshold of compression. Use of excessive compression will accent background and line noise during pauses in transmission.

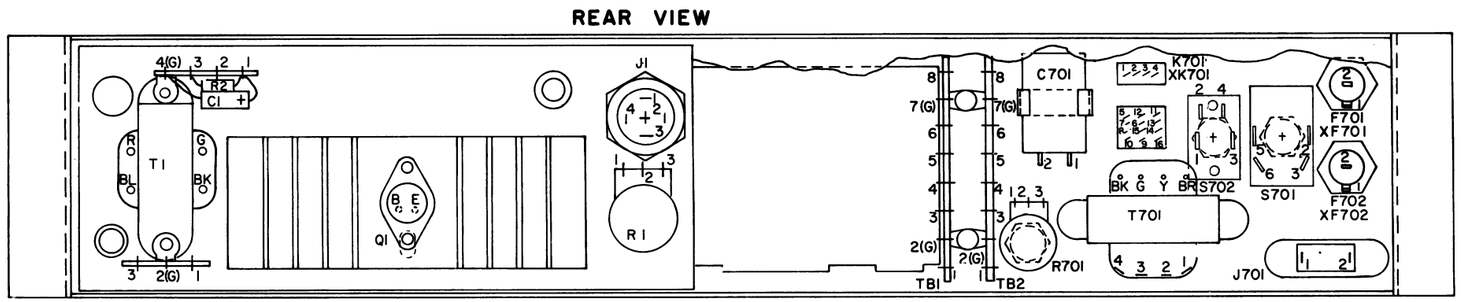
Procedure:

1. Feed a 1000-Hz signal onto the audio pair from the Transistorized Control Console having the largest line loss. Adjust audio generator to produce +18 dBm on the audio pair. However, if the source has been adjusted for less than +18 dBm on the line, set audio generator to this lower level.
2. Adjust the AUDIO LEVEL control (R701) for threshold of compression as indicated by a reading of 0.4 volt DC on a 20,000 ohm-per-volt meter connected from J19 on Compressor board to ground.
3. Connect an AC-VTVM across pins 1 and 2 of Mike Jack J902 on Power Supply EP-38-A. Adjust the Modulation Input Control on the Compressor board for a meter reading of 200 millivolts RMS.

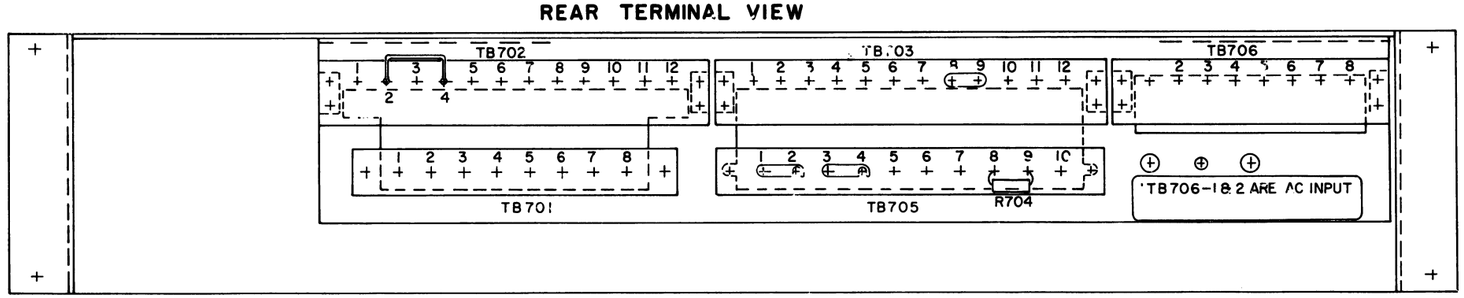
FRONT VIEW

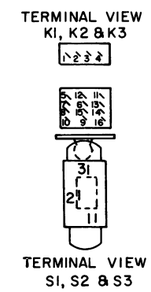


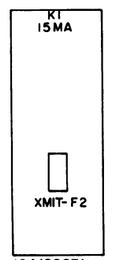
REAR VIEW



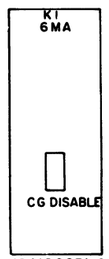
REAR TERMINAL VIEW



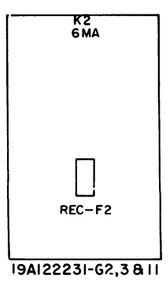




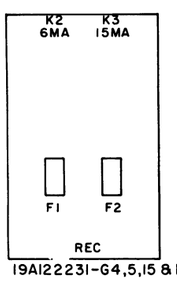
19A122231-G1,3,5,7&16



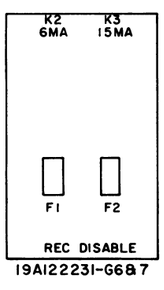
19A122231-G8,G13



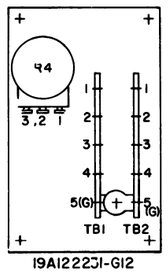
19A122231-G2,3&11



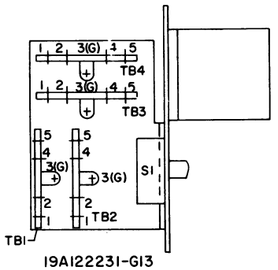
19A122231-G4,5,15&16



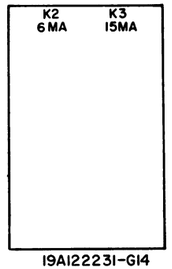
19A122231-G6&7



19A122231-G12



19A122231-G13



19A122231-G14

OUTLINE DIAGRAM

REMOTE CONTROL PANEL
MODEL 4KC16A10

(19D402786, Rev. 4)

PARTS LIST

LBI3704E

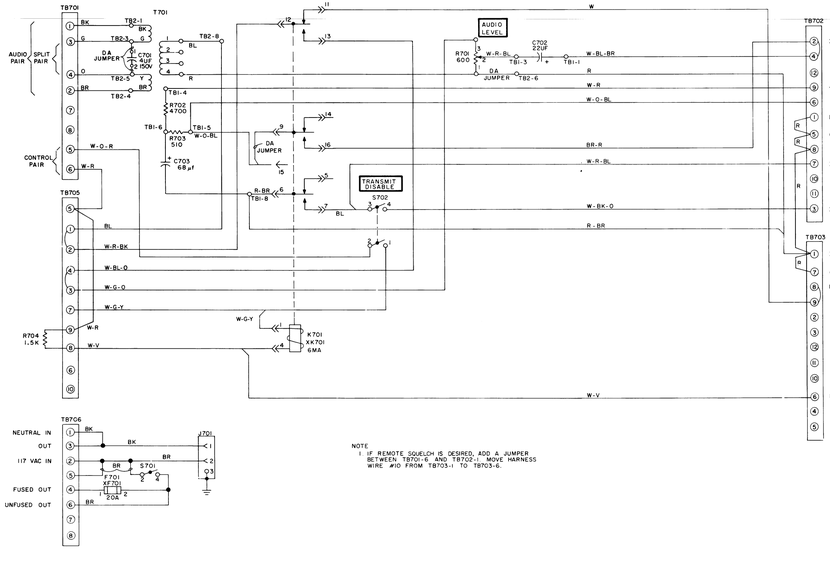
REMOTE CONTROL PANEL
MODEL 4KC16A10
(19D402661G1)

SYMBOL	GE PART NO.	DESCRIPTION
C701	748644591	- - - - - - - - - - CAPACITORS - - - - - - - - - - Electrolytic, non polarized: 4 µf ±10% -10%, 150 VDCW.
C702	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C703	5496267P11	Tantalum: 68 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - - - - FUSES - - - - - - - - - -
F701	748439095	Quick blowing: 20 amps at 250 v; sim to Bussman ABC-20.
F702*	748439095	Quick blowing: 20 amps at 250 v; sim to Bussman ABC-20. Deleted by REV B.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J701	712808lP1	Connector, phen: 2 contacts, 15 amps at 125 VRMS; sim to Cinch 54412844.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K701	19C307010P10	Armature: 5 ma max, 28 VDC nominal, 1.3 w max operating, 3480 ohms ±10% coil res, 3 form C contacts; sim to Allied Control TS-154-CC-C-3480. NOTE: When used with Channel Guard Relay Panel Assembly 19A122231G8, order 15 milliamp relay 19C307010P11.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R701	54947749114	Variable, carbon film: 600 ohms ±20%, 0.3 w; sim to CTS Series 70 Control.
R702	3R779472E	Composition: 4.7K ohms ±10%, 1/2 w.
R703	3R779511J	Composition: 510 ohms ±5%, 1/2 w.
R704	7141971G9	Kit: includes composition, 1.5K ohm ±10%, 1/2 w resistor with 2 spade tongue terminals.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S701*	19A116794P1	Toggle: DPST, 20 amps at 220 VRMS; sim to McGill 0111-0009. In REV B and earlier:
	7109677P1	Toggle: DPST, 12 amps at 125 v; sim to Arrow-Hart and Hegeman 82143-Y.
S702*	549189992	Toggle: DPST, 6 amps at 125 VAC/VDC; sim to Cutler-Hammer 8370X8. In REV B and earlier:
	747862392	Toggle: DPST, 3 amps at 125 VDC; sim to Arrow-Hart and Hegeman 20905-NC.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T701	19A115731P1	Audio freq: response 300 to 6000 Hz, +1.0 dB; Power: -18 dBm; max DC 20 mA combined, Pri: 600 ohms, Sec 1 and 2: 600 ohms.
		- - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1 and TB2	7775500P24	Phen: 8 terminals.
TB701	7117710P8	Phen: 8 terminals; sim to Cinch 1780.
TB702 and TB703	19C301086P8	Feed-thru, phen: 12 terminals; sim to GE CR151B.
TB705	7117710P10	Phen: 10 terminals; sim to Cinch 1799.
TB706	19C301086P6	Feed-thru, phen: 8 terminals; sim to GE CR151D.

*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XF701	19B209005P1	Fuseholder: 15 amps at 250 v; sim to Littelfuse 342012.
XF702*	19B209005P1	Fuseholder: 15 amps at 250 v; sim to Littelfuse 342012. Deleted by REV B.
XK701	5491595P5	Relay: 16 contacts; sim to Allied Control 30054.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - - -
	711871P4	Clip, spring tension. (Used with C701).
	549155P9	Retainer, spring. (Used with K701).
	19B216505P1	Adaptor plate. (Used with J701).
		ACCESSORY AND OPTION KITS
		2 FREQUENCY TRANSMIT, 1 FREQUENCY RECEIVE 19A122231G1
		RELAY PANEL ASSEMBLY 19C303973G4
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	19C307010P11	Armature: 15 ma, 30 VDC nominal, 1.5 w max operating, 1550 ohms ±10% coil res, 1 form A, 1 form C and 1 form D contacts; sim to Allied Control T154-X-631.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	7145098P4	Slide: SPDT, 0.5 amp at 125 VAC or VDC; sim to Continental Wirt SW-732.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XK1	5491595P5	Relay: 16 contacts; sim to Allied Control 30054.
		1 FREQUENCY TRANSMIT, 2 FREQUENCY RECEIVE 19A122231G2
		RELAY PANEL ASSEMBLY 19C303973G3
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR2	4037822P1	Silicon, 1000 mA, 400 PIV.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K2	19C307010P10	Armature: 6 ma, 28 VDC nominal, 1.5 w max operating, 3480 ohms ±10% coil res, 3 form C contacts; sim to Allied Control TS-154-CC-C-3480.
K3	19C307010P11	Armature: 15 ma, 30 VDC nominal, 1.5 w max operating, 1550 ohms ±10% coil res, 1 form A, 1 form C and 1 form D contacts; sim to Allied Control T154-X-631.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S2 and S3	7145098P4	Slide: SPDT, 0.5 amp at 125 VAC or VDC; sim to Continental Wirt SW-732.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XK2 and XK3	5491595P5	Relay: 16 contacts; sim to Allied Control 30054.
		DIODE KIT 19A122255G1
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR2	4037822P1	Silicon, 1000 mA, 400 PIV.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	19C307010P11	Armature: 15 ma, 30 VDC nominal, 1.5 w max operating, 1550 ohms ±10% coil res, 1 form A, 1 form C and 1 form D contacts; sim to Allied Control T154-X-631.
K2	19C307010P10	Armature: 6 ma, 28 VDC nominal, 1.5 w max operating, 3480 ohms ±10% coil res, 3 form C contacts; sim to Allied Control TS-154-CC-C-3480.
K3	19C307010P11	Armature: 15 ma, 30 VDC nominal, 1.5 w max operating, 1550 ohms ±10% coil res, 1 form A, 1 form C and 1 form D contacts; sim to Allied Control T154-X-631.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1 thru S3	7145098P4	Slide: SPDT, 0.5 amp at 125 VAC or VDC; sim to Continental Wirt SW-732.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XK1 thru XK3	5491595P5	Relay: 16 contacts; sim to Allied Control 30054-2.
		DIODE KIT 19A122253G1
	4037822P1	Silicon, 1000 mA, 400 PIV.
		CHANNEL GUARD 19A122233G8
		RELAY PANEL ASSEMBLY 19C303973G3
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
	4037822P1	Silicon, 1000 mA, 400 PIV.
		1 FREQUENCY TRANSMIT, 2 SEPARATE RECEIVERS 19A122231G6
		RELAY PANEL ASSEMBLY 19C303973G1
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR2	4037822P1	Silicon, 1000 mA, 400 PIV.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K2	19C307010P10	Armature: 6 ma, 28 VDC nominal, 1.5 w max operating, 3480 ohms ±10% coil res, 3 form C contacts; sim to Allied Control TS-154-CC-C-3480.
K3	19C307010P11	Armature: 15 ma, 30 VDC nominal, 1.5 w max operating, 1550 ohms ±10% coil res, 1 form A, 1 form C and 1 form D contacts; sim to Allied Control T154-X-631.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S2 and S3	7145098P4	Slide: SPDT, 0.5 amp at 125 VAC or VDC; sim to Continental Wirt SW-732.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XK2 and XK3	5491595P5	Relay: 16 contacts; sim to Allied Control 30054-2.
		DIODE KIT 19A122253G1
	4037822P1	Silicon, 1000 mA, 400 PIV.
		2 FREQUENCY TRANSMIT, 2 SEPARATE RECEIVERS 19A122231G7
		RELAY PANEL ASSEMBLY 19C303972G1, G4
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR2	4037822P1	Silicon, 1000 mA, 400 PIV.
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	19C307010P11	Armature: 15 ma, 30 VDC nominal, 1.5 w max operating, 1550 ohms ±10% coil res, 1 form A, 1 form C and 1 form D contacts; sim to Allied Control T154-X-631.
K2	19C307010P10	Armature: 6 ma, 28 VDC nominal, 1.5 w max operating, 3480 ohms ±10% coil res, 3 form C contacts; sim to Allied Control TS-154-CC-C-3480.
K3	19C307010P11	Armature: 15 ma, 30 VDC nominal, 1.5 w max operating, 1550 ohms ±10% coil res, 1 form A, 1 form C and 1 form D contacts; sim to Allied Control T154-X-631.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1 thru S3	7145098P4	Slide: SPDT, 0.5 amp at 125 VAC or VDC; sim to Continental Wirt SW-732.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XK1 thru XK3	5491595P5	Relay: 16 contacts; sim to Allied Control 30054-2.
		DIODE KIT 19A122255G1
	4037822P1	Silicon, 1000 mA, 400 PIV.
		CHANNEL GUARD 19A122233G8
		RELAY PANEL ASSEMBLY 19C303972G3
		- - - - - - - - - - RELAYS - - - - - - - - - -
K1	19C307010P11	Armature: 15 ma, 30 VDC nominal, 1.5 w max operating, 1550 ohms ±10% coil res, 1 form A, 1 form C and 1 form D contacts; sim to Allied Control T154-X-631.
		- - - - - - - - - - SWITCHES - - - - - - - - - -
S1	7145098P4	Slide: SPDT, 0.5 amp at 125 VAC or VDC; sim to Continental Wirt SW-732.
		- - - - - - - - - - SOCKETS - - - - - - - - - -
XK1 thru XK3	5491595P5	Relay: 16 contacts; sim to Allied Control 30054-2.
		INTERCOM COMPRESSOR 19A122233G9
		AMPLIFIER PANEL ASSEMBLY 19C303975G1
A1		COMPONENT BOARD ASSEMBLY 19C303939G1
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C1 and C2	19A116080P5	Polyester: 0.047 µf ±20%, 50 VDCW.
C3	19A115028P116	Polyester: 0.22 µf ±20%, 200 VDCW.
C4	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C6	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C7	5496267P107	Tantalum: 100 µf ±20%, 10 VDCW; sim to Sprague Type 150D.
C8	5496267P103	Tantalum: 150 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C9	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C10	5496267P17	Tantalum: 1.0 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C11	5496267P9	Tantalum: 3.3 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C12	19A115028P114	Polyester: 0.1 µf ±20%, 200 VDCW.
C13	5496267P19	Tantalum: 22 µf ±20%, 35 VDCW; sim to Sprague Type 150D.
C14	54944B1P128	Ceramic disc: 2700 pf ±10%, 1000 VDCW; sim to EMC Type ZF Disc@.
C17	19A115028P107	Polyester: 0.01 µf ±20%, 200 VDCW.
C19	7491930P10	Polyester: 0.22 µf ±20%, 100 VDCW; sim to GE Type 61F.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR2	4037822P1	Silicon, 1000 mA, 400 PIV.
CR3 and CR4	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
CR9	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1 thru J30	4033513P4	Contact, electrical: sim to Bead Chain L93-3.

(Cont'd on page 14)



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.

(19D402680, Rev. 3)

SCHEMATIC DIAGRAM

REMOTE CONTROL PANEL
MODEL 4KC16A10, REV. C

SYMBOL	GE PART NO.	DESCRIPTION
		- - - - - - - - - - - RELAYS - - - - - - - - - - -
K1	19C307010P14	Armature: 24 VDC nominal, 1.5 w max operating, 430 ohms 15% coil res, 6 form C contacts; sim to Parelco R10-E250-1.
		- - - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A115889P3	Silicon, NPN.
Q2	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q3 and Q4	19A115889P3	Silicon, NPN.
Q5 thru Q7	19A115889P1	Silicon, NPN.
Q8	19A115300P2	Silicon, NPN; sim to Type 2N3053.
Q10	19A115768P1	Silicon, PNP; sim to Type 2N3702.
Q11	19A115362P1	Silicon, NPN; sim to Type 2N2925.
		- - - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P474J	Composition: 470K ohms ±5%, 1/2 w.
R5	19B209358P9	Variable, carbon film: approx 3K to 100K ohms ±20%, 0.25 w; sim to CTS Type U-201.
R6	3R77P472K	Composition: 4.7K ohms ±10%, 1/2 w.
R7	19B209358P7	Variable, carbon film: approx 800 to 25K ohms ±20%, 0.25 w; sim to CTS Type U-201.
R9	3R77P333K	Composition: 33K ohms ±10%, 1/2 w.
R10	3R77P103K	Composition: 10K ohms ±10%, 1/2 w.
R11	3R77P332J	Composition: 3.3K ohms ±5%, 1/2 w.
R13	3R77P153J	Composition: 15K ohms ±5%, 1/2 w.
R14	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
R15	3R77P333J	Composition: 33K ohms ±5%, 1/2 w.
R16	3R77P104J	Composition: 100K ohms ±5%, 1/2 w.
R17	3R77P275J	Composition: 2.7 megohms ±5%, 1/2 w.
R18	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R19	3R77P394J	Composition: 390K ohms ±5%, 1/2 w.
R20	3R77P623J	Composition: 62K ohms ±5%, 1/2 w.
R21	3R77P153J	Composition: 15K ohms ±5%, 1/2 w.
R22	3R77P102K	Composition: 1K ohms ±10%, 1/2 w.
R23	3R77P103K	Composition: 10K ohms ±10%, 1/2 w.
R24	3R77P102K	Composition: 1K ohms ±10%, 1/2 w.
R25	3R77P104K	Composition: 100K ohms ±10%, 1/2 w.
R26	3R77P102K	Composition: 1K ohms ±10%, 1/2 w.
R27 and R28	19B209358P5	Variable, carbon film: approx 200 to 5K ohms ±20%, 0.25 w; sim to CTS Type U-201.
R29	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
R30*	19B209358P6	Variable, carbon film: approx 300 to 10K ohms ±20%, 0.25 w; sim to CTS Type U-201.
		In REV C and earlier:
	19B209358P5	Variable, carbon film: approx 200 to 5K ohms ±20%, 0.25 w; sim to CTS Type U-201.
R32	3R77P821K	Composition: 820 ohms ±10%, 1/2 w.
R33	3R77P222K	Composition: 2.2K ohms ±10%, 1/2 w.
R34	19B209022P15	Wirewound: 1 ohm ±5%, 2 w; sim to IRC Type BWH.
R35	3R78P270K	Composition: 27 ohms ±10%, 1 w.
R36	3R77P682K	Composition: 6.8K ohms ±10%, 1/2 w.
R41	3R77P823J	Composition: 82K ohms ±5%, 1/2 w.
R42	3R77P202J	Composition: 2K ohms ±5%, 1/2 w.
R43	3R77P103J	Composition: 10K ohms ±5%, 1/2 w.
R44	3R152P623J	Composition: 62K ohms ±5%, 1/4 w.
R45	3R152P393J	Composition: 39K ohms ±5%, 1/4 w.
R52 and R53	3R152P393J	Composition: 39K ohms ±5%, 1/4 w.
R54	3R152P623J	Composition: 62K ohms ±5%, 1/4 w.
R55*	3R77P180K	Composition: 18 ohms ±10%, 1/2 w. Added by REV C.
		- - - - - - - - - THERMISTORS - - - - - - - - - -
RT1	19B209143P2	Rod: 4000 ohms ±10%; sim to Globar Type 789F-12.
		- - - - - - - - - - - SOCKETS - - - - - - - - - - -
XK1	19B209172P1	Relay, phen: 22 contacts; sim to Allied Control 30054-24.
		- - - - - - - - - - - CAPACITORS - - - - - - - - -
C1	5496267P12	Tantalum: 150 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1		Connector. Includes:
	19A116061P2	Receptacle: 4 female contacts; sim to Amphenol Type 91-PN4F-1000.
	19A116061P4	Lockwasher, internal tooth.
	19A116061P5	Nut, knurled.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P1 thru P3	4029840P2	Contact, electrical: sim to AMP 42827-2.
P4	4029840P1	Contact, electrical: sim to AMP 41854.
P9	4029840P1	Contact, electrical: sim to AMP 42827-2.
P10 thru P12	4029840P2	Contact, electrical: sim to AMP 42827-2.
P13	4029840P1	Contact, electrical: sim to AMP 41854.
P14 thru P17	4029840P2	Contact, electrical: sim to AMP 42827-2.
P18	4029840P1	Contact, electrical: sim to AMP 41854.
P20 thru P22	4029840P2	Contact, electrical: sim to AMP 42827-2.
P24 and P25	4029840P2	Contact, electrical: sim to AMP 42827-2.
P27 thru P30	4029840P2	Contact, electrical: sim to AMP 42827-2.
		- - - - - - - - - TRANSISTORS - - - - - - - - - -
Q1	19A116118P3	Silicon, NPN.
		- - - - - - - - - - - RESISTORS - - - - - - - - - -
R1	5496870P11	Variable, carbon film: 5K ohms ±20% 0.5 w; sim to Mallory LC(5K).
R2	3R77P101K	Composition: 100 ohms ±10%, 1/2 w.
		- - - - - - - - - - TRANSFORMERS - - - - - - - - - -
T1	19A115612P1	Audio freq: 0.3-3 KHz freq range, Pri: 24.5 ohms ±5% imp, 1.38 ohms DC res, Sec: 3.3 ohms imp, 0.18 ohm DC res.
		- - - - - - - - TERMINAL BOARDS - - - - - - - - -
TB1	7775500P7	Phen: 3 terminals.
TB2	7775500P3	Phen: 4 terminals.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A122217P1	Heat sink. (Used with Q1 in Amplifier Panel Assembly, 19C303975G1).
	7487773P5	Knob: sim to Eastman Chemical 28739. (Used with R1 in Amplifier Panel Assembly, 19C303975G1).
	4035439P1	Heat sink: sim to Birtcher 3AL-635-2R. (Used with Q8 in Component Board Assembly, 19C303936G1).
	4036555P1	Insulator, washer: nylon. (Used with Q8 in Component Board Assembly, 19C303936G1).
	19A115368P1	Retainer, relay: sim to Allied Control 30040-3. (Used with K1 in Component Board Assembly, 19C303936G1).
		MODIFICATION KIT 19A122271G1
		- - - - - - - - - - - CABLES - - - - - - - - - -
	19B205411G1	Lead: approx 61 inches long with 1 terminal.
	19B205411G2	Lead: approx 44 inches long with 2 terminals.
		RELAY KIT 7145278G2
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
R1	5493035P10	Resistor, wirewound: 3.5 ohms ±5%, 5 w; sim to Hamilton Hall Type HR.
	7775500P7	Terminal board, phen: 3 terminals.
		COMPRESSOR AMPLIFIER 19A122231G10
		AMPLIFIER PANEL ASSEMBLY 19C303975G2
A2		COMPONENT BOARD ASSEMBLY 19C303936G3
		- - - - - - - - - - CAPACITORS - - - - - - - - - -
C3	19A115028P116	Polyester: 0.22 µf ±20%, 200 VDCW.
C4	5496267P2	Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C6	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C7	5496267P107	Tantalum: 100 µf ±20%, 10 VDCW; sim to Sprague Type 150D.
C8	5496267P103	Tantalum: 150 µf ±20%, 6 VDCW; sim to Sprague Type 150D.
C9	5496267P10	Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D.
C17	19A115028P107	Polyester: 0.01 µf ±20%, 200 VDCW.
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR1	19A115250P1	Silicon, fast recovery, 225 mA, 50 PIV.
		- - - - - - - JACKS AND RECEPTACLES - - - - - - -
J1	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J5	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J7	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J9	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J12	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J19 and J20	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
J22	4033513P4	Contact, electrical: sim to Bead Chain L93-3.
		- - - - - - - - - TRANSISTORS - - - - - - - - - -
Q2	19A115362P1	Silicon, NPN; sim to Type 2N2925.
Q3 and Q4	19A115889P3	Silicon, NPN.
Q5 thru Q7	19A115889P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R9	3R77P333K	Composition: 33K ohms ±10%, 1/2 w.
R10	3R77P103K	Composition: 10K ohms ±10%, 1/2 w.
R11	3R77P332J	Composition: 3.3K ohms ±5%, 1/2 w.
R13	3R77P153J	Composition: 15K ohms ±5%, 1/2 w.
R14	3R77P101J	Composition: 100 ohms ±5%, 1/2 w.
R15	3R77P333J	Composition: 33K ohms ±5%, 1/2 w.
R16	3R77P104J	Composition: 100K ohms ±5%, 1/2 w.
R17	3R77P275J	Composition: 2.7 megohms ±5%, 1/2 w.
R18	3R77P331J	Composition: 330 ohms ±5%, 1/2 w.
R19	3R77P394J	Composition: 390K ohms ±5%, 1/2 w.
R20	3R77P623J	Composition: 62K ohms ±5%, 1/2 w.
R21	3R77P153J	Composition: 15K ohms ±5%, 1/2 w.
R22	3R77P102K	Composition: 1K ohms ±10%, 1/2 w.
R23	3R77P103K	Composition: 10K ohms ±10%, 1/2 w.
R25	3R77P104K	Composition: 100K ohms ±10%, 1/2 w.
R26	3R77P102K	Composition: 1K ohms ±10%, 1/2 w.
R27	19B209358P5	Variable, carbon film: approx 200 to 5K ohms ±20%, 0.25 w; sim to CTS Type U-201.
R55*	3R77P180K	Composition: 18 ohms ±10%, 1/2 w. Added by REV C.
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P1	4029840P2	Contact, electrical: sim to AMP 42827-2.
P5	4029840P2	Contact, electrical: sim to AMP 42827-2.
P9	4029840P2	Contact, electrical: sim to AMP 42827-2.
P12	4029840P2	Contact, electrical: sim to AMP 42827-2.
		REMOTE REPEATER DISABLE 19A122231G11
		RELAY PANEL ASSEMBLY 19C303972G3
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
CR2	4037822P1	Silicon, 1000 mA, 400 PIV.
		- - - - - - - - - - - RELAYS - - - - - - - - - - -
K2	19C307010P10	Armature: 28 VDC nominal, 1.5 w max operating, 3480 ohms ±10% coil res, 3 form C contacts; sim to Allied Control TS-154-CC-C.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R152P152K	Composition: 1.5K ohms ±10%, 1/4 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - - -
S2	7145098P4	Slide: SPDT, 0.5 amp at 125 VAC or VDC; sim to Continental Wirt SW-732.
		- - - - - - - - - - SOCKETS - - - - - - - - - - -
XK2	5491595P5	Relay: 16 contacts; sim to Allied Control 30054.
		DIODE KIT 19A122255G1
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
	4037822P1	Silicon, 1000 mA, 400 PIV.
		AUDIO LIMITER 19A122231G12
		AUDIO LIMITER BOARD 19B205699G1
		- - - - - - - - - - - PLUGS - - - - - - - - - - -
P1	4033348P1	Contact, electrical: sim to Bead Chain M-125-34.
P2	4029840P2	Contact, electrical: sim to Amp 42827-2.
		- - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A115123P1	Silicon, NPN.
Q2	19A115768P1	Silicon, PNP.
Q3	19A115728P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	3R77P332K	Composition: 3.3K ohms ±10%, 1/2 w.
R2	3R77P303K	Composition: 30K ohms ±10%, 1/2 w.
R3	3R77P203J	Composition: 20K ohms ±5%, 1/2 w.
R4	5494774P104	Variable, carbon film: 10K ohms ±20%, 0.3 w; sim to CTS Series 70 Control.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1	7775500P203	Phen: 5 terminals.
TB2	7775500P55	Phen: 5 terminals.
		REMOTE/REPEAT WITH CHANNEL GUARD 19A122231G13
		RELAY BOARD ASSEMBLY 19C303972G6
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR3 and CR4	19A115250P1	Silicon,fast recovery, 225 ma, 50 PIV.
		- - - - - - - - - - - RELAYS - - - - - - - - - -
K1	19C307010P11	Armature: 15 ma, 30 VDC nominal, 1.5 w max operating, 1550 ohms ±10% coil res, 1 form A, 1 form C and 1 form D contact; sim to Allied Control T154-X-631.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A115768P1	Silicon, PNP.
Q2 thru Q4	19A115123P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2	3R77P512J	Composition: 5.1K ohms ±5%, 1/2 w.
R3	3R77P104J	Composition: 100K ohms ±5%, 1/2 w.
R4	3R77P393J	Composition: 39K ohms ±5%, 1/2 w.
R5	3R77P512J	Composition: 5.1K ohms ±5%, 1/2 w.
R6	3R77P204J	Composition: 200K ohms ±5%, 1/2 w.
R7 and R8	3R77P393J	Composition: 39K ohms ±5%, 1/2 w.
R9 and R10	3R77P474J	Composition: 470K ohms ±5%, 1/2 w.
R11	3R77P393J	Composition: 39K ohms ±5%, 1/2 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - - -
S1	7145098P4	Slide: SPDT, 0.5 amp at 125 VAC or VDC; sim to Continental Wirt SW-732.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1 thru TB4	7487424P7	Miniature, phen: 4 terminals.
		- - - - - - - - - - - SOCKETS - - - - - - - - - -
XK1	5491595P5	Relay: 16 contacts; sim to Allied Control 30054.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	5491595P9	Retainer, spring. (Used with K1).
		DIODE KIT 19A122255G1
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
	4037822P1	Silicon, 1000 mA, 400 PIV.
		REMOTE/REPEAT WITH CHANNEL GUARD AND REPEAT DISABLE 19A122231G13 19A122231G14
		RELAY BOARD ASSEMBLY 19C303972G6 (Used with 19A122231G13)
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR3 and CR4	19A115250P1	Silicon, fast recovery, 225 MA, 50 PIV.
		- - - - - - - - - - - RELAYS - - - - - - - - - -
K1	19C307010P11	Armature: 15 ma, 30 VDC nominal, 1.5 w max operating, 1550 ohms ±10% coil res, 1 form A, 1 form C and 1 form D contact; sim to Allied Control T154-X-631.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A115768P1	Silicon, PNP.
Q2 thru Q4	19A115123P1	Silicon, NPN.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R2	3R77P512J	Composition: 5.1K ohms ±5%, 1/2 w.
R3	3R77P104J	Composition: 100K ohms ±5%, 1/2 w.
R4	3R77P393J	Composition: 39K ohms ±5%, 1/2 w.
R5	3R77P512J	Composition: 5.1K ohms ±5%, 1/2 w.
R6	3R77P204J	Composition: 200K ohms ±5%, 1/2 w.
R7 and R8	3R77P393J	Composition: 39K ohms ±5%, 1/2 w.
R9 and R10	3R77P474J	Composition: 470K ohms ±5%, 1/2 w.
R11	3R77P393J	Composition: 39K ohms ±5%, 1/2 w.
		- - - - - - - - - - SWITCHES - - - - - - - - - - -
S1	7145098P4	Slide: SPDT, 0.5 amp at 125 VAC or VDC; sim to Continental Wirt SW-732.
		- - - - - - - - - TERMINAL BOARDS - - - - - - - -
TB1 thru TB4	7487424P7	Miniature, phen: 4 terminals.
		- - - - - - - - - - - SOCKETS - - - - - - - - - -
XK1	5491595P5	Relay: 16 contacts; sim to Allied Control 30054-2.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	5491595P9	Retainer, spring. (Used with K1).
		DIODE KIT 19A122255G1
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
	4037822P1	Silicon.
		RELAY BOARD ASSEMBLY 19C303972G7 (Used with 19A122231G14)
		- - - - - - - - DIODES AND RECTIFIERS - - - - - -
CR2	4037822P1	Silicon, 1000 mA, 400 PIV.
		- - - - - - - - - - - RELAYS - - - - - - - - - - -
K2	19C307010P10	Armature: 28 VDC nominal, 1.5 w max operating, 3480 ohms ±10% coil res, 3 form C contacts; sim to Allied Control TS-154-CC-C.
K3	19C307010P11	Armature: 30 VDC nominal, 1.5 w max operating, 1550 ohms ±10% coil res, 1 form A, 1 form C, 1 form D contacts; sim to Allied Control T154-X-631.
		- - - - - - - - - - - - SOCKETS - - - - - - - - - -
XK2 and XK3	5491595P5	Relay: 16 contacts; sim to Allied Control 30054-2.
		- - - - - - - - - - MISCELLANEOUS - - - - - - - - -
	5491595P9	Retainer, spring. (Used with K2 and K3).
		DIODE KIT 19A122255G1
		- - - - - - - DIODES AND RECTIFIERS - - - - - - -
	4037822P1	Silicon, 1000 mA, 400 PIV.

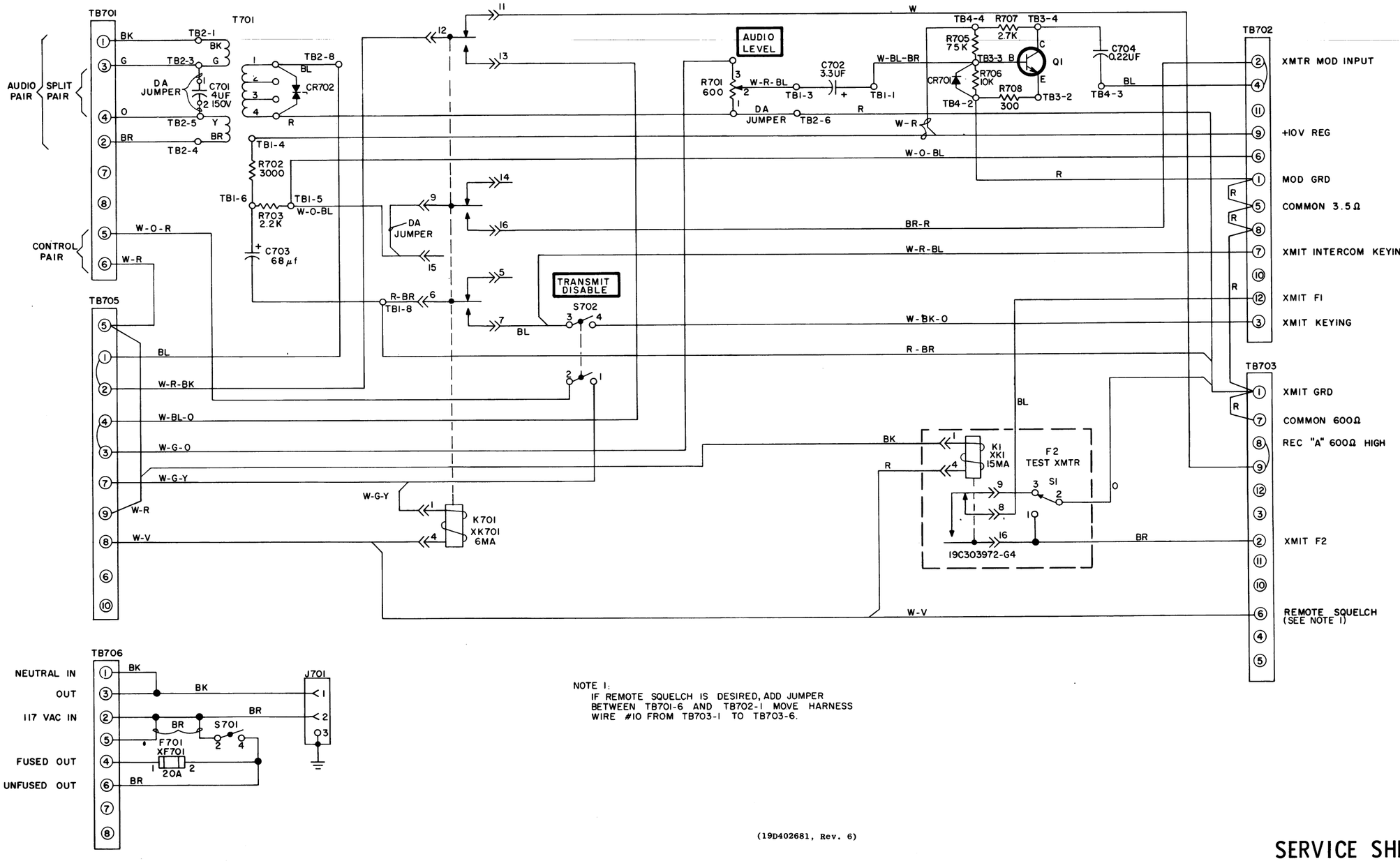
PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for descriptions of parts affected by these revisions.

REV. A - To reduce hum in line-to line connections. Removed ground from control pair.

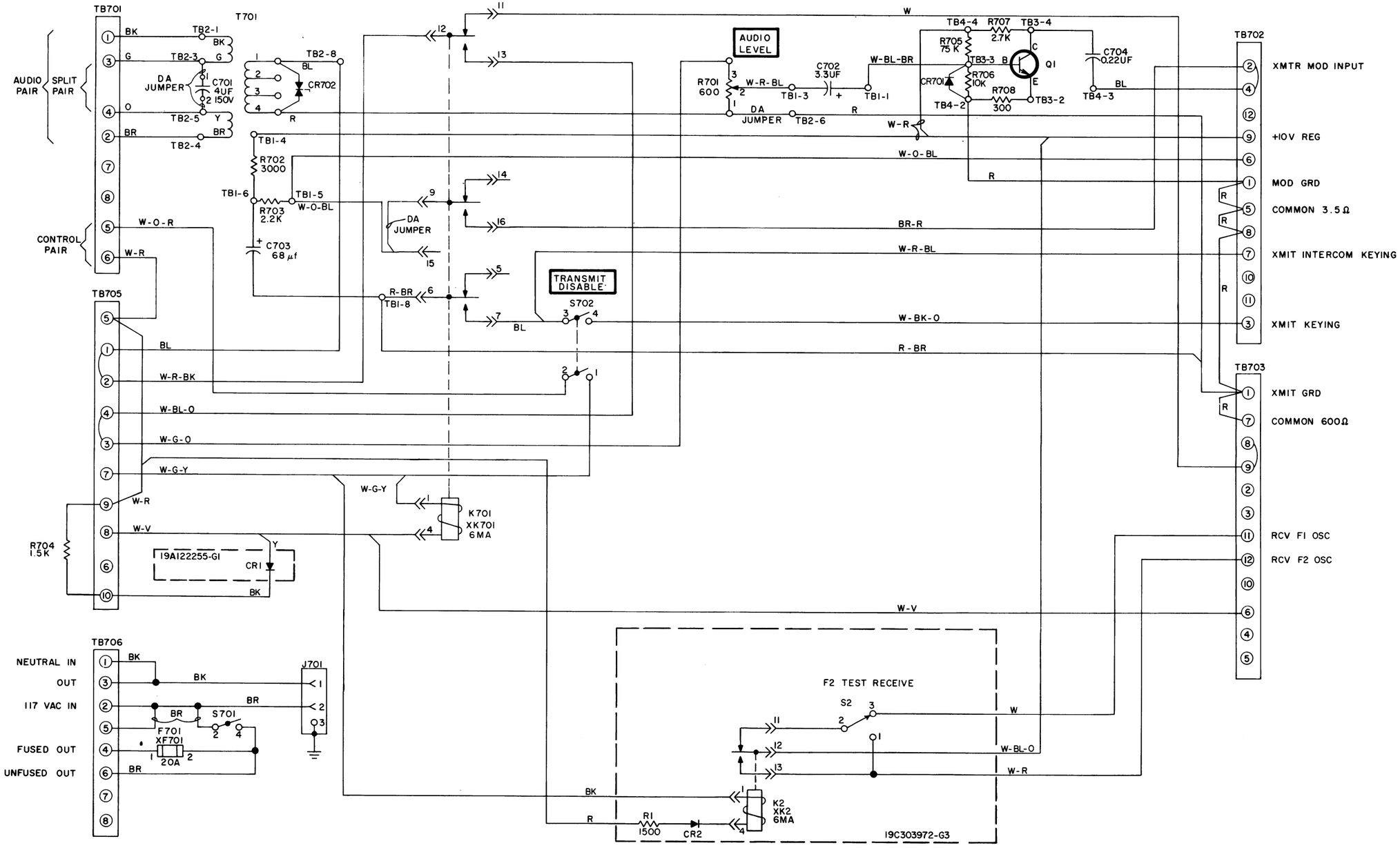
REV. B - To improve ground connection, to AC receptacle, and to eliminate unused fuse. Added ground lug to J701 and deleted F702.

REV. C - To improve humidity problem. Switches S701 and S702 were changed.



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

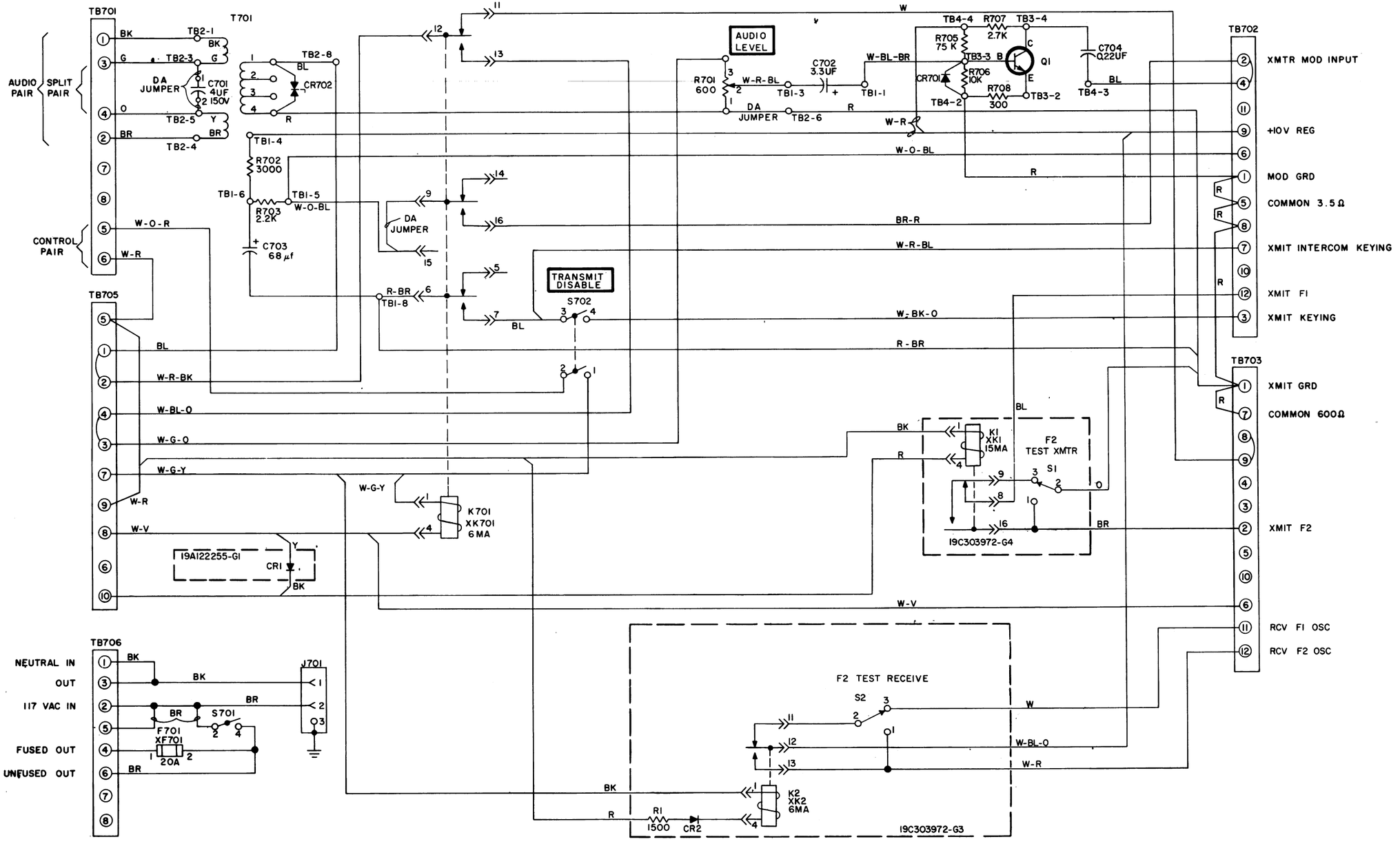
(19D402681, Rev. 6)



SERVICE SHEET

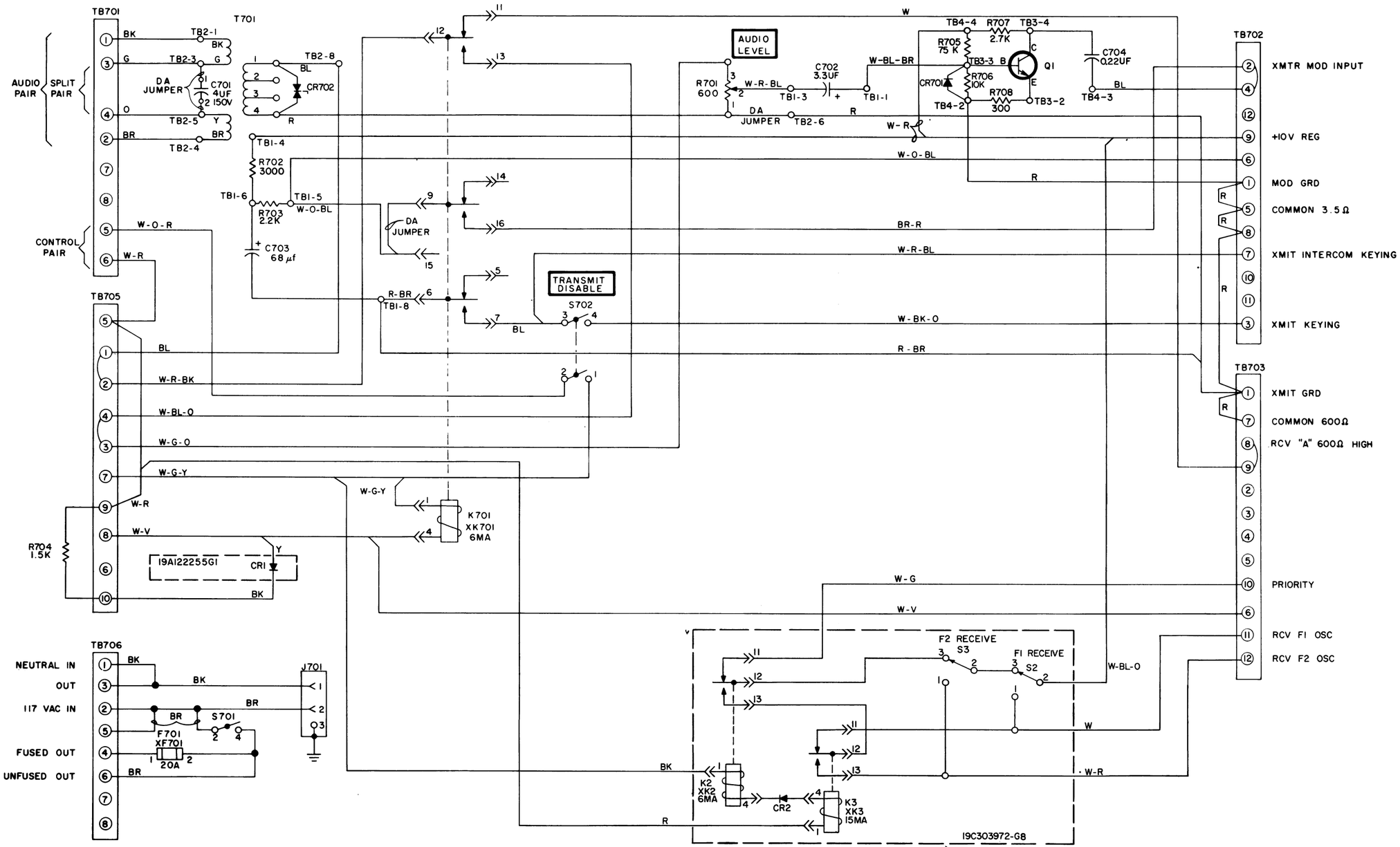
1-FREQ TRANSMIT & 2-FREQ RECEIVE
19A122231G2

(19D402682, Rev. 6)



SERVICE SHEET

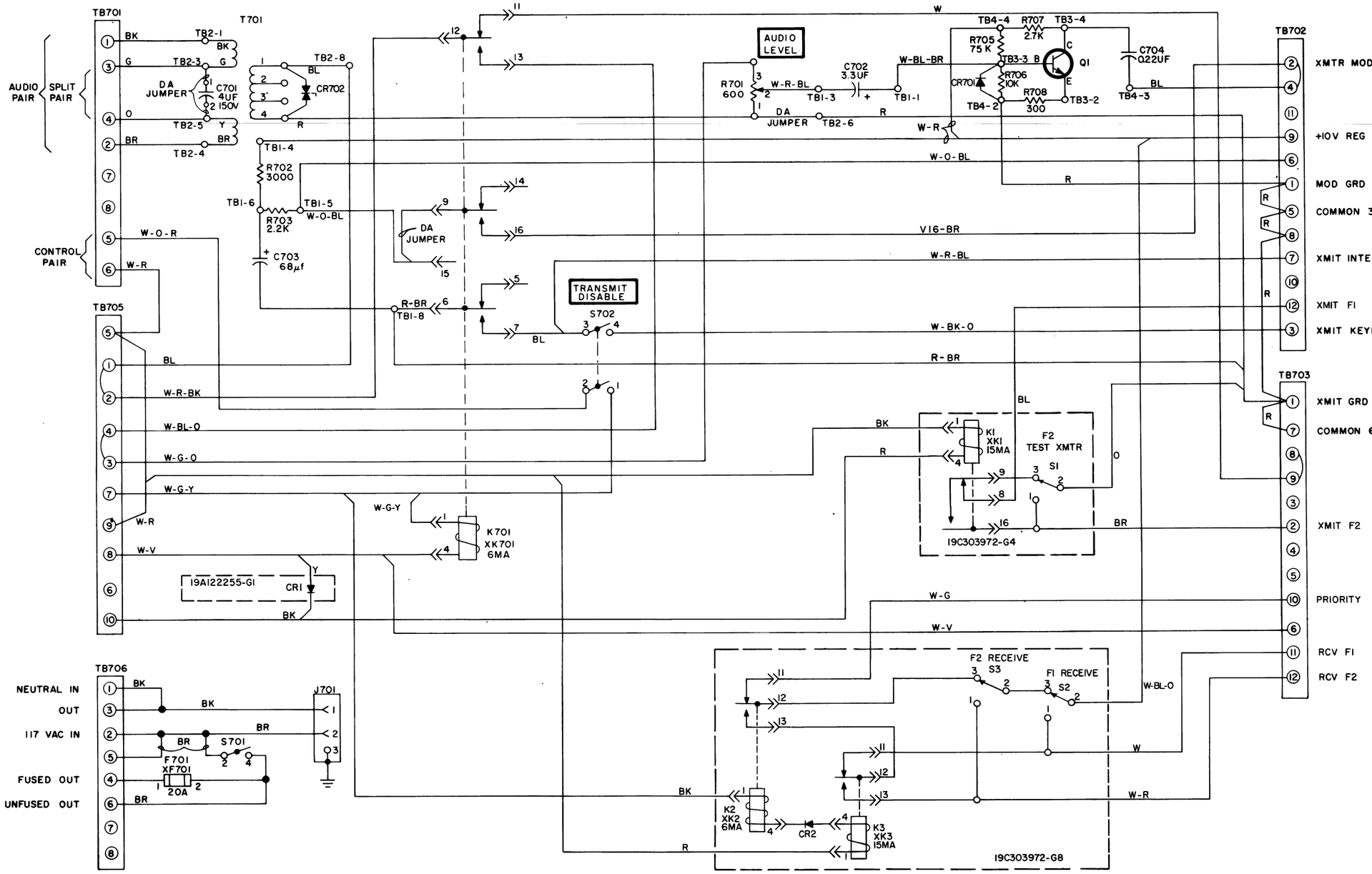
2-FREQ TRANSMIT & 2-FREQ RECEIVE 19A122231G3



SERVICE SHEET

1-FREQ TRANSMIT &
PRIORITY SEARCH/LOCK MONITOR
19A122231G15

(19D413450, Rev. 3)

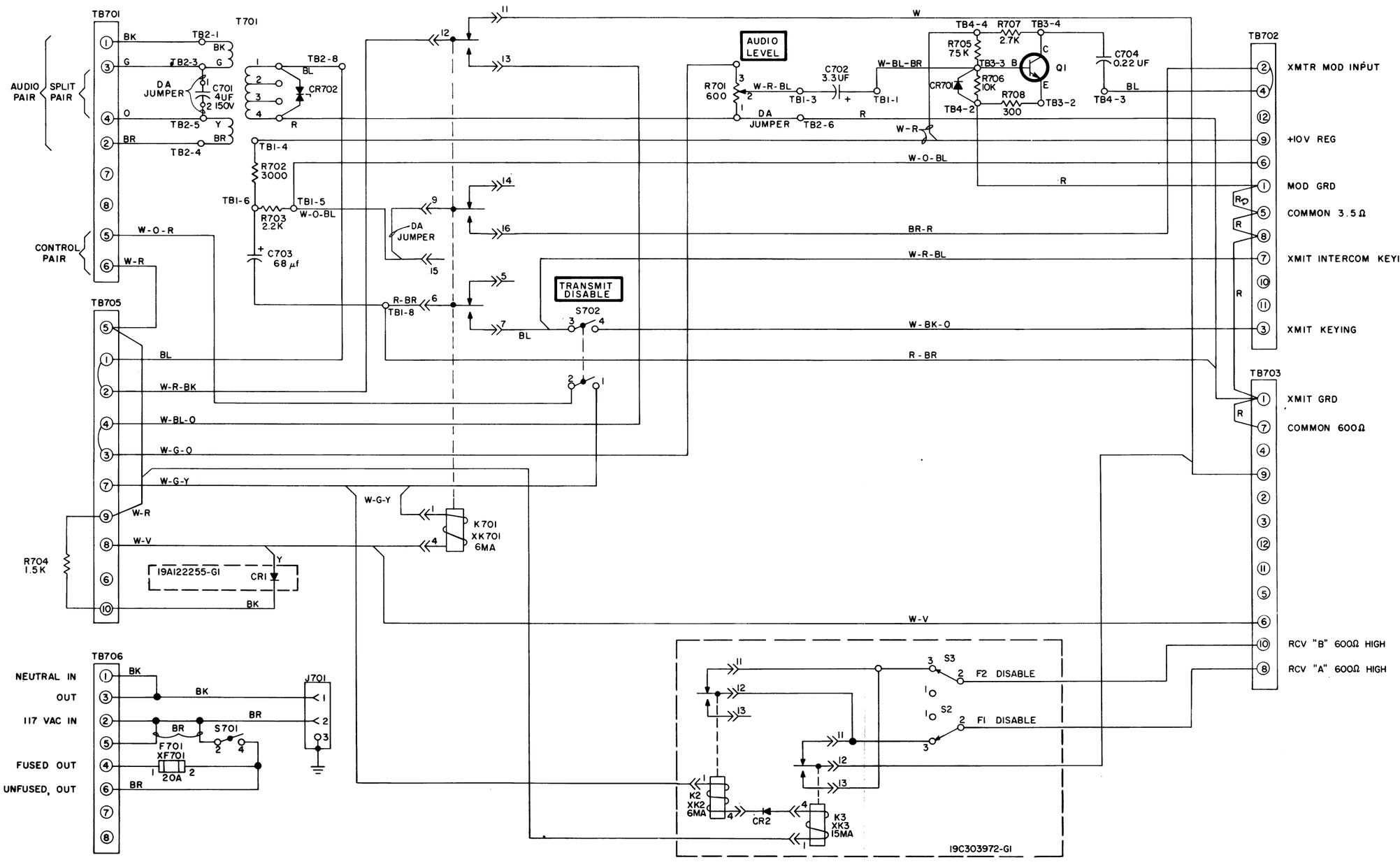


(19D413451, Rev. 4)

SERVICE SHEET

2-FREQ TRANSMIT & PRIORITY SEARCH-LOCK MONITOR 19A122231G16

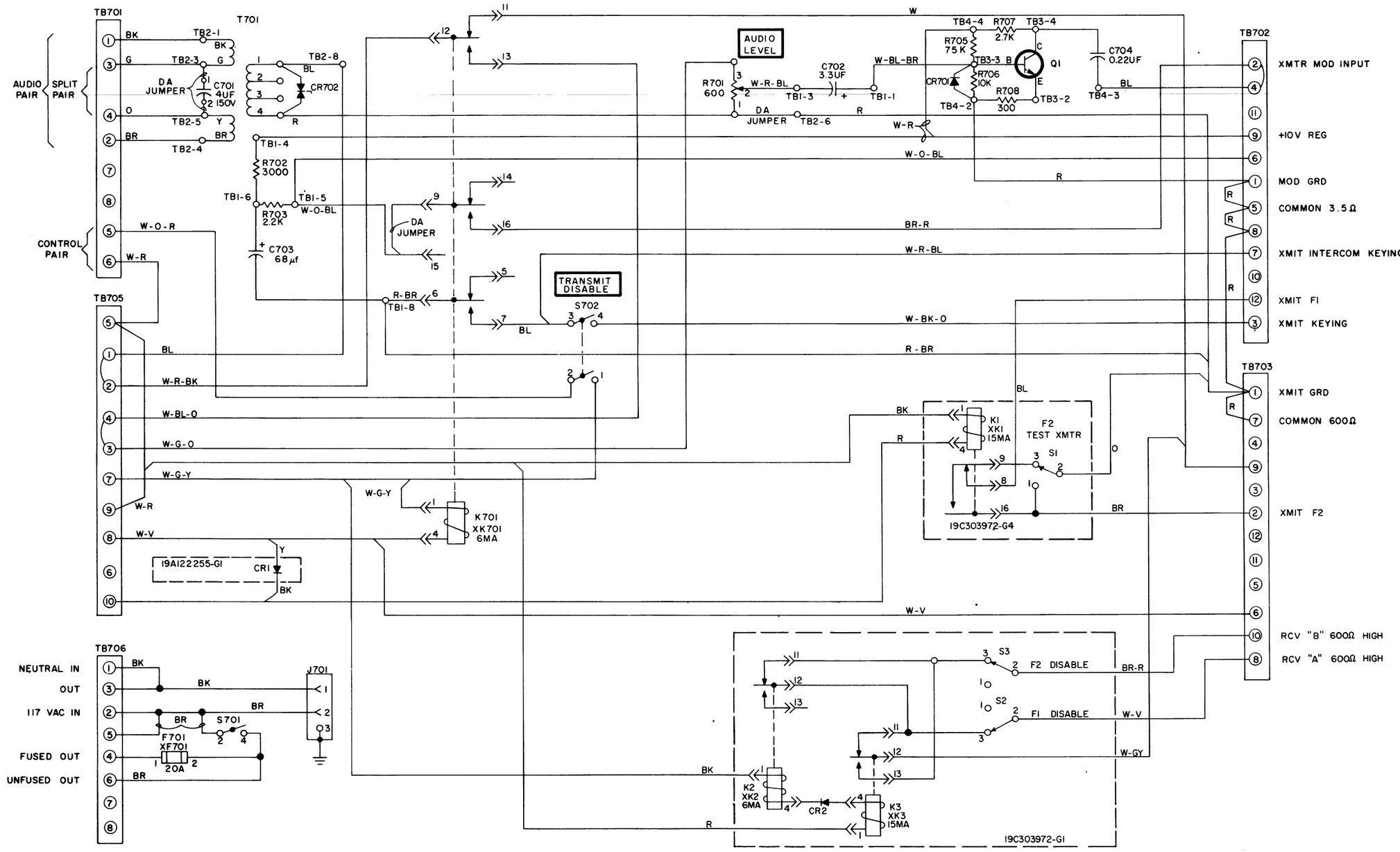
Issue 4



SERVICE SHEET

1-FREQ TRANSMIT &
TWO SEPARATE RECEIVERS
19A122231G6

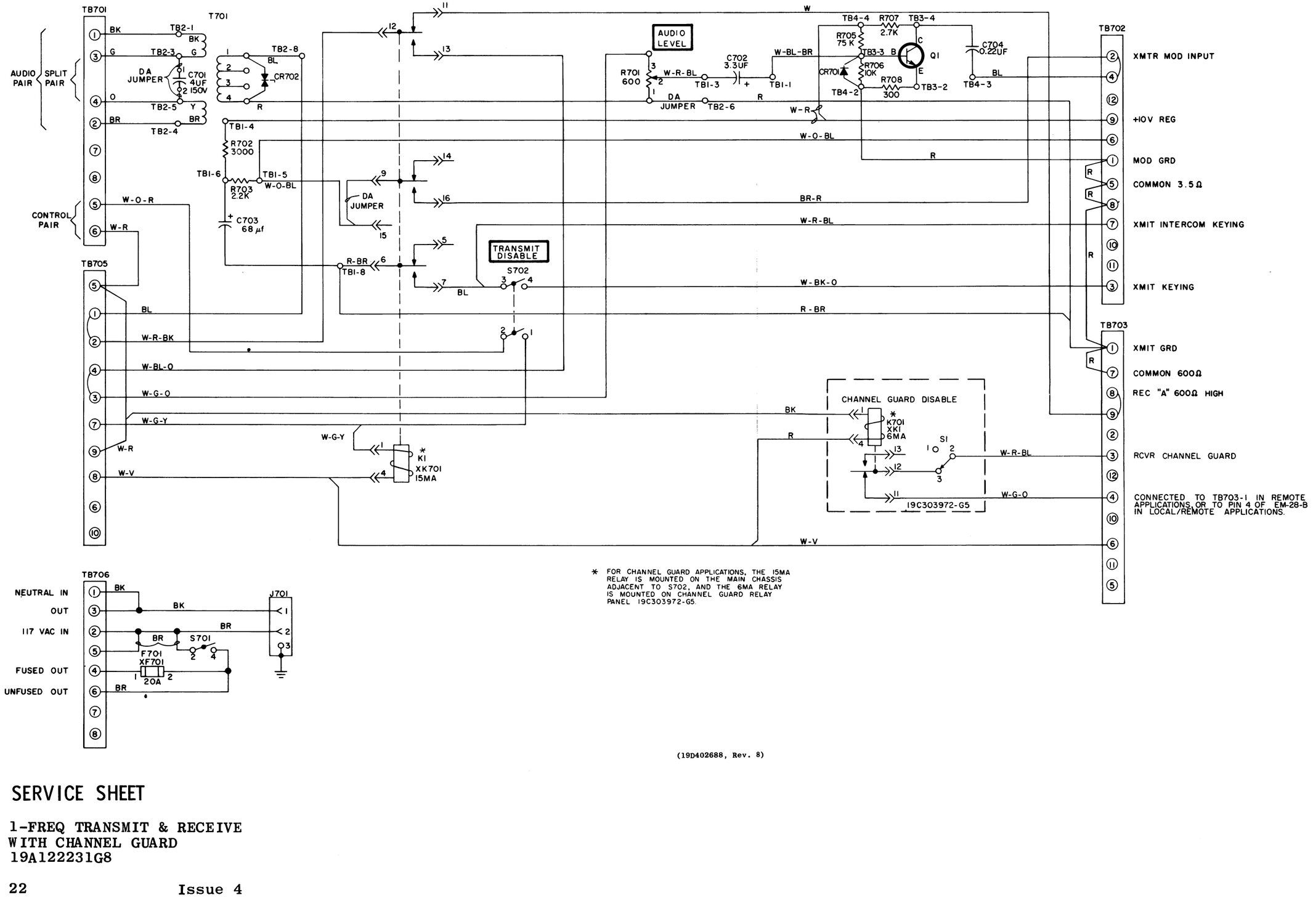
(19D402686, Rev. 6)



(19D402687, Rev. 6)

SERVICE SHEET

2-FREQ TRANSMIT & TWO SEPARATE RECEIVERS 19A122231G7



* FOR CHANNEL GUARD APPLICATIONS, THE 15MA RELAY IS MOUNTED ON THE MAIN CHASSIS ADJACENT TO S702, AND THE 6MA RELAY IS MOUNTED ON CHANNEL GUARD RELAY PANEL 19C303972-G5.

(19D402688, Rev. 8)

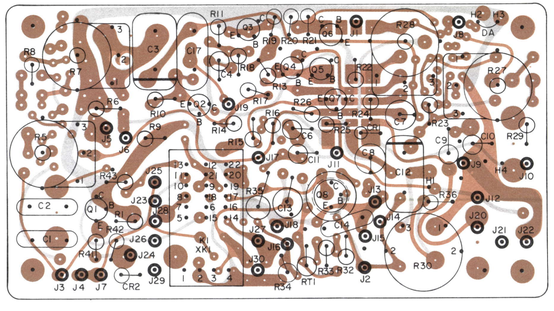
SERVICE SHEET

1-FREQ TRANSMIT & RECEIVE WITH CHANNEL GUARD 19A122231G8

TROUBLESHOOTING PROCEDURES

SYMPTOM	PROCEDURE
No audio from the speaker	1. Check for audio input with AC-VTVM at TB701-1 & -2. 2. Make sure that the VOLUME control R1 is not set at minimum (fully counterclockwise). 3. Check to see that K1 is not energized. 4. Check the audio input with an AC-VTVM at A1-J17. If no audio, check T701 and C701. 5. Check the setting of LINE INPUT control R7 (refer to the Adjustment Procedure). If R7 cannot be adjusted for the correct reading, check relay contacts K1-11, -12 and -13. 6. Check supply voltages at J1, J2 and J13 on A1 (refer to the Schematic Diagram). 7. Check Bias Adjust R30 for a setting of 0.55 volt DC measured across R34 on A1. If R30 cannot be adjusted for the correct reading, check Q8, T1 and relay contacts K1-14, -15 and -16. 8. Check the DC voltages on Q3 thru Q6 (refer to the Schematic Diagram).
No audio on the line when the microphone is keyed.	1. Check the microphone leads and relay contacts K1-11 thru -22. 2. Check the setting of MIC GAIN R5 and LINE OUTPUT R28 (refer to the Adjustment Procedure). 3. Key the microphone and check the DC voltages on Q1 (refer to the Schematic Diagram). 4. Check capacitor C13 on A1.
No audio to the transmitter modulation input (TB702-2).	Check the setting of Modulation Input Control R27 (refer to Adjustment Procedure).

OUTLINE DIAGRAM



RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

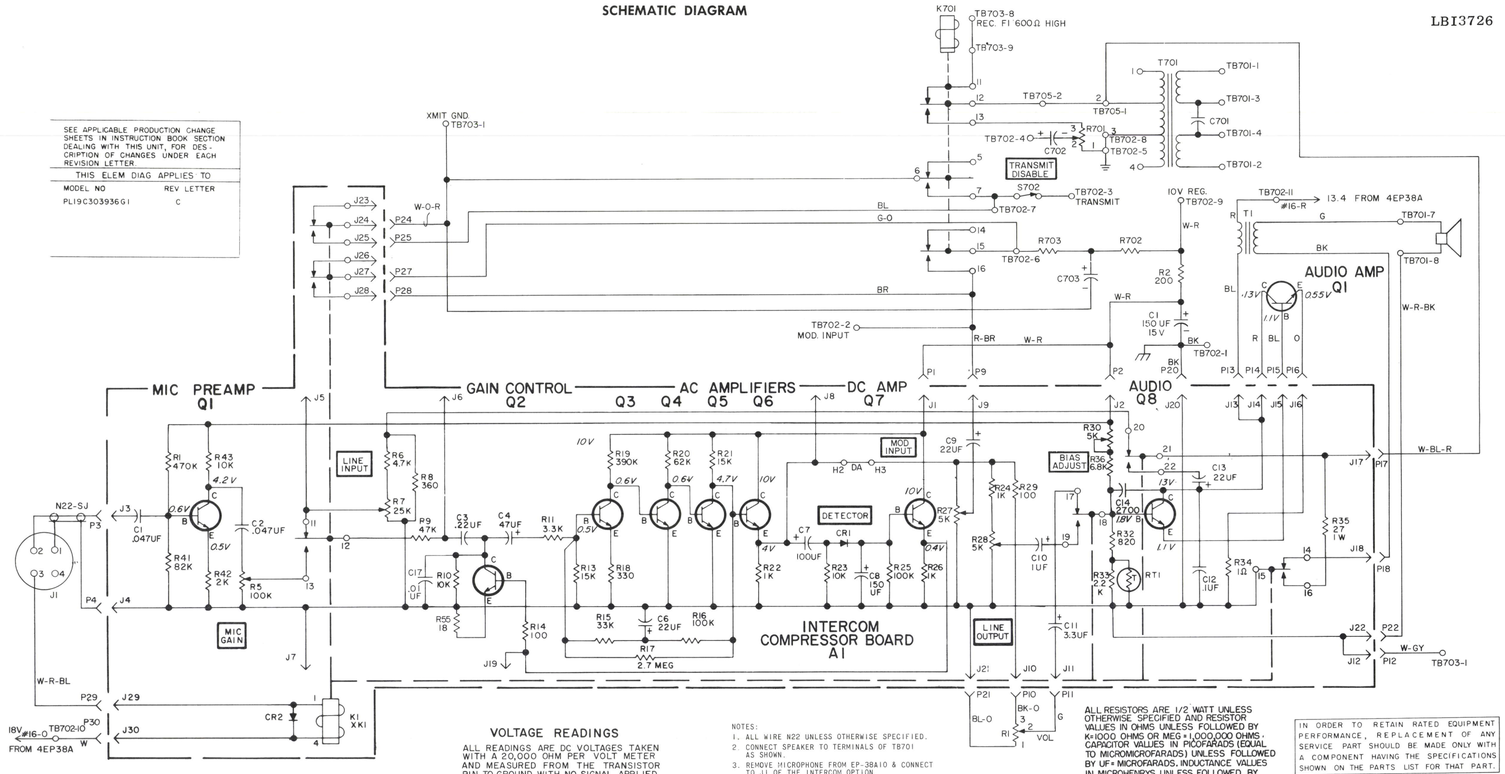
(19C311168, Rev. 3)
(19C303937, Sh. 1, Rev. 9)
(19C303937, Sh. 2, Rev. 9)

SCHEMATIC DIAGRAM

LBI3726

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

THIS ELEM DIAG APPLIES TO	
MODEL NO	REV LETTER
PLI9C303936G1	C



VOLTAGE READINGS

ALL READINGS ARE DC VOLTAGES TAKEN WITH A 20,000 OHM PER VOLT METER AND MEASURED FROM THE TRANSISTOR PIN TO GROUND WITH NO SIGNAL APPLIED. READING AT EMITTER OF Q7 INDICATES THRESHOLD OF COMPRESSION.

NOTES:
1. ALL WIRE N22 UNLESS OTHERWISE SPECIFIED.
2. CONNECT SPEAKER TO TERMINALS OF T701 AS SHOWN.
3. REMOVE MICROPHONE FROM EP-38A10 & CONNECT TO J1 OF THE INTERCOM OPTION.
4. REMOVE WIRES FROM TERMINALS 1 & 4 OF TRANSFORMER T701 & CONNECT TO TERMINALS 2 & 3 OF TRANSFORMER T701.

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF=MICROFARADS. INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

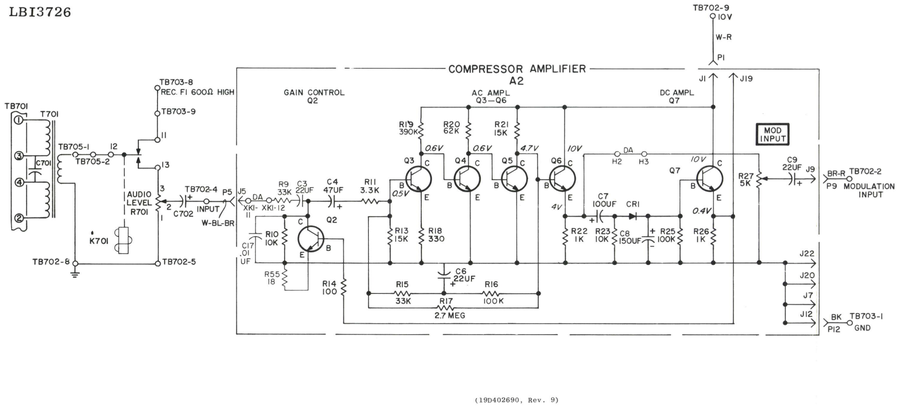
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

(19D402689, Rev. 11)

SERVICE SHEET

INTERCOM-COMPRESSOR
OPTION 7620
19A122231G9

LBI3726



IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

VOLTAGE READINGS.

ALL READINGS ARE DC VOLTAGES TAKEN WITH A 20,000 OHM PER VOLT METER AND MEASURED FROM THE TRANSISTOR PIN TO GROUND WITH NO SIGNAL APPLIED. READING AT EMITTER OF Q7 INDICATES THRESHOLD OF COMPRESSION.

NOTE I. REMOVE JUMPER FROM TB702-4 TO TB702-2

ALL RESISTORS ARE 1/2 WATT UNLESS OTHERWISE SPECIFIED AND RESISTOR VALUES IN OHMS UNLESS FOLLOWED BY K=1000 OHMS OR MEG=1,000,000 OHMS. CAPACITOR VALUES IN PICOFARADS (EQUAL TO MICROMICROFARADS) UNLESS FOLLOWED BY UF= MICROFARADS, INDUCTANCE VALUES IN MICROHENRYS UNLESS FOLLOWED BY MH= MILLIHENRYS OR H=HENRYS.

SEE APPLICABLE PRODUCTION CHANGE SHEETS IN INSTRUCTION BOOK SECTION DEALING WITH THIS UNIT, FOR DESCRIPTION OF CHANGES UNDER EACH REVISION LETTER.

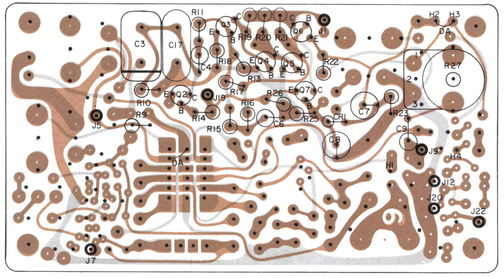
THIS ELEM DIAG APPLIES TO

MODEL NO.	REV LETTER
PLI9A122231G10	A
PLI9C30393G3	C

TROUBLESHOOTING PROCEDURE

SYMPTOM	PROCEDURE
No audio to the transmitter modulation input (TB702-2).	1. Check the audio input with an AC-VTVM at TB702-4 and A2-J5. If no audio, check T701 and C701. 2. Check the setting of AUDIO LEVEL control R701 and Transmitter Modulation Input Control R27 (refer to the Adjustment Procedure). 3. Check supply voltages at J1 on A2 (refer to the Schematic Diagram). 4. Check the DC voltages on Q3 thru Q6 (refer to the Schematic Diagram).

OUTLINE DIAGRAM

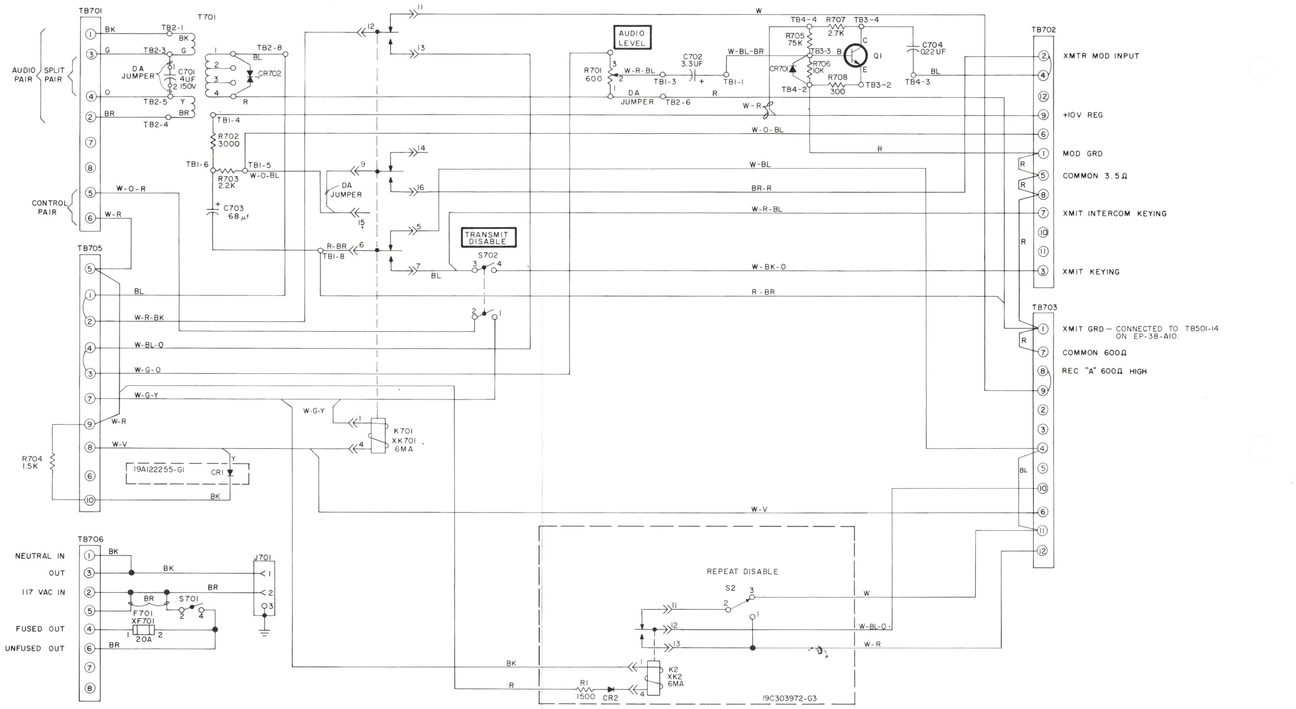


(19C311169, Rev. 2)
(19C303937, Sh. 1, Rev. 9)
(19C303937, Sh. 2, Rev. 9)

RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

SERVICE SHEET

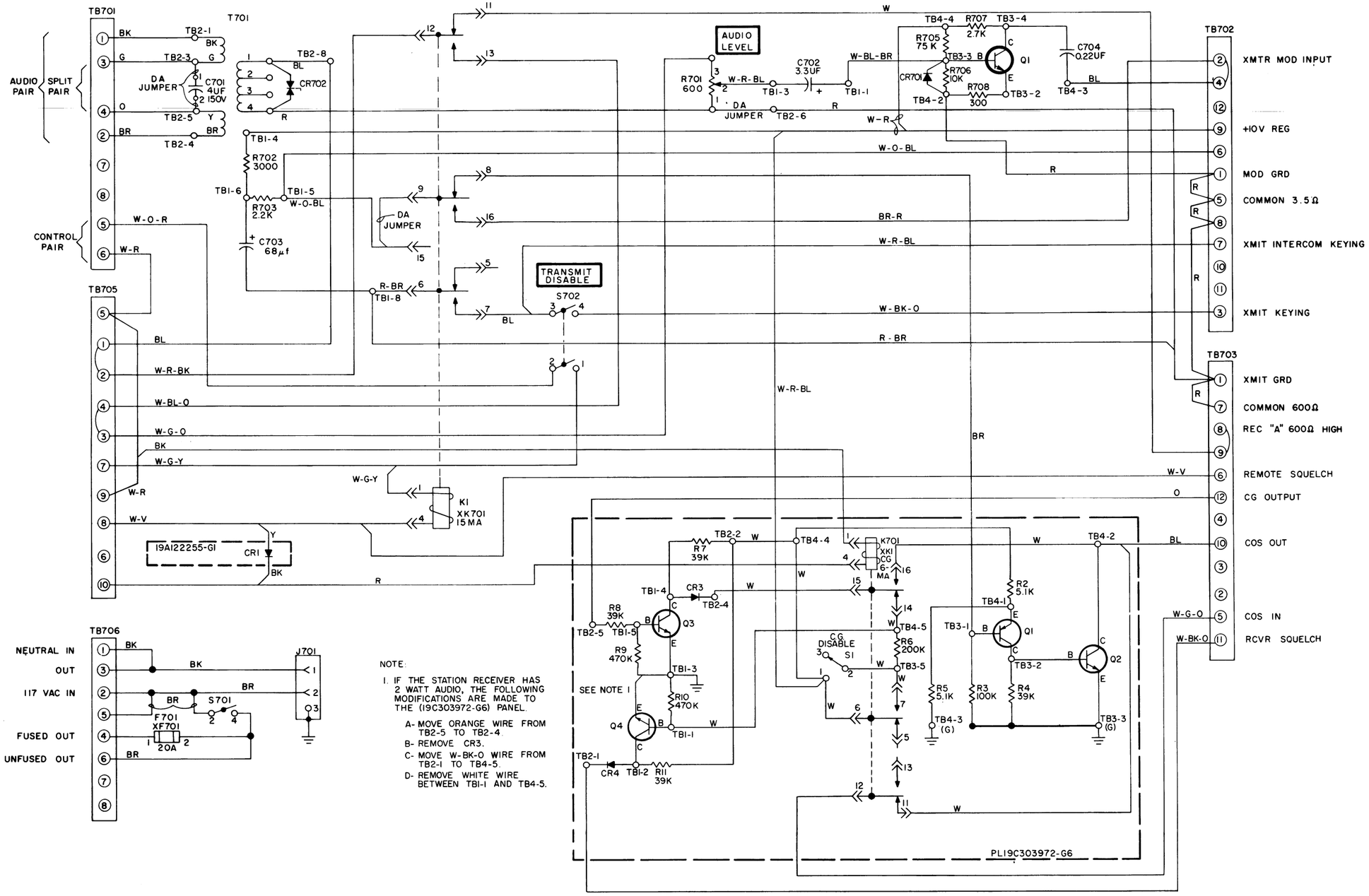
COMPRESSOR-AMPLIFIER (OPTION 7621)
19A122231G10



(19D402702, Rev. 7)

SERVICE SHEET

REMOTE/REPEATER DISABLE
OPTION 7651
19A122231G11



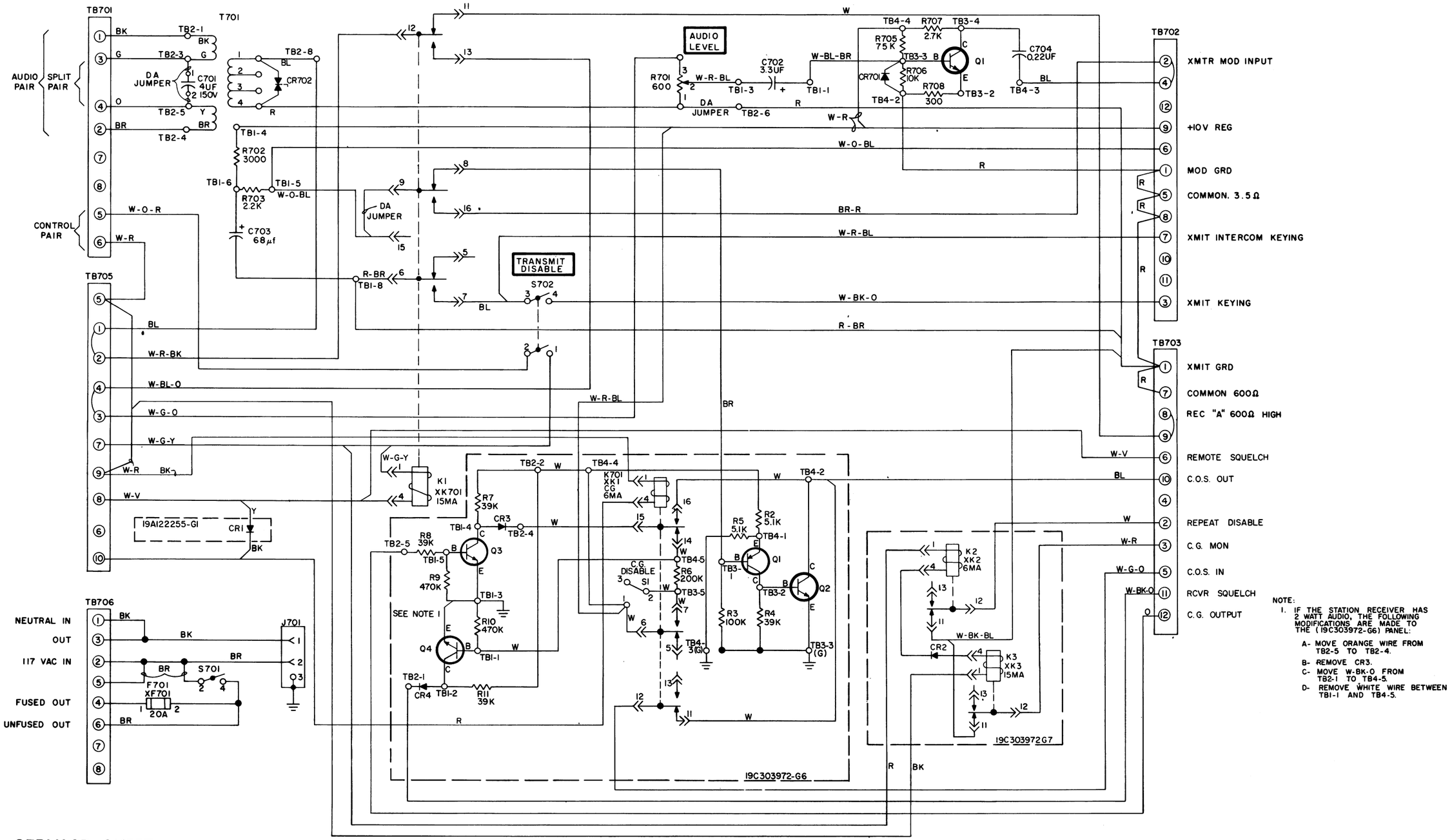
NOTE:

1. IF THE STATION RECEIVER HAS 2 WATT AUDIO, THE FOLLOWING MODIFICATIONS ARE MADE TO THE (19C303972-G6) PANEL.
   - A- MOVE ORANGE WIRE FROM TB2-5 TO TB2-4.
   - B- REMOVE CR3.
   - C- MOVE W-BK-O WIRE FROM TB2-1 TO TB4-5.
   - D- REMOVE WHITE WIRE BETWEEN TBI-1 AND TB4-5.

(19D413095, Rev. 6)

SERVICE SHEET

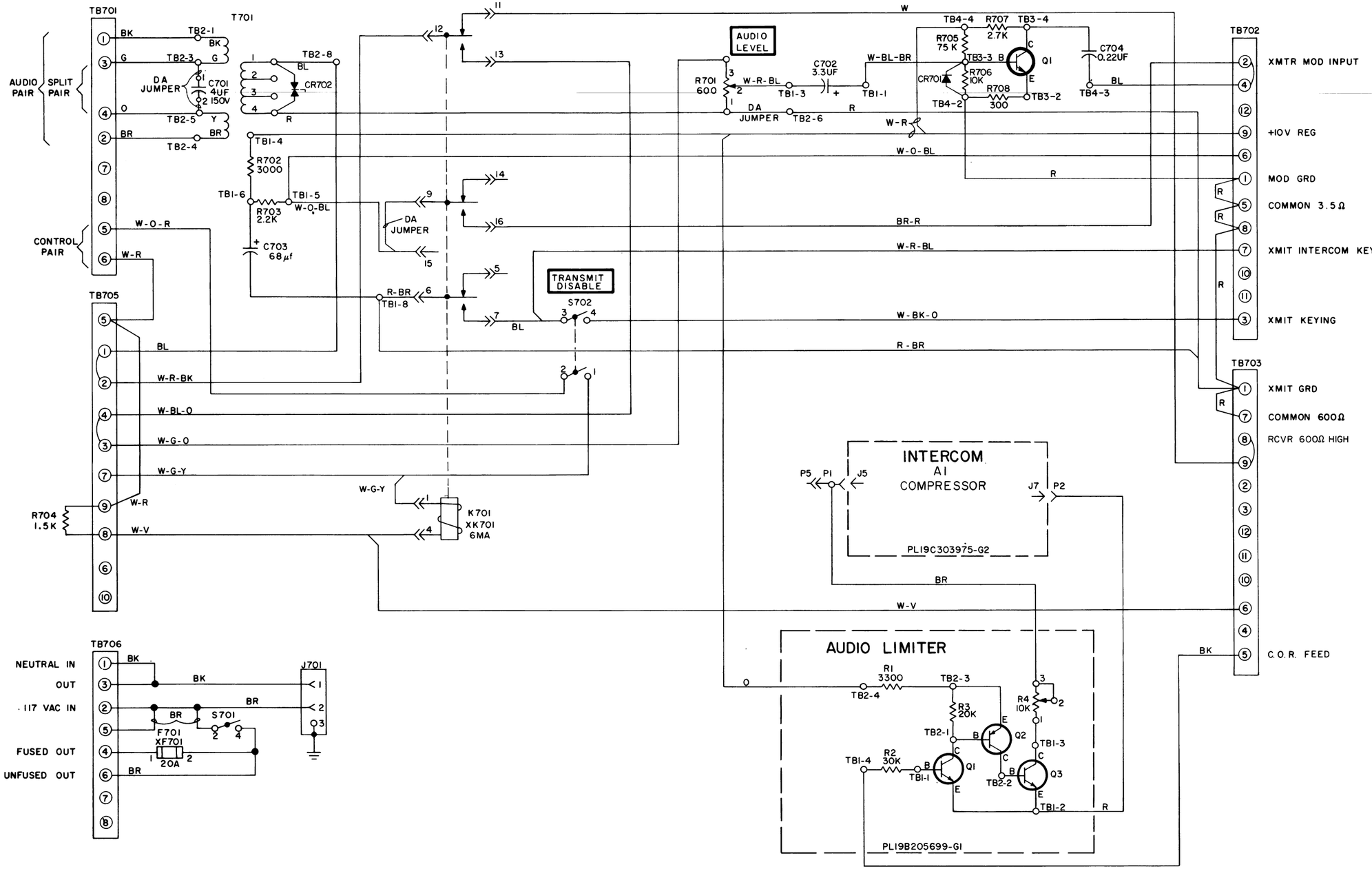
REMOTE/REPEATER WITH CHANNEL GUARD (OPTION 7659) 19A122231G13



SERVICE SHEET

REMOTE/REPEATER WITH
CHANNEL GUARD DISABLE (OPTION 7660)
19A122231G14

(19D413096, Rev. 6)



(19D402831, Rev. 5)

SERVICE SHEET

LOCAL/REMOTE CONTROL
19A122231G12

$E = IR$ $\quad I = \frac{E}{R}$

$.010 \times 3000$