.9

MOBILE RADIO

# MASTR® Progress Line

## BASE STATION REPEATER CONTROL PANEL MODEL 4KC19A10



## SPECIFICATIONS *

| | |
|---|---|
| INPUT VOLTAGE | 117 volts AC ±10%, 50/60 Hz |
| TEMPERATURE RANGE | -30°C to +60°C (-22°F to +140°F) |
| NOMINAL FREQUENCY RANGE | 300 to 3000 Hz |
| FREQUENCY RESPONSE | Receiver response corrected to be ±3 db from 1000 Hz reference from 300 to 3000 Hz, when using transmitter as signal source. |
| RATED OUTPUT | 0.2 volt RMS @ 1 kHz |
| DIMENSIONS (H x W) | 3-1/2" X 19" |

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

KC-19-A

GENERAL ELECTRIC

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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 Repeater Control Panel Model 4KC19A10 is used in MASTR® Progress Line repeater, remote/repeater and shared repeater applications. The panel provides mounting space for the following:

- Audio Coupler A701
- Carrier-Operated Switch A702
- Drop-Out Delay Timer A703
- 3-Minute Limit Timer A704 (optional)
- Channel Guard Filter FL702 (optional)
- Type 90 Tone Decoder board A1701 (optional)
- Digital Decoder (optional)
- Tone-Controlled Switch A705 (for shared repeaters)
- Carrier-Operated Relay (optional)
- AC power switch S701, fuse and convenience outlet
- Terminal boards for power line and station interconnections

All transmitter keying and timing circuits and the audio coupler circuit are fully transistorized -- no electromechanical devices are used. However, an optional carrier operated relay circuit is available for applications where external switching functions are required.

For ease of adjustment, the LIMIT TIMER ADJUST, DELAY TIMER ADJUST and AUDIO COUPLER LEVEL can be adjusted through holes in the front of the panel. Instructions for setting the controls are contained in the Adjustment Procedure as listed in the Table of Contents.

Instructions for setting the Frequency Adjust on Decoder Board A1701 and the 10-volt regulator on Tone Controlled Switch A705 are contained in the applicable Maintenance Manual.

# CIRCUIT ANALYSIS

## POWER CIRCUITS

The 117-volts AC applied to terminals TB706-1 and -2 supplies the station power supply(s), and is controlled by CABINET POWER switch S701. A 20-ampere fuse in the unregulated output line provides circuit protection. The convenience outlet (S701) connected across the unregulated input may be used with either a two-prong or three-prong plug.

**WARNING**

**117-volts AC is always present at TB706-1, -2, -3 and -5, even with CABINET POWER switch S701 in the OFF position. Keep away from these terminals when servicing the control panel.**

A regulated 10 volts and 12.6 volts from power supply EP-38-A provides operating and switching voltages for the component boards. As the audio output lead and the 10-volt lead are tied together at TB1-5, an audio filter composed of C701, R701 and R702 prevents any audio on the line from reaching the power supply.

## AUDIO COUPLER A701

Audio Coupler A701 matches the receiver discriminator output to the transmitter input. The circuit also compensates the receiver output, keeping the resultant response (from mobile transmitter-to repeater receiver-to repeater transmitter) within ±3 dB of a 1000 Hz reference from 300 to 3000 Hz.

Audio from the station receiver is taken from the volume control on the EP-38-A and coupled through C1 to the base of audio amplifier Q1. The output of Q1 is applied through AUDIO COUPLER LEVEL control R2 to amplifiers Q2 and Q3. De-emphasis is provided by R3 and C5. The output of Q3 is connected to TB1-5, and then applied with +10 volts to the emitter of Q1 on the Carrier-Operated Switch. In Channel Guard applications, the output of Q3 is coupled through high-pass filter FL701 to the Carrier-Operated Switch.

## CARRIER-OPERATED SWITCH A702

Unsquelching the station receiver activates the Carrier-Operated Switch (COS). When the receiver is unsquelched, the COS feed voltage from the receiver rises from zero volts to approximately 3-volts DC. This voltage is connected to H1 on the COS where it forward biases diode CR1, turning on NPN transistor Q2. When conducting, the collector of Q2 goes to ground potential and turns on PNP transistors Q1 and Q3.

Q1 operates as an AC and DC switch. When turned on, audio (from the Audio Coupler) and +10 volts (from TB1-5) are connected from the collector of Q1 to TB702-2, and applied to the diode gating circuit on the EP-38-A. The +10 volts forward biases the diode and the audio is applied to the transmitter modulator.

Turning on Q3 applies 12.6 volts to TB701-1, where it is connected to the timing circuits by means of jumpers. Refer to Note 1 on the Schematic Diagram for jumper connection for the different timer applications.

If neither of the timers are used, the 12.6 volts is jumpered to TB701-5 which connects the voltage to the base of keying transistor A702-Q4, turning the stage on. When turned on, the collector of Q4 drops to ground potential. This lights the transmit indicator light (DS1) and provides the ground (through TB702-3) to key the transmitter.

The emitter of Q4 is connected to ground through XMIT DISABLE switch S1. Placing the switch in the XMIT DISABLE position (down) opens the ground lead so that the transmitter cannot be keyed while the equipment is being serviced.

**WARNING**

Always place toggle switch S1 in the TRANSMIT-DISABLE position when servicing the station. This disables the COS and prevents an incoming signal from keying the station transmitter.

After servicing the station, always place the TRANSMIT-DISABLE switch back in the Operate (up) position.

## DROP-OUT DELAY TIMER A703

Drop-Out Delay Timer A703 decreases the number of transmitter "on-off" cycles by keeping the transmitter keyed for a pre-determined delay period after the receiver squelches. The delay period is normally set for one second in Repeater Control Station applications, and up to five seconds in standard Repeater Base Stations. Unsquelching the receiver at any time during the delay period keeps the transmitter operating without interruption. After the delay time lapses and no signal is applied to the receiver, the transmitter keying circuit de-energizes and the transmitter turns off.

12.6 volts from the collector of Q3 (on the COS) is applied to the base of Q1 on the Drop-Out Delay Timer, turning the transistor on. Turning the stage on rapidly discharges capacitor C1 and switches the Schmitt Trigger so that Q2 is off and Q3 is on. This turns on Q4 and applies 10 volts (through a jumper on TB701) to the base of Q4 on the COS. Turning on Q4 on the COS keys the station transmitter and keeps it keyed as long as the receiver is unsquelched.

Squelching the receiver turns off Q1, Q2 and Q3 on the COS. The Schmitt Trigger on the Drop-Out Delay Timer remains switched, however, until C1 charges up to approximately 5 volts through potentiometer R10. This turns on Q2 which turns off Q3 and Q4, turning the transmitter off. The delay time may be adjusted for one to six seconds by DELAY TIMER ADJUST R10.

## OPTIONS

### 3-MINUTE LIMIT TIMER A704

The 3-Minute Timer is required by the FCC in certain repeater station applications to automatically shut off the transmitter after a maximum of three minutes continuous operation. The timer prevents the transmitter from accidentally "locking on" and tying up the channel.

Unsquelching the receiver energizes the COS, switching 12.6 volts to H1 on the 3-Minute Timer board (through a jumper on TB701). The switching circuits consist of a Schmitt Trigger (Q4 and Q6) and a DC switch (Q5). Q4 in the Schmitt Trigger is normally off so that Q6 is normally on, keeping Q5 turned on. When both the Drop-Out Delay Timer and the 3-Minute Timer are used, the +10 volts from the collector of Q5 is jumpered at TB701 and applied to the base of Q1 on the Drop-Out Delay Timer. If the Drop-Out Delay Timer is not used, the +10 volts from Q5 is applied to the base of Q4 on the COS, keying the transmitter.

In the timing circuit, Q1, VR1 and R2 are connected to form a constant current source to provide a linear charging current for capacitor C1. Q2 and Q3 operate as a compound-connected emitter-follower.

As C1 slowly charges up, the output voltage of the emitter-follower rises proportionally. When the charge on C1 is large enough to cause approximately 1.5 volts at the base of Q4, the transistor turns on. Turning on Q4 turns off Q6 and Q5. Turning off Q5 removes the +10 volts to the Drop-Out Delay Timer (when both timers are used), or to the base of Q4 on the COS.

When the receiver is squelched, C1 rapidly discharges through the collector-base junction of Q1 and R1 to reset the timing circuit. When required by FCC regulations, the timer can be set for a timing cycle of three minutes or less by LIMIT TIMER ADJUST R3.

CHANNEL GUARD FILTER FL702

In repeaters with Channel Guard, high-pass filter FL702 is connected in series with the output of the COS. The filter attenuates frequencies below 300 Hz to prevent Channel Guard tones from being applied to the transmitter modulation input.

Audio and tone from the COS is applied to a 187 Hz notch filter consisting of Q1, Q2 and associated circuitry. Negative feed-back for the notch filter is connected from the collector of Q2 to the junction of C2 and R2.

The notch filter output is applied to a low-pass filter consisting of Q3 and Q4. Negative feed-back is developed across R12. R16 controls the amount of feedback in the low-pass filter.

The output of Q3 is coupled through emitter-follower Q5 and applied to the emitter of Q1 on the COS (A702).

CARRIER-OPERATED RELAY

The Carrier-Operated Relay option may be installed in place of the Carrier-Operated Switch on the repeater panel to provide relay contacts for external switching functions.

When the station receiver unsquelches, the collector voltage of the receiver audio amplifier (Q9) rises from zero volts to approximately two volts. This voltage is connected to H1 on the Carrier-Operated Relay (COR) where it forward biases CR1 and turns on Q1. When turned on, the collector of Q1 goes to ground potential and turns on Q2. As the transistor is in series with the 12.6-volt supply and the coil of relay K1, turning on Q2 energizes the relay.

Contacts 6 & 7

Closing contacts 6 and 7 switches +10 volts and the Audio Coupler output to the audio diode gating circuit on the EP-38-A. The +10 volts forward biases the diode so that audio can be applied to the transmitter.

Contacts 12 & 13

Closing contacts 12 and 13 switches 12.6 volts to TB701-1, where it is connected to the timing circuits by means of jumpers on the terminal board. Refer to Note 1 on the repeater Schematic Diagram for jumper connection for the different timer applications.

If neither timer is used, the voltage is jumpered to TB701-5 and applied to the base of keying transistor Q3 on the COR, turning the stage on. When turned on, the collector drops to ground potential which lights transmit indicator light DS1 and keys the station transmitter.

The emitter of Q3 is connected to ground through XMIT DISABLE switch S1. Placing the switch in the XMIT DISABLE position (down) opens the ground lead so that the transmitter cannot be keyed while the equipment is being serviced.

Contacts 8 thru 16

Two form "C" contacts (8 through 16) are connected to terminals 7 through 12 on TB703 where connection can be made for external switching functions. The contacts are rated at 0.5 ampere at 12-volts DC. Refer to the Schematic Diagram for the COR (see Table of Contents) for connections to TB703.

TYPE 90 DECODER BOARD

The Type 90 Decoder board is used in conjunction with the Drop-Out Delay Timer and Carrier-Operated Switch for keying the transmitter in pulse tone applications. The Decoder board mounts on the front of the repeater panel in the option mounting area.

A signal modulated by the proper tone energizes the relay on the decoder board. This provides a ground for the emitter of Q1 on the Drop-Out Delay board, turning the transistor on. Turning on Q1 switches the Schmitt Trigger which turns on Q4. The 12.4-volt output at the collector of Q4 is connected to the base of Q4 on the Carrier-Operated Switch, turning it on. This lights the transmit indicator light (DS1) and keys the station transmitter. The transmitter remains keyed until the carrier is cut off (receiver squelched) for more than 5 seconds.

One set of contacts on the decoder relay may also be used to activate an external alarm. For complete operating and maintenance information, refer to the Maintenance Manual for the Decoder LBI-3684).

DIGITAL DECODER

The Digital Decoder option is used in conjunction with the Drop-Out Delay Timer and the Carrier-Operated Switch for "dial-on" (enable) and "dial-off" (disable) repeater operation. The decoder mounts on the front of the repeater panel in the option mounting area.

Applying the correct "ON" code to the decoder provides a ground for the emitter of Q1 on the Drop-Out Delay board, turning Q1 on. This switches the Schmitt Trigger which turns on Q4. The 12.4-volt output at the collector of Q4 is applied to the base of transistor Q4 on the Carrier-Operated

Switch, turning it on. This lights the transmit indicator light (DS1) and keys the station transmitter. The transmitter remains keyed until the carrier is removed (receiver squelched) and the Drop-Out Delay Timer operates. The repeater remains enabled for normal operation upon receipt of an RF signal from other radios in the system.

Applying the correct "OFF" code to the decoder removes the ground to the emitter of Q1 on the Drop-Out Delay board and disables the COS circuit. This disables the repeater so that an RF signal will not key the transmitter until the "ON code is applied to the decoder.

The decoder may be connected so that the "ON" code must be applied to the decoder each time the repeater is enabled. Connections for this mode of operation as well as complete operating and maintenance information are contained in the Decoder Maintenance Manual (LBI-4080).

### TONE-CONTROLLED SWITCH A705

Tone-Controlled Switch A705 is used with the Carrier-Operated Switch for keying the transmitter in shared repeater applications. The tone switch assembly mounts on the component side of the repeater panel in the option mounting area.

The shared repeater may be equipped to operate with up to 10 different Channel Guard tones. A signal received at the station with the proper Channel Guard tone activates a transistorized switch that applies 10 volts to the Tone-Controlled Switch. The 10-volts turns on a tone gating transistor, causing its collector to drop to ground potential, providing a ground return for keying transistor Q4 on the COS. Turning Q4 on lights the transmit indicator light and keys the station transmitter.

One portion of the Tone-Controlled Switch assembly contains a 10-volt regulator circuit which supplies the tone circuitry in the Shared Repeater Panel. The 10-volt regulator is operated by a regulated 12.4 volts from power supply EP-38-A.

For complete maintenance and operating instructions for the Tone-Controlled switch, refer to the Maintenance Manual for the Shared Repeater Panel (LBI-3699).

## MAINTENANCE

As the standard repeater panel contains transistorized timing and switching circuits, maintenance on relays and clock timers will not be required. Should any of the component boards require servicing, refer to the Circuit Analysis for operation of the circuit, and to the appropriate Outline and Schematic Diagram as listed in the Table of Contents.

NOTE

If any of the component boards are removed from the repeater panel for servicing, connect a ground lead from one corner of the board (ground) to the repeater panel chassis.

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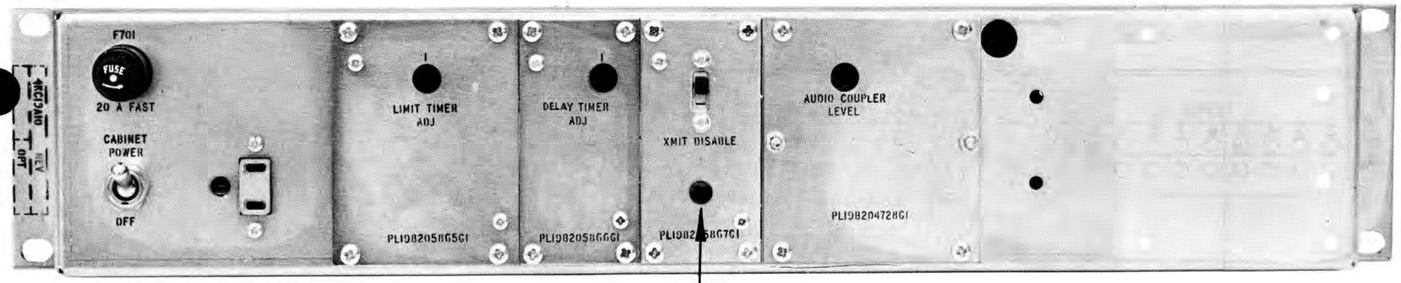



TRANSMIT INDICATOR LIGHT

## ADJUSTMENT PROCEDURES

Before starting the repeater adjustment, make sure that the station is properly installed and all connections and adjustments made according to the instructions shipped with the equipment

NOTE

As prolonged "on-the-air" testing is a violation of FCC regulations, make all of the repeater adjustments with the transmitter output connected to a dummy load.

### CARRIER-OPERATED SWITCH

To make sure that the COS is operating, unsquelch the station receiver by turning the SQUELCH control on power supply EP-38-A clockwise. Then check to see if the Transmit Indicator Light is on.

### AUDIO COUPLER

EQUIPMENT REQUIRED

1. A signal generator on the repeater receiver operating frequency.
2. An FM deviation meter.

PROCEDURE

1. Apply a 1000 microvolt, on-frequency signal modulated by 1000 Hz at ±3.3 kHz deviation (10 kHz for wide-band) to the receiver antenna jack.
2. Adjust the AUDIO COUPLER LEVEL control for a reading of ±3.3 kHz (10 kHz for wide-band) on the deviation meter.

### DROP-OUT DELAY TIMER

Check the Delay Timer and make any necessary adjustments according to the following procedure:

1. Using the SQUELCH control on the EP-38-A, quickly unsquelch and squelch the receiver. Note the time required for the Transmit Indicator Light to turn off.
2. If an adjustment is necessary, turn the DELAY TIMER ADJUST clockwise to increase the delay time, or counterclockwise to decrease the delay time.

### 3-MINUTE LIMIT TIMER

When required by the FCC, timing cycle on the 3-Minute Timer must be set for three minutes or less. Check the timing cycle and make any necessary adjustments according to the following procedure:

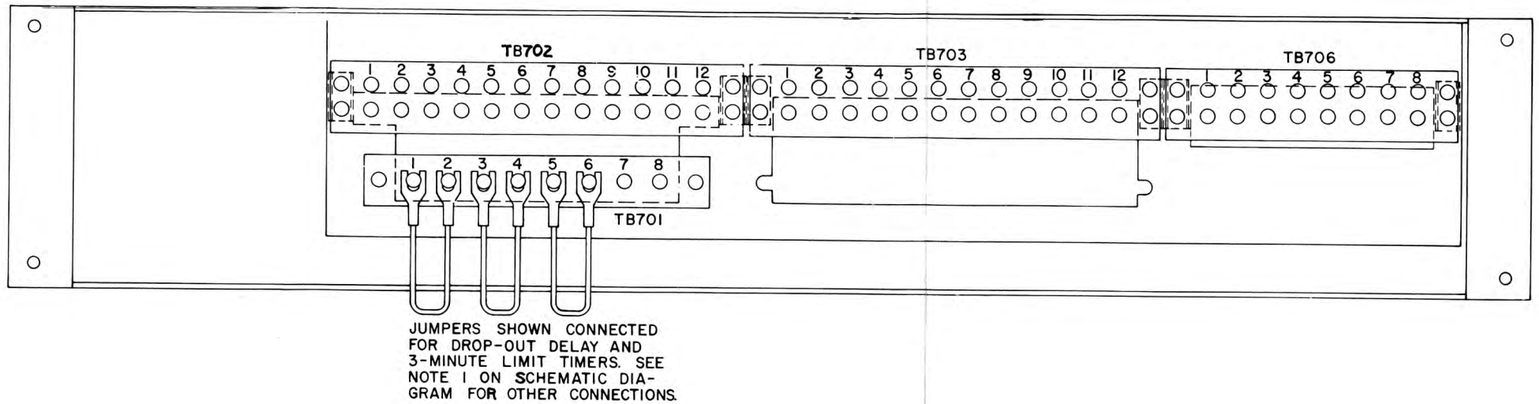
1. Unsquelch the receiver by turning the SQUELCH control on the EP-38-A to the right. Note the time required for the Transmit Indicator Light to turn off.
2. If an adjustment is necessary, turn the LIMIT TIMER ADJUST clockwise to increase the timing cycle, or counterclockwise to decrease the timing cycle.

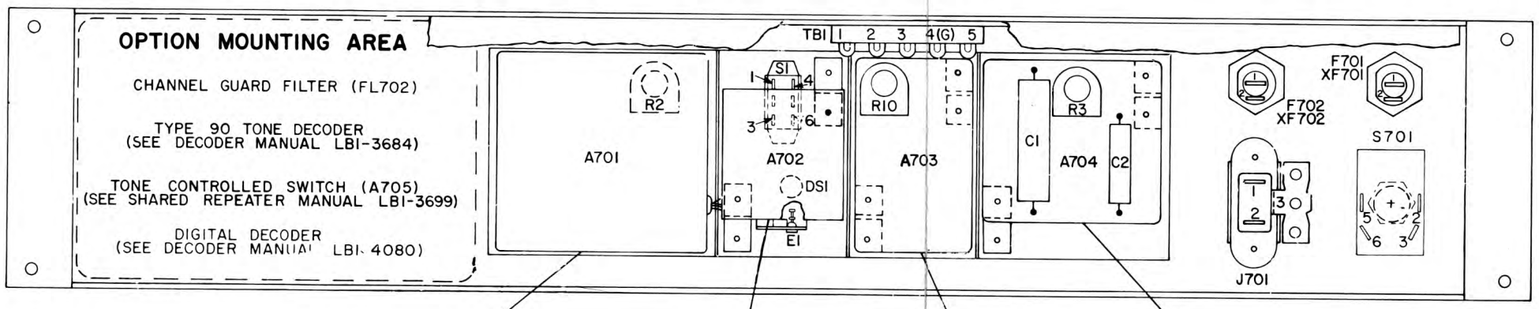
EQUIPMENT REQUIRED

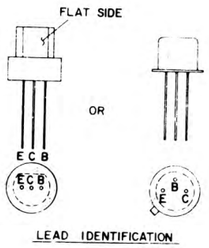
1. An audio oscillator (300-1000 Hz).
2. An AC-VTVM.

PROCEDURE

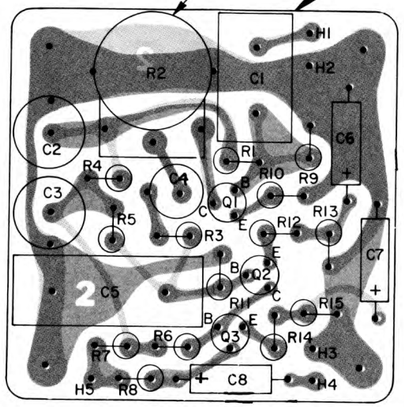
1. Connect the VTVM across H1 and H2 (Gnd) on Filter Board A702.
2. Apply a 1000 Hz signal to H1 and H2 and adjust the oscillator output level control for a reading of 0 dB.
3. Connect the VTVM across H4 and H5 (Gnd).
4. Apply a 300 Hz signal to H1 and H2, and adjust R16 on the Filter Board for a reading of 0 dB.



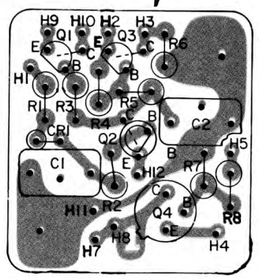




AUDIO COUPLER ADJUST



AUDIO COUPLER
A701

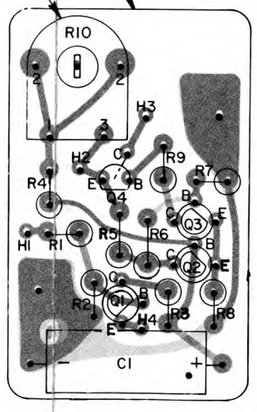
(19B204679, Sh. 1, Rev. 2)
(19B204679, Sh. 2, Rev. 2)



CARRIER-OPERATED SWITCH
A702

(19B205857, Sh. 1, Rev. 1)
(19B205857, Sh. 2, Rev. 1)

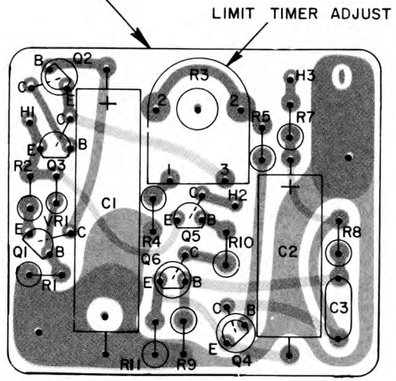
DELAY TIMER ADJUST



DROP-OUT DELAY TIMER
A703

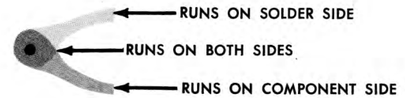
(19B205854, Sh. 1, Rev. 0)
(19B205854, Sh. 2, Rev. 0)

LIMIT TIMER ADJUST



3-MINUTE LIMIT TIMER (OPTIONAL)
A704

(19B205860, Sh. 1, Rev. 0)
(19B205860, Sh. 2, Rev. 0)




## OUTLINE DIAGRAM

REPEATER PANEL
MODEL 4KC19A10

(19D402907, Rev. 5)

NOTES:

1. FOR OPERATION WITH DROP-OUT DELAY TIMER AND 3-MINUTE LIMIT TIMER, JUMPER 1-2, 3-4 AND 5-6.

   FOR OPERATION WITH DELAY TIMER ONLY, JUMPER 1-4 AND 5-6.

   FOR OPERATION WITH LIMIT TIMER ONLY, JUMPER 1-2 AND 3-5.

   FOR OPERATION WITH NO TIMER ACTION, JUMPER 1-5.

2. WHEN FL702 IS INSTALLED (IN CHANNEL GUARD REPEATERS) BREAK CONNECTION AT POINT "X" AND ADD CONNECTIONS SHOWN AS DASHED LINES.

3. FOR REMOTE/REPEAT, REMOVE JUMPER BETWEEN TB703-1 AND TB703-4.

4. FOR SHARED REPEATER, REMOVE JUMPER BETWEEN TB703-1 AND TB703-3.

5. J701-3 IS MECHANICALLY GROUNDED.

WIRING INSTRUCTIONS:

1. ALL WIRES UNLESS OTHERWISE SPECIFIED ARE SF24.
2. TERMINATE ALL #14 & #16 WIRES ON TB706 WITH A7117269P1.
3. TERMINATE ALL WIRES TO S701 WITH 19B209151P1.

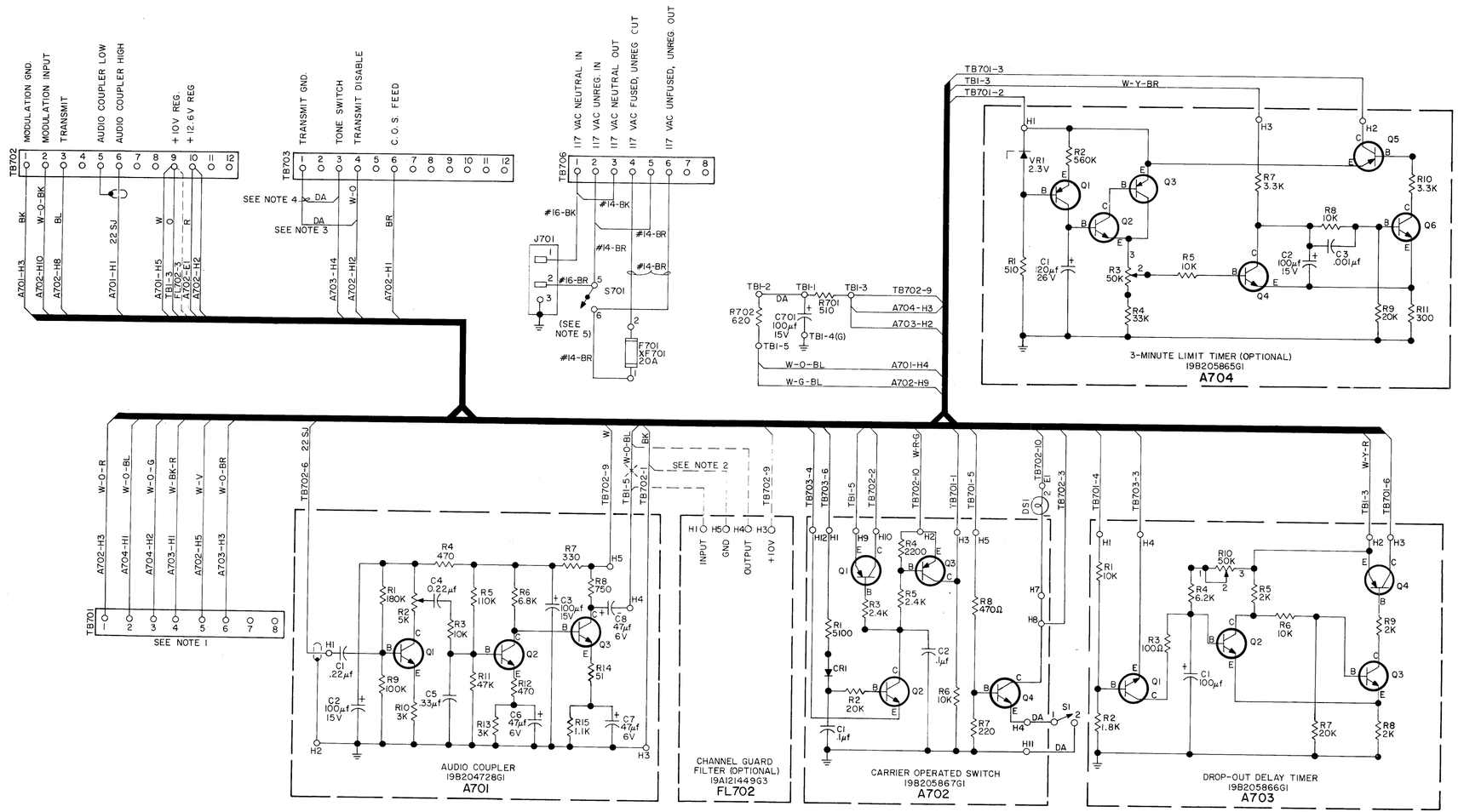
IN ORDER TO RETAIN RATED EQUIPMENT PERFORMANCE, REPLACEMENT OF ANY SERVICE PART SHOULD BE MADE ONLY WITH A COMPONENT HAVING THE SPECIFICATIONS SHOWN ON THE PARTS LIST FOR THAT PART.

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 |
|---|---|
| 4KC19A10 | E |




(19D402878, Rev. 11)

## SCHEMATIC DIAGRAM

REPEATER PANEL
MODEL 4KC19A10

## PARTS LIST

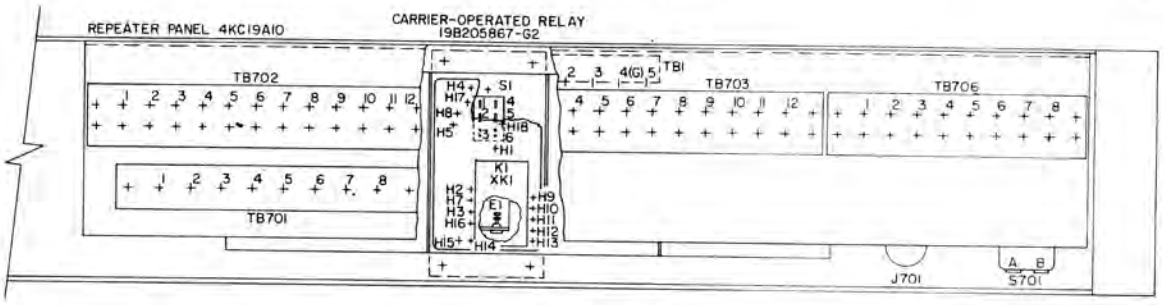
LBI-3854E

MASTR REPEATER CONTROL PANEL
4KC19A10

| SYMBOL | GE PART NO. | DESCRIPTION |
|---|---|---|
| A701 | | AUDIO COUPLER ASSEMBLY 19B204728G1 |
| | | - - - - - - - - - MISCELLANEOUS - - - - - - - - - |
| | 19A121344P1 | Panel |
| | 19A121359G1 | Cover. |
| | 7150186P105 | Spacer. (Mounts component board). |
| | 5490407P2 | Rubber grommet. |
| | | AUDIO COUPLER BOARD 19B204683G1 |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - |
| C1 | 19A115028P116 | Polyester: 0.22 µf ±20%, 200 VDCW. |
| C2 and C3 | 5495670P10 | Electrolytic: 100 µf +75% -10%, 15 VDCW; sim to Sprague 30D. |
| C4 | 7491930P110 | Polyester: 0.22 µf ±20%, 100 VDCW; sim to GE Type 61F. |
| C5 | 19A115028P117 | Polyester: 0.33 µf ±20%, 100 VDCW. |
| C6 thru C8 | 5496267P2 | Tantalum: 47 µf ±20%, 6 VDCW; sim to Sprague Type 150D. |
| | | - - - - - - - - - - TRANSISTORS - - - - - - - - - |
| Q1 | 19A115123P1 | Silicon, NPN; sim to Type 2N2712. |
| Q2* and Q3* | 19A116774P1 | Silicon, NPN; sim to Type 2N5210. |
| | | In REV C and earlier: |
| | 19A115123P1 | Silicon, NPN; sim to Type 2N2712. |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - |
| R1 | 3R77P184J | Composition: 0.18 megohm ±5%, 1/2 w. |
| R2 | 7491365P102 | Variable, carbon film: 5000 ohms ±20%, .08 w, sim to CTS Type UPE-70. |
| R3 | 3R77P103J | Composition: 10,000 ohms ±5%, 1/2 w. |
| R4 | 3R77P471J | Composition: 470 ohms ±5%, 1/2 w. |
| R5 | 3R77P114J | Composition: 0.11 megohm ±5%, 1/2 w. |
| R6 | 3R77P682J | Composition: 6800 ohms ±5%, 1/2 w. |
| R7 | 3R77P331J | Composition: 330 ohms ±5%, 1/2 w. |
| R8 | 3R77P751J | Composition: 750 ohms ±5%, 1/2 w. |
| R9 | 3R77P104J | Composition: 0.1 megohm ±5%, 1/2 w. |
| R10 | 3R77P302J | Composition: 3000 ohms ±5%, 1/2 w. |
| R11 | 3R77P473J | Composition: 47,000 ohms ±5%, 1/2 w. |
| R12 | 3R77P471J | Composition: 470 ohrs ±5%, 1/2 w. |
| R13 | 3R77P302J | Composition: 3000 ohms ±5%, 1/2 w. |
| R14 | 3R77P510J | Composition: 51 ohms ±5%, 1/2 w. |
| R15 | 3R77P112J | Composition: 1100 ohms ±5%, 1/2 w. |
| A702 | | CARRIER OPERATED SWITCH ASSEMBLY 19B205867G1 |
| A1 | | CARRIER OPERATED SWITCH BOARD 19B205862G1 |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - |
| C1 and C2 | 19A116080P7 | Polyester: 0.1 µf ±20%, 50 VDCW. |
| CR1 | 19A115250P1 | Silicon. |
| | | - - - - - - - - - TRANSISTORS - - - - - - - - - |
| Q1 | 19A115768P1 | Silicon, PNP. |
| Q2 | 19A115123P1 | Silicon, NPN. |
| Q3 | 19A115768P1 | Silicon, PNP. |
| Q4 | 19A115300P1 | Silicon, NPN. |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - |
| R1 | 3R77P512J | Composition: 5100 ohms ±5%, 1/2 w. |
| R2 | 3R77P203J | Composition: 20,000 ohms ±5%, 1/2 w. |
| R3 | 3R77P242J | Composition: 2400 ohms ±5%, 1/2 w. |
| R4 | 3R77P222K | Composition: 2200 ohms ±10%, 1/2 w. |
| R5 | 3R77P242J | Composition: 2400 ohms ±5%, 1/2 w. |
| R6 | 3R77P103K | Composition: 10,000 ohms ±10%, 1/2 w. |
| R7 | 3R77P221K | Composition: 220 ohms ±10%, 1/2 w. |
| R8* | 3R77P471K | Composition: 470 ohms ±10%, 1/2 w. |
| | | In Models earlier than REV A: |
| | 3R77P122K | Composition: 1200 ohms ±10%, 1/2 w. |
| | | - - - - - - - - - INDICATING DEVICES - - - - - - - - - |
| DS1 | 4034664P1 | Lamp, incandescent: 28 v; sim to GI 2148. |
| | | - - - - - - - - - - TERMINALS - - - - - - - - - - |
| E1 | 4034512P3 | Terminal, feed-thru: sim to Sealectro RST-MM-10-TUR. |
| | | - - - - - - - - - - SWITCHES - - - - - - - - - - |
| S1 | 19B209040P1 | Slide: DPDT, 0.5 amp at 125 v; sim to Continental-Wirt Type 126. |
| | | - - - - - - - - - MISCELLANEOUS - - - - - - - - - |
| | 4036555P1 | Insulator, washer: nylon. (Used with Q4 on A1). |
| | 19B204949P1 | Jewel. (Used with DS1). |
| | 4031053P7 | Nut, push on. (Used with DS1). |
| | 19A121730P1 | Angle. (Used to Mount E1). |
| | 4035711P4 | Clip, spring tension. (Used with DS1). |
| | 7142162P96 | Spacer. (Used with DS1). |
| A703 | | DROP-OUT DELAY TIMER ASSEMBLY 19B205866G1 |
| A1 | | DELAY TIMER BOARD 19B205883G1 |
| | | - - - - - - - - - CAPACITORS - - - - - - - - - |
| C1 | 19A115680P7 | Electrolytic: 100 µf +150% -10%, 15 VDCW; sim to Mallory Type TT. |
| | | - - - - - - - - - TRANSISTORS - - - - - - - - - |
| Q1 thru Q3 | 19A115123P1 | Silicon, NPN; sim to Type 2N2712. |
| Q4 | 19A115768P1 | Silicon, PNP. |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - - |
| R1 | 3R77P103J | Composition: 10,000 ohms ±5%, 1/2 w. |
| R2 | 3R77P182J | Composition: 1800 ohms ±5%, 1/2 w. |
| R3 | 3R77P101J | Composition: 100 ohms ±5%, 1/2 w. |
| R4 | 3R77P622J | Composition: 6200 ohms ±5%, 1/2 w. |
| R5 | 3R77P202J | Composition: 2000 ohms ±5%, 1/2 w. |
| R6 | 3R77P103J | Composition: 10,000 ohms ±5%, 1/2 w. |
| R7 | 3R77P203J | Composition: 20,000 ohms ±5%, 1/2 w. |
| R8 and R9 | 3R77P202J | Composition: 2000 ohms ±5%, 1/2 w. |
| R10 | 19B209358P8 | Variable, carbon film: approx 100 to 50,000 ohms ±20%, 0.25 w; sim to CTS Type U-201. |
| | | - - - - - - - - - MISCELLANEOUS - - - - - - - - - |
| | 19A122774P1 | Panel. (Used to mount A1). |
| A704 | | 3-MINUTE LIMIT TIMER ASSEMBLY 19B205865G1 |
| A1 | | LIMIT TIMER BOARD 19B205864G1 |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - - |
| C1 | 19A115680P9 | Electrolytic: 120 µf +150%-10%, 26 VDCW; sim to Mallory Type TT. |
| C2 | 19A115680P7 | Electrolytic: 100 µf +150%-10%, 15 VDCW; sim to Mallory Type TT. |
| C3 | 7774750P4 | Ceramic disc: .001 µf +100% -0%, 500 VDCW. |
| | | - - - - - - - - - TRANSISTORS - - - - - - - - - |
| Q1 | 19A115768P1 | Silicon, PNP. |
| Q2 | 19A115123P1 | Silicon, NPN. |
| Q3 | 19A115768P1 | Silicon, PNP. |
| Q4 | 19A115123P1 | Silicon, NPN. |
| Q5 | 19A115768P1 | Silicon, PNP. |
| Q6 | 19A115123P1 | Silicon, NPN. |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - |
| R1 | 3R77P511J | Composition: 510 ohms ±5%, 1/2 w. |
| R2* | 3R77P564J | Composition: 0.56 megohm ±5%, 1/2 w. |
| | | In Models of REV A and earlier: |
| | 3R77P684J | Composition: 0.68 megohm ±5%, 1/2 w. |
| R3 | 19B209358P8 | Variable, carbon film: approx 100 to 50,000 ohms ±20%, 0.25 w; sim to CTS Type U-201. |
| R4 | 3R77P333K | Composition: 33,000 ohms ±10%, 1/2 w. |
| R5 | 3R77P103J | Composition: 10,000 ohms ±5%, 1/2 w. |
| R7 | 3R77P332J | Composition: 3300 ohms ±5%, 1/2 w. |
| R8 | 3R77P103J | Composition: 10,000 ohms ±5%, 1/2 w. |
| R9 | 3R77P203J | Composition: 20,000 ohms ±5%, 1/2 w. |
| R10 | 3R77P332J | Composition: 3300 ohms ±5%, 1/2 w. |
| R11 | 3R77P301J | Composition: 300 ohms ±5%, 1/2 w. |
| | | - - - - - - - - - VOLTAGE REGULATORS - - - - - - - - - |
| VR1 | 4036887P1 | Silicon, Zener. |
| | | - - - - - - - - - MISCELLANEOUS - - - - - - - - - |
| | 19A122773P1 | Panel. (Used to mount A1). |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - - |
| C701 | 7489483P16 | Electrolytic: 100 µf +75% -10%, 15 VDCW; sim to Sprague 30D. |
| | | - - - - - - - - - - FUSES - - - - - - - - - - |
| F701 | 7484390P5 | Quick blowing: 20 amps at 250 v; sim to Bussman ABC-20. |
| F702* | 7484390P5 | Quick blowing: 20 amps at 250 v; sim to Bussman ABC-20. Deleted by Rev C. |
| | | - - - - - - - - - JACKS AND RECEPTACLES - - - - - - - - - |
| J701* | 7128081P1 | Connector, phen: 2 contacts. |
| | | In Models of REV B and earlier: |
| | 19B209162P2 | Socket: phen, 125 VRMS, 15 amp; sim to Alden 402 ACEHG. |
| R701 | 3R77P511J | Composition: 510 ohms ±5%, 1/2 w. |
| R702 | 3R77P621J | Composition: 620 ohms ±5%, 1/2 w. |
| | | - - - - - - - - - - SWITCHES - - - - - - - - - - |
| S701* | 19A116794P1 | Toggle: DPST, 20 amps at 220 VRMS; sim to McGill 0111-0009. |
| | | In REV D and earlier: |
| | 7109677P1 | Toggle: DPST, 6 amps at 250 v or 12 amps at 125 v; sim to Arrow-Hart and Hegeman 82143-V. |
| | | - - - - - - - - - TERMINAL BOARDS - - - - - - - - - |
| TB1 | 7775100P9 | Phen: 5 terminals. |
| TB701 | 7117110P8 | Phen: 8 terminals; sim to Cinch 1780. |
| TB702 and TB703 | 19C3C1086P8 | Feed-thru, phen: 12 terminals; sim to GE CR151D. |
| TB706 | 19C3C1086P6 | Feed-thru, phen: 8 terminals; sim to GE CR151D. |
| | | - - - - - - - - - - SOCKETS - - - - - - - - - - |
| XF701 | 19B209005P1 | Fuseholder, post type, phen: 15 amps at 250 v; sim to Littelfuse 342012. |
| XF702* | 19B209005P1 | Fuseholder, post type, phen: 15 amps at 250 v; sim to Littelfuse 342012. Deleted by REV C. |
| | | - - - - - - - - - MISCELLANEOUS - - - - - - - - - |
| | 7160398P2 | Spring nut. (Mounts TB702, 703, 706). |
| A2 | | CARRIER-OPERATED RELAY OPTION (WITH RELAY) 19B205867G2 |
| | | CARRIER-OPERATED RELAY BOARD 19B205889G1 |
| | | - - - - - - - - - CAPACITORS - - - - - - - - - |
| C1* | 19A116080P7 | Polyester: 0.1 µf ±20%, 50 VDCW. |
| | | In Models earlier than REV A: |
| | 7774750P6 | Ceramic disc: .002 µf +100% -0%, 500 VDCW. |
| C2* | 19A115080P7 | Polyester: 0.1 µf ±20%, 50 VDCW. |
| | | In Models earlier than REV A: |
| | 19A115028P114 | Polyester: 0.1 µf ±20%, 200 VDCW. |
| | | - - - - - - - - DIODES AND RECTIFIERS - - - - - - |
| CR1 | 19A115250P1 | Silicon. |
| CR2* | 4037822P1 | Silicon. Added by REV A. |
| | | - - - - - - - - - - RELAYS - - - - - - - - - - |
| K1 | 5491395P14 | Armature: 1.5 w operating, 520 ohms ±15% coil res, 4 form C contacts; sim to Allied Control T154-X-131. Contact rating 0.5 amp at 12 VDC. |
| | | - - - - - - - - - TRANSISTORS - - - - - - - - - |
| Q1 | 19A115123P1 | Silicon, NPN. |
| Q2 | 19A115768P1 | Silicon, PNP. |
| Q3 | 19A115300P1 | Silicon, NPN. |
| | | - - - - - - - - - - RESISTORS - - - - - - - - - |
| R1 | 3R77P512J | Composition: 5100 ohms ±5%, 1/2 w. |
| R2 | 3R77P242J | Composition: 2400 ohms ±5%, 1/2 w. |
| R3* | 3R77P471K | Composition: 470 ohms ±10%, 1/2 w. |
| | | In Models earlier than REV A: |
| | 3R77P122K | Composition: 1200 ohms ±10%, 1/2 w. |
| R4* | 3R77P203J | Composition: 20,000 ohms ±5%, 1/2 w. Added by REV A. |
| XK1 | 5491595P7 | Relay: 10 contacts; sim to Allied Control 30054-4. |
| | | - - - - - - - - - - SOCKETS - - - - - - - - - - |
| DS1 | 4034664P1 | Lamp, incandescent: 28 v; sim to GE 2148. |
| | | - - - - - - - - - INDICATING DEVICES - - - - - - - - - |
| E1 | 4034512P3 | Terminal, feed-thru: sim to Sealectro RST-MM-10-TUR. |
| | | - - - - - - - - - - TERMINALS - - - - - - - - - - |
| S1 | 19B209040P1 | Slide: DPDT, 0.5 amp at 125 v; sim to Continental-Wirt Type 126. |
| | | - - - - - - - - - - SWITCHES - - - - - - - - - - |
| | 4036555P1 | Insulator, washer: nylon. (Used with Q3 on A2). |
| | 5491595P9 | Retainer. (Used with K1 on A2). |
| | 19B204949P1 | Jewel: red plastic lens. (Used with DS1). |
| | 4031053P7 | Nut, push on. (Used with DS1). |
| | 19A121730P1 | Angle. (Used to mount E1). |
| | 4035711P4 | Clip, spring tension. (Used with DS1). |
| | 7142162P96 | Spacer. (Used with DS1). |
| FL702 | | CHANNEL GUARD FILTER 19A121449G3 |
| | | FILTER BOARD 19B219325G1 |
| | | - - - - - - - - - - CAPACITORS - - - - - - - - - |
| C1 | 19C300075P 47001G | Polyester: 47,000 pf ±2%, 100 VDCW; sim to GE Type 61F. |
| C2 | 19C300075P 10002G | Polyester: 100,000 pf ±2%, 100 VDCW; sim to GE Type 61F. |
| C3 | 19C300075P 47001G | Polyester: 47,000 pf ±2%, 100 VDCW; sim to GE Type 61F. |
| C4 | 19C300075P 10001G | Polyester: 10,000 pf ±2%, 100 VDCW; sim to GE Type 61F. |
| C5 | 5496267P14 | Tantalum: 15 µf ±20%, 20 VDCW; sim to Sprague Type 150D. |
| C6 and C7 | 19C300075P 47001G | Polyester: 47,000 pf ±2%, 100 VDCW; sim to GE Type 61F. |
| C8 | 19A116080P7 | Polyester: 0.1 µf ±20%, 50 VDCW. |
| C9 | 19C300075P 47001G | Polyester: 47,000 pf ±2%, 100 VDCW; sim to GE Type 61F. |
| C10 | 5496267P10 | Tantalum: 22 µf ±20%, 15 VDCW; sim to Sprague Type 150D. |
| | | - - - - - - - - - TRANSISTORS - - - - - - - - - |
| Q1 | 19A115362P1 | Silicon, NPN; sim to Type 2N2925. |
| Q2 and Q3 | 19A115768P1 | Silicon, PNP; sim to Type 2N3702. |
| Q4 and Q5 | 19A115362P1 | Silicon, NPN; sim to Type 2N2925. |
| | | - - - - - - - - - RESISTORS - - - - - - - - - |
| R1 | 19A116278P325 | Metal film: 17,800 ohms ±2%, 1/2 w. |
| R2 | 19A116278P293 | Metal film: 9090 ohms ±2%, 1/2 w. |
| R3 | 19A116278P325 | Metal film: 17,800 ohms ±2%, 1/2 w. |
| R4 | 19A116278P317 | Metal film: 14,700 ohms ±2%, 1/2 w. |
| R5 | 19A116278P333 | Metal film: 21,500 ohms ±2%, 1/2 w. |
| R6 | 19A116278P253 | Metal film: 3480 ohms ±2%, 1/2 w. |
| R7 | 3R77P103J | Composition: 10,000 ohms ±5%, 1/2 w. |
| R8 | 19A116278P221 | Metal film: 1620 ohms ±2%, 1/2 w. |
| R9 | 19A116278P201 | Metal film: 1000 ohms ±2%, 1/2 w. |
| R10 | 3R77P751J | Composition: 750 ohms ±5%, 1/2 w. |
| R11 | 19A116278P412 | Metal film: 130,000 ohms ±2%, 1/2 w. |
| R12 | 19A116278P233 | Metal film: 2150 ohms ±2%, 1/2 w. |
| R13 | 3R77P103J | Composition: 10,000 ohms ±5%, 1/2 w. |
| R14 | 19A116278P265 | Metal film: 4640 ohms ±2%, 1/2 w. |
| R15 | 19A116278P419 | Metal film: 154,000 ohms ±2%, 1/2 w. |
| R16 | 19B209113P1 | Variable, wirewound: 250 ohms ±20%, 2.5 w; sim to CTS Series 110. |
| R17 and R18 | 19A116278P317 | Metal film: 147,000 ohms ±2%, 1/2 w. |
| R19 | 3R77P102J | Composition: 1000 ohms ±5%, 1/2 w. |
| R20 | 3R77P621J | Composition: 620 ohms ±5%, 1/2 w. |

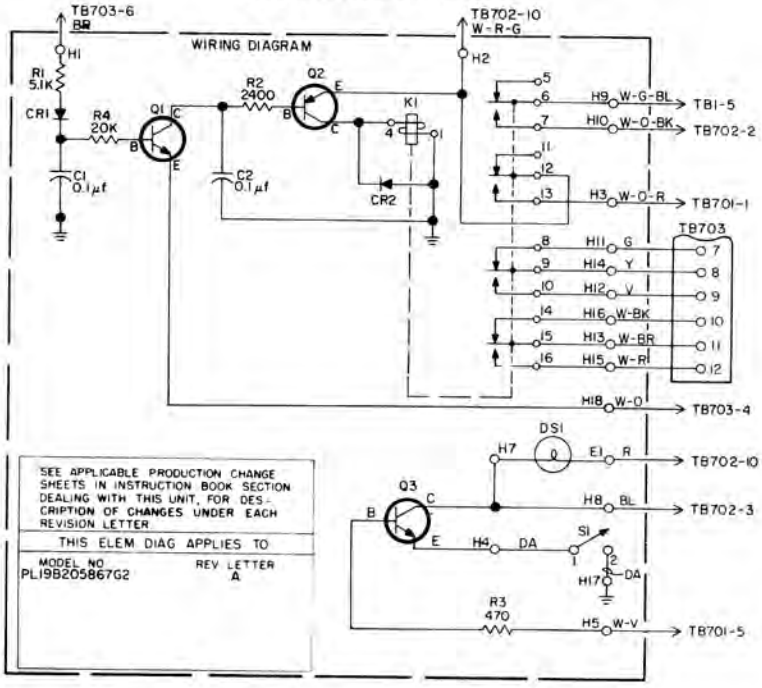
*COMPONENTS ADDED, DELETED OR CHANGED BY PRODUCTION CHANGES

## OUTLINE DIAGRAM




(19C311376, Rev. 2)

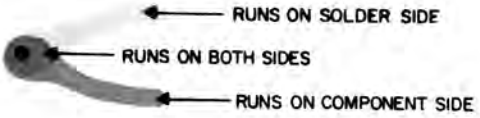
## SCHEMATIC DIAGRAM

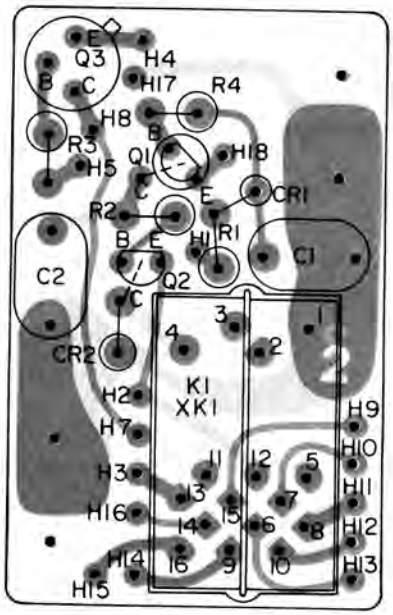



(19C311376, Rev. 3)

THIS INSTRUCTION COVERS INSTALLATION OF CARRIER OPERATED RELAY WITH EXTRA EXTERNAL CONNECTIONS (PL19B205867G2) OPTION IN PLACE OF CARRIER OPERATED SWITCH PL19B205867G1.

1. REMOVE CARRIER OPERATED SWITCH PL19B205867G1 FROM THE 4KC19A10 PANEL.
2. INSTALL CARRIER OPERATED RELAY PL19B205867G2 IN SPACE WHERE PL19B205867G1 PANEL WAS USING HARDWARE THAT MOUNTED THE PL19B205867G1 PANEL.
3. CONNECT LEADS FROM PL19B205867G2 PANEL PER WIRING DIAGRAM.




(19A122883, Rev. 1)
(19B205887, Sh. 1, Rev. 2)
(19B205887, Sh. 2, Rev. 2)

# SCHEMATIC & OUTLINE DIAGRAM

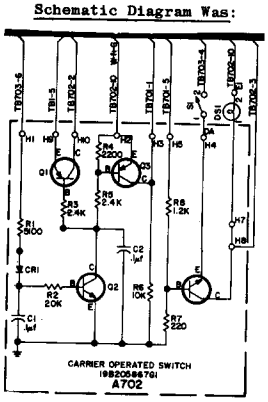
CARRIER OPERATED RELAY
OPTION 7662

## 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 (4KC19A10) - To provide priority for remote control unit in remote/repeater applications. Changed A702-R8, and changed connections to A702-Q2 and -Q4.

**Schematic Diagram Was:**




REV. A (COR-19B205867-G2) - To provide audio priority for remote control unit in remote/repeater applications. Changed C1, C2 and R3, and added CR2 and R4.

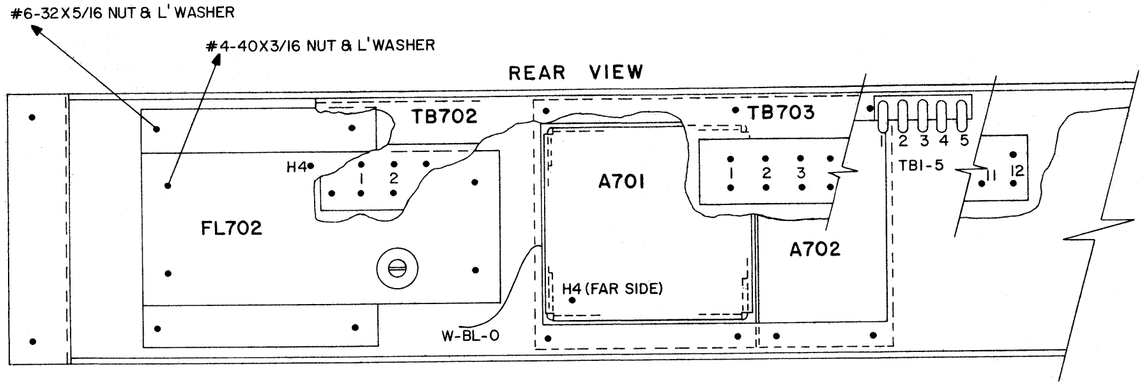
REV. B (4KC19A10) - To shorten maximum time on 3-minute timer. Changed A704-R2.

REV. C (4KC19A10) - To improve ground connection to AC receptacle, and eliminate un-used part. Added ground lug to J701, and deleted F702.

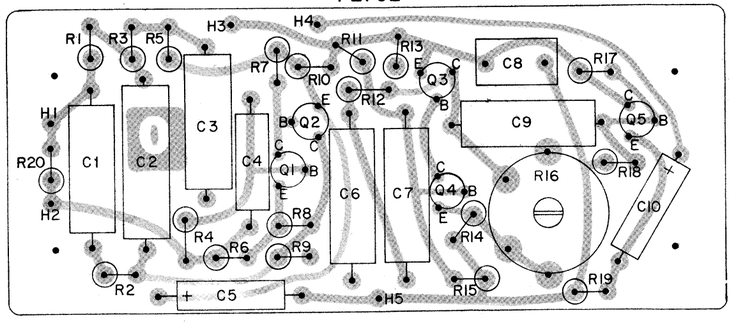
REV. D (4KC19A10) - To reduce audio distortion. Changed Q2 and Q3.

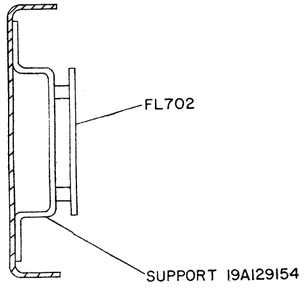
REV. E (4KC19A10) - To incorporate an improved switch. Changed S701.

## OUTLINE DIAGRAM




FL702

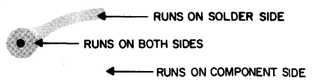


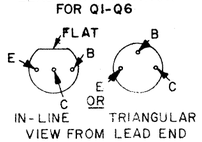

(19D416637, Rev. 0)
(19B219359, Sh. 1, Rev. 0)
(19B219359, Sh. 2, Rev. 0)

INSTRUCTIONS:

1. ASSEMBLE FL702 TO SUPPORT WITH #4 SCREWS AS SHOWN. ASSEMBLE BRACKET TO PANEL WITH #6 SCREWS AS SHOWN.
2. REMOVE METAL COVER FROM A701. DISCONNECT W-BL-O WIRE FROM A701-H4, RECONNECT W-BL-O WIRE (FROM TBI-5) TO FL702 H4 (OUTPUT).
3. CONNECT W-BL-O WIRE FROM FL702-HI (INPUT) TO A701-H4. REASSEMBLE COVER ON A701.
4. CONNECT BK WIRE FROM FL702-H5 (GND) TO TB702-1.
5. CONNECT O WIRE FROM FL702-H3 (+10V) TO TB702-9.

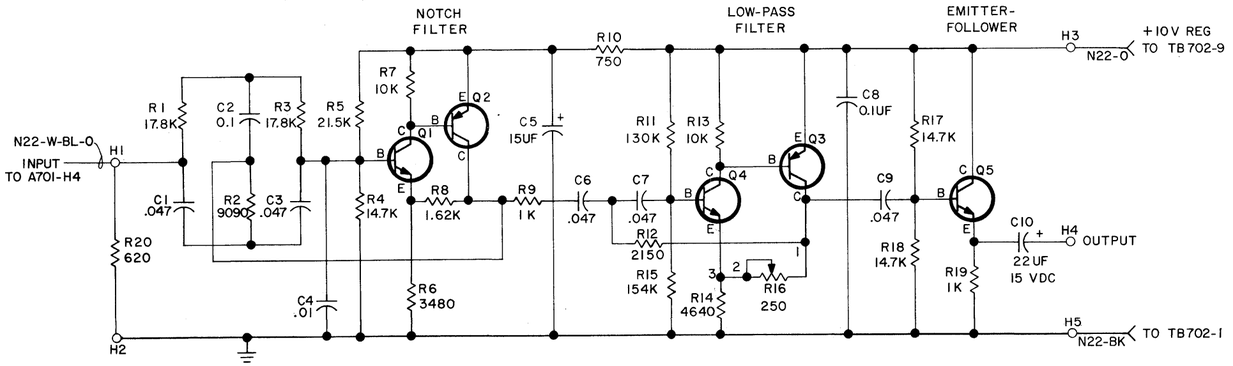



LEAD IDENTIFICATION FOR Q1-Q6




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

## SCHEMATIC DIAGRAM




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.

NOTE:
1. TERMINATE WIRES FROM H3 & H5 WITH 19B209260P102.

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 |
| 19B219325G1 | |

(19C317890, Rev. 2)

END OF DOCUMENT

**SCHEMATIC & OUTLINE DIAGRAM**

CHANNEL GUARD FILTER FL702

Issue 2