

**PURC**  
**PICK-UP RECORDING CAPABILITY ACCESSORY**

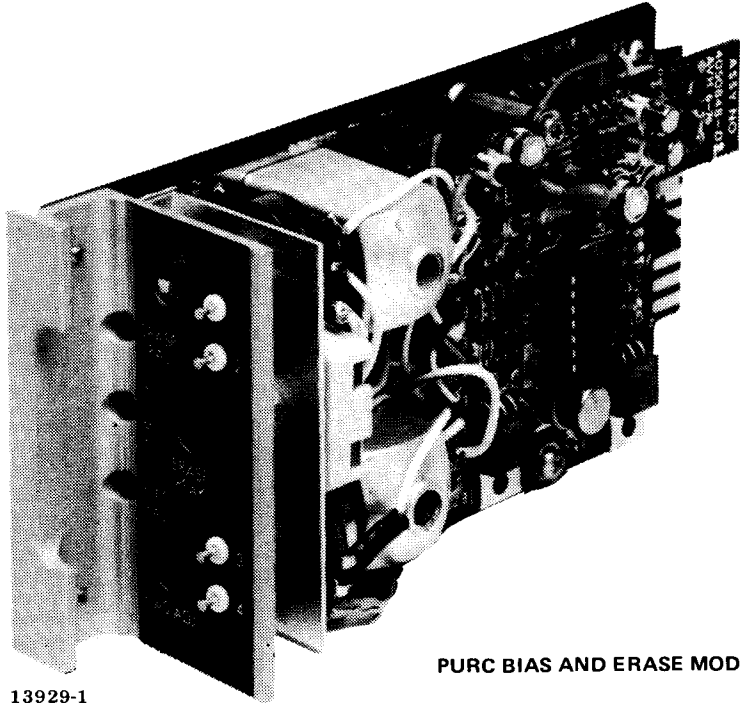
**FOR MM-1200, MM-1100, AND AG-440C**  
**RECORDER/REPRODUCERS**

**OPERATION AND MAINTENANCE**

**AMPEX CORPORATION**  
**AUDIO-VIDEO SYSTEMS DIVISION**

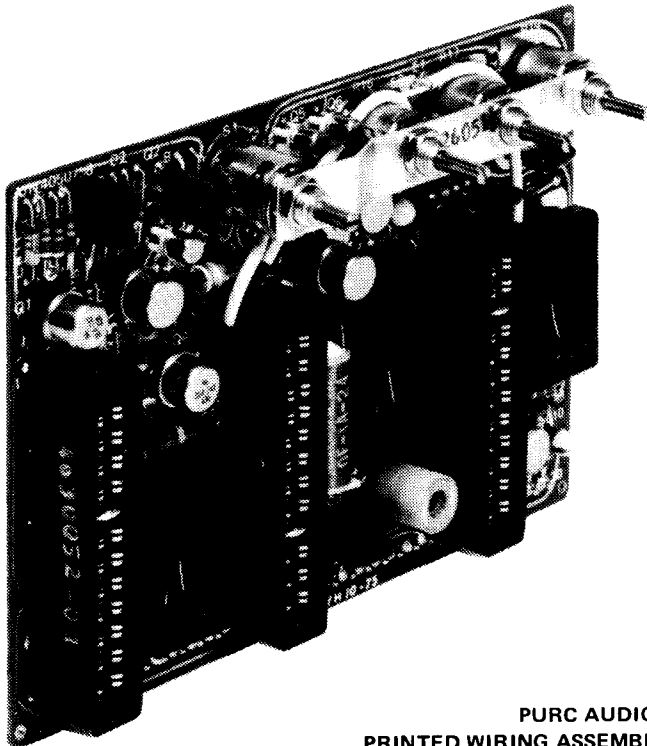
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13929-1

PURC BIAS AND ERASE MODULE



13929-2

PURC AUDIO SWITCHING  
PRINTED WIRING ASSEMBLY (MM-1100)

PURC Accessory Kit

## SECTION 1

### GENERAL INFORMATION

This manual provides operation and maintenance information for the PURC (Pick-Up Recording Capability) Accessory Kit, Ampex Part numbers 4010236-04, -07, and -08. The three versions of the accessory are applicable to Ampex Recorder/Reproducer models as follows: -04 to MM-1100; -07 to MM-1200; and -08 to AG-440C.

The PURC accessory eliminates the problem of overlaps and gaps in recordings when inserting (dubbing) new material within previously recorded programs. One PURC accessory kit is required for each channel to be converted to PURC operation.

The PURC accessory kit contains individual electronic components in addition to a PURC bias and erase module which takes the place of the standard bias amplifier module. After the accessory kit has been installed, the standard bias amplifier module may be reinstalled for standard recording applications if desired.

In a recorder system without PURC, initiating record mode energizes the erase and record heads simultaneously. Since there is a physical distance between the erase and record heads, a period of over-recording on unerased tape occurs. When the dub is terminated, a gap is left in the program. The

length of time of this gap is a function of the distance between the erase and record heads and the tape speed.

In a system equipped with PURC, separate erase and bias amplifier circuits are provided, and the turn-on and turn-off times of the amplifiers are individually controlled. When record mode is initiated, the erase circuit is energized first; then, after a delay, the bias amplifier is energized. When the recording is terminated, the erase circuit is de-energized first; and then, after a delay, the bias amplifier is de-energized. Thus the problem of over-recording and gap is eliminated in the dubbed portion of the recording.

When PURC is installed in an AG-440C recorder, it is recommended that the erase head be relocated from position 1 to position 2 (if vacant), which is adjacent to the record head. If the erase head is in position 1, the time interval to start recording is too long, especially when operating at 3.75 in/s. Erase Head Kit, Ampex Part Number 4850178-01 (1/4-inch tape) or 4850178-02 (1/2-inch tape), provides a dummy-head post and necessary parts for relocation of the erase head. Installation instructions for the erase head kit are included in this manual. (Note: This kit is not a part of the PURC kit and must be ordered separately.)

## SECTION 2

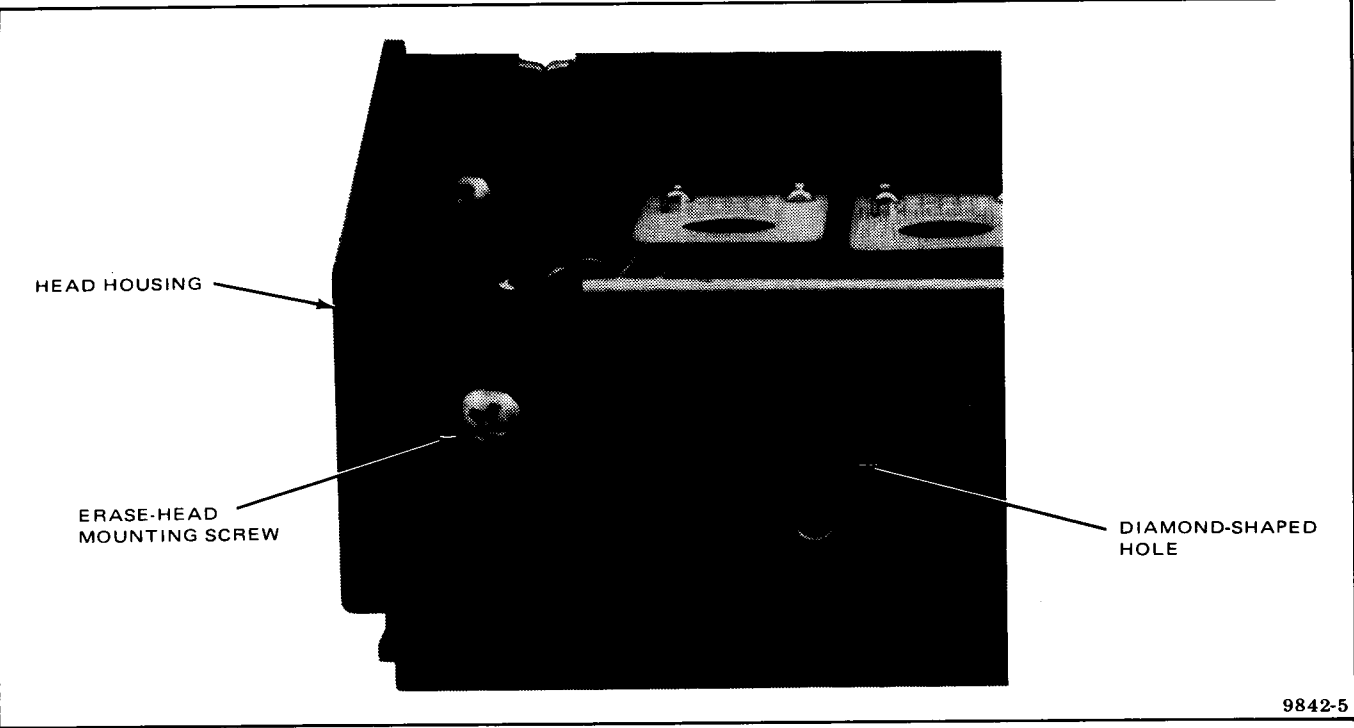
### INSTALLATION

Installation of the PURC accessory in MM-1100 and MM-1200 Recorder/Reproducers consists of replacing existing printed wiring assemblies with the PURC units and selecting the appropriate tape speed components. Installation for the AG-440C also requires minor connector pin reassignment and parts addition to the switching electronics, the addition of the PURC record insert switch, and an optional relocation of the erase head stack. The parts contained in the three versions of the PURC accessory kit (Ampex Part Number 4010236-04, -07, and -08) and the applicable recorder/reproducer model are given in the list of materials for assembly number 4010236 located in the last section of this manual. After the installation procedures are completed, an alignment procedure given in the *Maintenance* section must be completed prior to operation of the equipment.

#### AG-440C SERIES ERASE HEAD RELOCATION

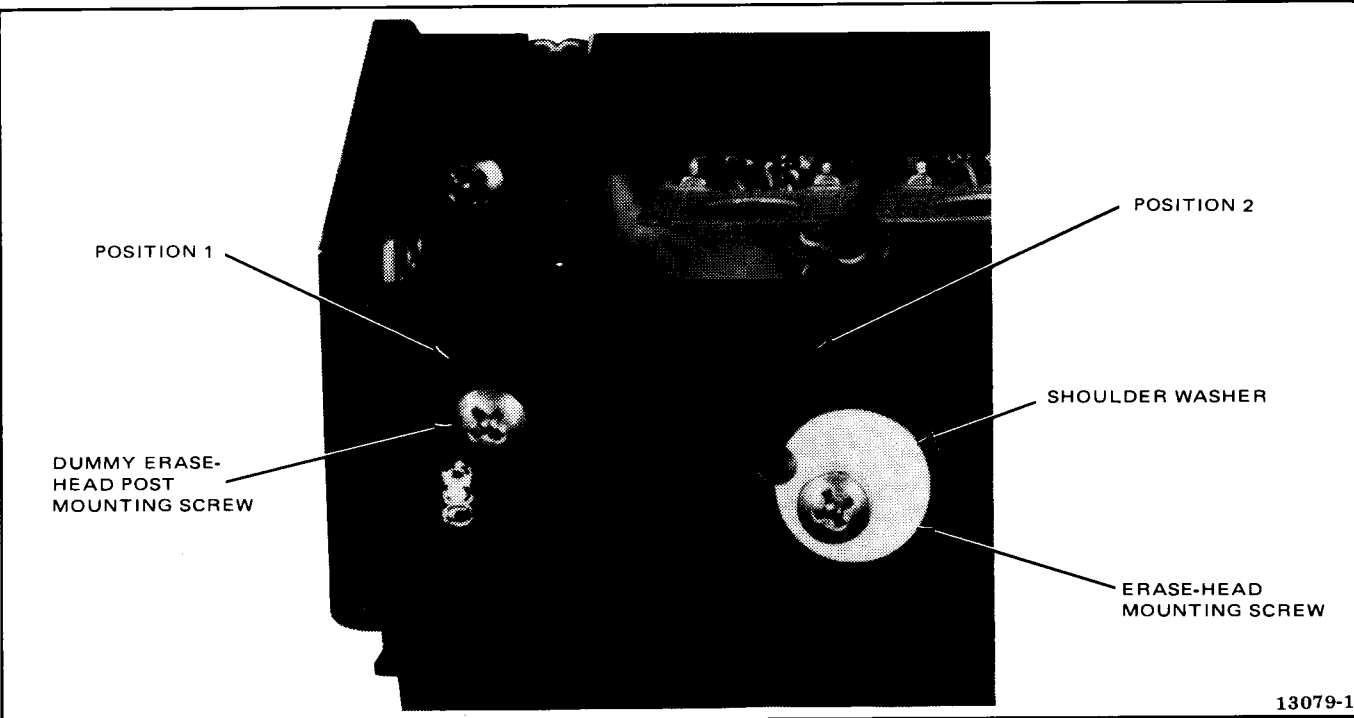
To relocate the erase head from position 1 to position 2 (next to the record head), use kit 4850178-01 (1/4-inch tape) or 4850178-02 (1/2-inch tape) and proceed as follows:

1. Remove the head cover by loosening the screw on the slanted rear surface of the stainless-steel head assembly cover.
2. Remove the erase-head mounting screw (Figure 2-1) and save the shims but discard the spacer, both located between the head stack and head housing.
3. Install the erase head in position 2 as follows:
  - a. Place spacer (4220259-01 for 1/4-inch tape or 4220259-02 for 1/2-inch tape) on top of the head stack before mounting in the head housing.
  - b. Place shoulder washer (4440311) with the shoulder facing downward in the diamond-shaped hole at the top of the head housing (Figure 2-2).
  - c. Use a no. 11 (3/16-inch) drill bit to align the notch in the shoulder washer with the hole at the left of the diamond-shaped hole. This establishes the position of the head stack within the head housing.
  - d. On 1/4-inch tape machines, secure head stack with screw and shims removed in step 2. On 1/2-inch tape machines, secure head stack with new 10-32 X 0.5 inch long cross-recessed screws (part. no. 471-089).
4. Install dummy-head post as follows:
  - a. On 1/4-inch tape machines, install dummy-head post (4210136-02) in position 1 with new 10-32 X 0.5 inch long cross-recessed screw (471-089).
  - b. On 1/2-inch tape machines, install dummy-head post (4210136-02) in position 1 using screw removed in step 2.
5. Load tape on the recorder. Adjust and check erase-head tape wrap as follows:
  - a. Loosen erase-head stack mounting screw and rotate stack so that double gap on head stack is evenly centered on tape.
  - b. Lightly cover head face with tape editing pencil or grease pencil.
  - c. Initiate high-speed play mode for ten seconds.



9842-5

Figure 2-1. Erase-Head Mounting (Before Modification)



13079-1

Figure 2-2. Erase-Head Mounting Position 2 (After Modification)

- d. Lift tape from head and check head area cleaned by tape. Cleaned area should be centered on head gap. Repeat steps 5a through 5d as required to obtain correct tape wrap.
  - e. Clean head with head cleaner (4010823 or 087-007).
  - f. Recheck requirements of step 3c.
6. If erase-head height is not correct, use additional shims to adjust the height. Erase-head height is adjusted with shims (0.010, 0.002, 0.003, and 0.005 inch thick, Ampex Part No. 4350025-01, 4350025-02, 4350025-03, and 4350025-04 respectively). Proceed as follows:
- a. Remove the head by removing the erase-head mounting screw.
  - b. Except for the four-track, 1/4-inch erase heads, shim the head until the ferrite portion of the outermost head (head furthest from tape transport) is just visible at the outermost edge of the tape. Add shims until the similar portion of the bottom head is barely visible below the tape bottom edge. Then remove exactly half the shim thickness that was needed to move the head stack from the top to the bottom of the tape.
  - c. Adjust four-track, 1/4-inch erase-head height to the dimension shown in Figure 2-3.
7. Recheck requirements of step 5.

### AG-440C INSTALLATION

Use PURC Accessory Kit 4010236-08 for an AG-440C system. Proceed as follows:

1. Unplug all connectors at the rear of the record/reproduce unit to be converted to PURC operation.
2. Remove the record/reproduce unit from the system (two front-mounting screws) and place unit on a work bench.
3. Remove record amplifier, bias amplifier, and reproduce amplifier modules from the record/reproduce unit.
4. Remove top and bottom covers by removing one screw in the center of each cover and loosening two screws at the rear of each cover.
5. Remove two screws from each side of the rear panel to gain access to the rear panel assembly as shown in Figure 2-4.

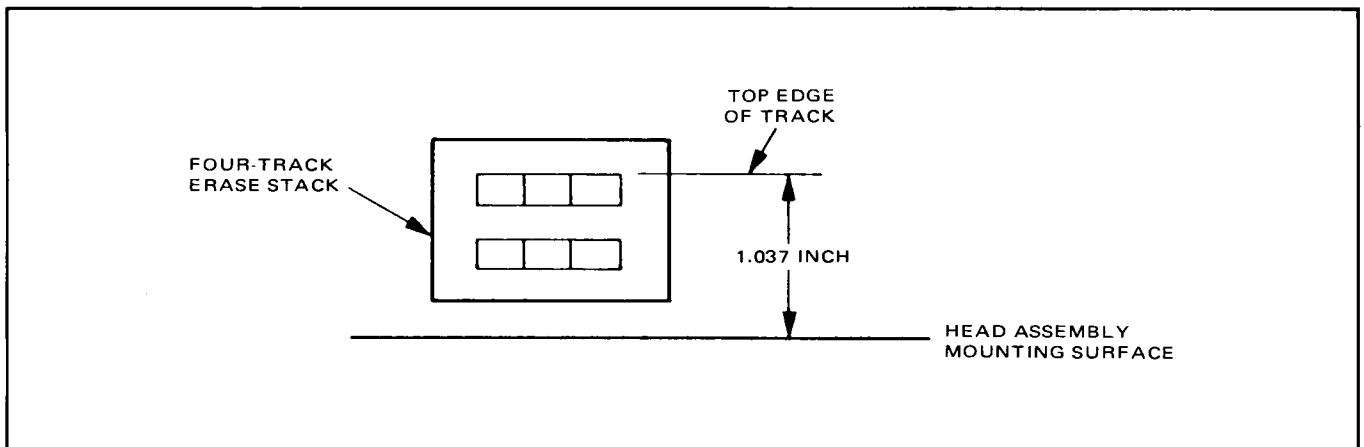
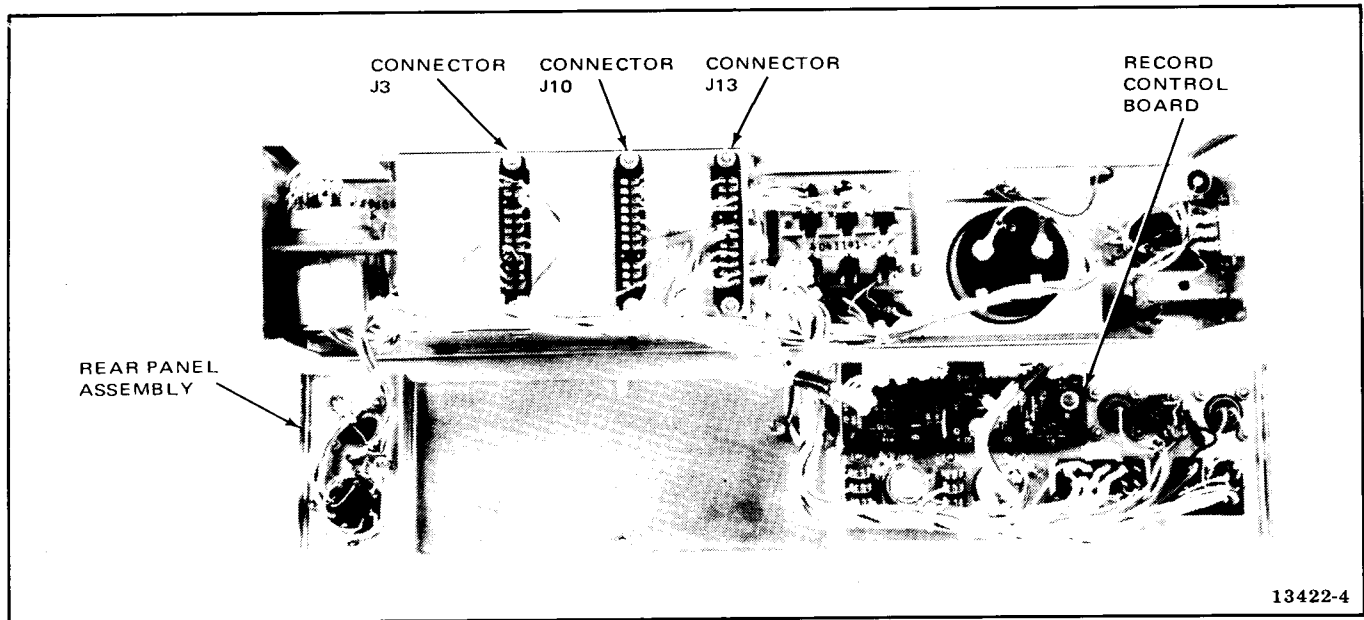


Figure 2-3. Erase-Head Height Dimension



13422-4

Figure 2-4. AG-440C Record/Reproduce Unit

6. Unplug connectors P1 and P2 from the record control board.
7. Remove the record control board from the rear panel assembly (two screws).
8. On the record control board, install a 1K resistor (041-410) between the base of 9Q4 and pin 2 of J2 on the board (see schematic 4840415).
9. Reinstall record control board on the rear panel assembly and connect connectors P1 and P2.
10. Remove shield that covers record connector J10 and reproduce connector J3 (two screws).
11. Add wire from pin 6 of J10 to pin B of J13.
12. Perform the following wiring changes on connector J13.
  - a. Remove existing wire connected to pin C (white wire with blue tracer) and connect to pin N.
  - b. Remove the 5-mH choke 4L1 (051-342) and the 220-pF capacitor 4C3 (034-358) connected between J13 pin F and J10 pin 7/8. Replace with the new components from the kit and connect between J13 pin D and J10 pin 7/8. See schematic 4840415.
  - c. Remove jumper wire between pin F and pin H.
  - d. Connect a jumper wire between pin D and pin H.
  - e. Connect a jumper wire between pin F and pin 9.
  - f. Install diode (013-599) with cathode (band end) connected to pin N and anode connected to pin K.
13. Reinstall shield removed in step 10.
14. Reinstall rear panel removed in step 5.
15. Reinstall top and bottom covers removed in step 4.
16. Install the appropriate delay ramp capacitor C3 in the PURC bias and erase amplifier as follows.



- a. For 3.75/7.5-in/s operation, use 0.068  $\mu$ F (064-272).
  - b. For 7.5/15-in/s operation, use 0.047  $\mu$ F (064-270).
17. Install record amplifier module, reproduce amplifier module, and new PURC bias and erase amplifier module into record/reproduce unit.
  18. Reinstall record/reproduce unit into system and reconnect connectors removed in step 1.

### AG-440C INSERT SWITCH INSTALLATION

Installation of the insert switch is not required unless it is desired to stop the record function on all channels simultaneously without stopping transport motion. This capability is particularly useful for 4- and 8-channel recorders where operating the individual channel SAFE pushbuttons at the same time would be difficult.

To install the insert switch, proceed as follows:

1. Remove the bottom cover from the transport control box assembly and ensure that the space between the STOP and EDIT switches is clear of wires.
  2. Mark the position of the insert switch as shown in Figure 2-5 and drill a 1/8-inch diameter pilot hole through the escutcheon, through the transport top plate, and through the control box chassis.
  3. Remove the pushbutton escutcheon (two Allen screws) from the transport.
  4. Using the previously drilled pilot hole, counterbore both sides of the escutcheon as shown in Figure 2-5. Note that the counterbores have different diameters and depths.
  5. With a file, produce the rectangular hole in the escutcheon as shown in Figure 2-5.
  6. Remove the left escutcheon for access to the control box assembly mounting screws. Disconnect all cables from the control box assembly and remove it from the transport.
- See Figure 2-6 for the location of mounting screws.
7. Using a slow speed electric drill, drill 1/2-inch diameter holes in the transport top assembly and the control box assembly chassis (use a sheet metal bit for the chassis).
  8. Drill a 1/8-inch diameter hole to mount the two-terminal strip shown in Figure 2-6.
  9. Install the terminal strip and the new insert switch as shown in Figure 2-6.
  10. Adjust the height of the new insert switch so as to match the other pushbutton switches.
  11. Remove the diode CR601 from pin 7 of J606 and pin 10 of J605, and discard it.
  12. Install a jumper between pin 10 of J605 and the nearest terminal of the newly installed terminal strip (see Figure 2-6).
  13. Install a new CR601 (013-678) with the banded cathode end to the remaining untied terminal of the terminal strip, and the anode end to pin 7 of J606.
  14. Connect a pair of wires between the two terminals of the terminal strip and the two insert switch terminals.
  15. Solder all connections.
  16. Reinstall the transport control box assembly.
  17. Temporarily put the pushbutton escutcheon (with the new insert switch pushbutton in place) on the transport. With an ohmmeter, check that the contacts open when the button is pressed. Remove the control box assembly and re-adjust the height of the switch if necessary.
  18. Reconnect all cables to the control box assembly.
  19. Reinstall the escutcheons and the bottom cover of the control box assembly.
  20. For each channel converted to PURC operation, perform the adjustment procedure located in the *Maintenance* section of this manual.

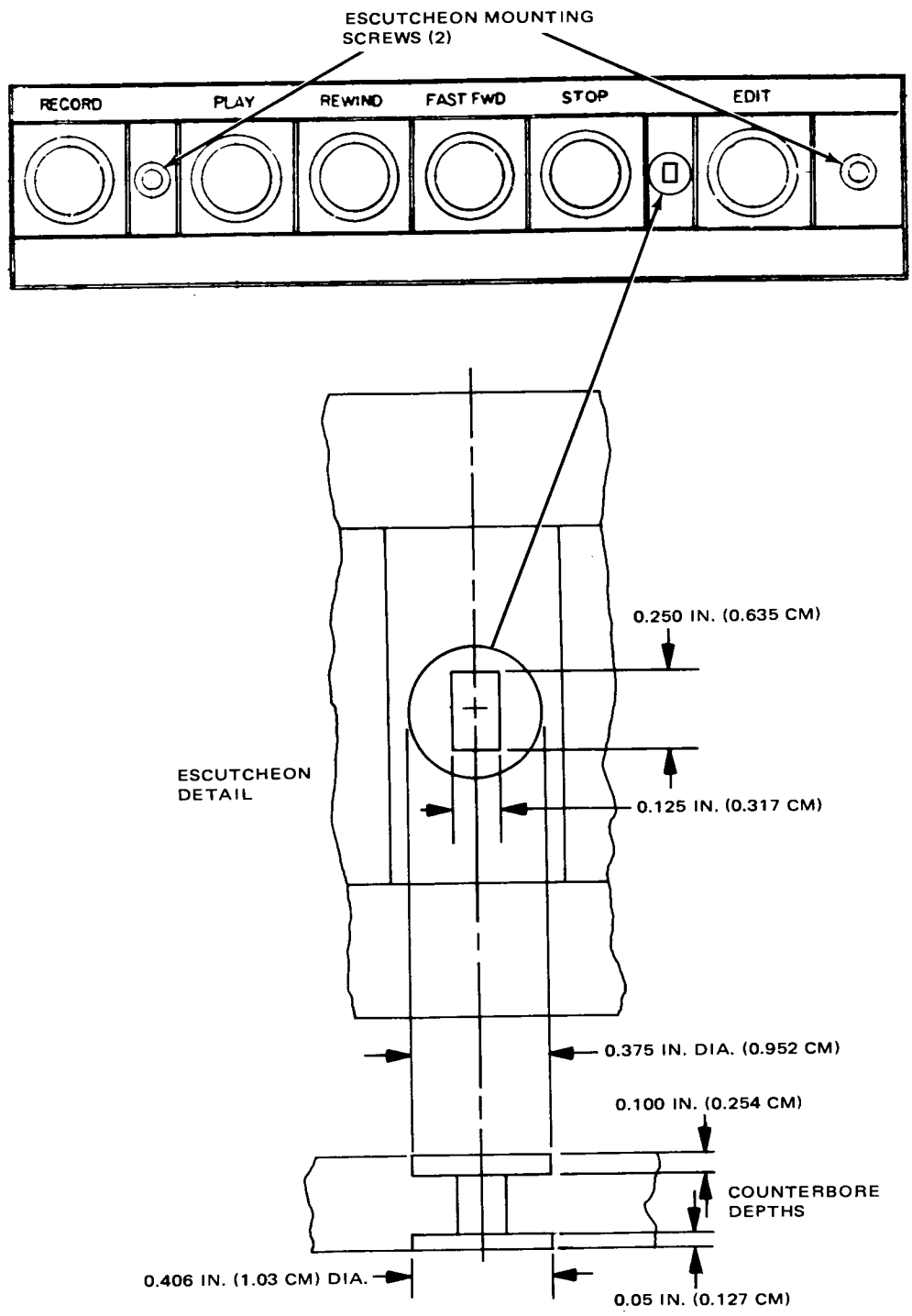
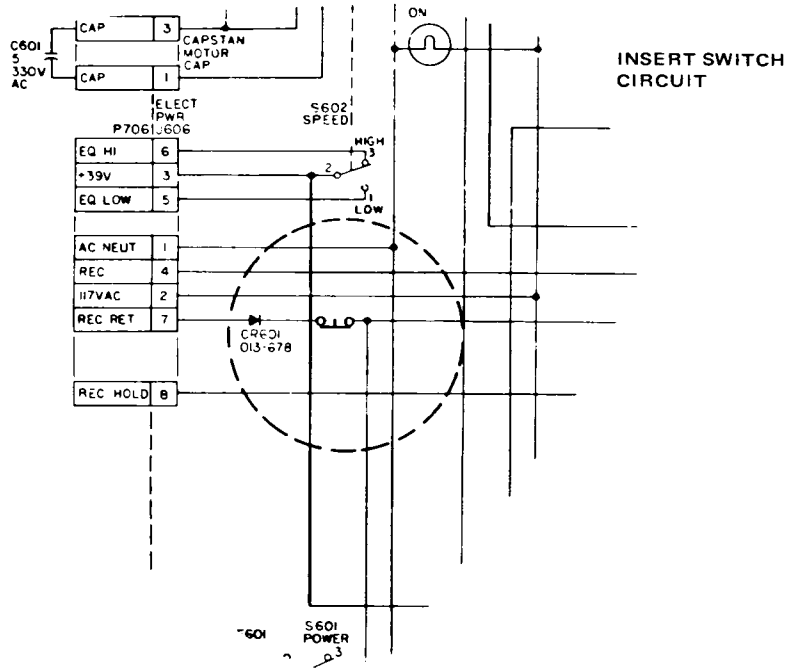


Figure 2-5. Insert Switch Escutcheon Drilling Detail

PART OF AG-440C  
SCHEMATIC 4840261



CONTROL BOX  
MOUNTING  
SCREWS (3)

TRANSPORT  
TOP PLATE  
1/2-INCH  
(1.27 CM)  
DIAMETER  
HOLE

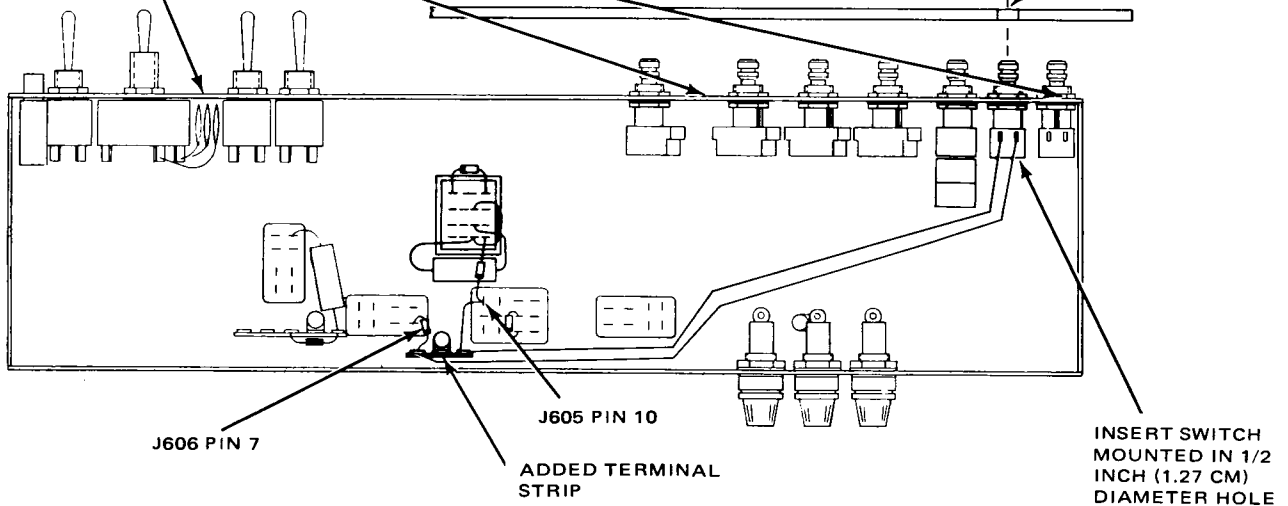


Figure 2-6. Insert Switch Mounting Details

## MM-1100 INSTALLATION

Install PURC Accessory Kit 4010236-04 in an MM-1100 system as follows:

1. Remove each side panel from the console as follows:
  - a. Loosen two cross-recessed screws available through two access holes.
  - b. Lift the panel to disengage from the screws and lift panel out from a catch at the bottom of the console.
2. Unplug all connectors at the rear of the electronics assembly chassis containing the channels to be converted to PURC operation.
3. At the front of the console, remove the four mounting screws that secure the electronics assembly to the console.
  4. Slide the electronics assembly out from the console and place on a work bench.
  5. Remove the top cover from the electronics assembly chassis (ten screws).
  6. Remove each standard audio-switching printed wiring assembly (PWA) to be replaced with a PURC audio switching PWA as follows:
    - a. Loosen the setscrew (Figure 2-7) closest to the PWA on each of the four shaft couplers. Slide the four shaft extenders forward toward the front of the electronics assembly.
    - b. Unplug the two connectors (P4) that connect to the audio switching PWA.
    - c. Remove the bias amplifier, record, and reproduce plug-in modules from the electronics assembly chassis.

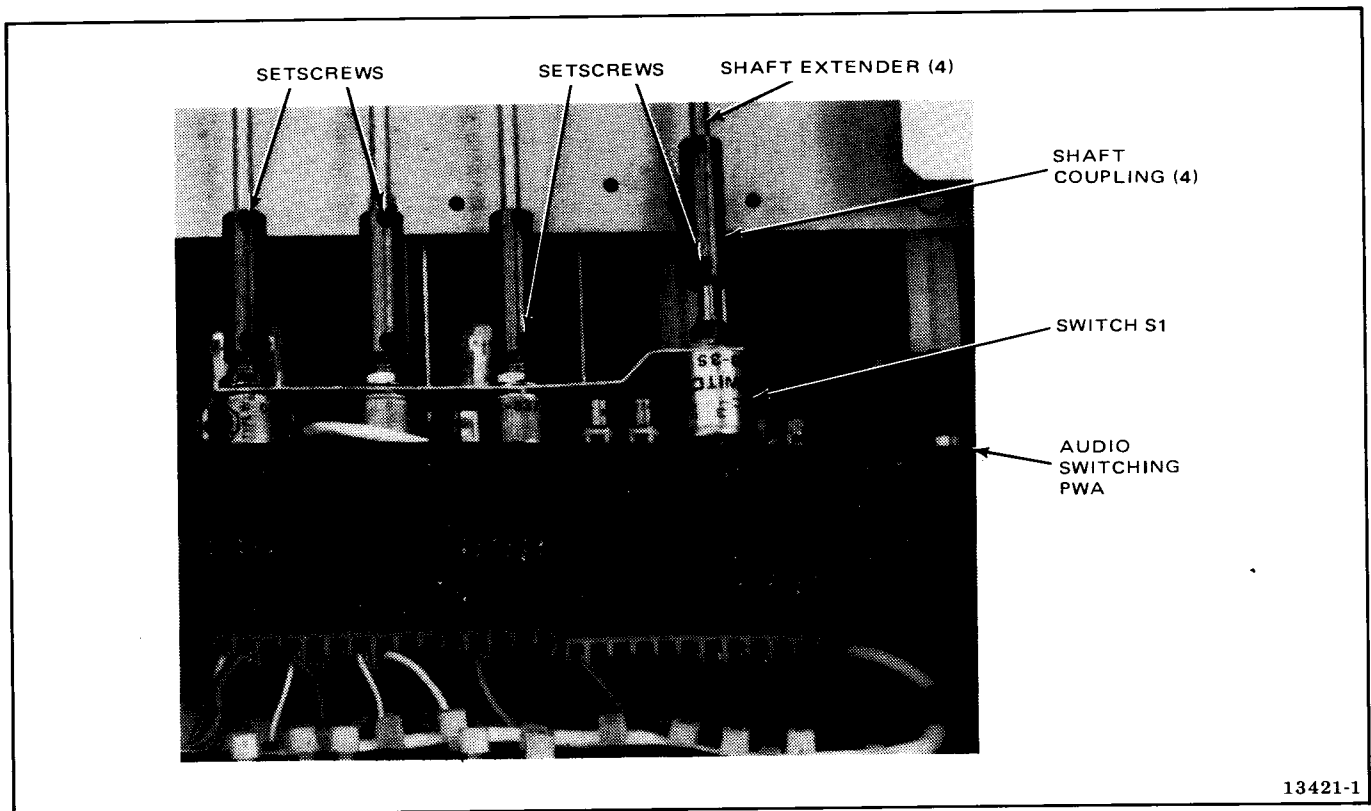


Figure 2-7. MM-1100 Electronics Assembly

- d. Lift the standard audio-switching PWA from the electronics assembly chassis.
7. Remove the three plug-in relays from the standard audio-switching PWA and transfer to the new PURC audio switching PWA included in the kit. (Relays are interchangeable.)
8. *For 7.5/15-in/s systems only*, replace existing resistor R4 on the new PURC audio switching PWA with a 22K resistor (041-406) supplied in the kit. (Note: No change is required for 15/30-in/s systems.)
9. Install new PURC audio switching PWA into the electronics assembly chassis.
10. Plug connector P4 into PURC audio switching PWA.
11. Install four shaft couplers removed in step 6a. If the existing shaft extender for selector switch S1 is too short, use new shaft extender (4210350-04) furnished in the kit. See Figure 2-7.
12. *For 7.5/15-in/s operation only*, replace C3 in the PURC bias and erase amplifier with the 0.047- $\mu$ F capacitor from the kit. Refer to schematic 4840428 and assembly drawing 4050848. The factory installed C3 (0.022  $\mu$ F) is correct for 15/30-in/s operation.
13. Reinstall record and reproduce modules. Install new PURC bias and erase amplifier.
14. Reinstall top cover on the electronics assembly chassis (ten screws).
15. Reinstall electronics assembly into the console and reconnect connectors removed in step 2.
16. Perform the PURC adjustment procedure, in the *Maintenance* section of the manual, on each channel converted to PURC operation.

## MM-1200 INSTALLATION

PURC installation for MM-1200 recorders *operating at 15/30 in/s* requires only the replacement of the standard bias PWA with the PURC bias and erase amplifier.

However, MM-1200 recorders *operating at 7.5/15 in/s* require two changes:

1. Replace C3 with the 0.047- $\mu$ F capacitor (064-270) from the kit. Refer to schematic 4840428 and assembly drawing 4050848.
2. Replace R2 in the audio switcher assembly (4050774) with a 22K resistor from the kit. Refer to schematic 4840388 in this manual and assembly drawing 4050774 in the MM-1200 Operation and Maintenance manual, Catalog Number 4890400.

## SECTION 3 OPERATION

### GENERAL INFORMATION

When performing a PURC insert edit, it is necessary to anticipate the actual time that the edit recording on the tape begins and to anticipate when the actual recording on the tape ends. When record mode is initiated by pressing the RECORD pushbutton, the erase head is energized first; then after a time interval the record head is energized. When the recording is terminated, the erase head is de-energized first; then after a time

interval the record head is de-energized. These on and off times are illustrated in Figure 3-1.

The approximate on and off time delay to be considered while performing edit functions is calculated by dividing the distance between the erase and record head by the tape speed. The distance between the erase and record head and the approximate on and off time delay for each recorder/reproducer model are summarized in Tables 3-1 and 3-2 respectively.

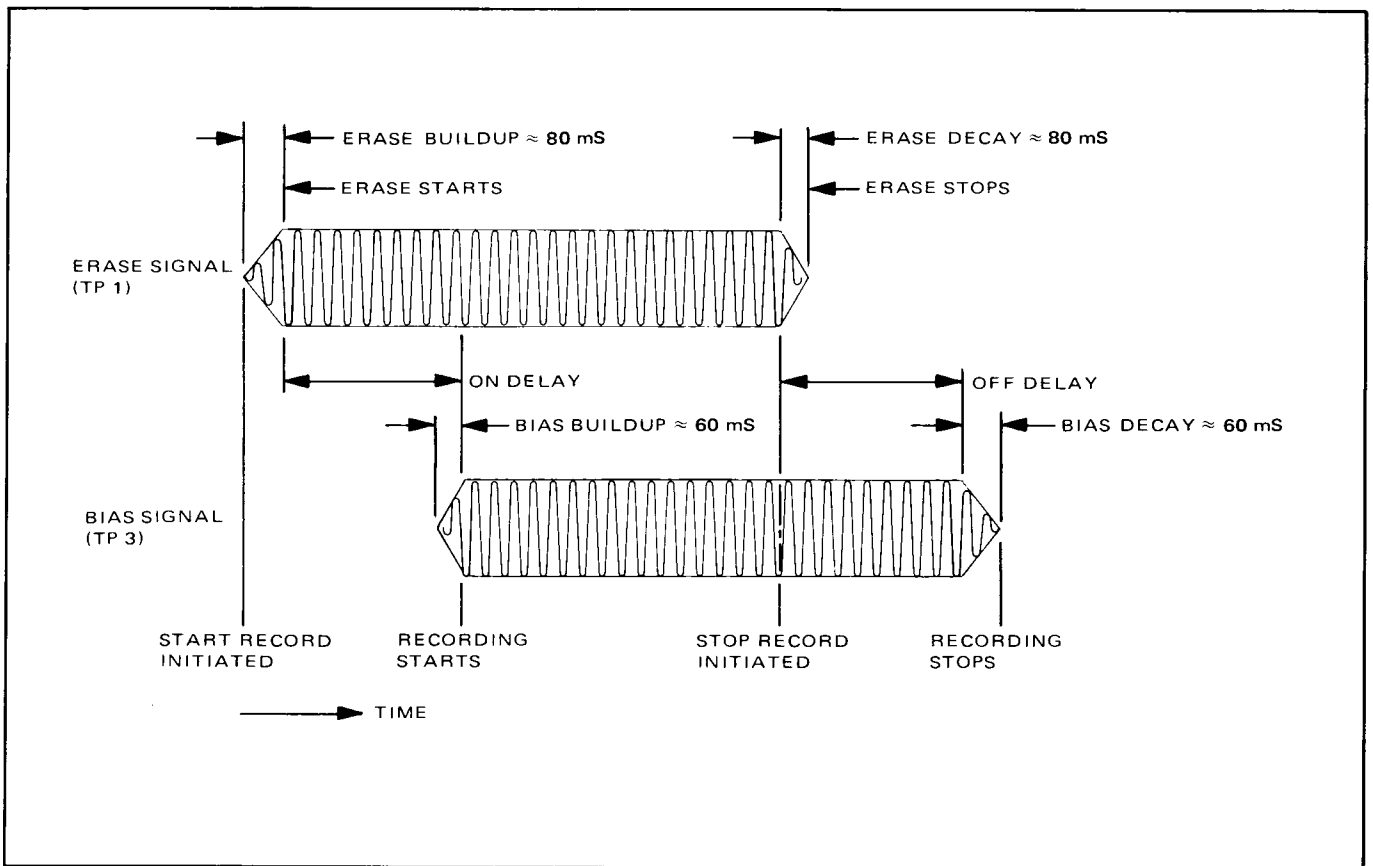


Figure 3-1. PURC On/Off Timing Relationships

Table 3-1. Approximate Distance Between Erase and Record Head

| MODEL/HEAD CONFIGURATION |  | DISTANCE     |
|--------------------------|--|--------------|
| MM-1200/MM-1100:         | Standard position  | 1-3/4 inches |
| AG-440C:                 | Erase head in position 1 and record head in position 3                                     | 3-5/8 inches |
| AG-440C:                 | Erase head in position 2 and record head in position 3                                     | 2.0 inches   |
| AG-440C:                 | Erase head in position 1 and record head in position 2 (2-channel/4-track switchable head) | 1-1/2 inches |

Table 3-2. PURC Edit Delay Times

| TAPE SPEED<br>(IPS) | APPROXIMATE ON/OFF DELAY TIME (MS) |                                   |                                   |                                   |
|---------------------|------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
|                     | MM-1200/MM-1100                    | AG-440C                           |                                   |                                   |
|                     |                                    | ERASE HD POS 1<br>RECORD HD POS 3 | ERASE HD POS 2<br>RECORD HD POS 3 | ERASE HD POS 1<br>RECORD HD POS 2 |
| 30                  | 58                                 | 121                               | 66                                | 50                                |
| 15                  | 116                                | 242                               | 113                               | 100                               |
| 7.5                 | 232                                | 484                               | 266                               | 200                               |

## EDITING PROCEDURES

Suggested methods of performing insert edits are given below, followed by step-by-step operational procedures for each recorder/reproducer model.

If a single track insert edit is to be made, such as correcting a single word, mark the back side of the tape with a white felt-tip pen or tape-editing pencil where the correction should start and where the correction should end. While performing the edit function, start the record mode when the first mark passes the erase head and stop the record mode when the second mark passes the erase head.

If an insert edit is to be made on one or several tracks of a multi-track recording, monitor one or several of the tracks in sel sync mode. This will aid in synchronizing the new recording with the tracks being monitored.

The on and off delay times, shown in Table 3-2, can be used to anticipate when the start and stop

recording times are to take place. If one of the tracks is recorded with a timing signal, such as the SMPTE time-and-control code signal, precise editing can be obtained.

### AG-440C Recorder/Reproducers

To perform a PURC insert edit on an AG-440C, proceed as follows:

1. For channels to be edited, press the corresponding SYNC and READY pushbuttons.
2. For channels not to be edited, press the corresponding SAFE and/or SYNC pushbuttons.
3. Rewind the tape to a point before the point to be edited.
4. Place system in play mode.
5. At a time prior to the edit point (Table 3-2), press the RECORD pushbutton.

6. Just prior to the stop edit point (Table 3-2), press the Insert, SAFE, or STOP pushbutton. The Insert pushbutton stops the record function on all channels leaving the transport in motion. If SAFE pushbutton is pressed, the record function is stopped on associated channel while leaving the transport in motion. If STOP pushbutton is pressed, the transport will stay in motion long enough for the edit to be completed.

### **MM-1100/MM-1200 Recorder/Reproducers**

To perform a PURC insert edit on an MM-1100 or MM-1200, proceed as follows:

1. For channels to be edited, set the corresponding READY/SAFE switch to READY.
2. For channels not to be edited, set the corresponding READY/SAFE switch to SAFE.
3. Set SEL SYNC/REPRO switch to SEL SYNC or REPRO as desired.
4. Rewind the tape to a point before the point to be edited.
5. Place system in play mode.
6. At a time prior to the edit point (Table 3-2), press PLAY and RECORD pushbuttons simultaneously.
7. Just prior to the stop edit point (Table 3-2), hold the RECORD pushbutton pressed and momentarily press the STOP pushbutton. Transport will continue to run.
8. Press STOP pushbutton to stop the transport.



## SECTION 4

### THEORY OF OPERATION

This section provides theory of operation of the PURC accessory. The text is supported by simplified schematics and a timing diagram. Complete schematic diagrams are found in Section 6, *Parts Lists and Schematics*.

#### GENERAL

The PURC accessory replaces the single bias/erase amplifier of AG-440C, MM-1100, and MM-1200

Recorder/Reproducers with a module containing circuitry which controls turn on and turn off of separate bias and erase amplifiers. The MM-1100 requires, in addition, a replacement audio switcher module which provides record switching applicable to PURC timing requirements.

Figure 4-1 is a block diagram of the PURC circuitry (dotted lines) and related audio switching circuits. Timing relationships of the bias and erase switching are shown in Figure 4-2.

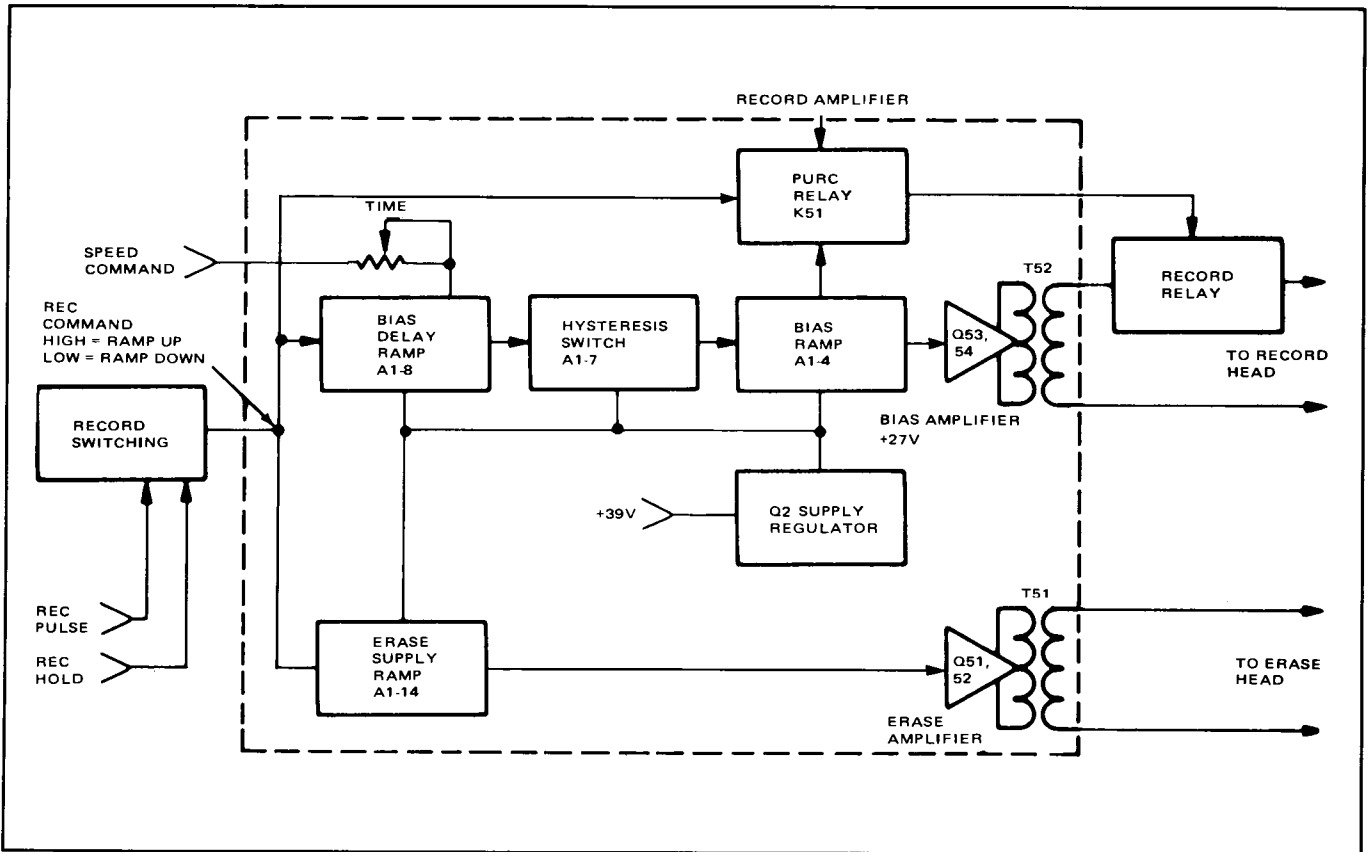


Figure 4-1. PURC Block Diagram

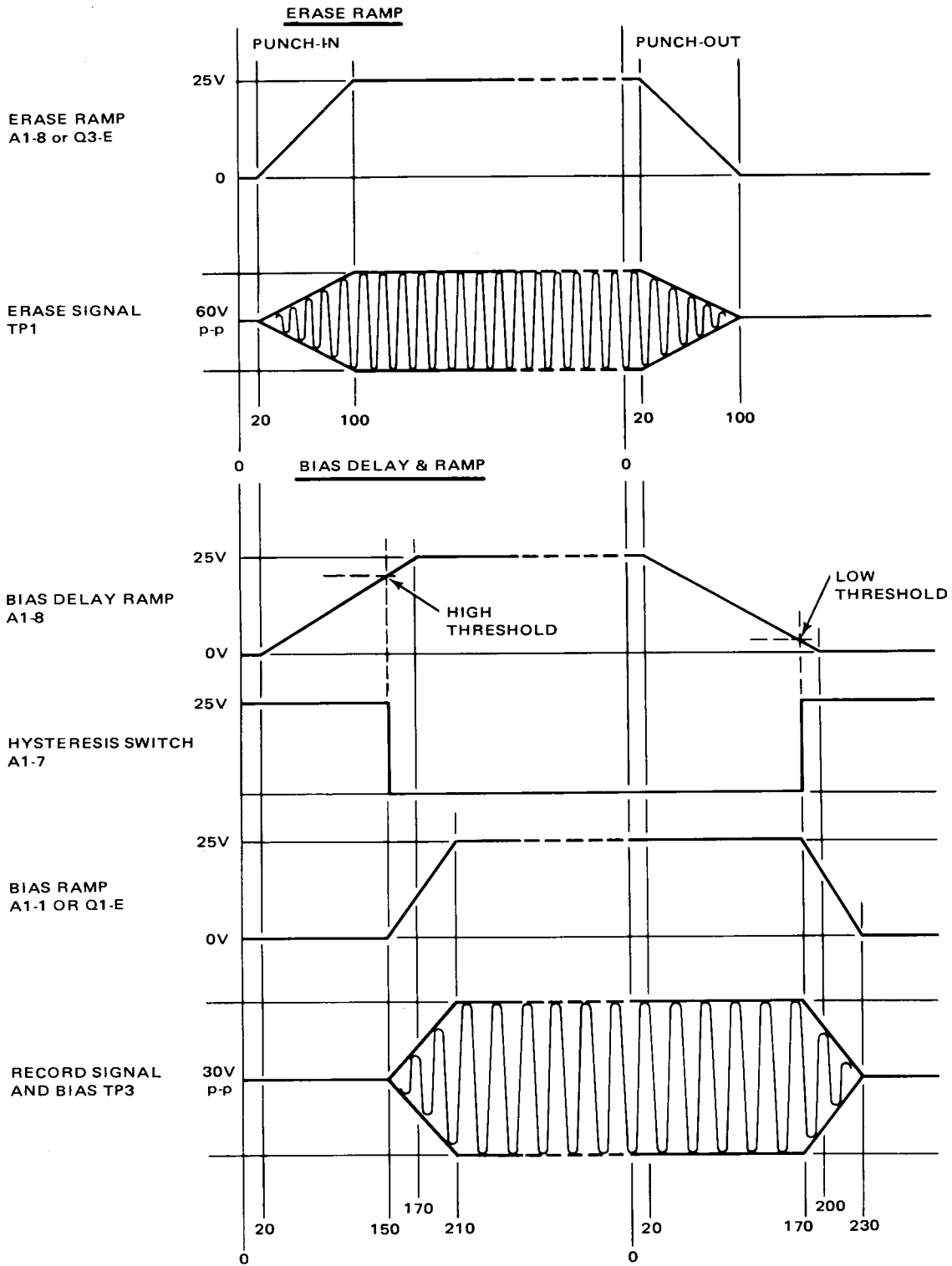


Figure 4-2. Typical Ramp and Delay Timing, Milliseconds

At the end of the initial mechanical record switching delays, during which the record relay is energized (approximately 20 milliseconds), a high record command from the record switching circuits starts the following timing sequence:

1. PURC relay, K51, is energized connecting the record amplifier to the head.
2. The erase ramp turns on the erase amplifier at the ramp rate, reaching full power after 80 ms.
3. The bias delay timing ramp (adjusted for the time in milliseconds corresponding to the tape speed and the distance the tape travels between the erase and record heads) triggers the hysteresis switch at its high threshold.
4. The hysteresis switch goes low, which starts the bias ramp.
5. The bias ramp turns on the bias amplifier at the ramp rate, reaching full power after 60 ms.

The erase and bias ramp times shown in Figure 4-2 are fixed; the bias delay varies with the three recorders (see the *Operation* section). The levels are maintained as long as the record function is on. When the record function is switched off (20-ms mechanical delay), the record command goes low and the following ramp down sequence takes place:

1. The erase and bias delay ramps start down.
2. The erase amplifier turns completely off after 80 ms.
3. The bias delay ramp triggers the hysteresis switch low threshold.
4. The hysteresis switch goes low, starting the bias down ramp.
5. PURC relay K51 is de-energized as the delay ramp nears zero, disconnecting the audio from the record amplifier.
6. The bias amplifier turns off completely after 60 ms.

7. The record relay is de-energized.

In the following circuit descriptions the terms "ramp up" and "ramp down" are synonymous with the record on and record off functions.

## CIRCUIT DESCRIPTION

### AG-440C Recorder/Reproducer

Refer to schematic diagrams 4840428 and 4840415 and to simplified schematic, Figure 4-3, for the circuit description given in the following paragraphs. The PURC circuits are shown within the dotted lines in the simplified schematic; the remaining circuitry shown is part of the record control.

Simultaneously pressing the RECORD and PLAY buttons (or the RECORD button alone if the transport is in the play mode) with the SAFE/READY switch in READY produces a +24-Vdc level at the base of transistor 9Q1. Transistors 9Q1/9Q2 form a regenerative latch. When 9Q1 turns on, its collector goes low which turns 9Q2 on. As the collector of 9Q2 rises, 9Q1 turns on harder until both transistors are saturated. The 9Q1/9Q2 latch will remain on until the return path at the emitter of 9Q1 is disconnected. The emitter circuit of 9Q2 supplies record hold current to other control circuits in the recorder. The low at the base of 9Q2 also turns on transistor 9Q3 which in turn forward biases transistor 9Q4 to energize record relay 4K1. When transistor 9Q3 turns on, pin F goes high which starts the PURC record timing sequence.

As shown in the timing diagram, Figure 4-2, the erase and bias delay ramps start immediately, while the bias ramp is started at the hysteresis switch high threshold. Varying the bias delay ramp slope changes the delay time between erase turn on and bias turn on to compensate for the tape speed and head distance. The +39V record-on level at pin F turns PURC transistors Q4 and Q5 on. Transistor Q4 energizes PURC relay K51. Note, however, that in the AG-440C application, the connection between pins 12 and D bypass the Q4/K51 circuit. At record off, pin F goes low and the collector of Q5 goes high to start the erase

and bias delay down ramps. Zener diode VR2 clamps the integrator input reference level at 15 volts at record off to prevent latch-up and assure immediate ramp down starting.

The erase ramp output from A1-14 is set by resistor R13 and capacitor C2 for 80 milliseconds. Transistor Q3 is turned on at this controlled rate providing a ramped supply voltage to erase amplifier Q51/Q52 through transformer T51.

The bias delay ramp output from integrator A1-8 is controlled by timing components C3, R25, R52, and R12. Larger capacitance or resistance increases the length of the ramp (up or down) and hence delays the bias turn on/off. For low speed operation, which requires a longer ramp, FET switch Q6 is turned off by the +39-volt low speed command at pin B, providing a large R component in the integrating circuit. At the high speed Q6 turns on, and the R component is halved. R14 changes the ratio of the ramp up to the ramp down time and is typically adjusted for a slightly longer down ramp to compensate for the difference between bias buildup and decay in the recorded signal. The output of the bias delay ramp integrator is fed via limiting resistor R15 to the inverting input of hysteresis switch A1-7.

The hysteresis switch, A1-7, controls the start of the bias up and down ramps by switching low at record on to start the bias ramp up, and high at record off to start the bias ramp down. The switching points occur at high and low thresholds of the hysteresis switch which operates as a comparator with controlled hysteresis. The hysteresis is controlled by shifting the reference voltage at the non-inverting input through feedback resistor R7 when the output voltage changes state.

The bias ramp starts when the hysteresis switch changes state. Both the ramp up (record on) and ramp down (record off) are set by resistor R4 and capacitor C1 for 60 milliseconds. The bias ramp provides slow turn on/off of Q1, which supplies voltage to bias amplifier Q53/Q54 through transformer T52.

Pressing the Insert switch starts the PURC ramp down sequence by opening the transistor 9Q1 emitter return line. Transistors 9Q1/9Q2 unlatch,

turning transistor 9Q3 off. Transistor 9Q4 remains forward biased by the bias delay ramp down until the ramp approaches 0V, thus holding record relay 4K1 energized during the ramp down sequence.

### MM-1100 Recorder/Reproducer

Refer to schematic diagrams 4840428 and 4840381 and to the simplified schematic of Figure 4-4 for the circuit description given in the following paragraphs. The PURC circuits are shown within the dotted lines on the simplified schematic; the remaining circuitry shown is part of the audio switcher module.

Simultaneously pressing the RECORD and PLAY buttons with the NORMAL/SET-UP/BIAS switch set to NORMAL enables a record pulse from the transport control PWA to energize relay K3. When relay K3 energizes, contacts 6 and 7 close and enable the record pulse to energize relay K1. When K1 energizes, contacts 15 and 16 pass a low record hold level from the transport control PWA to the base of Q9. Transistor Q9 turns on and provides a +39-Vdc record command signal to pin F which starts the PURC record timing sequence.

Transistors Q1-Q4 comprise an additional record relay holding circuit which holds relay K1 on for the duration of the PURC record timing sequence. The low record hold level turns Q1 off, providing forward bias current to the base of Q3 and charging current to capacitor C2. Q3 turns on, forward biasing both Q2 and Q4 which holds relay K1 energized. At record turn off, the record hold level at J4 pin 9 goes high. Pin F goes low through Q9 which starts the PURC turn off (or ramp down) sequence. Transistor Q1 turns on, providing a discharge path for C2 through CR1 and R4. After a delay which exceeds the PURC ramp down time, Q3 turns off, turning Q2 and Q4 off, which de-energizes record relay K1.

The PURC record on (ramp up) timing sequence starts with the +39V high at pin F. As shown in the timing diagram, Figure 4-2, the erase and bias delay ramps start immediately, while the bias ramp is started at the hysteresis switch high threshold. Varying the bias delay ramp slope changes the delay time between erase turn on and bias turn on to compensate for the tape speed and head distance.

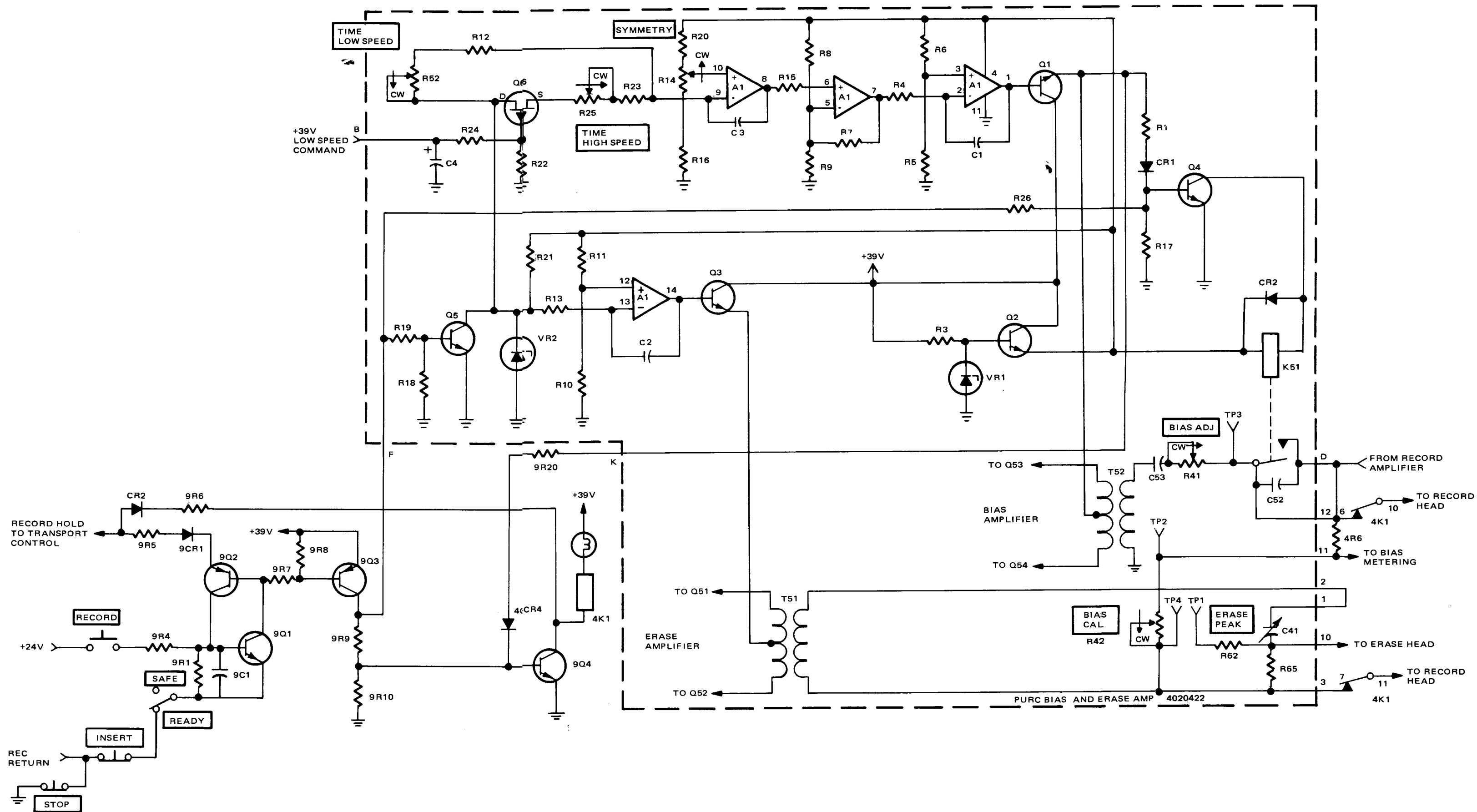


Figure 4-3. AG-440C PURC Circuit  
Simplified Schematic

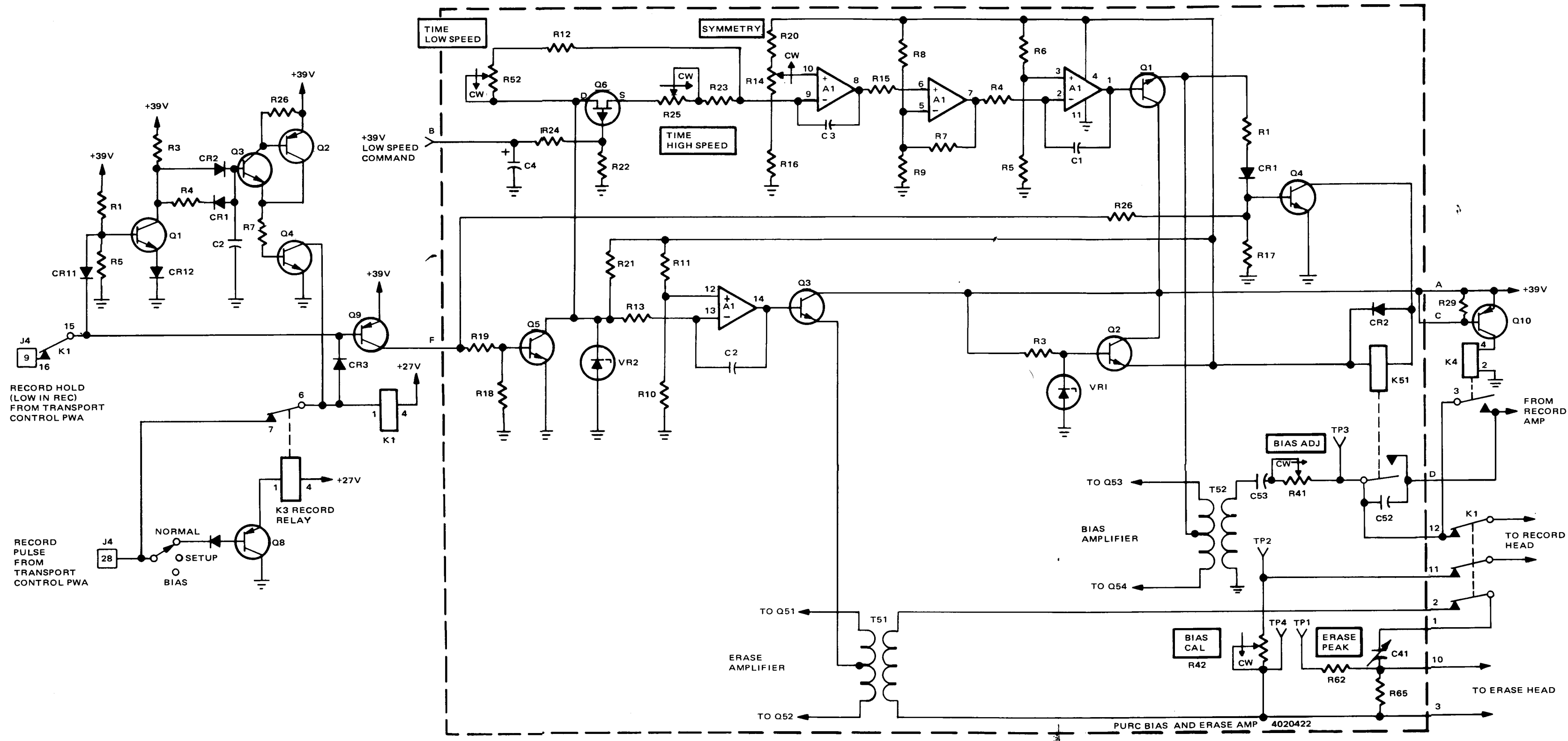


Figure 4-4. MM-1100 PURC Circuitry  
Simplified Schematic

The +39V record-on level at pin F turns PURC transistors Q4 and Q5 on. Transistor Q4 energizes PURC relay K51, which connects the output of the record amplifier to the record head. (Note that relay K4 on the audio switcher module is held de-energized by the reverse bias level to the base of Q10 from pin C.) At record off, pin F goes low and the collector of Q5 goes high to start the erase and bias delay down ramps. Zener diode VR2 clamps the integrator input reference level at 15 volts at record off to prevent latch-up and assure immediate ramp down starting.

The erase ramp output from A1-14 is set by resistor R13 and capacitor C2 for 80 milliseconds. Transistor Q3 is turned on at this controlled rate, providing a ramped supply voltage to erase amplifier Q51/Q52 through transformer T51.

The bias delay ramp output from integrator A1-8 is controlled by timing components C3, R25, R52, and R12. Larger capacitance or resistance increases the length of the ramp (up or down) and hence delays the bias turn on/off. For low speed operation, which requires a longer ramp, FET switch Q6 is turned off by the +39-volt low speed command at pin B, providing a large R component in the integrating circuit. At the high speed Q6 turns on, and the R component is halved. R14 changes the ratio of the ramp up to the ramp down time, and is typically adjusted for a slightly longer down ramp to compensate for the difference between bias buildup and decay in the recorded signal. The output of the bias delay ramp integrator is fed via limiting resistor R15 to the inverting input of hysteresis switch A1-7.

The hysteresis switch A1-7 controls the start of the bias up and down ramps by switching low at record on to start the bias ramp up, and high at record off to start the bias ramp down. The switching points occur at high and low thresholds of the hysteresis switch, which operates as a comparator with controlled hysteresis. The hysteresis is controlled by shifting the reference voltage at the non-inverting input through feedback resistor, R7, when the output voltage changes state.

The bias ramp starts when the hysteresis switch changes state. Both the ramp up (record on) and ramp down (record off) are set by resistor R4 and

capacitor C1 for 60 milliseconds. The bias ramp provides slow turn on/off of Q1 which supplies voltage to bias amplifier Q53/Q54 through transformer T52. As the ramp reaches zero, transistor Q4 turns off, de-energizing relay K51 which disconnects the record amplifier from the record head.

### MM-1200 Recorder/Reproducer

Refer to schematic diagrams 4840428 and 4840388 and to the simplified schematic of Figure 4-5 for the circuit description given in the following paragraphs. The PURC circuits are shown within the dotted lines on the simplified schematic; the remaining circuitry shown is from the audio switcher module.

Simultaneously pressing RECORD and PLAY buttons with the READY/SAFE switch set to READY enables a low record pulse from the transport control PWA to energize record relay K3. When relay K3 energizes, contacts 12 and 13 close, connecting the low record hold signal from the transport control PWA to the base of transistor Q2. Transistor Q2 turns on and provides a +39-Vdc record command signal to pin F which starts the PURC record timing sequence.

Transistors Q4-Q6 (audio switcher) comprise an additional record relay holding circuit which holds record relay K3 energized for the duration of the PURC record timing sequence. The low record hold level turns Q2 on, providing forward bias current to the base of Q4 and charging current to capacitor C2. Q4 turns on, forward biasing both Q5 and Q6, which holds relay K3 energized. At record turn off, the record hold level goes high. Pin F goes low through Q2 which starts the PURC turn off (or ramp down) sequence. Transistor Q2 turns off, providing a discharge path for C2 through CR1 and R4. After a delay which exceeds the PURC ramp down time, Q4 turns off, turning Q5 and Q6 off, which de-energizes record relay K3.

The PURC ramp up timing sequence starts with the +39V high level at pin F. As shown in the timing diagram, Figure 4-2, the erase and bias delay ramps start immediately, while the bias ramp is started at the hysteresis switch high threshold. Varying the bias delay ramp slope changes the

delay time between erase turn on and bias turn on to compensate for the tape speed and head distance. The +39V record-on level at pin F turns PURC transistors Q4 and Q5 on. Transistor Q4 energizes PURC relay K51 which connects the output of the record amplifier to the record head. (Note that relay K1 in the audio switcher module is held de-energized by the reverse biasing level to the base of Q3 from pin C.) At record off, pin F goes low, and the collector of Q5 goes high to start the erase and bias delay down ramps. Zener diode VR2 clamps the integrator input reference level at 15 volts at record off to prevent latch-up and assure immediate ramp down starting.

The erase ramp output from A1-14 is set by resistor R13 and capacitor C2 for 80 milliseconds. Transistor Q3 is turned on at this controlled rate providing a ramped supply voltage to erase amplifier Q51/Q52 through transformer T51.

The bias delay ramp output from integrator A1-8 is controlled by timing components C3, R25, R52, and R12. Larger capacitance or resistance increases the length of the ramp (up or down) and hence delays the bias turn on/off. For low speed operation, which requires a longer ramp, FET switch Q6 is turned off by the +39-volt low speed command at pin B, providing a large R component in the integrating circuit. At the high speed Q6 turns on,

and the R component is halved. R14 changes the ratio of the ramp up to the ramp down time, and is typically adjusted for a slightly longer down ramp to compensate for the difference between bias buildup and decay in the recorded signal. The output of the bias delay ramp integrator is fed via limiting resistors R15 to the inverting input of hysteresis switch A1-7.

The hysteresis switch, A1-7, controls the start of the bias up and down ramps by switching low at record on to start the bias ramp up, and high at record off to start the bias ramp down. The switching points occur at high and low thresholds of the hysteresis switch, which operates as a comparator with controlled hysteresis. The hysteresis is controlled by shifting the reference voltage at the non-inverting input through feedback resistor, R7, when the output voltage changes state.

The bias ramp starts when the hysteresis switch changes state. Both the ramp up (record on) and ramp down (record off) are set by resistor R4 and capacitor C1 for 60 milliseconds. The bias ramp provides slow turn on/off of Q1 which supplies voltage to bias amplifier Q53/Q54 through transformer T52. As the ramp reaches zero, transistor Q4 turns off, de-energizing relay K51 which disconnects the record amplifier from the record head.



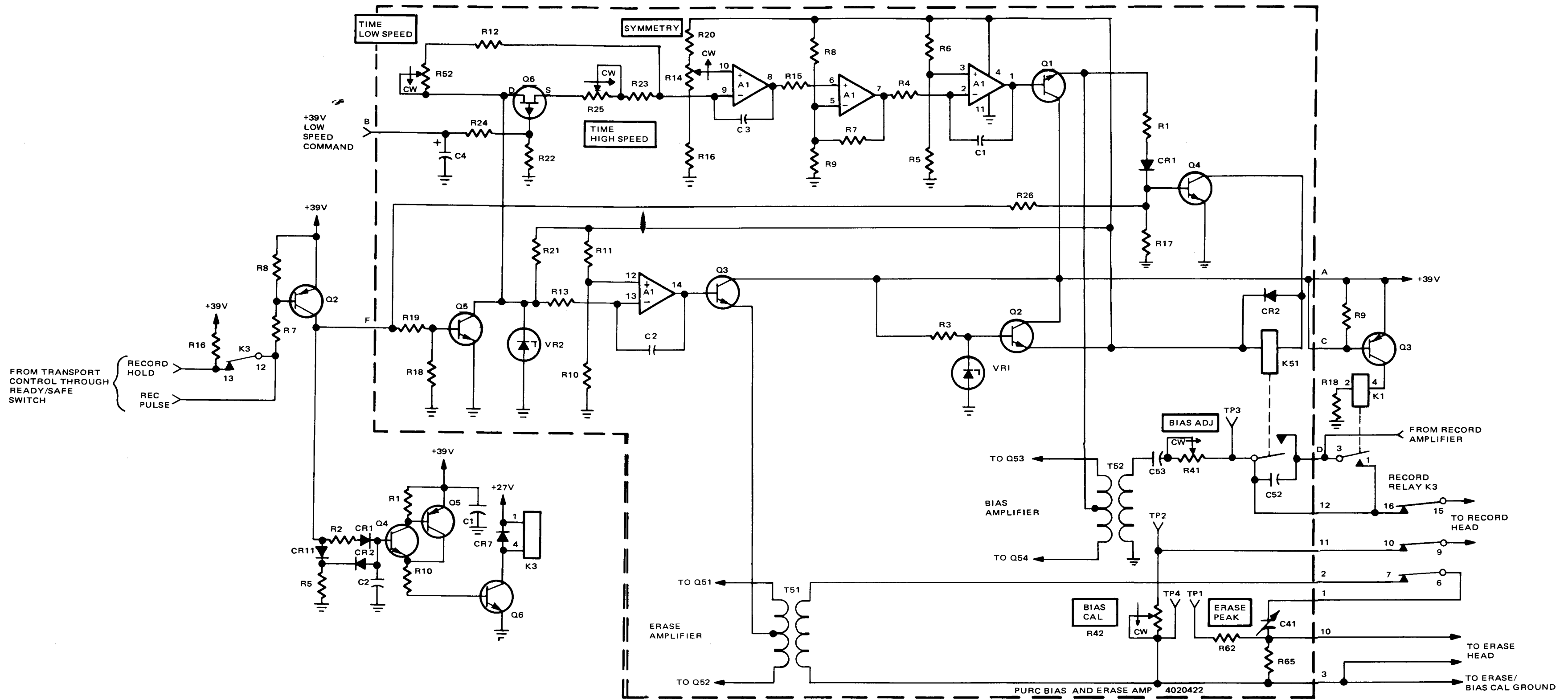


Figure 4-5. MM-1200 PURC Circuitry Simplified Schematic

## SECTION 5

### MAINTENANCE

The PURC accessory consists of solid-state circuits that require little maintenance under normal usage. Detailed troubleshooting and corrective maintenance procedures are not given in this manual; however, data supplied in the manual aids in locating and correcting malfunctions. In addition, adjustment procedures are provided to ensure proper operation of PURC after PURC is installed, and after corrective maintenance has been performed.

#### TEST EQUIPMENT

Test equipment required for the adjustment procedures is given in Table 5-1. Equivalent equipment can be substituted for the equipment suggested in the table.

Table 5-1. Test Equipment

| EQUIPMENT TYPE                                 | SUGGESTED MODEL                     |
|--|-------------------------------------|
| Oscilloscope with X10 Probe                    | Tektronix 453                       |
| Audio Oscillator                               | Hewlett-Packard, Model 204C or 209D |
| AC Voltmeter                                   | Hewlett-Packard, Model 400F         |
| Special Test Cable (for use with AC Voltmeter) | See Figure 5-1                      |
| DC Voltmeter (20,000 ohms/volt)                | Any                                 |
| Wave Analyzer (optional)                       | Hewlett-Packard, Model 302A         |
| Extender Board                                 | Ampex Part Number 4020153-04        |

#### PREVENTIVE MAINTENANCE

Preventive maintenance is not required for the PURC system.

#### TROUBLESHOOTING

If a malfunction should occur in the PURC system, employ standard audio troubleshooting techniques to isolate faults to a certain stage or component. To aid in troubleshooting the PURC module, ac and dc voltages are given in Table 5-2. Measure the rms voltages using an ac voltmeter and 3-foot long coax cable (Figure 5-1). Schematics, parts lists, and assembly drawings of the PURC accessory components are included in this manual. For information regarding the associated recorder/reproducer, refer to the applicable Operation and Maintenance manual as follows:

| MODEL   | CATALOG NO. |
|---------|-------------|
| AG-440C | 4890328     |
| MM-1200 | 4890400     |
| MM-1100 | 4890321     |

Table 5-2. PURC Bias and Erase Amplifier Voltages

| TEST LOCATION | VOLTAGE  |
|---------------|----------|
| TP1, TP3      | 3-5V rms |
| E20, E23      | 25 Vdc   |
| Emitter Q3    | 23 Vdc   |
| Emitter Q6    | 23 Vdc   |

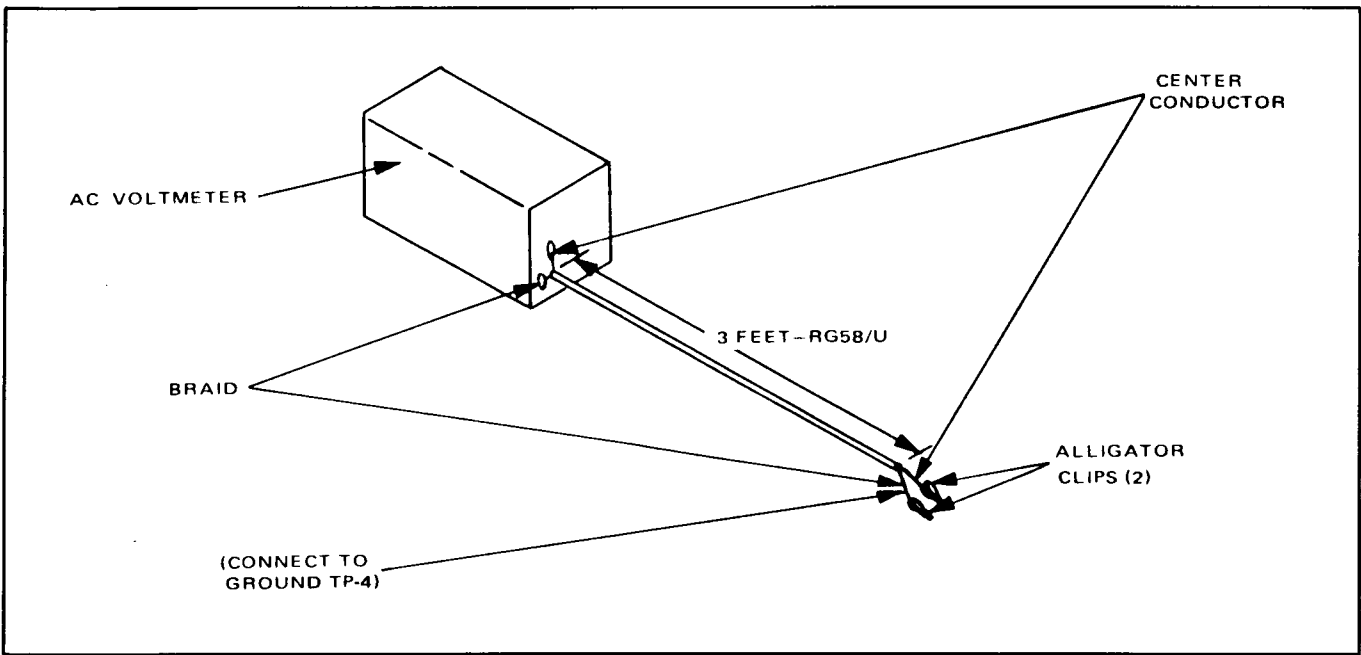


Figure 5-1. Special Test Cable for Use With AC Voltmeter

## CORRECTIVE MAINTENANCE

When replacing components in the PURC system, refer to the assembly drawings and lists of materials included in this manual for component location and identification information. If components are replaced, perform the applicable adjustment procedures given below.

## ADJUSTMENTS

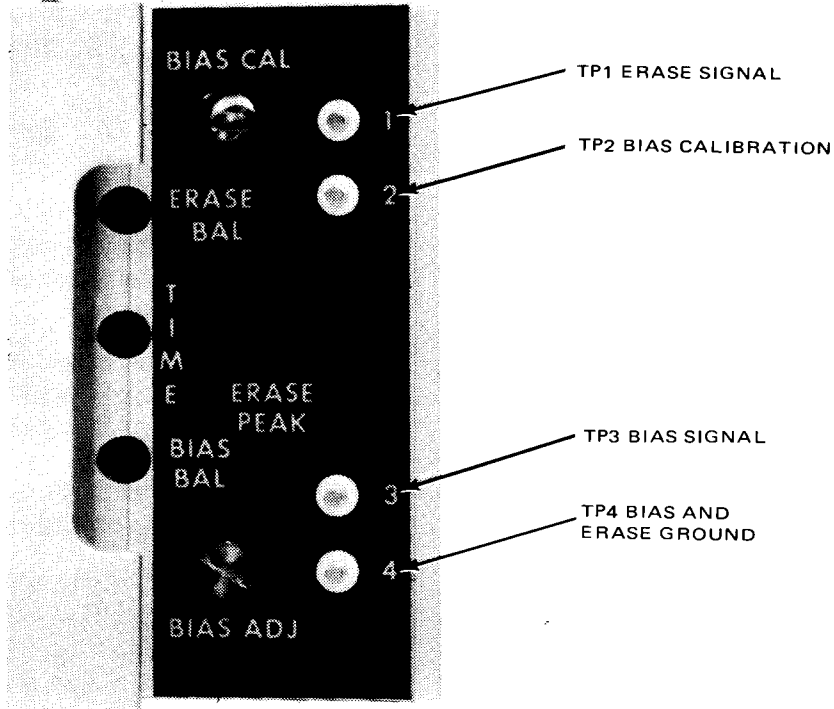
After the PURC accessory has been installed, or after any corrective maintenance, perform the following adjustment procedures.

### Erase and Bias Adjustment (AG-440C, MM-1100, MM-1200)

Proceed as follows:

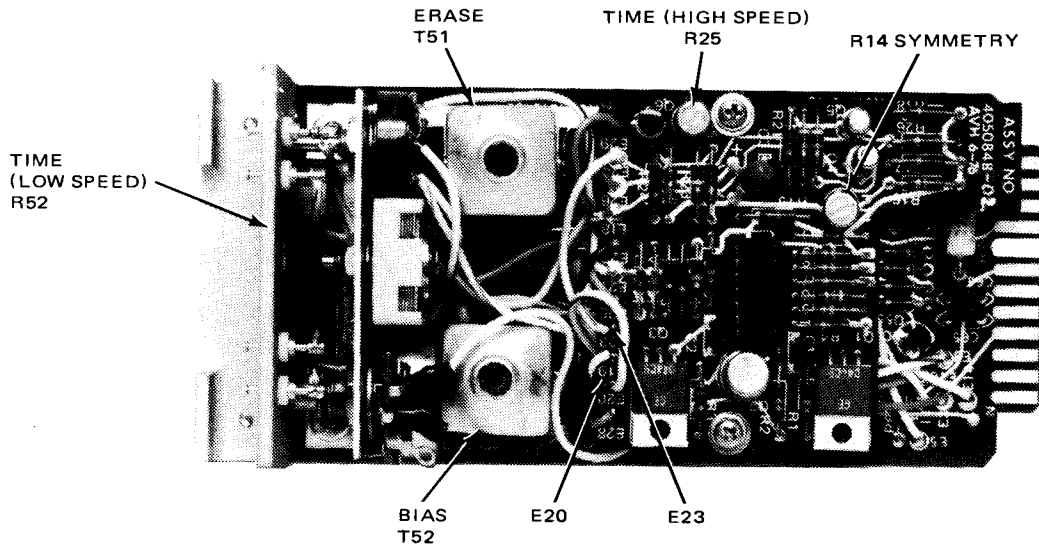
1. Demagnetize the recorder/reproducer head assembly.
2. With system power off, remove the PURC bias and erase module to be adjusted from the system. Place module on extender board 4020153-04 and re-install the module.

3. Turn the ERASE PEAK control, C41, fully counterclockwise (maximum capacitance).
4. Connect a scope or an ac voltmeter with the special test cable shown in Figure 5-1 to TP1; connect the ground lead to TP4 (Figure 5-2). (Note: The use of the ac voltmeter and special test cable is preferred, as a more accurate adjustment can be obtained.)
5. Place channel being adjusted into the record mode (without tape).
6. Adjust the T51 slug (see Figure 5-3) for a maximum reading.
7. On MM-1100 or MM-1200 recorders with 24 channel head assemblies catalog numbered 4020372-02, -04, -06, or -08; and AG-440C recorders using 1/4-inch tape with a 2-channel, quarter track head; perform steps *a* and *b*. (Or, alternately, replace R66 with a 390 ohm, 1/2 watt resistor and perform step *c* only.) On all other versions perform step *c* only.
  - a. Turn ERASE PEAK control C41 slowly clockwise (cw) and note the reading on the voltmeter just before a 2- to 3-dB jump occurs.



13456-2

Figure 5-2. PURC Bias and Erase Module Test Points



13929-3

Figure 5-3. PURC Bias and Erase Module, Side View

- If a scope is used, turn ERASE PEAK control C41 slowly clockwise and note voltage level just before a distorted sine wave appears. See Figure 5-4.
- b. Turn ERASE PEAK control C41 slowly counterclockwise until the voltmeter indicates 1 dB below the point where the 2- to 3-dB jump occurred in step a. If a scope is used, turn ERASE PEAK control C41 slowly counterclockwise until the peak disappears. Then turn the control clockwise until the scope indicates 10% below the voltage level noted in step a just before the distorted sine wave appeared.
  - c. Adjust ERASE PEAK control C41 for maximum reading on ac voltmeter or scope (note the instructions at the beginning of step 7).
8. Connect the scope or ac voltmeter to TP3 and TP4 ground.
  9. Adjust the T52 slug (see Figure 5-3) for a maximum reading.
  10. To adjust for minimum 2nd harmonic distortion in the bias and erase signals, thread bulk-erased tape on the recorder, place system in the record mode, and perform steps 11 through 13. A wave analyzer may be used instead if available.
  11. To adjust for minimum 2nd harmonic distortion in the bias signal, use an ac voltmeter with a X10 scope probe and a bias trap as shown in Figure 5-5.
  12. Adjust BIAS BAL control R51 for a minimum reading.
  13. To adjust for minimum 2nd harmonic distortion in the erase signal, use the setup shown in Figure 5-5 and adjust ERASE BAL control R52 for minimum.
  14. Adjust BIAS ADJ control R41 and BIAS CAL control R42 per instructions in the associated Operation and Maintenance manual.

#### Audio Switching (PURC) Adjustment (MM-1100 Only)

Refer to the MM-1100 Operation and Maintenance manual, Catalog Number 4890321, for standard operating settings for the RECORD, REPRO, and SEL SYNC controls. Use the following procedure to adjust the bias trap on the newly installed audio switcher module.

1. Set all selector switches on the electronics assemblies to the SET-UP position.
2. Set switches on the control box as follows:
  - a. Place the READY/SAFE switch of the channel where the new audio switcher module is installed to the SAFE position.

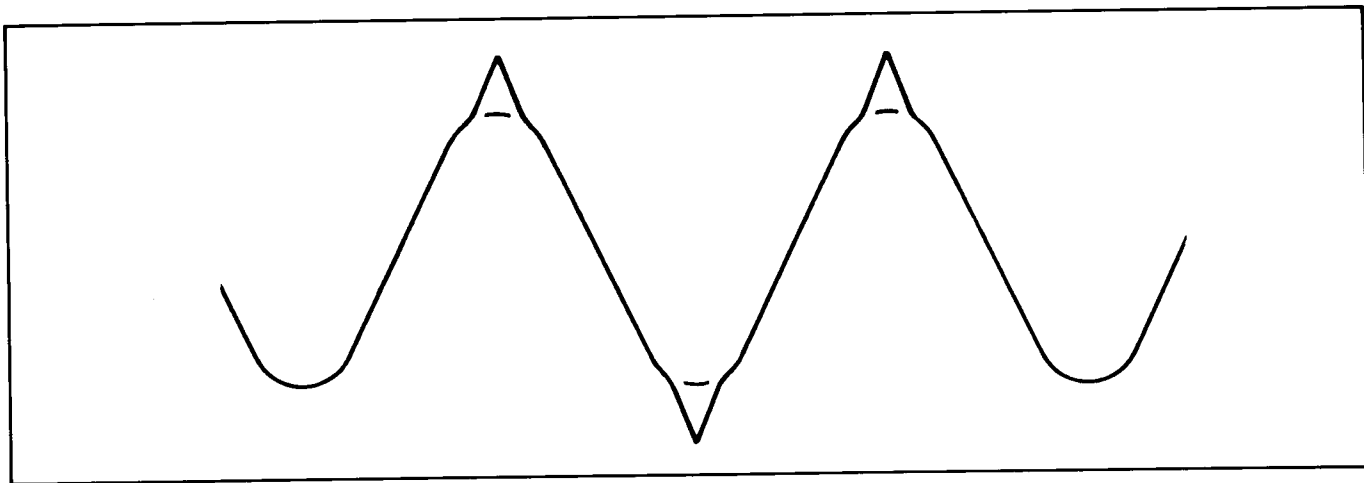


Figure 5-4. Distorted Sine Wave (TP1) When 24-Track or 1/4-Track Erase Head is Saturated

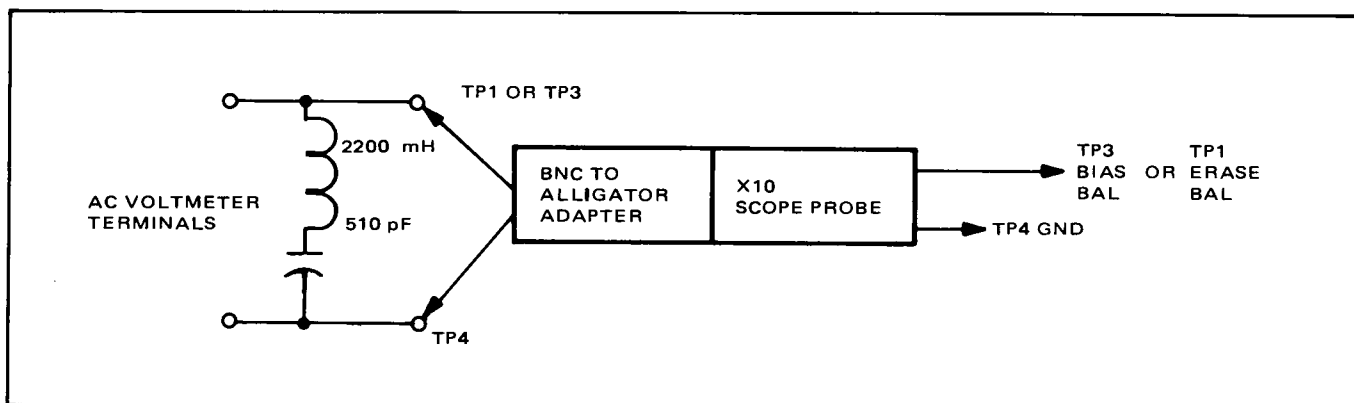


Figure 5-5. Second Harmonic Distortion Adjustment Setup

- b. Place the READY/SAFE switch for the adjacent channel to the READY position.
  - c. Place the INPUT MON/NORM MON switch to the NORM MON position.
  - d. Place the SEL SYNC/REPRO switch to the SEL SYNC position.
3. Install only the reproduce amplifier PWA in the audio switcher being tested and place the recorder in the record mode.
  4. Connect an oscilloscope to the output connector for the channel under test and adjust the Sel-Sync bias trap inductor L2 on the audio switcher module until a minimum bias leakage amplitude is observed. L2 is located between the record and reproduce PWA's; see drawing 4050758 at the end of this manual.
  4. Connect an audio oscillator to the input of the recorder and set the frequency to 700 Hz.
  5. Connect an oscilloscope to the line output connector.
  6. Thread a blank tape on the transport.
  7. Set the READY/SAFE switch for the PURC channel to READY; set the other channels to SAFE.
  8. Start the system in the record mode and record a three-minute section of tape.
  9. Rewind the tape to the beginning of the recording and change the oscillator frequency to 5 kHz.
  10. Set the system to the play mode with the monitor switch set to REPRO.
  11. While observing the 700-Hz playback signal on the scope, press the RECORD button and note whether a gap or an overlap appears on the scope. See Figure 5-6 for typical waveforms.
  12. After waiting at least four seconds, switch the recorder out of record. For the AG-440C, press the Insert switch momentarily; for the MM-1100 and MM-1200, hold the RECORD button pressed while momentarily pressing the STOP button. Observe where any gap or overlap appears.
  13. Adjust TIME control R52 so that there are equal lengths of gap or overlap at each end of the recorded 5-kHz insert.

### Timing Adjustment (AG-440C, MM-1100, MM-1200)

The PURC timing should be optimized by the symmetry control, R14, at the speed most commonly used. Adjust the timing as follows:

1. Set controls R14, R25, and R52 on the PURC bias and erase module to their mid point. See Figure 5-3 for the location of the controls.
2. Install the three PWAs in the audio switcher module and turn the power on.
3. Set TAPE SPEED switch to LOW.

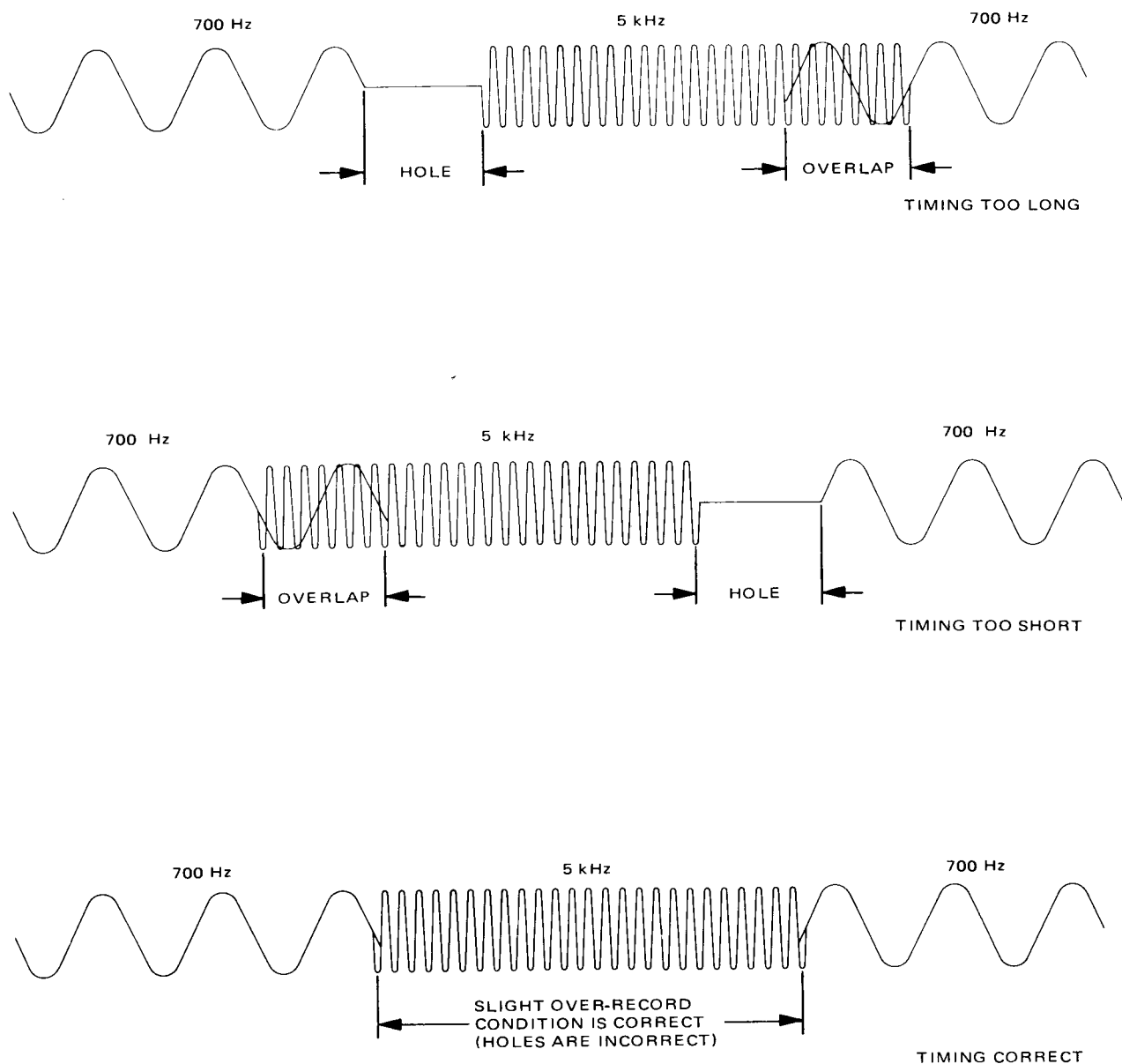


Figure 5-6. PURC Timing Adjustment Waveforms

14. Adjust symmetry control R14 for an optimum 25% overlap of the 700 Hz previously recorded material with the 5-kHz insert; i.e., 25% of the bias buildup time should overlap 25% of the erase buildup time (seen on the oscilloscope as the decay of the 700-Hz

recorded signal). If there are gaps at each end of the insert, adjust R14 slowly clockwise until the gaps are closed. If there is more than 25% overlap at each end, adjust R14 counterclockwise. Re-adjust the TIME control, if necessary, for the optimum overlap.

15. Set the TAPE SPEED switch to HIGH.
16. Adjust R25 for the optimum overlap. Do not re-adjust the TIME control R52; the low speed timing will be affected. If the recorder is most frequently used at the high speed,

R14 may be readjusted during the high speed TIME control adjustment since the optimum setting of R14 for high speed is shifted slightly toward the clockwise position compared with the low speed setting.



## SECTION 6

### PARTS LISTS AND SCHEMATICS

This section contains the parts lists and schematics for the  
Pick-Up Recording Capability (PURC) Accessory, Ampex  
Part Number 4010236.

| TITLE  | ASSEMBLY NO. | REV. | PAGE NO. |
|--|--------------|------|----------|
| Pick-Up Recording Capability Accessory Kit; MM-1100,<br>MM-1200, AG-440C . . . . . | 4010236      | E    | 6-2      |
| Bias and Erase Amplifier Assembly . . . . .  | 4020422      | A    | 6-3      |
| Bias and Erase Amplifier Schematic . . . . .                                       | 4840428      | A    | 6-5      |
| Bias and Erase Amplifier PWA (Main) . . . . .                                      | 4050850      | C    | 6-7      |
| Bias and Erase Amplifier PWA Schematic<br>(See page 6-5) . . . . .                 | 4840428      | A    |          |
| Bias and Erase Amplifier PWA (Small) . . . . .                                     | 4050848      | A    | 6-10     |
| Bias and Erase Amplifier PWA Schematic<br>(See page 6-5) . . . . .                 | 4840428      | A    |          |
| Audio Switching PWA . . . . .  | 4050758      | B    | 6-13     |
| Audio Switching PWA Schematic . . . . .  | 4840381      | A    | 6-15     |
| Audio Switcher PWA Schematic . . . . .   | 4840388      | C    | 6-17     |
| Electronics Schematic . . . . .  | 4840415      | A    | 6-19     |

| ITEM NO. | AMPEX PART NO. | REFERENCE NUMBER | DESCRIPTION   | JEDEC NO. OR MFR. PART NO. |
|----------|----------------|------------------|---|----------------------------|
|          | 4010236-04     |                  | PICK-UP RECORDING CAPABILITY ACCESSORY KIT, MM1100                |                            |
|          | 4010236-07     |                  | PICK-UP RECORDING CAPABILITY ACCESSORY KIT, MM1200                |                            |
|          | 4010236-08     |                  | PICK-UP RECORDING CAPABILITY ACCESSORY KIT, AG440C                |                            |
| 2        | 4020422-01     |                  | BIAS AND ERASE AMPLIFIER ASSEMBLY                                 |                            |
| 3        | 4050758-02     |                  | AUDIO SWITCHING PWA (MM1100)                                      |                            |
| 4        | 4100081-01     |                  | PUSHBUTTON, RECTANGULAR, SMALL (AG440C)                           |                            |
| 5        | 4210350-04     |                  | SHAFT, EXTENDER (MM1100)  |                            |
| 6        | 4620144-20     |                  | SWITCH, PUSHBUTTON, NC (AG440C)                                   |                            |
| 8        | 013-599        |                  | DIODE (AG440C)  | IN914                      |
| 9        | 013-678        |                  | DIODE (AG440C)  | IN4005                     |
| 10       | 034-358        |                  | CAPACITOR, 220 PF, 5% (AG440C)                                    |                            |
| 12       | 041-406        |                  | RESISTOR, COMP, 22K, 1/4W, 5% (MM1100)                            |                            |
| 13       | 041-410        |                  | RESISTOR, COMP, 1K, 1/4W, 5% (AG440C)                             |                            |
| 15       | 051-342        |                  | CHOKER, 5 MHY (AG440C)  |                            |
| 17       | 064-270        | C3               | CAPACITOR, CER, 0.047 UF, 100V, ±10% (7-1/2 - 15 IPS)             |                            |
| 18       | 064-272        | C3               | CAPACITOR, CER, 0.068 UF, 100V, ±10% (3-3/4 - 7-1/2 IPS) (AG440C) |                            |
| 20       | 180-243        |                  | TERMINAL STRIP (AG440C)   |                            |
| 21       | 473-325        |                  | SCREW, SEM, XREC, No 4-40 x 0.31 (AG440C)                         |                            |
| 22       | 492-032        |                  | NUT, SMALL PATTERN, NO 4-40 (AG440C)                              |                            |
| 23       | 501-008        |                  | WASHER, PLAIN, NO 4 (AG440C)                                      |                            |
| 24       | 502-013        |                  | WASHER, LOCK, ET, NO 4 (AG440C)                                   |                            |
| 26       | 4840415        |                  | SCHEMATIC, ELECTRONICS (AG440C)                                   |                            |
| 28       | 4840381        |                  | SCHEMATIC, AUDIO SWITCHING (MM1100)                               |                            |
| 32       | 4840428        |                  | SCHEMATIC, BIAS AND ERASE AMP, PURC                               |                            |
| 34       | 4890408-01     |                  | MANUAL, PURC ACCESSORY  |                            |

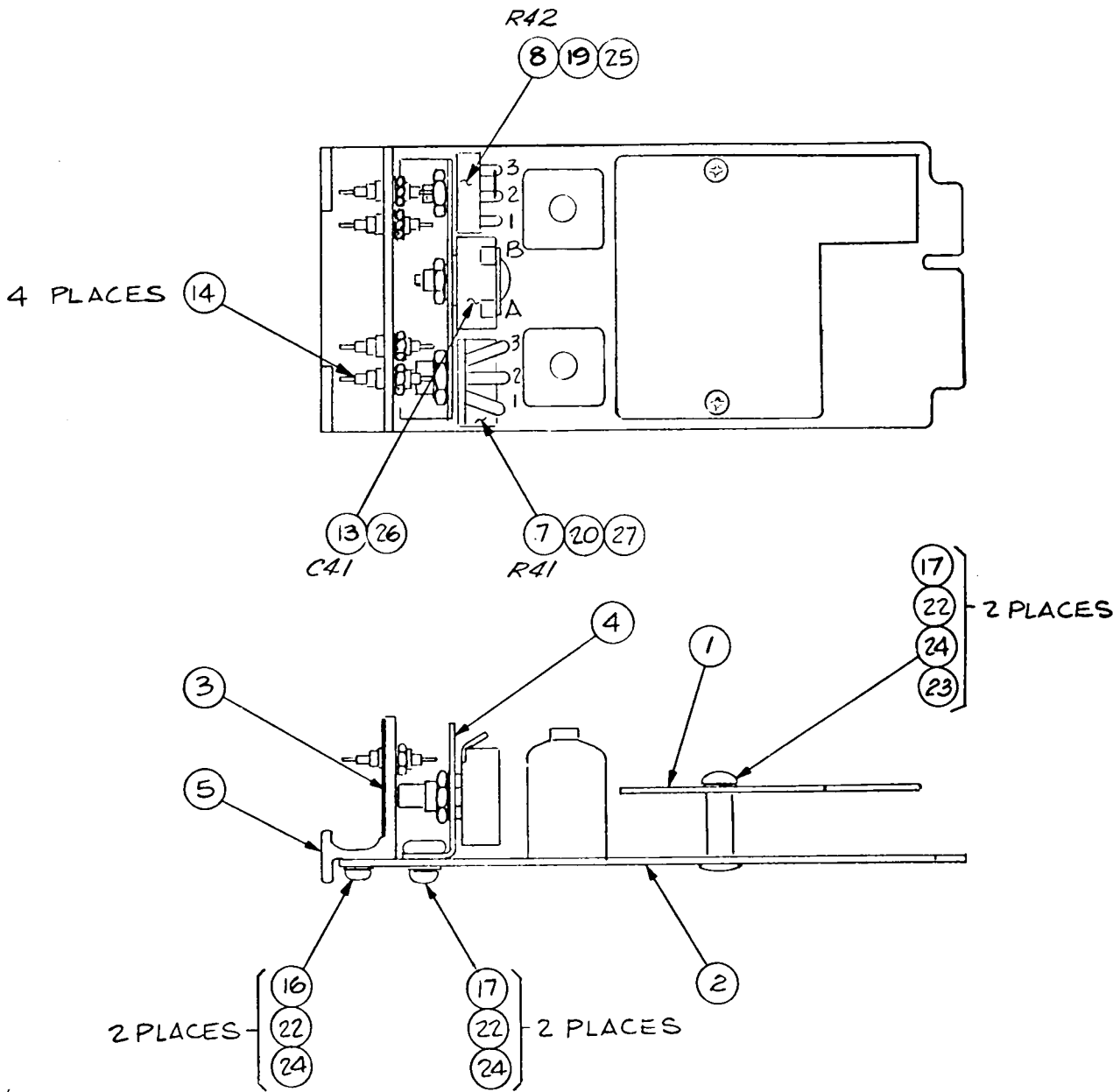
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SHEET 1 OF 1

| ITEM NO. | AMPEX PART NO. | REFERENCE NUMBER | DESCRIPTION                                     | JEDEC NO. OR MFR. PART NO. |
|----------|----------------|------------------|---|----------------------------|
|          | 4020422-01     |                  | BIAS AND ERASE AMPLIFIER ASSEMBLY (NHA 4010236) |                            |
| 1        | 4050848-02     |                  | BIAS AND ERASE AMPLIFIER PWA (SMALL)            |                            |
| 2        | 4050850-02     |                  | BIAS AND ERASE AMPLIFIER PWA (MAIN)             |                            |
| 3        | 4110291-01     |                  | LABEL   |                            |
| 4        | 4260458-02     |                  | BRACKET, BIAS EQUALIZATION                      |                            |
| 5        | 4330293-01     |                  | PLATE, FRONT                                    |                            |
| 7        | 4520145-20     | R41              | POTENTIOMETER, HIGH TORQUE, 25K, 20%            |                            |
| 8        | 4520154-01     | R42              | POTENTIOMETER, BIAS CALIBRATE, 750 OHM, 20%     |                            |
| 13       | 038-293        | C41              | CAPACITOR, TRIM, 880-2330PF                     |                            |
| 14       | 173-064        | TP1-4            | TERMINAL, FEED THRU, TURRET                     |                            |
| 16       | 471-060        |                  | SCREW, PAN HD, XREC, 4-40 x 0.250 LG            |                            |
| 17       | 471-061        |                  | SCREW, PAN HD, XREC, 4-40 x 0.312 LG            |                            |
| 19       | 492-046        |                  | NUT, HEX, 1/4-32                                |                            |
| 20       | 492-095        |                  | NUT, HEX, 3/8-32                                |                            |
| 22       | 501-008        |                  | WASHER, FLAT, NO 4                              |                            |
| 23       | 501-751        |                  | WASHER, FIBER, FLAT, NO 4                       |                            |
| 24       | 502-024        |                  | WASHER, LOCK, INT TOOTH, NO 4                   |                            |
| 25       | 502-028        |                  | WASHER, LOCK, INT TOOTH, 1/4 INCH               |                            |
| 26       | 502-059        |                  | WASHER, LOCK, INT TOOTH, NO 12                  |                            |
| 27       | 502-083        |                  | WASHER, LOCK, INT TOOTH, 3/8 INCH               |                            |
| 37       | 4840428        |                  | SCHEMATIC                                       |                            |

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SHEET 1 OF 1

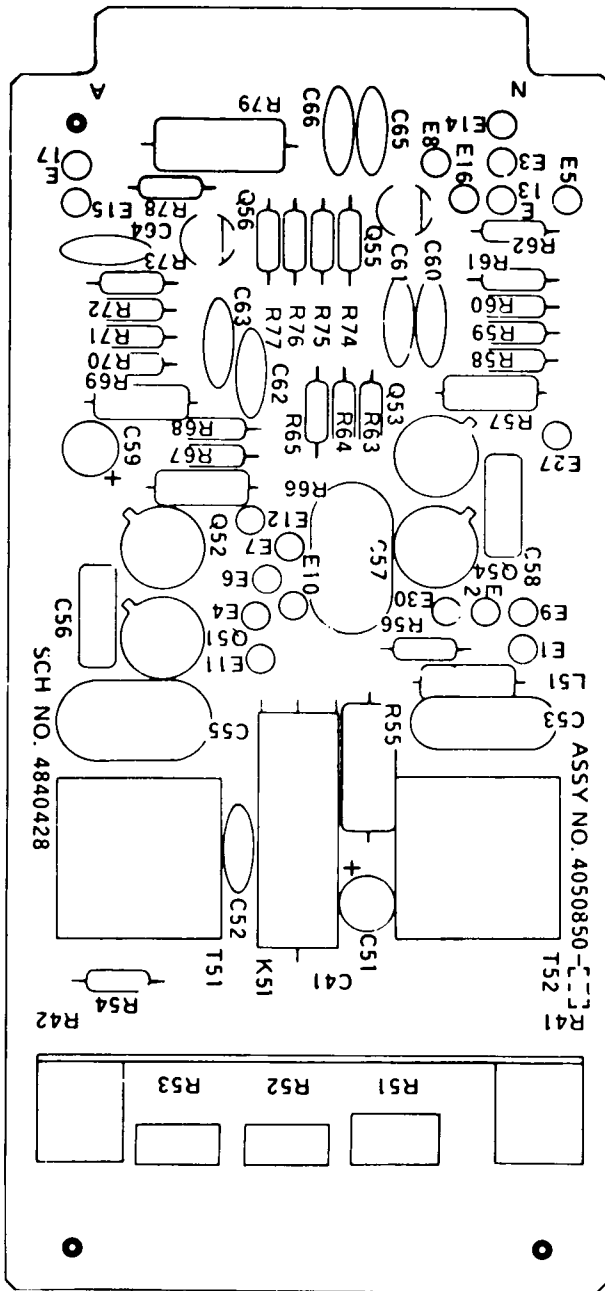


Assembly No. 4020422A. Bias and Erase Amplifier Assembly

| ITEM NO. | AMPEX PART NO. | REFERENCE NUMBER | DESCRIPTION                                       | JEDEC NO. OR MFR. PART NO. |
|----------|----------------|------------------|---|----------------------------|
|          | 4050850-02     |                  | BIAS AND ERASE AMPLIFIER PWA (MAIN) (NHA 4040422) |                            |
| 4        | 4580123-01     | T51, 52          | COIL, OSCILLATOR                                  | 2N3904                     |
| 6        | 103307-03      | REF: R79         | STANDOFF, 0.313 LG                                |                            |
| 8        | 014-653        | Q55, 56          | TRANSISTOR  |                            |
| 11       | 020-592        | K51              | RELAY, REED, SPST                                 |                            |
| 14       | 030-057        | C60-63, 65, 66   | CAPACITOR, CER, 0.01 UF, 100V, 20%                |                            |
| 15       | 030-094        | C56, 58          | CAPACITOR, CER, 1.0 UF, 25B, 20%                  |                            |
| 16       | 030-144        | C64              | CAPACITOR, CER, 0.05 UF, 100V, 20%                |                            |
| 17       | 030-544        | C52              | CAPACITOR, CER, 220 PF, 500V, 10%                 |                            |
| 20       | 034-370        | C57              | CAPACITOR, MICA, 6800 PF, 300V, 5%                |                            |
| 21       | 034-924        | C55              | CAPACITOR, MICA, 3000 PF, 500V, 5%                |                            |
| 22       | 034-925        | C53              | CAPACITOR, MICA, 1100 PF, 500V, 5%                |                            |
| 26       | 037-895        | C51, 59          | CAPACITOR, TANT, 3.3 UF, 35V, 20%                 |                            |
| 30       | 041-352        | R55              | RESISTOR, COMP, 82 OHM, 1W, 5%                    |                            |
| 31       | 041-394        | R62, 72, 73      | RESISTOR, COMP, 100K, 1/4W, 5%                    |                            |
| 32       | 041-406        | R54              | RESISTOR, COMP, 22K, 1/4W, 5%                     |                            |
| 33       | 041-407        | R63, 64          | RESISTOR, COMP, 3.3K, 1/4W, 5%                    |                            |
| 34       | 041-410        | R74, 75          | RESISTOR, COMP, 1K, 1/4W, 5%                      |                            |
| 35       | 041-411        | R76, 77          | RESISTOR, COMP, 47K, 1/4W, 5%                     |                            |
| 36       | 041-414        | R67, 68          | RESISTOR, COMP, 2.2K, 1/4W, 5%                    |                            |
| 37       | 041-421        | R66              | RESISTOR, COMP, 22 OHM, 1/2W, 5%                  |                            |
| 38       | 041-419        | R78              | RESISTOR, COMP, 100 OHM, 1/4W, 5%                 |                            |
| 39       | 041-432        | R65              | RESISTOR, COMP, 220K, 1/4W, 5%                    |                            |
| 40       | 041-442        | R58-61, 70, 71   | RESISTOR, COMP, 2.7K, 1/4W, 5%                    |                            |
| 41       | 041-489        | R69, 57          | RESISTOR, COMP, 33 OHM, 1/2W, 5%                  |                            |
| 42       | 041-472        | R56              | RESISTOR, COMP, 51K, 1/4W, 5%                     |                            |
| 46       | 043-520        | R79              | RESISTOR, WW, 39 OHM, 3W, 5%                      |                            |
| 50       | 058-650        | R51              | RESISTOR, VAR, CERMET, 100 OHM, 1W, 10%           |                            |
| 51       | 075-068        | R53              | RESISTOR, VAR, CERMET, 50 OHM, 1/2W, 10%          |                            |
| 52       | 075-051        | R52              | RESISTOR, VAR, CERMET, 1 MEG, 1/2W, 20%           |                            |
| 54       | 280-998        |                  | SPACER, TRANSISTOR, TO-5, REF Q51,52,53,54        | 2N5320S                    |
| 57       | 540-015        | L51              | INDUCTOR, FIXED, 1000 UH, 5%                      |                            |
| 60       | 580-771        | Q51, 52, 53, 54  | TRANSISTOR  |                            |
| 79       | 4840428        |                  | SCHEMATIC   |                            |
|          |                |                  |   |                            |

C

SHEET 1 OF 1

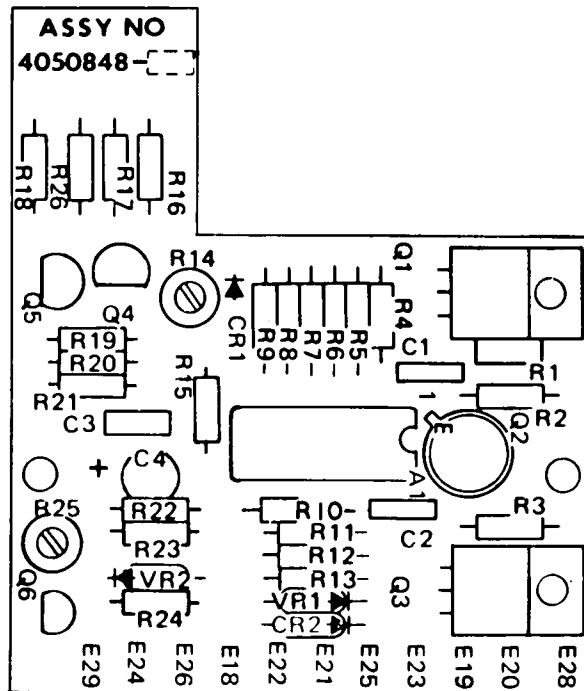


Assembly No. 4050850C. Bias and Erase Amplifier PWA (Main)

| ITEM NO. | AMPEX PART NO. | REFERENCE NUMBER    | DESCRIPTION  | JEDEC NO. OR MFR. PART NO. |
|----------|----------------|---------------------|--|----------------------------|
|          | 4050848-02     |                     | BIAS AND ERASE AMPLIFIER PWA (SMALL) (NHA 4020422) |                            |
| 5        | 013-354        | VR2                 | DIODE  | IN965B                     |
| 6        | 013-467        | VR1                 | DIODE  | IN971B                     |
| 7        | 013-599        | CR1, 2              | DIODE  | IN914                      |
| 8        | 014-248        | Q4, 5               | TRANSISTOR   | 2N2222                     |
| 10       | 041-393        | R4,12,13,24         | RESISTOR, COMP, 1 MEG, 1/4W, 5%                    |                            |
| 11       | 041-406        | R1, 5, 8, 9, 10, 15 | RESISTOR, COMP, 22K, 1/4W, 5%                      |                            |
| 12       | 041-407        | R3                  | RESISTOR, COMP, 3.3K, 1/4W, 5%                     |                            |
| 13       | 041-408        | R2                  | RESISTOR, COMP, 10K, 1/4W, 5%                      |                            |
| 14       | 041-411        | R19, 20             | RESISTOR, COMP, 47K, 1/4W, 5%                      |                            |
| 15       | 041-414        | R17, 18, 21         | RESISTOR, COMP, 2.2K, 1/4W, 5%                     |                            |
| 16       | 041-436        | R16                 | RESISTOR, COMP, 18K, 1/4W, 5%                      |                            |
| 17       | 041-442        | R7                  | RESISTOR, COMP, 2.7K, 1/4W, 5%                     |                            |
| 18       | 041-572        | R11                 | RESISTOR, COMP, 51K, 1/4W, 5%                      |                            |
| 19       | 041-750        | R6                  | RESISTOR, COMP, 24K, 1/4W, 5%                      |                            |
| 20       | 041-778        | R22                 | RESISTOR, COMP, 2.2 MEG, 1/4W, 5%                  |                            |
| 22       | 058-270        | R14                 | RESISTOR, VAR, CERMET, 10K, 1/2W                   |                            |
| 23       | 058-611        | R25                 | RESISTOR, VAR, CERMET, 1 MEG, 1/2W                 |                            |
| 25       | 064-266        | C1, 2, 3            | CAPACITOR, CER, MONO, 0.022 UF, ±10%               |                            |
| 26       | 067-049        | C4                  | CAPACITOR, TANT, 4.7 UF, 50V, 20%                  |                            |
| 28       | 280-130        |                     | PAD, TRANSISTOR MOUNT, REF Q4, 5, 6                |                            |
| 29       | 280-998        |                     | PAD, TRANSISTOR MOUNT, REF Q2                      |                            |
| 30       | 580-156        | Q6                  | TRANSISTOR   | 2N5461                     |
| 31       | 580-167        | Q2                  | TRANSISTOR   | 2N5320                     |
| 32       | 580-760        | Q1, 3               | TRANSISTOR   | D44C9                      |
| 33       | 586-626        |                     | SOCKET, IC, 14 PIN, DUAL IN-LINE, REF A1           |                            |
| 34       | 587-458        | A1                  | INTEGRATED CIRCUIT                                 | LM324N                     |
| 36       | 4840428        |                     | SCHEMATIC  |                            |
| 37       | 041-774        | R23                 | RESISTOR, COMP, 1.5M, 1/4W, 5%                     |                            |
| 38       | 041-515        | R26                 | RESISTOR, COMP, 180K, 1/4W, 5%                     |                            |

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SHEET 1 OF 1



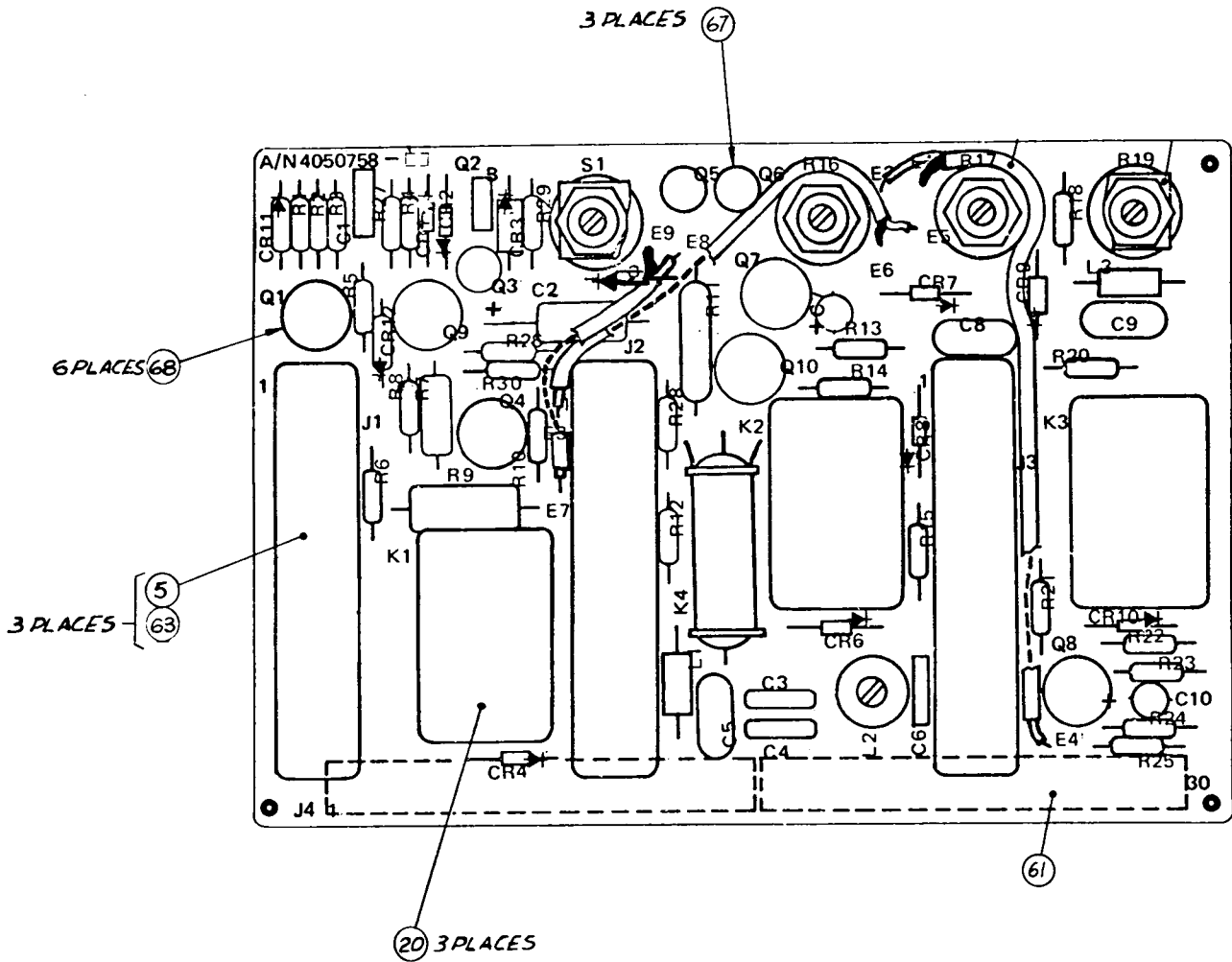
Assembly No. 4050848A. Bias and Erase Amplifier PWA (Small)



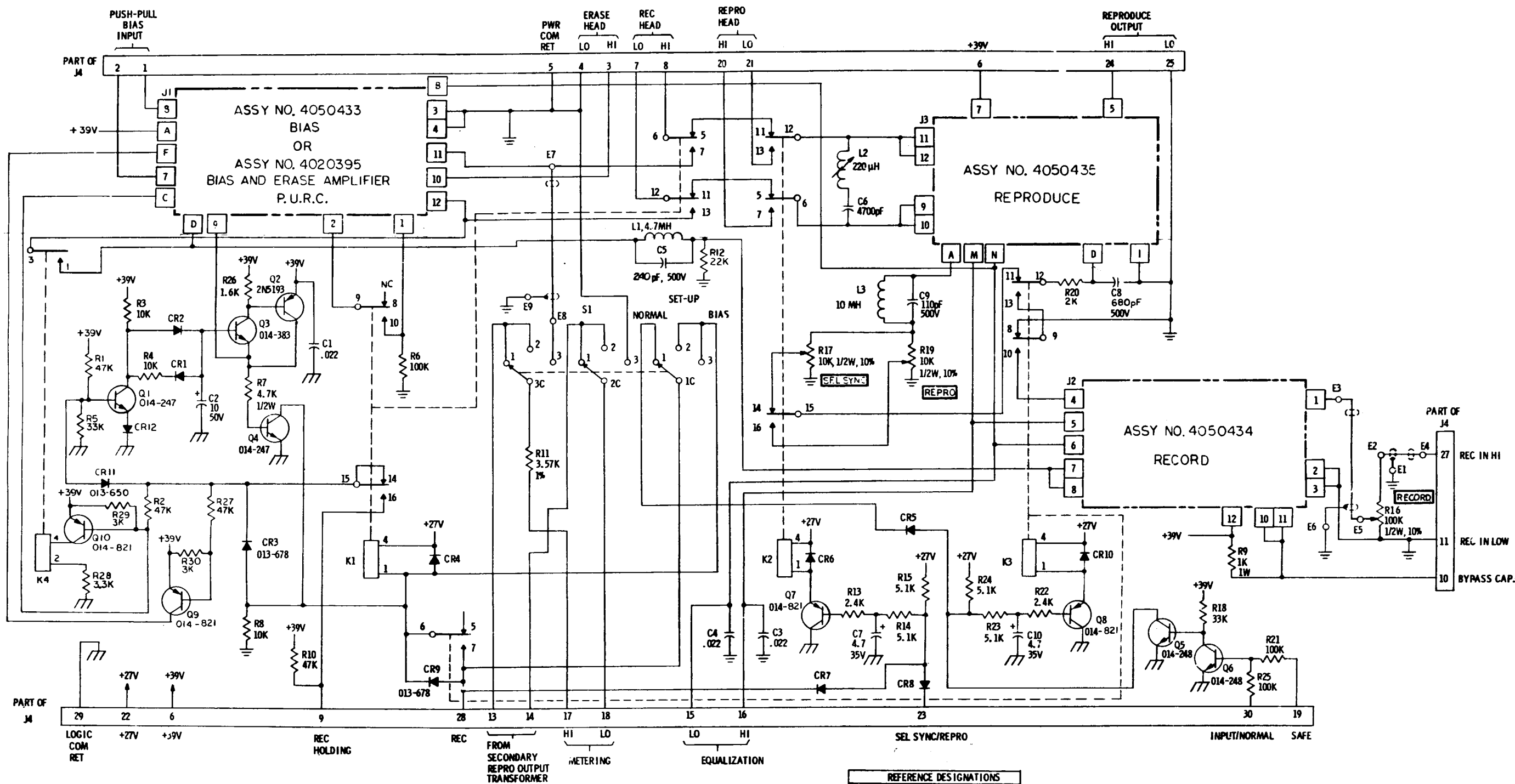
| ITEM NO. | AMPEX PART NO. | REFERENCE NUMBER          | DESCRIPTION                                   | JEDEC NO. OR MFR. PART NO. |
|----------|----------------|---------------------------|---|----------------------------|
|          | 4050758-02     |                           | AUDIO SWITCHING PWA (NHA 4010236)             |                            |
| 2        | 4840381        |                           | SCHEMATIC                                     |                            |
| 4        | 4260511-02     |                           | STRAP, POT SUPPORT                            |                            |
| 5        | 4630052-01     | J1,J2,J3                  | CONNECTOR, MODIFIED                           |                            |
| 8        | 013-650        | CR11                      | DIODE   | IN270                      |
| 9        | 013-599        | CR1,2,4,5,6,7,8,<br>10,12 | DIODE   | IN914                      |
| 10       | 013-678        | CR3,9                     | DIODE   | IN4005                     |
| 12       | 014-247        | Q1,4                      | TRANSISTOR                                    | 2N2219                     |
| 13       | 014-248        | Q5,6                      | TRANSISTOR                                    | 2N2222                     |
| 14       | 014-821        | Q7-10                     | TRANSISTOR                                    | 2N2905A                    |
| 15       | 014-383        | Q3                        | TRANSISTOR                                    | 2N2484                     |
| 18       | 020-592        | K4                        | RELAY, REED, SPST                             |                            |
| 20       | 020-810        |                           | SOCKET, RELAY WITH RETAINING SPRING           |                            |
| 23       | 034-543        | C5                        | CAPACITOR, MICA, 240 PF, 500V, 1%             |                            |
| 24       | 034-927        | C8                        | CAPACITOR, MICA, 680 PF, 500V, 5%             |                            |
| 25       | 034-938        | C9                        | CAPACITOR, MICA, 110 PF, 500V, 5%             |                            |
| 27       | 035-730        | C6                        | CAPACITOR, MYLAR, 4700 PF, 50V, 5%            |                            |
| 28       | 035-828        | C1,2,3                    | CAPACITOR, MYLAR, 0.022 UF, 50V, 5%           |                            |
| 30       | 037-908        | C7,10                     | CAPACITOR, TANT, 4.7 UF, 35V, 20%             |                            |
| 31       | 037-980        | C2                        | CAPACITOR, TANT, 10UF, 50VDC                  |                            |
| 34       | 041-013        | R7                        | RESISTOR, COMP, 4.7K, 1/2W, 5%                |                            |
| 35       | 041-102        | R9                        | RESISTOR, COMP, 1K, 1W, 5%                    |                            |
| 36       | 041-394        | R6,21,25                  | RESISTOR, COMP, 100K, 1/4W, 5%                |                            |
| 38       | 041-406        | R12                       | RESISTOR, COMP, 22K, 1/4W, 5%                 |                            |
| 39       | 041-407        | R28                       | RESISTOR, COMP, 3.3K, 1/4W, 5%                |                            |
| 40       | 041-408        | R3,4,8                    | RESISTOR, COMP, 10K, 1/4W, 5%                 |                            |
| 41       | 041-411        | R1,2,10,27                | RESISTOR, COMP, 47K, 1/4W, 5%                 |                            |
| 42       | 041-437        | R26                       | RESISTOR, COMP, 1.6K, 1/4W, 5%                |                            |
| 43       | 041-518        | R5,18                     | RESISTOR, COMP, 33K, 1/4W, 5%                 |                            |
| 44       | 041-560        | R20                       | RESISTOR, COMP, 2K, 1/4W, 5%                  |                            |
| 45       | 041-561        | R14,15,23,24              | RESISTOR, COMP, 5.1K, 1/4W, 5%                |                            |
| 46       | 041-570        | R13,22                    | RESISTOR, COMP, 2.4K, 1/4W, 5%                |                            |
| 47       | 041-550        | R29,30                    | RESISTOR, COMP, 3.0K, 1/4W, 5%                |                            |
| 49       | 051-360        | L1                        | INDUCTOR, FIXED, 4.7 MH                       |                            |
| 50       | 051-952        | L3                        | INDUCTOR, 10 MH, 5%                           |                            |
| 53       | 057-759        | R11                       | RESISTOR, METAL FILM, 3.57K, 1/4W, 1%         |                            |
| 54       | 058-837        | R16                       | RESISTOR, VAR, CARBON, 100K, 1/2W, 10%        |                            |
| 55       | 058-838        | R17,19                    | RESISTOR, VAR, CARBON, 10K, 1/2W, 10%         |                            |
| 58       | 122-405        | S1                        | SWITCH, ROTARY, 3P3T                          |                            |
| 61       | 139-513        | J4                        | CONNECTOR, WAFER, RIGHT ANGLE                 |                            |
| 63       | 169-818        |                           | KEY, POLARIZING                               |                            |
| 67       | 280-130        |                           | PAD, MTG, TRANSISTOR, REF Q3,5,6              |                            |
| 68       | 280-998        |                           | PAD, MTG, TRANSISTOR, TO-5, REF Q1,4,7,8,9,10 |                            |
| 71       | 541-133        | L2                        | INDUCTOR, VAR, 220 UH                         |                            |
| 73       | 580-394        | Q2                        | TRANSISTOR                                    | 2N5193                     |

B

SHEET 1 OF 1



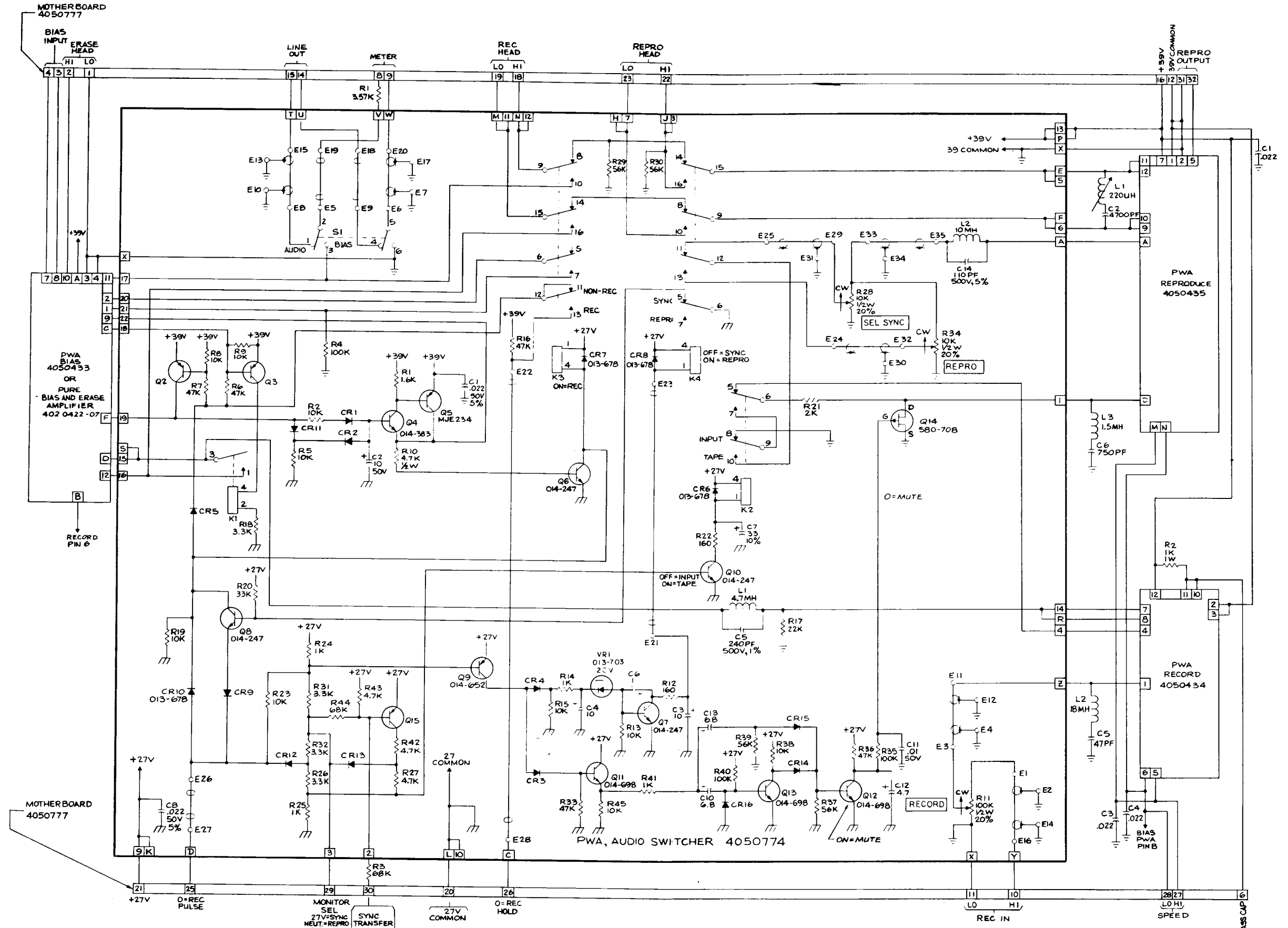
Assembly No. 4050758B. Audio Switching PWA



- NOTES: UNLESS OTHERWISE SPECIFIED
1. CAPACITANCE VALUES ARE IN MICROFARADS, 50V.
  2. DIODES ARE TYPE 013-599.
  3. RESISTANCE VALUES ARE IN OHMS, 1/4W, 5%.

| REFERENCE DESIGNATIONS |          |
|------------------------|----------|
| LAST USED              | NOT USED |
| E9                     |          |
| M                      |          |
| CR12                   |          |
| Q10                    |          |
| R50                    |          |
| C10                    |          |
| S1                     |          |
| J4                     |          |

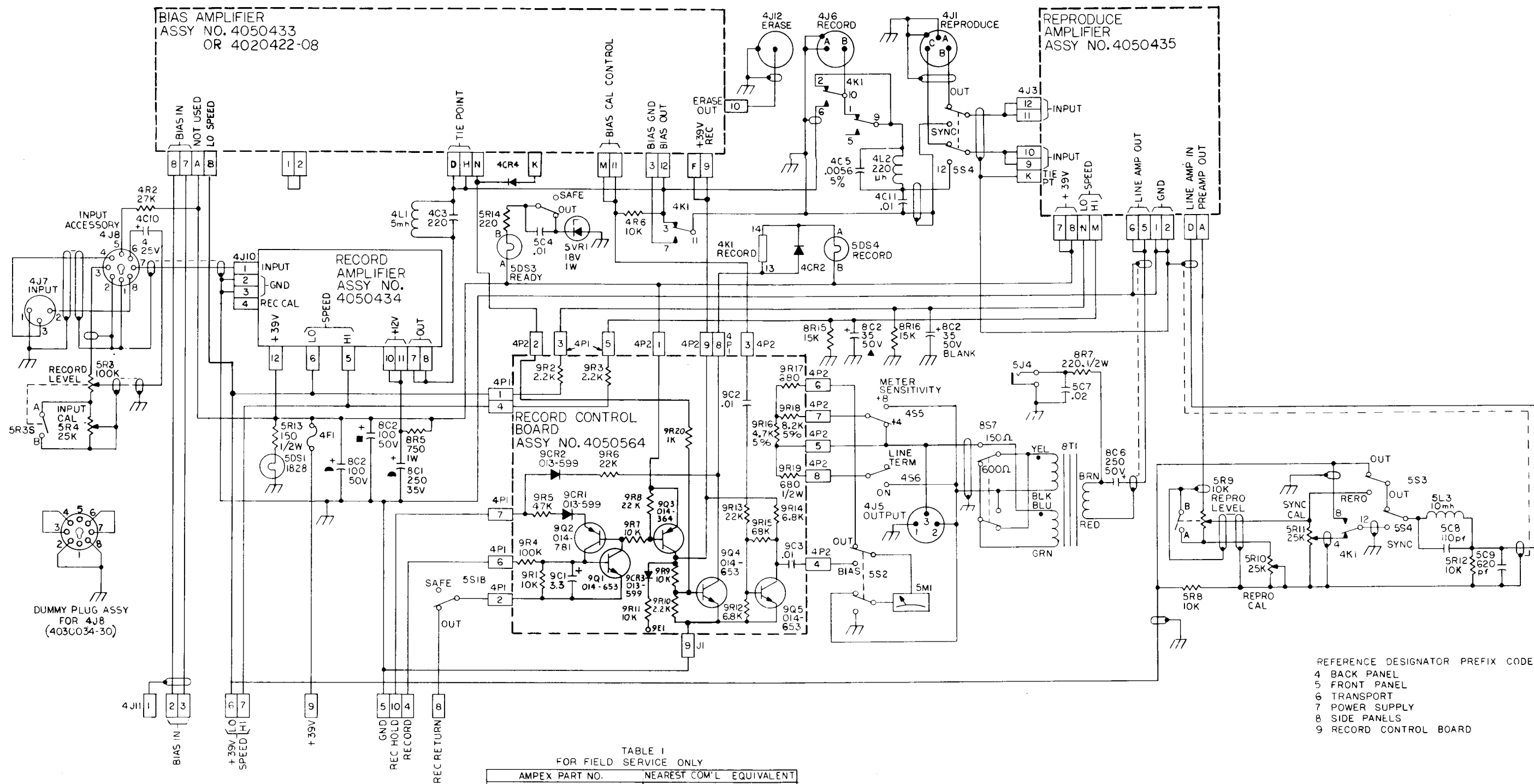
Schematic No. 4840381A.  
Audio Switching PWA



| REFERENCE DESIGNATIONS |          |
|------------------------|----------|
| LAST USED              | NOT USED |
| C14                    | C9       |
| CR11                   | CR12     |
| E25                    |          |
| K4                     |          |
| L2                     |          |
| Q15                    |          |
| R45                    |          |
| S1                     |          |
| VR1                    |          |

- NOTES: UNLESS OTHERWISE SPECIFIED
1. CAPACITANCE VALUES ARE IN MICROFARADS, 35V, 20%.
  2. RESISTANCE VALUES ARE IN OHMS, 1/4W, 5%.
  3. DIODES ARE 013-599.
  4. PWA. NO. IS 4050774-02 REV E.

Schematic No. 4840388C  
Audio Switcher PWA



REFERENCE DESIGNATOR PREFIX CODE  
 4 BACK PANEL  
 5 FRONT PANEL  
 6 TRANSPORT  
 7 POWER SUPPLY  
 8 SIDE PANELS  
 9 RECORD CONTROL BOARD

NOTES UNLESS OTHERWISE SPECIFIED  
 1 ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 10%  
 2 ALL CAPACITOR VALUES ARE IN MICROFARADS AT INDICATED VOLTAGE  
 3 ALL DIODES ARE TYPE 013-678  
 4 SEE TABLE 1 FOR FIELD SERVICE TRANSISTOR

TABLE 1  
 FOR FIELD SERVICE ONLY

| AMPEX PART NO. | NEAREST COM'L EQUIVALENT |
|----------------|--------------------------|
| 013-599        | 1N914                    |
| 014-364        | 2N2905A                  |
| 014-653        | 2N3904                   |
| 014-781        | MPS 6518                 |
| 013-678        | 1N4385                   |

| LAST REF DES USED |     | REF DES NOT USED |  |
|-------------------|-----|------------------|--|
| R 20              | P2  | DS2              |  |
| C11               | CR4 |                  |  |
| DS4               | VRI |                  |  |
| L3                | FI  |                  |  |
| T1                | K1  |                  |  |
| M1                | S7  |                  |  |
| J13               |     |                  |  |

Schematic No. 4840415A.  
 Electronics