

SECTION 6

PRINCIPLES OF OPERATION

6.1 TRANSPORT OPERATION**6.2 INTRODUCTION (See Figure 6-1)**

6.3 The tape transport uses a two-speed synchronous motor and a system of pulleys, belts, and clutches to drive the reel turntables and the capstan. The three modes of tape motion (play, rewind, and fast-forward) are set by two controls on the tape transport; the neutral position for each control is marked by a dot.

6.4 Power is applied to the drive motor when the POWER switch is turned to ON. The capstan (16, Figure 6-1) is immediately driven by a nylon belt (3) between the motor pulley (8) and the capstan flywheel. A second belt (14), in a groove of the capstan flywheel, drives the play takeup pulley (13). The shock-relief brake rollers (2 and 12) are moved against the fast-forward and rewind rubber-tired clutches (4 and 9). Both turntables remain motionless, with the machine in standby condition.

6.5 PLAY MODE

6.6 Since the capstan is rotating when the machine is in standby, the tape rapidly accelerates to play speed, set by the SPEED/EQUALIZATION switch, when the PLAY/REC switch is moved to PLAY. Other resulting action is as follows:

1. The play takeup pulley (13) and belt (14) contact the play takeup clutch (11).
2. The shock-relief brake roller (12) releases from the fast forward clutch tire (9).

3. The capstan idler (15) engages the capstan (16), which drives the tape, pulling the tape from the supply turntable and feeding it to the takeup turntable.

4. The shock-relief brake roller (2) remains engaged with the rewind clutch tire; therefore slippage occurs between the clutch and brake disc. The friction produced in this slippage, and the friction produced by the rewind-holdback brake (6) on the plastic drum (5), provide the required tape holdback tension.

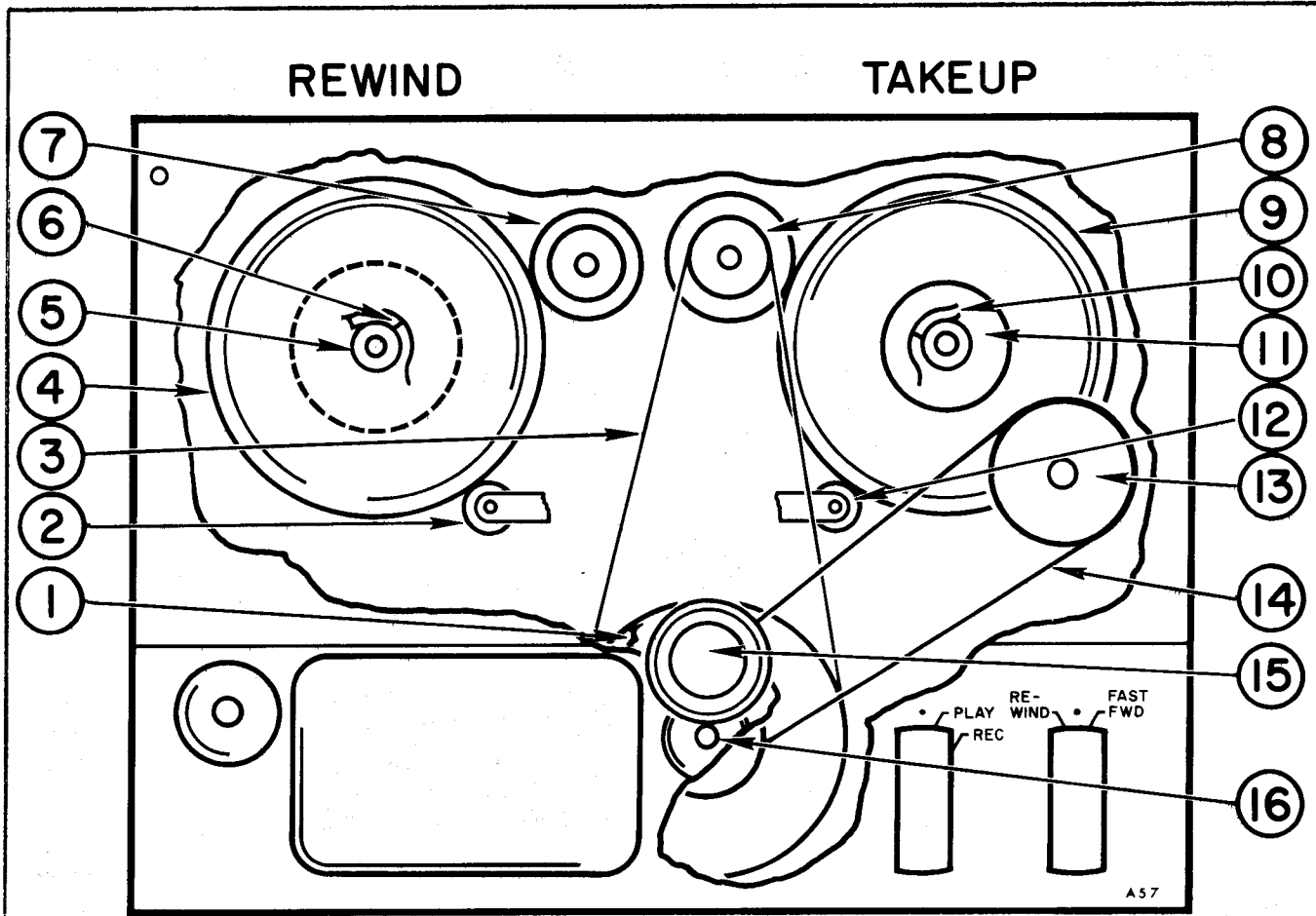
6.7 REWIND MODE

6.8 The REWIND/FAST-FWD control can be operated only when the PLAY control is in neutral. When the REWIND/FAST-FWD control is turned to REWIND, the following occurs:

1. Both shock-relief brake rollers (2 and 12) release.
2. The rewind idler (7) is clamped between the motor pulley (8) and the rewind clutch tire to drive the rewind turntable.
3. Holdback tension is provided by the holdback brake (10, on the takeup assembly) as tape is pulled from the takeup turntable.

NOTE

Fast-wind speed is halved when SPEED/EQUALIZATION switch is set to SLOW.



INDEX	TITLE
1.	Pulley, Capstan
2.	Roller, Brake, Shock-Relief
3.	Belt, Drive, Capstan
4.	Tire, Clutch, Rewind
5.	Drum (Plastic)
6.	Brake, Rewind-Holdback
7.	Idler, Rewind
8.	Pulley, Drive

INDEX	TITLE
9.	Tire, Clutch, Fast-Forward
10.	Brake, Takeup-Holdback
11.	Drum (Plastic)
12.	Roller, Brake, Shock-Relief
13.	Pulley, Play-Takeup
14.	Belt, Drive, Play-Takeup
15.	Idler, Capstan
16.	Capstan

Figure 6-1. Transport Tape Drive

6.9 FAST-FORWARD MODE

6.10 When the REWIND/FAST-FWD control is turned to FAST FWD, the following occurs:

1. Both shock-relief brake rollers (2 and 12) release.
2. The rubber-tired fast forward clutch (9) contacts the motor pulley (8) to drive the takeup turntable.
3. Holdback tension is provided by the holdback brake (6, on the supply turntable) as tape winds on the takeup turntable.

6.11 ELECTRONIC OPERATION (See Figure 6-2)

NOTE

Schematic diagrams are provided in Section 7.

6.12 RECORD CIRCUIT

6.13 The signal to be recorded enters receptacles J4 (input A) and/or J6 (input B), and then goes to INPUT ACCESSORY sockets J5 and/or J7, respectively. Either a dummy plug, an accessory transformer, or a microphone (refer to Section 1) must be inserted in J5 and J7 to complete the signal paths.

6.14 One side of the signal connects to the accessory sockets at pin 4, leaves at pin 3, connects across the RECORD LEVEL control, returns to socket pin 6, and finally leaves at pin 7. This allows a record-level control to be connected between the two amplifier stages of the microphone preamplifier. The preamplifier thus functions as a variable-gain device usable with a wide range of microphones.

6.15 After the accessory socket and level control, the two input signals are connected together through a resistive mixing circuit to the base of amplifier stage Q8; the col-

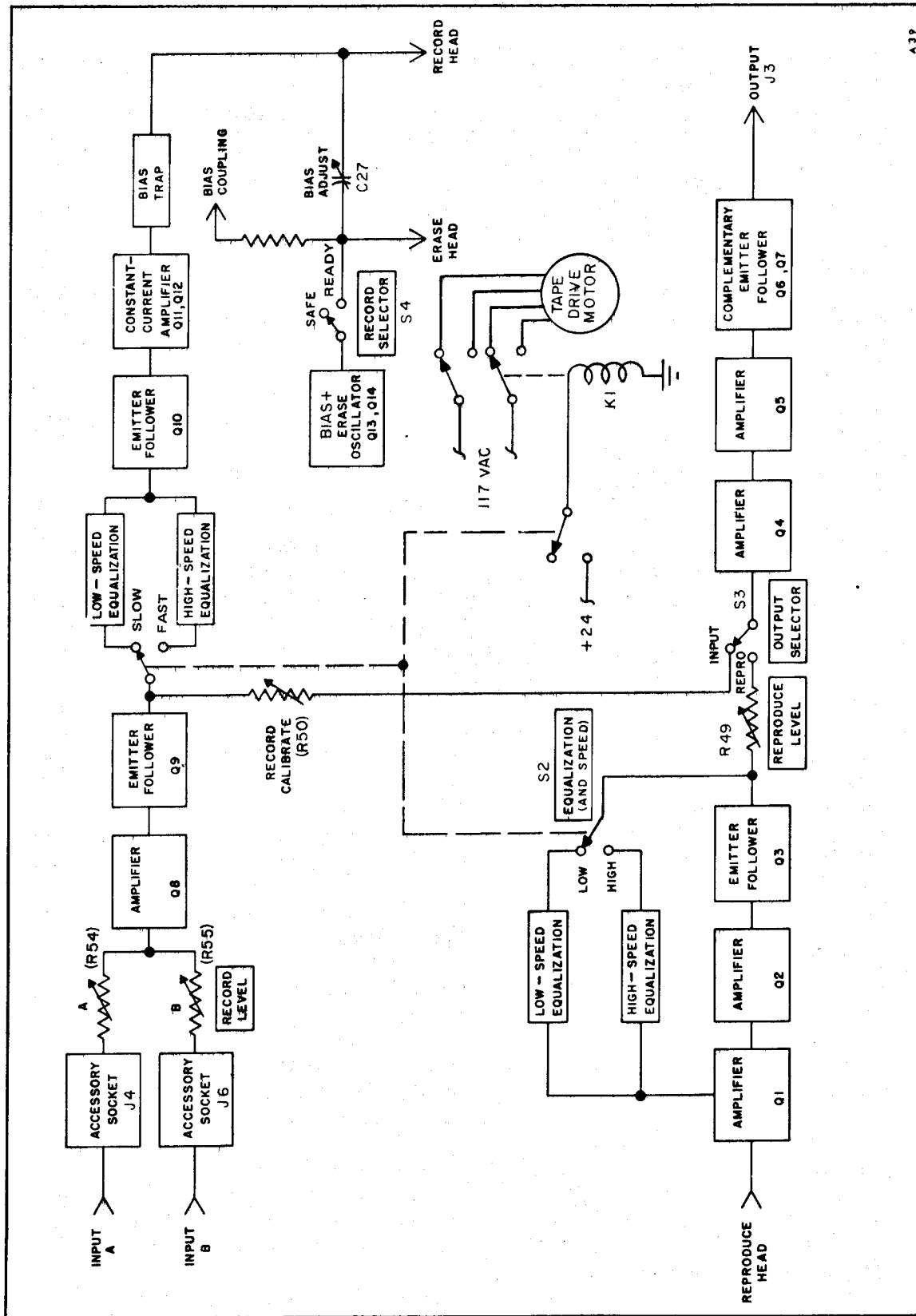
lector load for Q8 consists of the base circuit of emitter-follower stage Q9. Q9 output signals are 'record' and 'record monitor'.

6.16 The record signal is connected to contacts of SPEED/EQUALIZATION switch S2, for switching to the HIGH or LOW motor speed and record-equalization circuits. The equalization circuit consists of a resistor R29 which is shunted by resistor R56 and then capacitor C25 (high speed), or C26 (low speed), as selected by the switch. The record-monitor signal is connected, through resistor R51 and RECORD CAL control R50, to contacts of the OUTPUT SELECTOR switch. When that switch is at INPUT, the signal proceeds through the final three stages of the reproduce circuit (refer to paragraph 6.21) to the VU meter and output line for monitoring and calibration purposes.

6.17 In the record signal path, emitter-follower stage Q10 follows the record equalization circuit. The signal is then amplified in a constant-current amplifier stage, Q11 and Q12, in which Q12 acts as current booster for Q11. The circuit has a high ac impedance (to provide a current insensitive to head impedance changes, which occur when signal frequency changes), but a low dc impedance (so the dc operating voltage is fully utilized). The signal then proceeds through a bias trap (L1, C15), is mixed with the ac bias, and continues to the record head.

6.18 The record amplifier is energized through contacts of the RECORD SELECTOR switch S4 and PLAY/REC switch S5. In the record mode, this shifts the dc bias on transistor Q10, causing it, and subsequently Q11 and Q12, to conduct; when the switch contacts are open, the three transistors are cut off. Therefore, the amplifier operates only in the record mode.

6.19 Transistors Q13 and Q14 form the bias-and-erase oscillator, a conventional push-pull circuit connected as a tuned flip-flop. It is energized only in the record mode, through contacts of the RECORD SELECTOR and PLAY/REC switches.



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Figure 6-2. Electronic Circuit Diagram

Symmetry of the output waveform is adjusted by resistor R62, and the frequency is adjusted by a tuning slug in transformer T1 (nominal bias frequency is 100,000 Hz).

6.20 The bias-and-erase oscillator output proceeds from the secondary of T1 to the RECORD SELECTOR switch S4. When the switch is at RECORD, the bias current passes through capacitor C28 to the erase head. Another leg is adjusted by capacitor C27, mixed with the record signal and routed to the record head. In addition, a bias line passes through resistor R58 to pin 7 of receptacle J11. In two-channel equipment, pin 7 is connected to the bias oscillator output in the slave electronic assembly; which locks the two oscillator frequencies together so that no beat frequency is generated.

6.21 REPRODUCE CIRCUIT

6.22 From the reproduce head, the recorded signal passes through two amplifier stages (Q1 and Q2) and an emitter-follower stage (Q3). The reproduce equalization circuits connect from the emitter of Q3, through SPEED/EQUALIZATION switch S2, and then to the emitter of Q1. Variable resistor R47 (high speed) or R48 (low speed) is used for circuit equalization.

6.23 From emitter follower Q3 the signal proceeds through the REPRODUCE LEVEL control R49 and OUTPUT SELECTOR switch S3. The switch must be set at REPRODUCE

during playback. When this switch is at INPUT, the record monitor circuit connects through two amplifier stages (Q4 and Q5), a complementary emitter-follower stage Q6/Q7, and a transformer, to the VU meter and OUTPUT connector J3. Headsets with at least 4 ohms impedance can be used to monitor the output at PHONES jack J2 (series-connected with resistor R52 across the output transformer primary).

6.24 POWER SUPPLY, DOMESTIC

6.25 The ac line power is connected to the master electronic assembly; one side (fused by F1) connects through power switch S1 across the power transformer, T3, primary.

6.26 Diodes CR2 and CR3 provide full-wave rectification at the center-tapped secondary of T3. Transistor Q15 is a series (emitter-follower) power transistor. Zener diode VR1 holds the Q15 base (and thus the emitter) at a constant potential of 23.4 volts $\pm 5\%$.

6.27 POWER SUPPLY, INTERNATIONAL

6.28 The international type of recorder differs only in the power input; a selector switch on the electronic assembly back must be set to correspond with the ac-power line voltage of 115 or 230 volts.

6.29 Line power, connected to receptacle J10, is controlled by switch S1 and fused by F1.

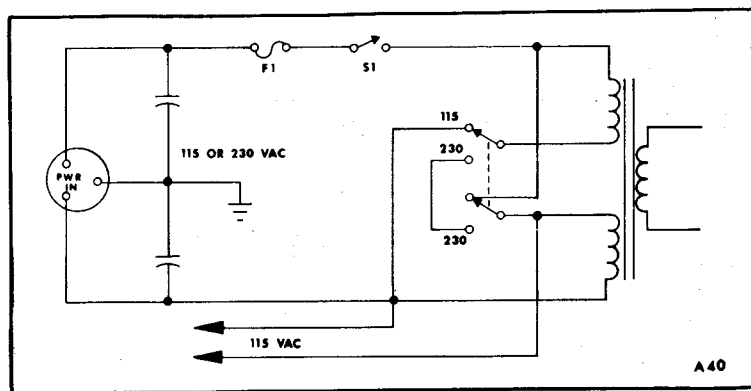
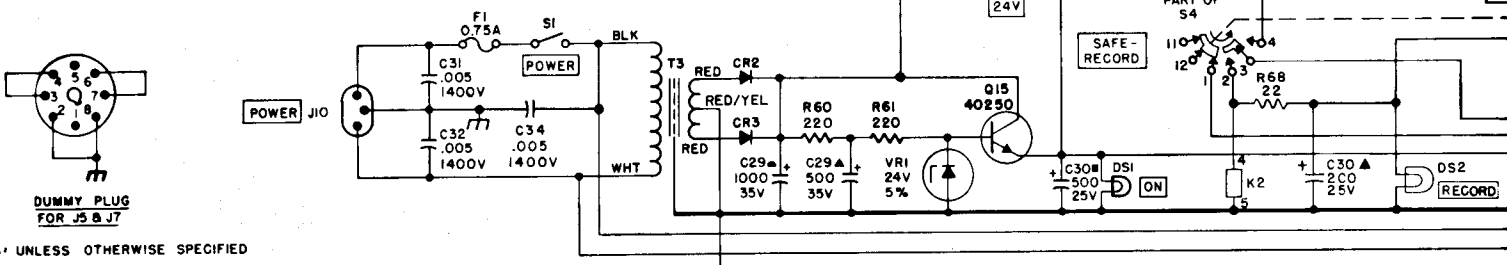
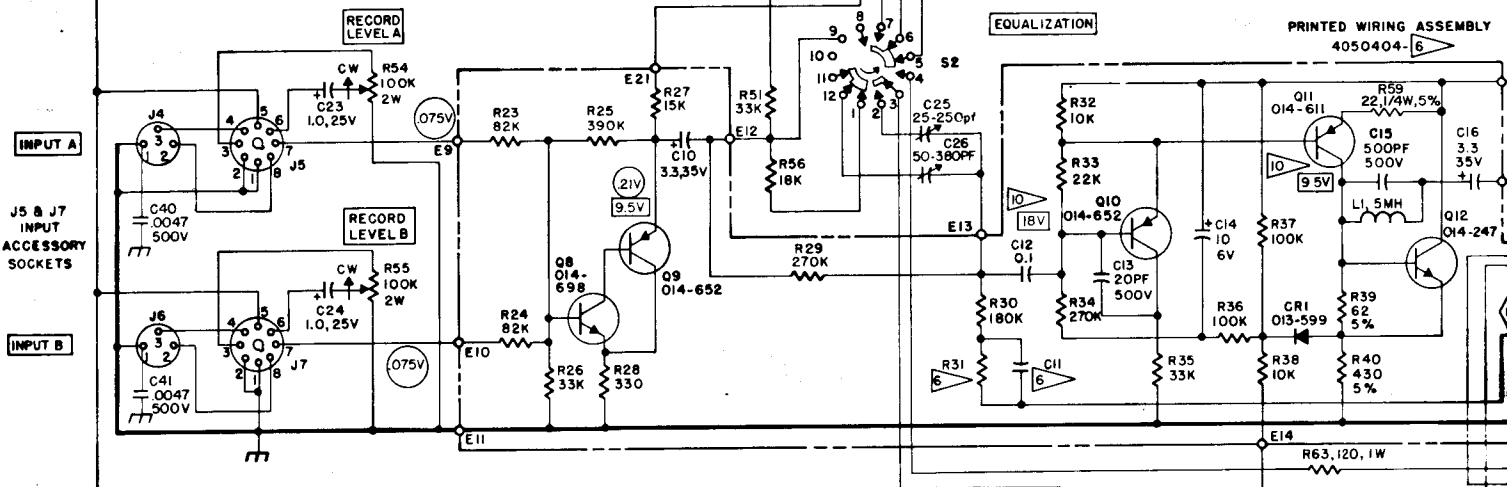
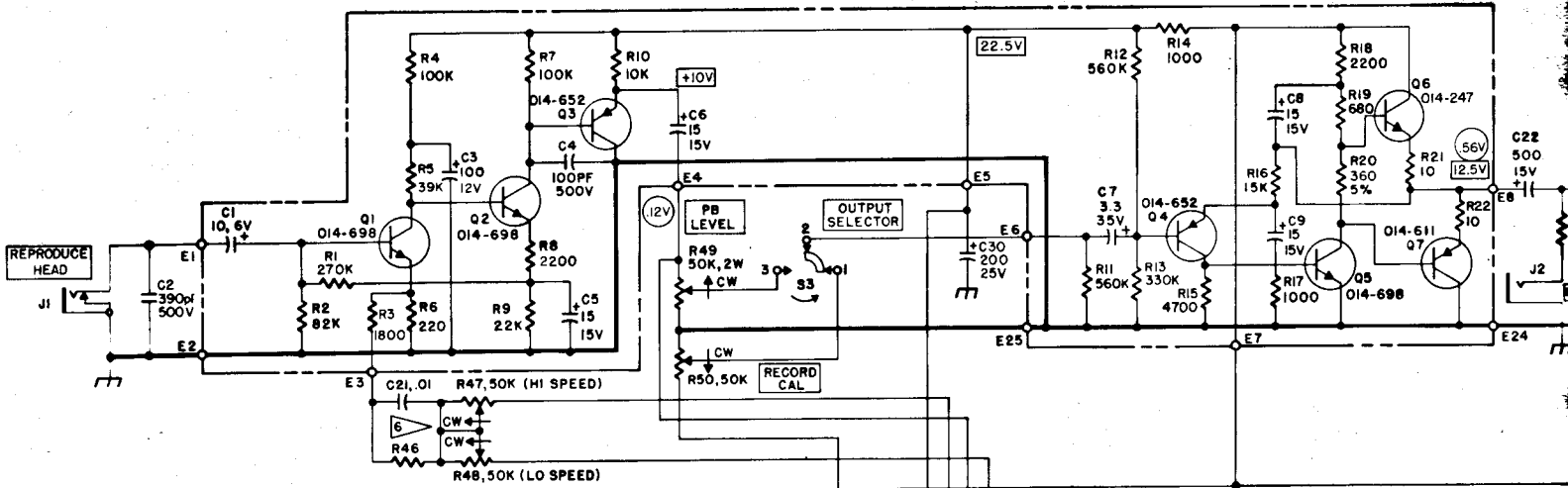


Figure 6-3. Input Circuit, International Version

6.30 The ac power connects across the two primary windings of power transformer T3, and the 115V-230V switch is connected between the windings. In the 230V switch position, the windings are connected in series

across the power line and 115 volts ac (at the windings junction) is routed to the transport. In the 115V switch position, the two windings are connected in parallel, and both sides of the line are routed to the transport.



- NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES ARE IN OHMS, 1/2W, 10%.
 2. ALL CAPACITOR VALUES ARE IN MICROFARADS, 100V.
 3. ALL DIODES ARE TYPE O13-678.
 4. ALL SWITCHES ARE IN CCW OR OFF POSITION.
 5. FOR FIELD SERVICE ONLY:
Q1, Q2, Q3, Q8 MAY BE 2N3565 OR 2N3117.
Q3, Q4, Q9, Q10 MAY BE 2N3906.
Q7, Q11 MAY BE 2N3638.
Q6 & Q12 MAY BE 2N2219.

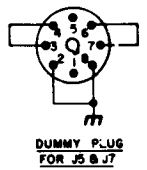
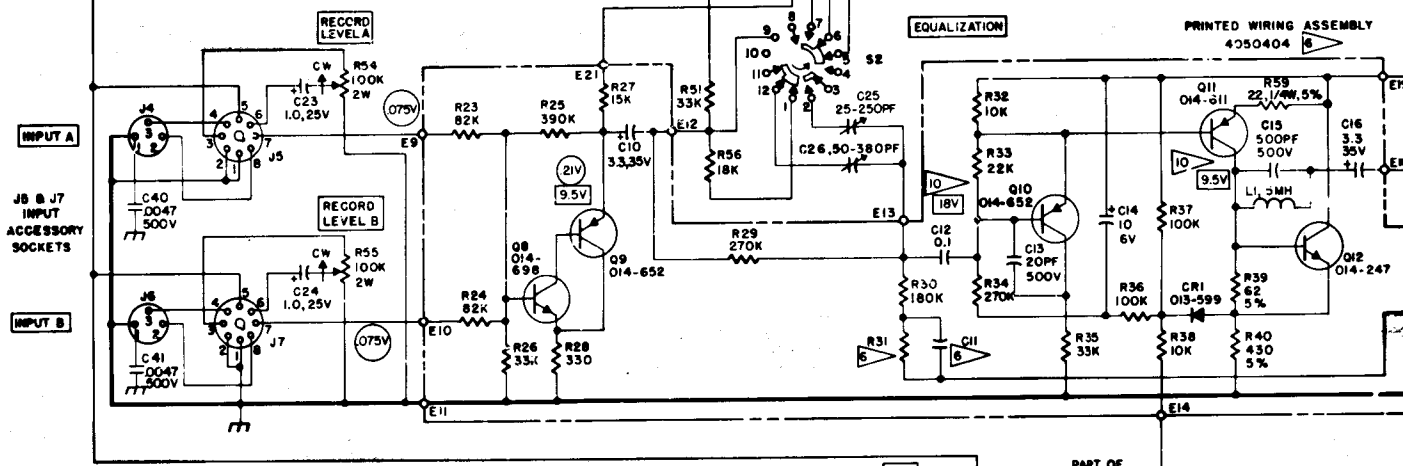
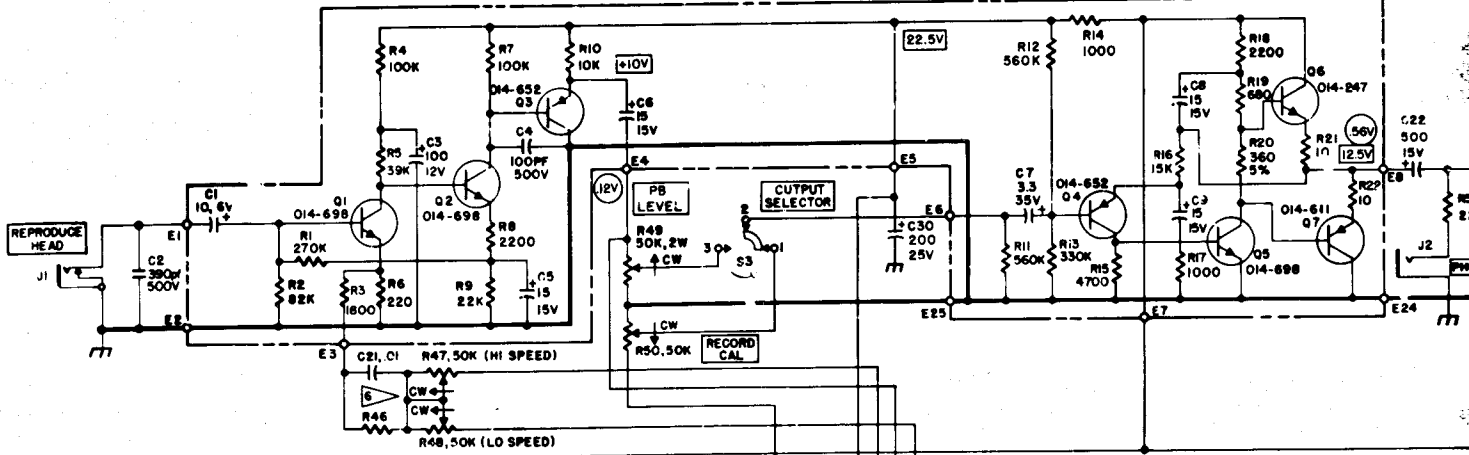
FOR NAB EQUALIZATION		
REF DES	DESCRIPTION	ASSEMBLY
R31	180K	4050404
R46	360K, 5%	4050251
C11	.018	4050404

FOR CCIR EQUALIZATION		
REF DES	DESCRIPTION	ASSEMBLY
R31	0	4050404
R46	2.2 meg	4050251
C11	OPEN	4050404

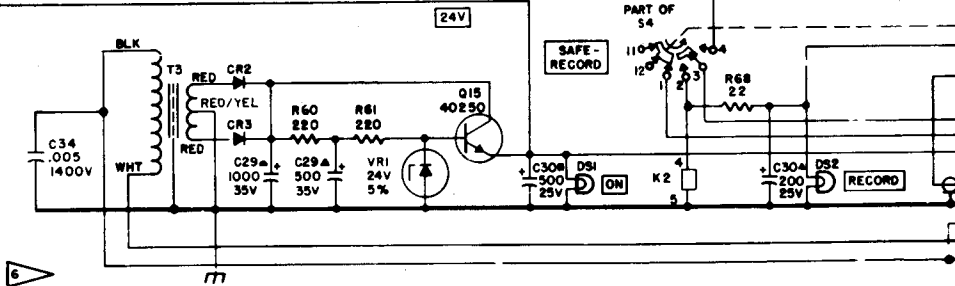
7. INDICATES VOLTS D.C. MEASURED WITH A 20,000Ω/V METER.
8. INDICATES VOLTS R.M.S. MEASURED WITH A HIGH IMPEDANCE VTVM AT OPERATING LEVEL OF 1000HZ.
9. INDICATES VOLTS R.M.S. MEASURED WITH A HIGH IMPEDANCE VTVM AT BIAS FREQUENCY WITH RECORDS IN RECORD MODE.

MEASURED WITH ELECTRONICS IN RECORD MODE.

PRINTED WIRING ASSEMBLY
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- NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR VALUES ARE IN OHMS, 1/2W, 10%.
 2. ALL CAPACITOR VALUES ARE IN MICROFARADS, 100V.
 3. ALL DIODES ARE TYPE O13-67B.
 4. ALL SWITCHES ARE IN CW OR OFF POSITION.
 5. FOR FIELD SERVICE ONLY:
Q1, Q2, Q5, Q8 MAY BE 2N3565 OR 2N3117.
Q3, Q4, Q9, Q10 MAY BE 2N3906.
Q7, Q11 MAY BE 2N3638.
Q6 & Q12 MAY BE 2N2219.



FOR NAB EQUALIZATION		
REF DES	DESCRIPTION	ASSEMBLY
R31	180K	4050404
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FOR GCIR EQUALIZATION		
REF DES	DESCRIPTION	ASSEMBLY
R31	0	4050404
R46	2.2 meg	4050251
C11	OPEN	4050404

7. \otimes INDICATES VOLTS D.C. MEASURED WITH A 20,000Ω/V METER.
 8. \otimes INDICATES VOLTS R.M.S. MEASURED WITH A HIGH IMPEDANCE VTVM AT OPERATING LEVEL OF 100 HZ.
 9. \otimes INDICATES VOLTS R.M.S. MEASURED WITH A HIGH IMPEDANCE VTVM AT BIAS FREQUENCY WITH ELECTRONICS IN RECORD MODE.
- \triangle MEASURED WITH ELECTRONICS IN RECORD MODE.

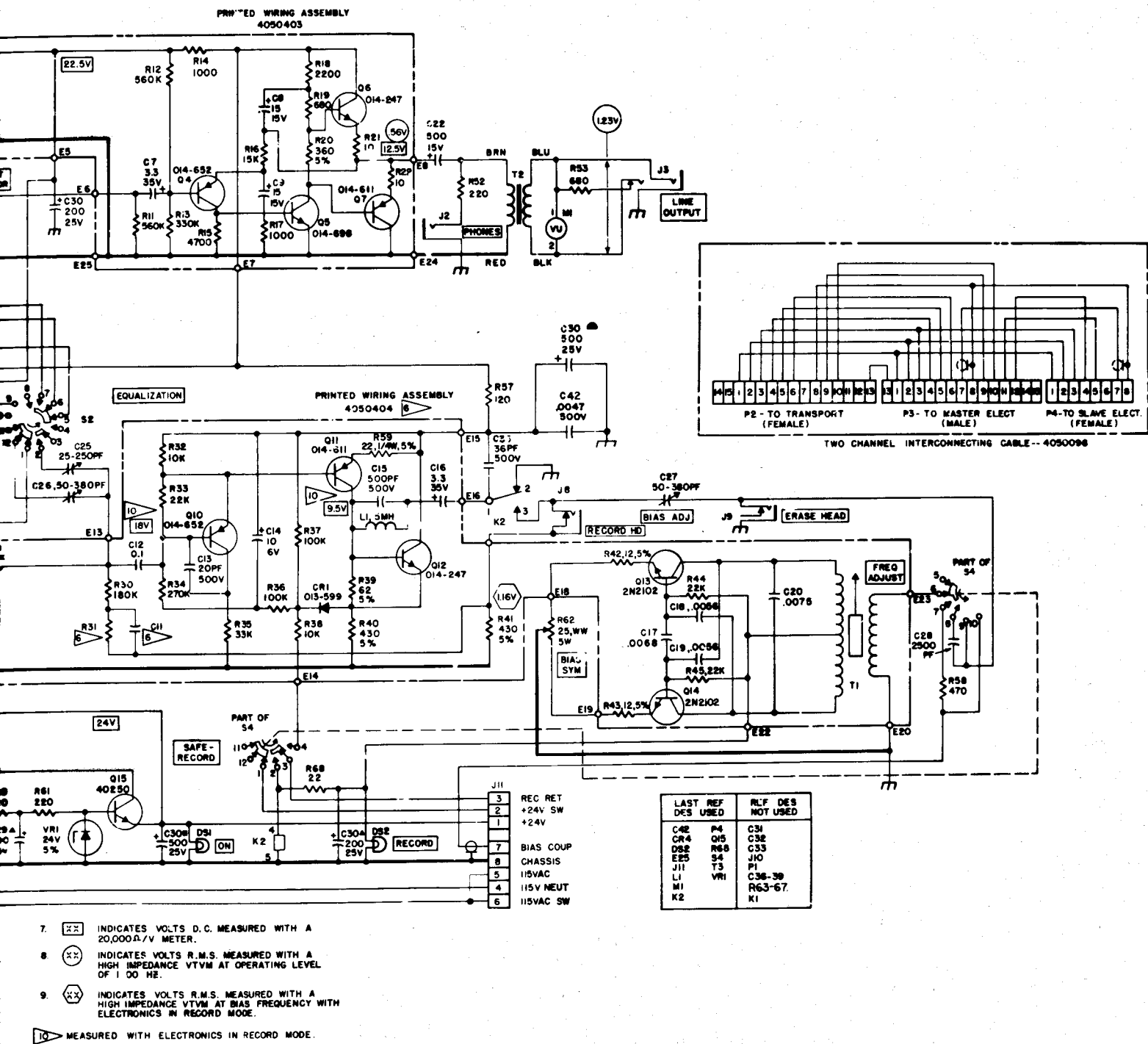


Figure 7-20. Schematic Diagram,
Slave Electronics
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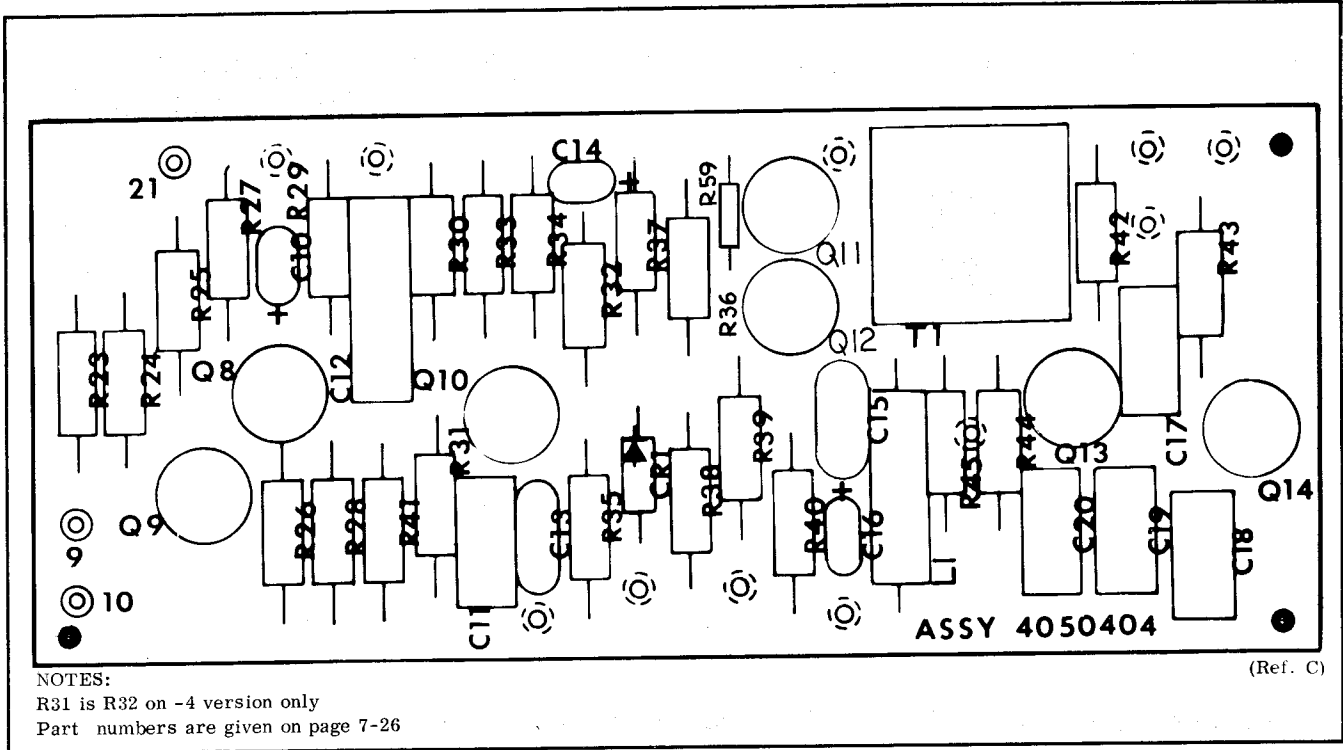


Figure 7-22. Record Printed Wiring Board

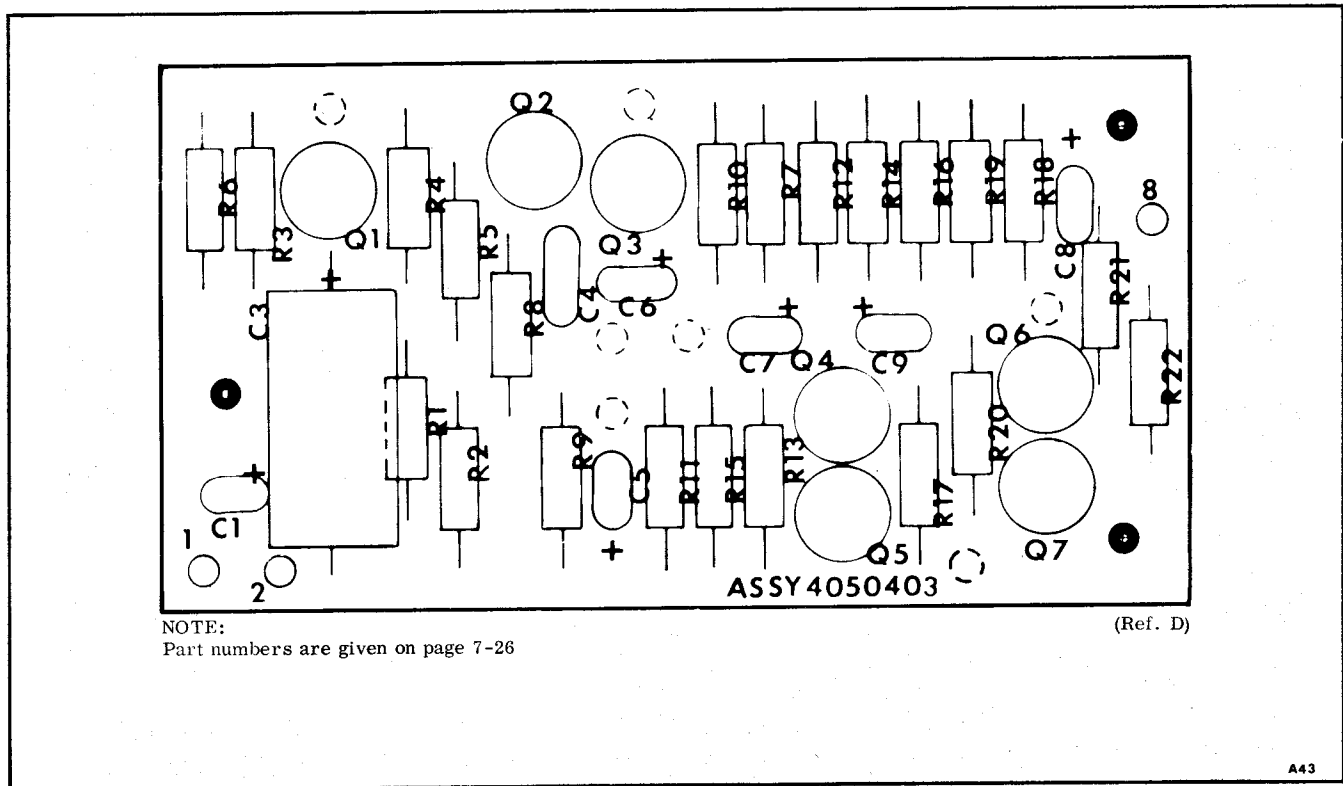


Figure 7-23. Reproduce Printed Wiring Board