TECHNICAL MANUAL
PD-II SERIES
CARTRIDGE
RECORDER AND REPRODUCER

INTERNATIONAL TAPETRONICS CORPORATION
2425 South Main Street Bloomington, Illinois 61701 Telephone: 309-828-1381

TECHNICAL MANUAL

(890-0013-000)

PD-II SERIES

CARTRIDGE

RECORDER AND REPRODUCER

REPRODUCER	826-0018-000
RECORDER/REPRODUCER	829-0008-000

INTERNATIONAL TAPETRONICS CORPORATION

2425 South Main Street, Bloomington, Illinois 61701 Telephone: 309-828-1381

TECHNICAL MANUAL

TABLE OF CONTENTS — PD-II SERIES

ILLUSTRATIONS

SECTION I

INTRODUCTION — PD-II SERIES

A. GENERAL DESCRIPTION

ITC PD-II magnetic cartridge Recorder/Reproducers and Reproducers are designed to meet or exceed the NAB standards for cartridge tape recording and reproducing. Two configurations--reproducer only and recorder/reproducer--are available and accept the NAB type A cartridge.

Solid-state electronics amplify the signals provided by laminated heads and supply an NAB equalized signal to the output transformer. Upon the conclusion of the audio, the Reproducer continues to advance the tape until a 1 kHz primary cue tone is detected, whereupon the 1 kHz cue detector stops the tape drive mechanism.

The printed circuit electronics include the latest silicon solid-state diodes, transistors, and integrated circuits. The series regulated power supply is an integrated circuit in a TO-220 case. All switching and logic is performed with solid state components. No relays are used.

The cue tone detector utilizes reliable R-C networks. The program amplifier has NAB equalization and a transformer coupled output. Several other features improve the ease and reliability of operation and serviceability. The ITC PD-II units are designed with a removable top cover which facilitates cleaning, maintenance and adjustment. Barrier type terminals are supplied for audio output and remote control. Socket connectors for head cables provide plug-in connection at the heads. This feature permits ease of reversing cue and program output for servicing and facilitates head replacement. A full-swing pressure roller is connected to the actuating solenoid by a mechanically simple chain linkage with a screw adjustment for pressure roller/capstan pressure. Air damping of the solenoid is adjustable with a needle valve. The direct-capstan, 450 RPM, hysteresis-synchronous drive motor with an electrolyzed shaft provides optimum tape drive. Provision is made for full remote control including indicating lamps.

B. SPECIFICATIONS - PD-II SERIES REPRODUCER

Power: 117 volts AC, 60 Hz, 112 Watts Maximum - Full Load (No Remotes)

Tape Speed: 7½ inches per second (direct drive hysteresis-synchronous motor with electrolyzed shaft and instrument-type permanently lubricated ball bearings)

Wow and Flutter: .2% NAB weighted or less

Timing Accuracy: ±.2%

Audio Output: +15 dBm before clipping; normally +5 dBm: 600 ohms

Distortion: 2% or less, record to playback at 0 VU record level

Noise: 50 dB or better below reference of 400 Hz at 3% THD

Cross Talk Between Channels: Better than 50 dB at 1 kHz

Frequency Response: ±2 dB from 50 to 12,000 Hz

Equalization: NAB (adjustable to compensate for head wear and other factors)

Cue Signal: NAB primary cue, 1 kHz, standard

Playback Time: 2 seconds to 10.5 minutes, NAB size A cartridge only

Start Time: Depends on air damping adjustment on solenoid

Ambient Temperature: 55 degrees C, maximum

Remote Control: All controls and indicators

Mounting: All units supplied as desk top mounting

Dimensions: 5 1/4" high (add 3/8" for rubber feet), 15" deep, 5 3/4" wide

Weight: 14 pounds

Head Configuration: NAB

C. SPECIFICATIONS - PD-II SERIES RECORDER/REPRODUCER

Audio Input: Line input impedance; 600 ohms balanced, -20 dBm to 0 dBm level

Metering: Taut-band movement with "A" scale

Distortion: 2% or less, record to playback at 0 VU record level

Noise: 50 dB or better below reference of 400 Hz at 3% THD

Cross Talk Between Channels: Better than 50 dB at 1 kHz

Frequency Response: ±2 dB from 50 to 12,000 Hz

Equalization: NAB

Cue Signals: 1 kHz primary cue, standard; automatically recorded at start of recording

Bias Oscillator Frequency: 75 kHz

Remote Control: All indicators and functions

Dimensions: 5 1/4" high (add 3/8" for rubber feet), 15" deep, 5 3/4" wide

Weight: 15 pounds

SECTION II

INSTALLATION AND OPERATION — PD-II SERIES

A. UNPACKING

Remove the ITC cartridge unit from the shipping carton and inspect the unit for damage. All packing material must be retained if a claim for shipping damage is to be filed; and, therefore, should be kept on hand until installation has been completed in case concealed damage is discovered. If shipping damage is found, contact ITC for assistance in the filing of claims.

B. INSTALLATION

PD-II Reproducers and Recorder/Reproducers are available in desk top mounting. Two inches of space should be provided above the machine for adequate ventilation. Records, paper, or other material should not be placed on top of the machine.

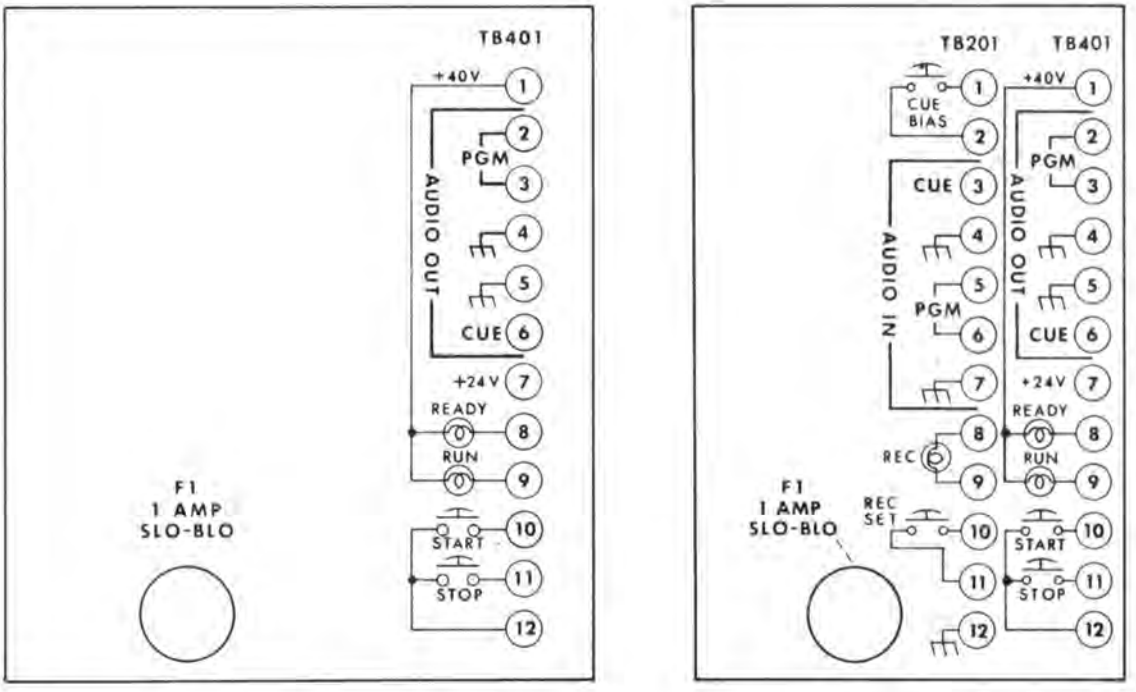


FIGURE 2-1

C. EXTERNAL CONNECTIONS - CONTROL

Remote control connections are provided on two 12 pin barrier terminal strips. The right (as viewed from the rear) terminal strip is used for audio connections for the reproducer and the left strip is for audio and control of the recorder. Barrier strip location is provided in Figure 2-1. Ground switching is employed for all remote control functions. Normally open, momentary action switches are utilized for both the remote START and STOP functions. Sample remote control schematics are shown in Figure 2-2 and Figure 2-3.

REPRODUCER
SAMPLE REMOTE CONTROL

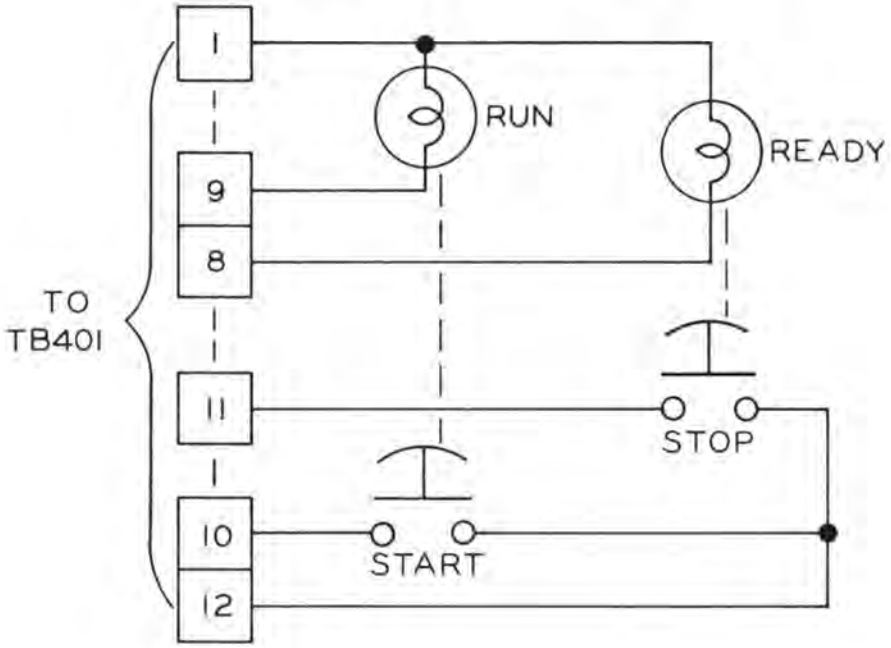


FIGURE 2-2

RECORDER
SAMPLE REMOTE CONTROL

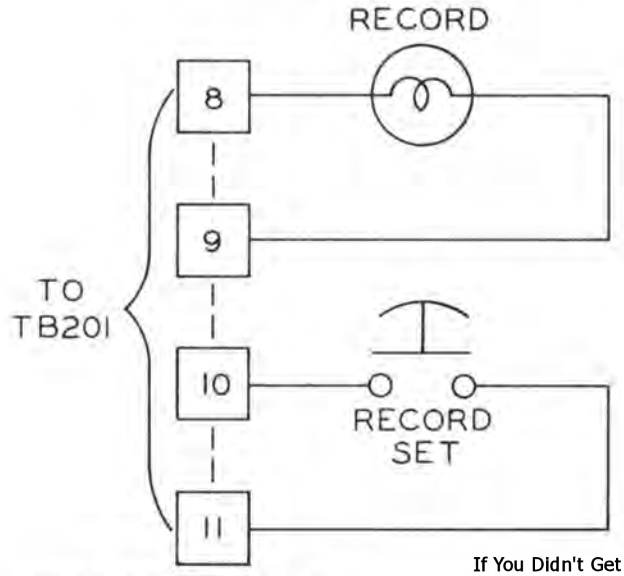


FIGURE 2-3

D. EXTERNAL CONNECTIONS - AUDIO

Terminal information is provided in Figure 2-1. The impedance of the audio input and output is 600 ohms.

E. CONTROL SWITCHES AND INDICATORS (See Figure 2-4)

CARTRIDGE SWITCH: The cartridge Sensing Micro Switch provides a "Ready" indication to the Reproducer's control circuit and illuminates the indicator lamp in the STOP Switch. The Cartridge Switch must be activated in order for the Reproducer to be started.

START SWITCH: The Start Switch is used to energize the Reproducer's pressure roller solenoid and put the tape in motion. The indicator lamp in the Start Switch shows that the machine is in a "Run" condition.

STOP SWITCH: The Stop Switch can be pressed to stop the tape drive system. (Remember that unless a cartridge stops automatically, it will not be properly cued for the next play.) The indicator lamp in the Stop Switch shows that a cartridge has been properly loaded and the machine is "Ready" to be started.

RECORD SWITCH: The Record Switch is used to place the unit in the recording mode. This condition can be achieved when a cartridge has been properly loaded in the Reproducer and the machine is "Ready" to be started. An indicator lamp in the Record Switch shows that the unit is in the recording mode.

LEVEL CONTROL: The Level Potentiometer provides an adjustment of the input level feeding the program recording amplifier. A visual indication of level is provided by the meter adjacent to this potentiometer.

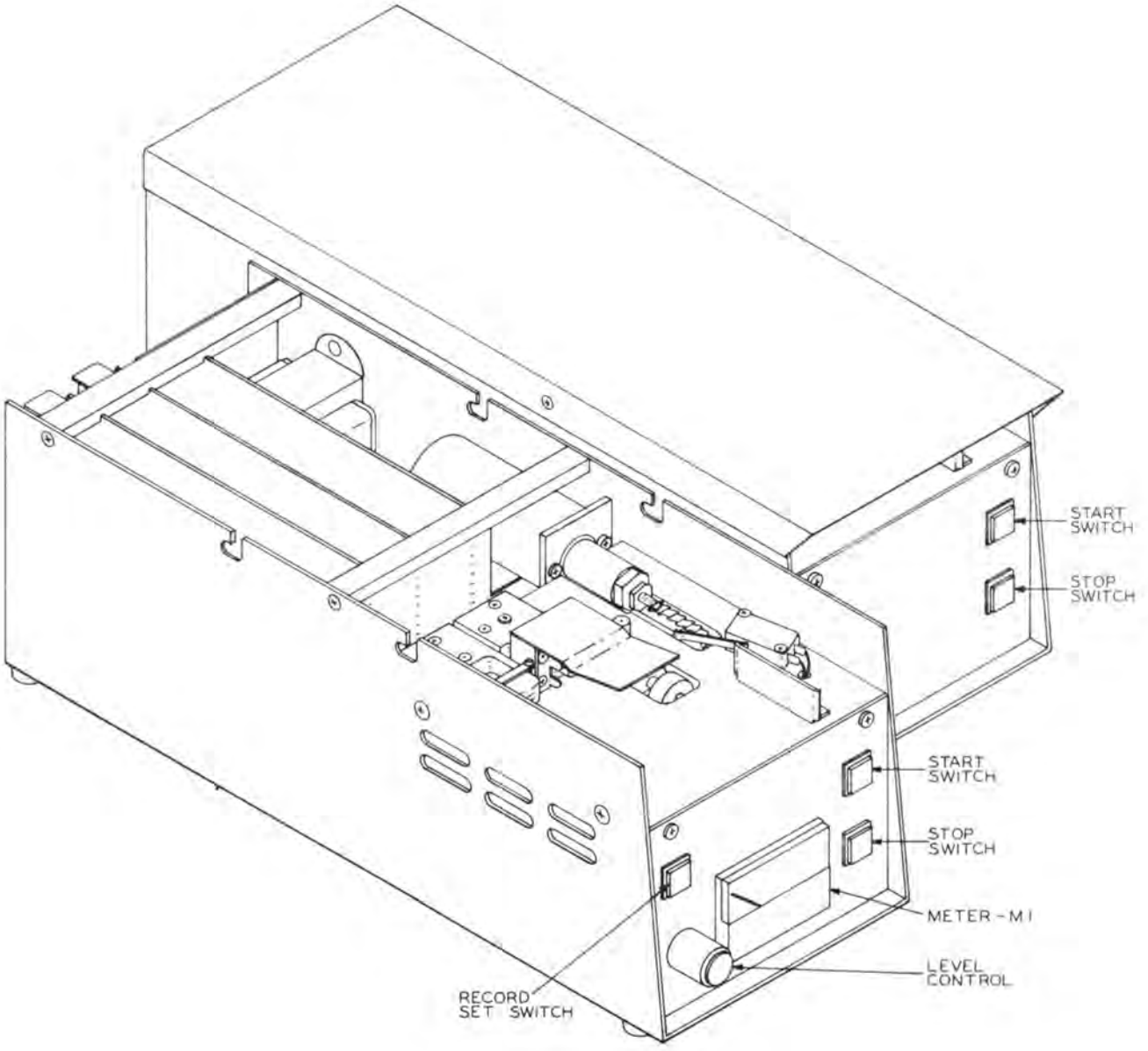


FIGURE 2-4

F. OPERATING PROCEDURES

To play a tape cartridge -

1. Insert a properly recorded tape cartridge into the right hand side of the cartridge slot.

2. Check to see that the ready lamp (stop switch) is illuminated, indicating that the cartridge has been properly inserted and that the Reproducer is "ready" for operation.

3. Press the start switch momentarily. The tape drive system will be started, and tape motion will continue until the primary (1 kHz) cue tone automatically stops the machine or until the stop switch is pressed.

SECTION III

PRINCIPLES OF MECHANICAL OPERATION — PD-II SERIES

A. HEAD ASSEMBLY

The dependability and the amount of maintenance is improved with the use of heads with a front contour of hyperbolic shape. The shape and material reduce the need for cleaning and relieve the problems caused by pressure pads.

The PD-II head assembly contains three tape guides of non-magnetic material which are rigidly supported and will not lose alignment. The head mounting bracket is of very sturdy construction with the azimuth pivot point directly behind the center of the head in both a vertical and horizontal plane. This feature permits azimuth adjustment without disturbing the height adjustment.

B. CAPSTAN DRIVE

Proper drive of cartridge tape is much more difficult than in reel-to-reel and other tape systems. In a cartridge the tape pulls from the center and winds back on the outside of an endless loop of tape. Therefore, the tape must slip upon itself as the cartridge plays. This slipping action does not occur at an even rate, and the tape tends to jerk as it pulls from the center of the hub. Also, the tape is coated with a lubricant which reduces drive friction. One means of improving tape drive would be to use a larger pressure roller. However, this is not possible since there is insufficient clearance in the bottom of the cartridge for a larger roller. Increasing the size of the capstan results in the improved tape drive required in a cartridge machine. The use of a 450 RPM direct drive motor results in a large capstan (.3180) diameter. The hystersis-synchronous direct drive motor will always turn at 450 RPM since there are no belts or pulleys to introduce speed variables.

With a large capstan, directly driven, extremely accurate tape drive can be achieved if the tape is not permitted to slip between the pressure roller and capstan. In the PD-II machine, this problem is eliminated by machining the shaft to a very high polish (4 micro inch finish or less) and then blasting the shaft with aluminum oxide particles. This causes a random roughened pattern which provides the positive tape drive demanded of modern cartridge machines. A solu-

tion to holding the roughened pattern and not permitting it to wear off is accomplished with a process called electrolyzing which provides a shaft finish life of approximately five years.

C. PRESSURE ROLLER LINKAGE

The chain assembly which causes the pressure roller to contact the capstan is a very simple mechanical concept which has a design life in excess of a million operations. The pressure roller cross shaft must have much greater turning torque as the roller contacts the capstan. The increased torque is usually gained by complicated and unreliable mechanical linkage assembly. In the PD-II the required torque is achieved by using a very simple but reliable chain and sprocket. The special shape of the solenoid plunger provides the required torque curve. The final pressure roller pressure is adjusted with the screw which attaches the chain to the plunger.

The solenoid and pressure roller action of the PD-II machine is extremely quiet in its operation. The speed and the resultant noise of this assembly is controlled by a needle valve at the rear of the solenoid. Long life and dependable operation with a minimum of maintenance is the basis of design of the PD-II Series cartridge machine.

SECTION IV

MECHANICAL ADJUSTMENTS — PD-II SERIES

A. GENERAL MECHANICAL INFORMATION

ITC tape cartridge machines are designed to provide reliable rugged mechanics which require a minimum of simplified adjustement:

1. Motor
2. Chain linkage/solenoid assembly
3. Head assembly

B. CAPSTAN SHAFT (MOTOR) POSITION

While the adjustment procedure outlined below will normally be required only if the motor has been removed, a check for proper positioning of the capstan should be part of the regular maintenance schedule.

1. Remove the rubber pressure roller and place the round steel capstan shaft locator gauge on the pressure roller shaft as shown in Figure 4-1.

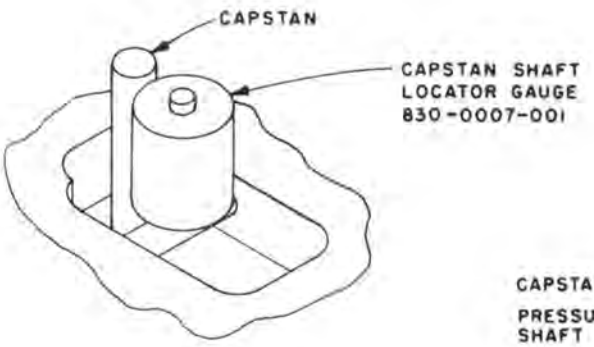


FIGURE 4-1

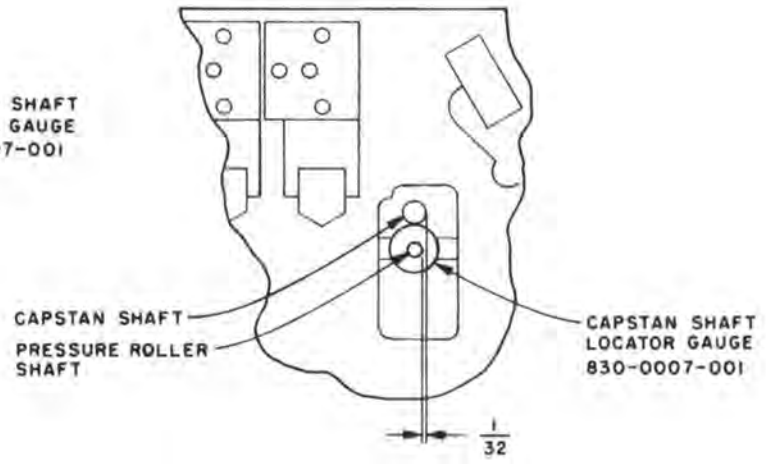


FIGURE 4-2

2. Loosen the motor mounting screws and manually press the steel capstan shaft locator gauge against the capstan shaft.

3. While squeezing the steel gauge and the capstan shaft together, position the capstan shaft as shown in Figure 4-2. The steel tool must lie flat against the capstan shaft to make the pressure roller shaft parallel with the capstan shaft.

   The slight offset between the two shafts allows the tape to come into contact with the capstan shaft before the pressure roller to minimize wow and flutter and to slightly "wrap" around the capstan shaft for better pull.

4. Tighten the motor mounting screws and recheck the adjustment.

5. Replace the rubber pressure roller on its shaft. The steel washer goes on the bottom and the nylon washer goes on the top just under the retainer clip.

C. PRESSURE ROLLER - COARSE SOLENOID ADJUSTMENT

This adjustment is made at the factory and should not normally have to be readjusted unless the motor assembly or the chain pulley is replaced.

1. Check to see that the set screw protruding from the chain pulley is inserted through the eleventh (counting from the solenoid plunger) link of the linkage chain as shown in Figure 4-3.

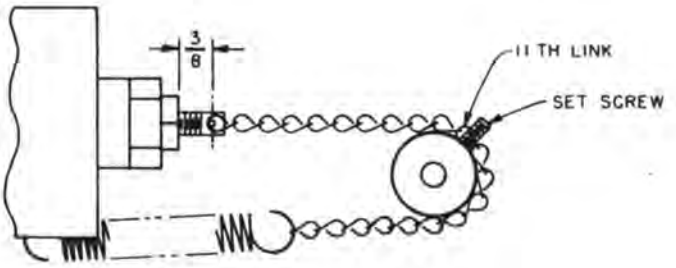


FIGURE 4-3

2. Loosen the solenoid plunger locknut and rotate the solenoid plunger and locknut until the space between the front edge of the solenoid plunger and the center of the roll pin clevis is 3/8 of an inch (see Figure 4-3).

3. Manually depress the solenoid plunger. When the solenoid plunger hits bottom (plunger strikes the solenoid seat) the pressure roller should be lying flat against the capstan shaft.

4. If the pressure roller contacts the capstan before the plunger bottoms, or if the plunger bottoms before the pressure roller contacts the capstan, loosen the set screw in the chain pulley, (with the left hand) hold the pressure roller against the capstan and the solenoid plunger in a bottomed position. With the right hand, pull the chain taut and tighten the set screw.

5. Rotate the solenoid plunger and locknut until the space between the front edge of the solenoid plunger and the center of the roll pin is 5/16 of an inch. Proceed with the fine solenoid adjustment as outlined below.

D. PRESSURE ROLLER - FINE SOLENOID ADJUSTMENT

This adjustment will normally be required only after parts replacement; but, for best results a check of the pressure roller/capstan pressure should be on a monthly routine maintenance schedule.

1. Using the pressure roller compression gauge (available from ITC), check the distance between the capstan shaft and the pressure roller shaft. The tool should advance to the first "step" and stop as shown in Figure 4-4.

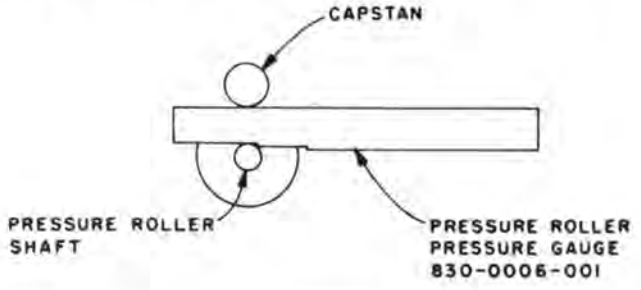


FIGURE 4-4

2. If adjustment is required, loosen the solenoid plunger locknut and rotate the solenoid plunger as follows:

   a. To increase the pressure, rotate the solenoid plunger so that it penetrates deeper into the solenoid (clockwise as viewed from the front panel). This will increase the pull of the solenoid on the plunger and, therefore, the pressure roller/capstan pressure will be increased.

   b. To decrease the pressure, rotate the plunger counter clockwise as viewed from the front panel.

3. Tighten the plunger locknut when proper pressure has been achieved. (If proper adjustment cannot be attained, complete the coarse adjustment outlined in Part "C" of Section IV before repeating the fine adjustment.)

E. SOLENOID DAMPING

The air damping of the solenoid is controlled by the adjustment of the set screw at the rear end of the solenoid seat. The speed of the solenoid operation is proportional to the speed at which air is allowed to move through the small hole on the underside of the solenoid seat. The noise of the solenoid operation shares the same relationship. See Figure 4-5 for parts location.

1. Turn the damping screw clockwise to reduce or counter clockwise to increase the speed of the solenoid operation.

2. Check the adjustment by inserting a cartridge and starting the Reproducer. Repeat the adjustment as required.

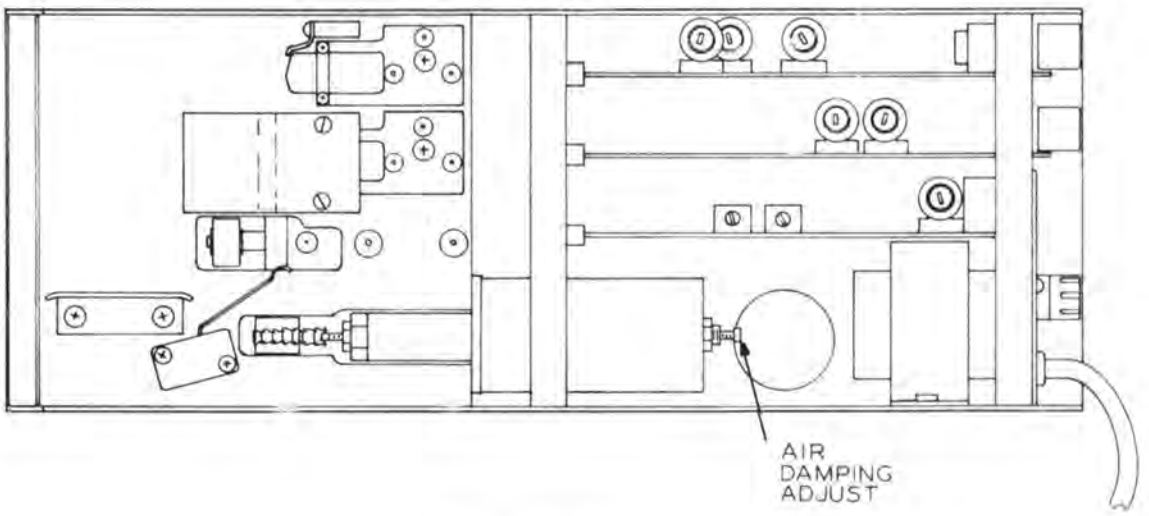


FIGURE 4-5

F. HEAD INSTALLATION AND ADJUSTMENTS

The head and track configuration of the PD-II unit is in accordance with the NAB standards.

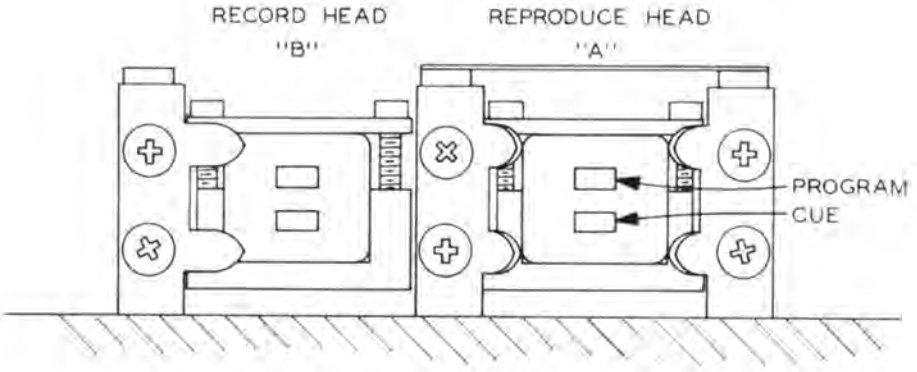


FIGURE 4-6

The magnetic tape head nearest the capstan shaft is head A, the reproducing head. Head B in the PD-II Reproducer is omitted. On the PD-II Recorder, head B is the recording head. (See Figure 4-6.)

On both record and play heads, the upper track is the program channel and the lower track is the cue channel.

1. Installation: The ITC PD-II units utilize the no-mount type heads to provide quick and easy installation.

   a. Loosen the two screws in the head mounting strap.

   b. Remove the old head and insert a new one. (The side of the head with the printing on it should be positioned up.)

   c. Align the rear edge of the head case so that it seats properly in the head mount block. (See Figure 4-7.)

   d. Push on the head socket with the notched end of the socket up.

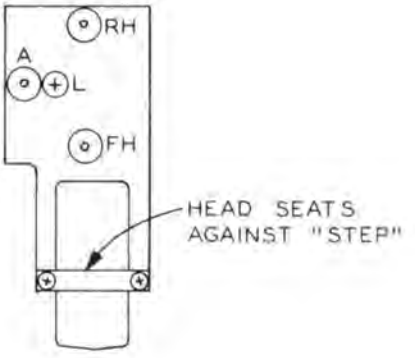


FIGURE 4-7

2. Height Adjustment: See Figure 4-8 for the location of the adjustment screws mentioned below.

   a. Loosen the lock screw (L) by turning it counter clockwise approximately four complete turns.

   b. Coarse height - adjust the front height screw (FH) until the top of the upper head track (pole piece) is 9/16 of an inch above the deck surface.

   c. Coarse zenith - adjust the front height screw (FH) until the face of the head is perpendicular with the surface of the deck. Rest one edge of a metal rule (or any gauge known to be square) on the deck surface and move it against the face of the head. When perpendicularity has been achieved, no space will be visible between the face of the head and the "square". (See Figure 4-9.)

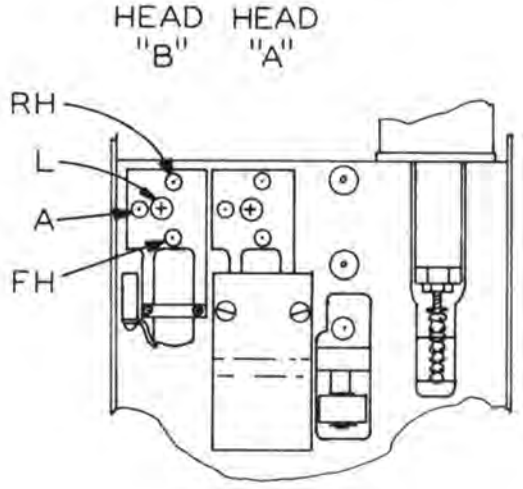


FIGURE 4-8

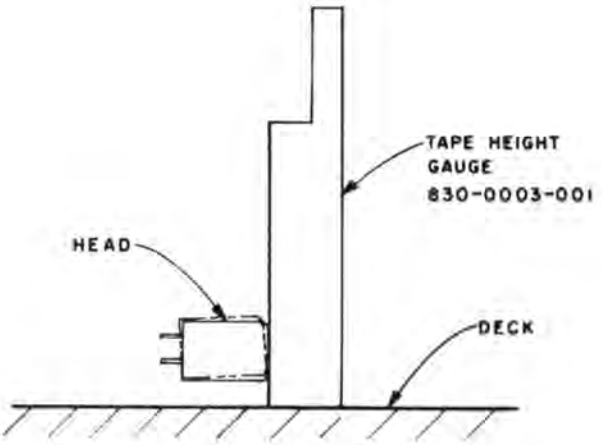


FIGURE 4-9

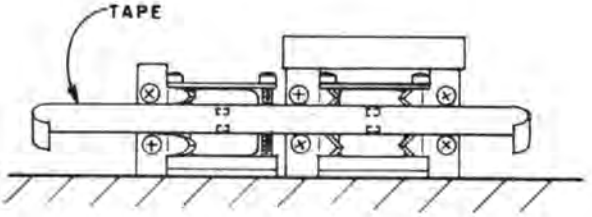


FIGURE 4-10

   d. Fine height and zenith - this adjustment is facilitated by using a strip of white "leader" tape or a piece of recording tape from which the oxide has been removed. (Shellac thinner, flux

remover or a similar solvent will loosen the oxide which can then be wiped off the transparent base.) (See Figure 4-10.)

1. Position the transparent tape across the face of the heads as the tape would be positioned if a cartridge was being played. Check to see that the tape is not being distorted (wrinkled) where it makes contact with the tape guides and attach it to one of the tape guide support blocks with adhesive tape to free one hand for adjustments.

2. Alternately adjust height screws FH and RH to position the top of the upper head track (pole piece) so that it is even with the upper edge of the tape, and to position the bottom of the lower head track (pole piece) so that it is even with the lower edge of the tape. Screws FH and RH should be adjusted by equal amounts in the same direction.

3. Recheck the zenith (perpendicularity) of the head as instructed in Step "C" above.

4. Remove the transparent tape.

3. Reproduce Head Azimuth Adjustment:

   a. Insert a test cartridge with a 15 kHz azimuth alignment tone.

   b. Meter the output of the Reproducer and adjust azimuth screw A of the reproducing head for maximum output level. (See Figure 4-8.)

   c. Tighten lock screw L.

4. Record Head Azimuth Adjustment:

   a. Perform the playback azimuth adjustment as outlined above.

   b. Select an erased 3 1/2 minute cartridge. (This cartridge should have the corner post properly positioned and be maintained as a test cartridge.)

   c. Feed a 15 kHz tone into the recorder 10 dB below normal level.

   d. Meter the output of the reproducer and adjust azimuth screw A of head B, the recording head, for maximum playback output level while recording the 15 kHz tone (see Figure 4-8).

   e. Tighten lock screw L of the record head.

G. TAPE GUIDE ADJUSTMENT

PD-II Series units use three independent tape guides to provide the maximum of tape guidance outside of the cartridge. The left tape guide has been specially formed to provide clearance for the cartridge corner post.

For optimum performance, not only should a check for proper tape guide positioning be made, but the position of the corner post in the cartridge should also be checked and adjusted if possible.

1. Check the positioning of each tape guide by advancing the tape height gauge into the tape guide as shown in Figure 4-11. The gauge should advance fully into the tape guide without friction, while resting flat on the deck--not tilted as shown by the dashed line (or its opposite) in Figure 4-11. The tape height gauge should be demagnetized so that it will not affect the "heads".

2. If adjustment is required, loosen the two mounting screws.

3. Keeping the tape height gauge flat on the deck, position the tape guide as shown in Figure 4-11.

   a. Keep the tape guides as close to the head as possible without coming into contact with the head mounting blocks or any parts mounted on these blocks.

   b. Keep the tape guides vertical. Normally the bottom edge of the tape guide's mounting surface should rest on or very near the surface of the deck plate.

4. Tighten the tape guide mounting screws and recheck the adjustment.

5. Check and adjust the other tape guides as required.

The slot in the tape guide is .249 inch wide (actual tape width is .246 + .002 inch). The width of this slot can also be properly gauged with the tape height gauge. The arm on the gauge should advance fully into the slot without friction, but there should be no room for noticeable movement of the tool in the slot.

Adjustments obtained with the tape height gauge should be accurate to less than .001 of an inch--much better than that obtained with most inexpensive optical devices.

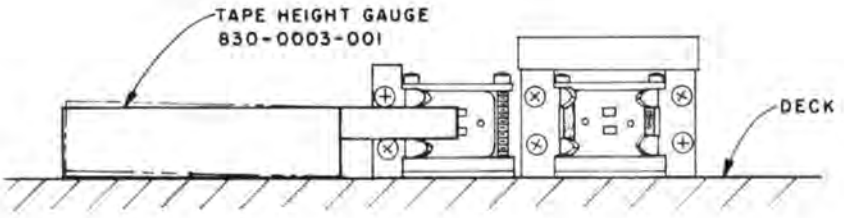
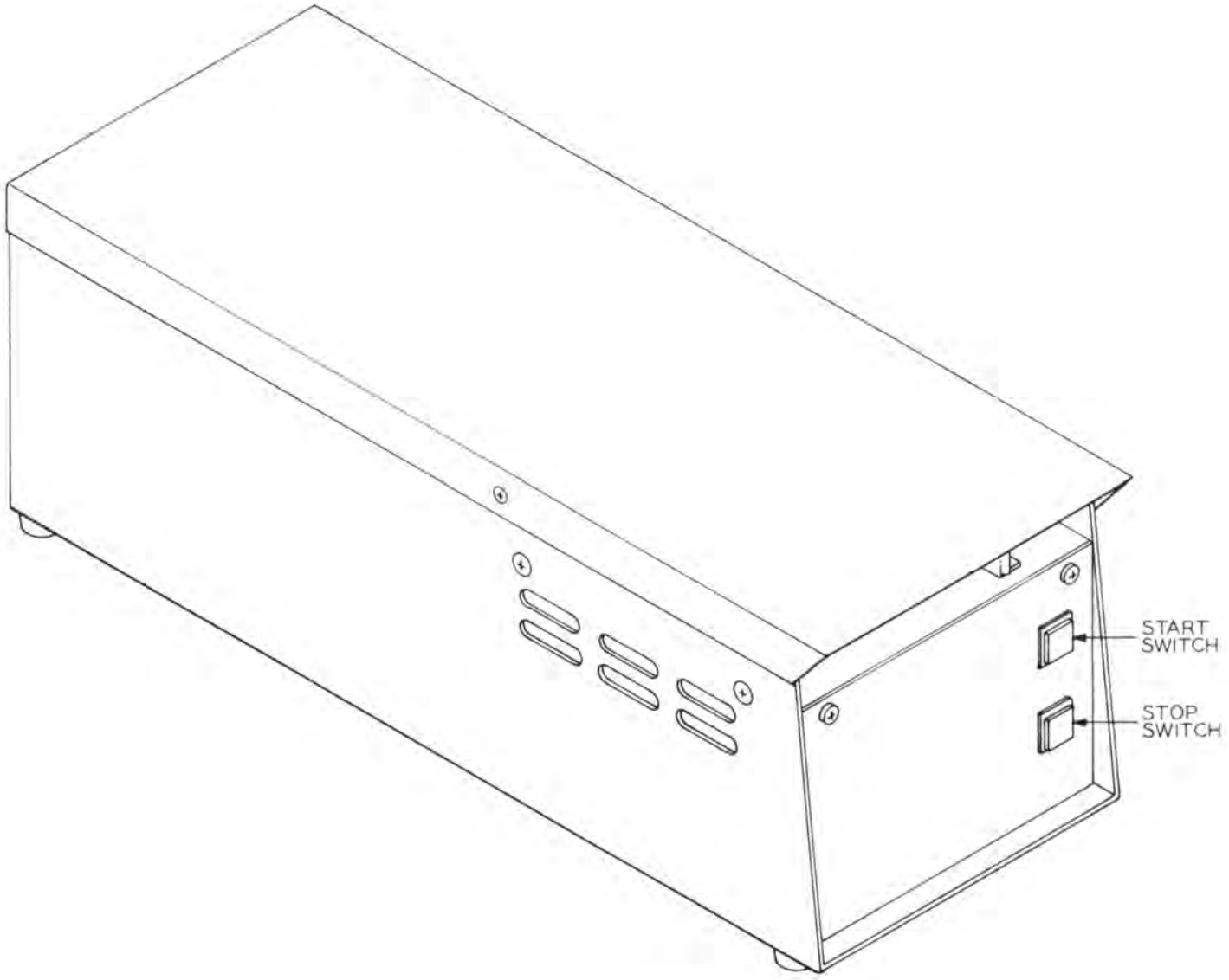


FIGURE 4-11

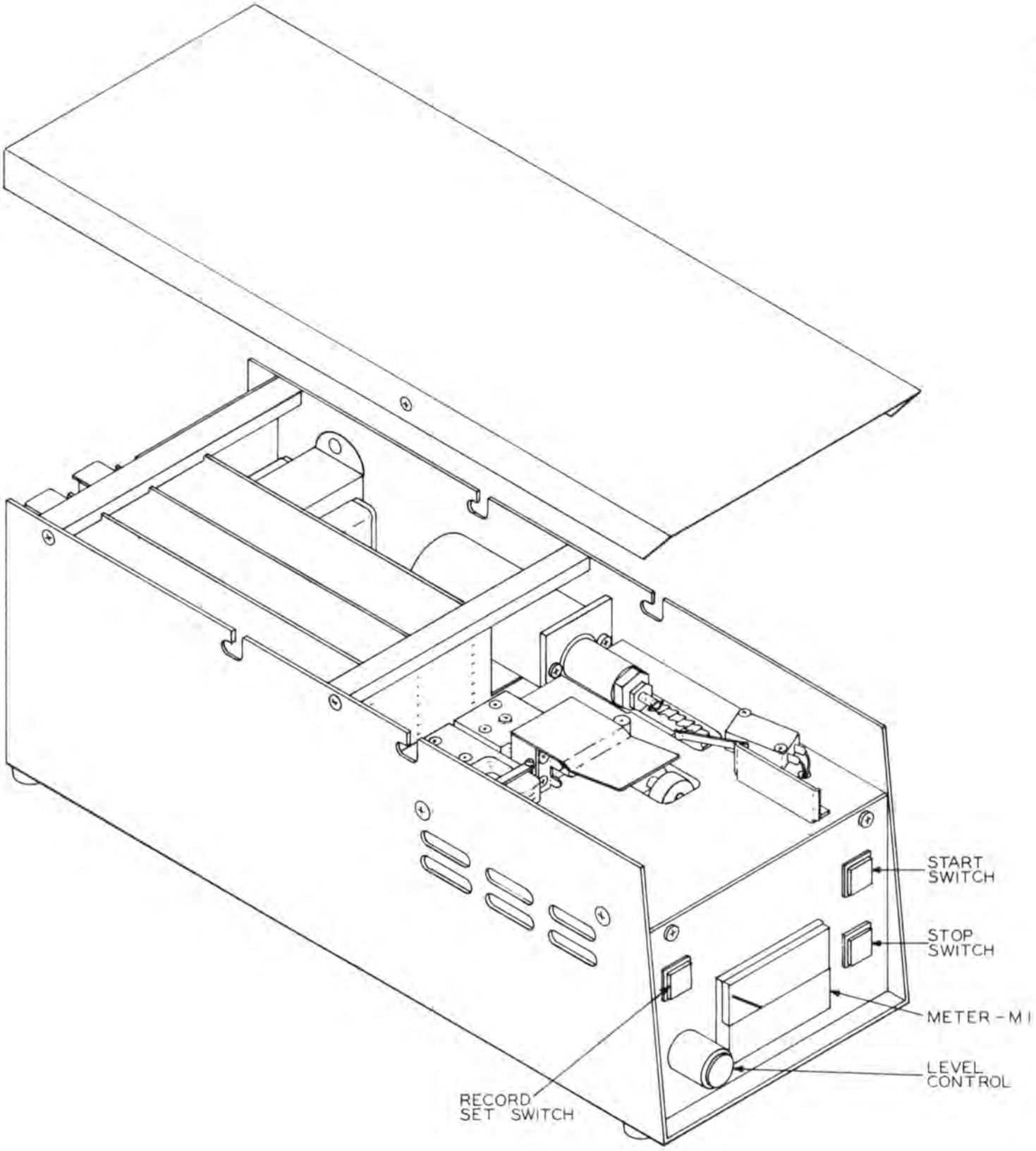
SECTION V

MECHANICAL DRAWINGS PD-II SERIES



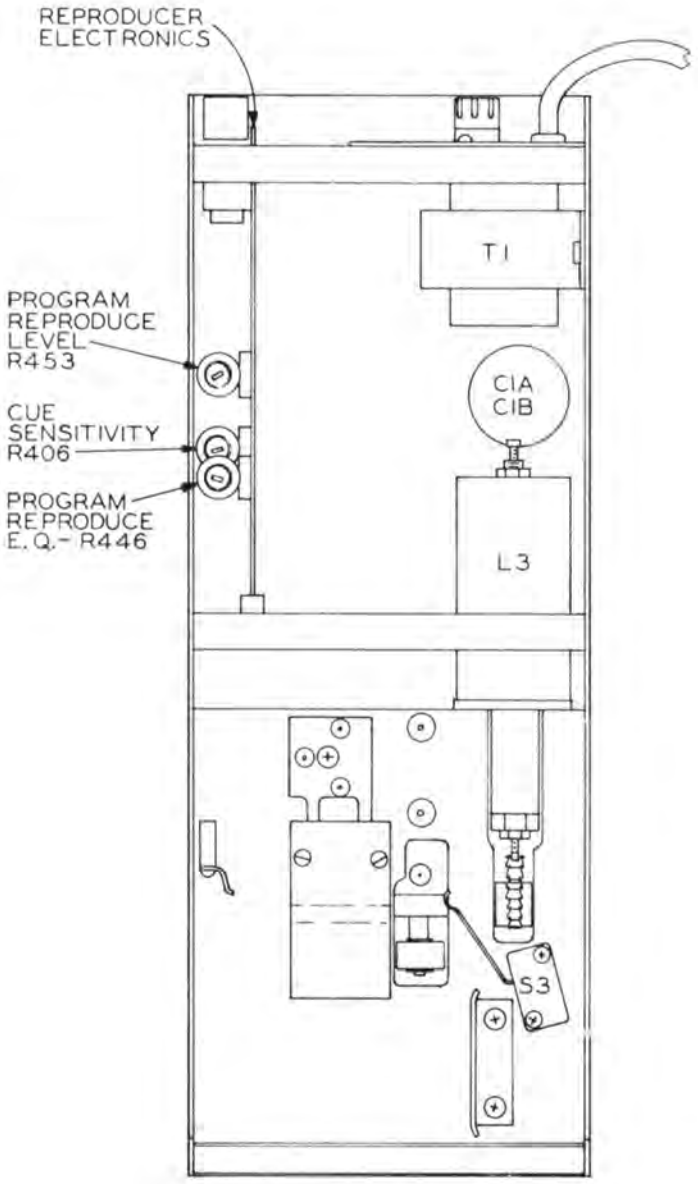
REPRODUCER

FIGURE 5-1



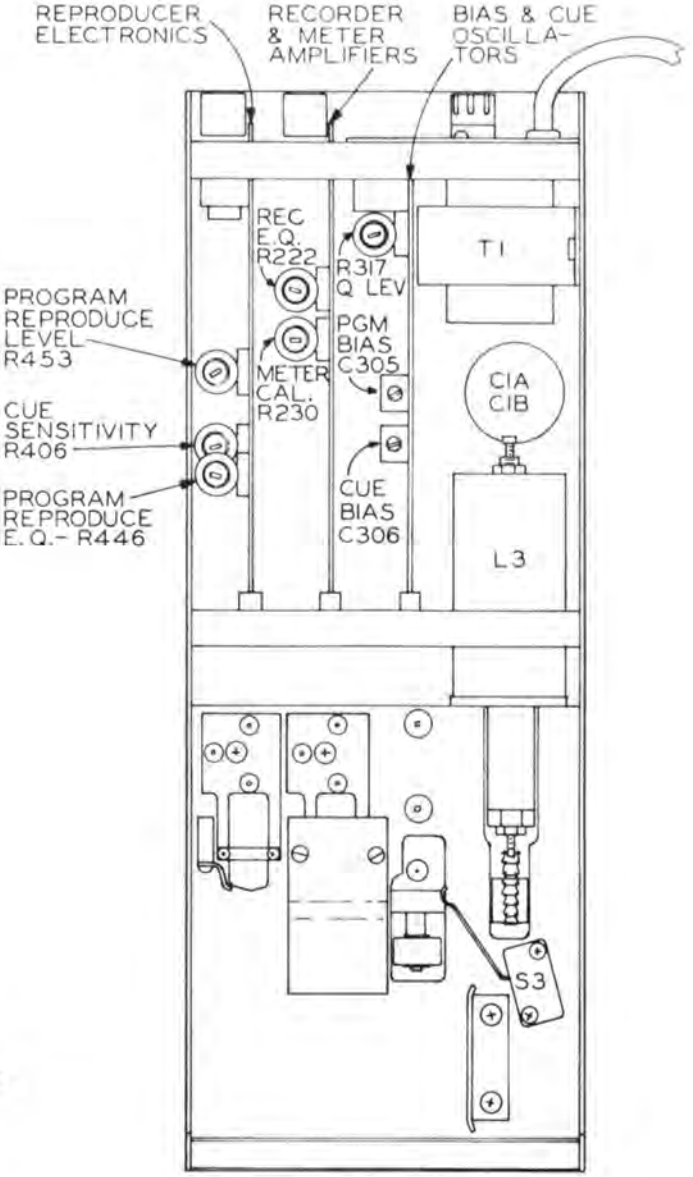
RECORDER/REPRODUCER

FIGURE 5-2



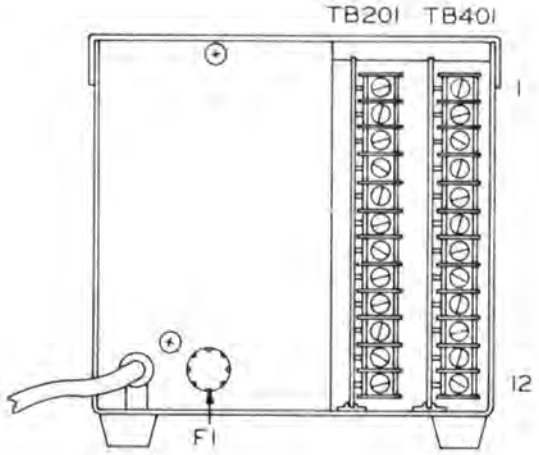
REPRODUCER - TOP VIEW

FIGURE 5-3



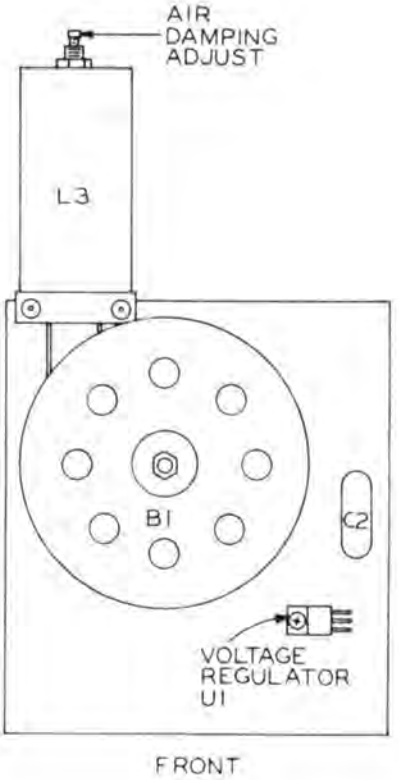
RECORDER - TOP VIEW

FIGURE 5-4



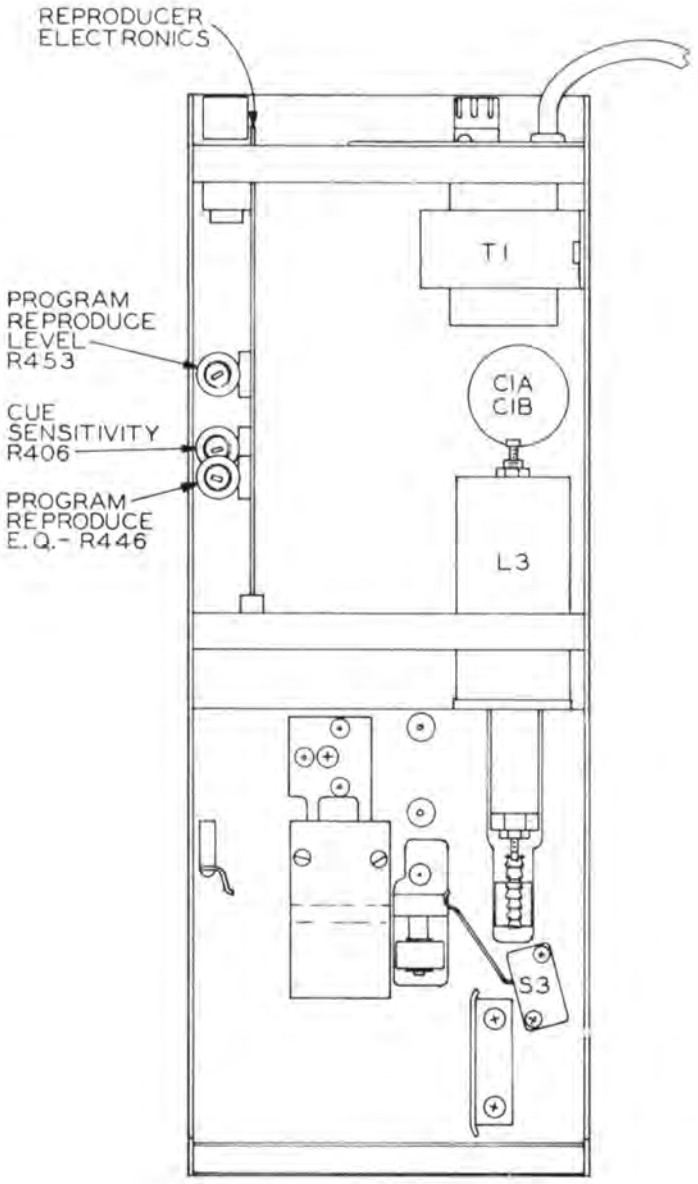
RECORDER – REAR VIEW

FIGURE 5-5



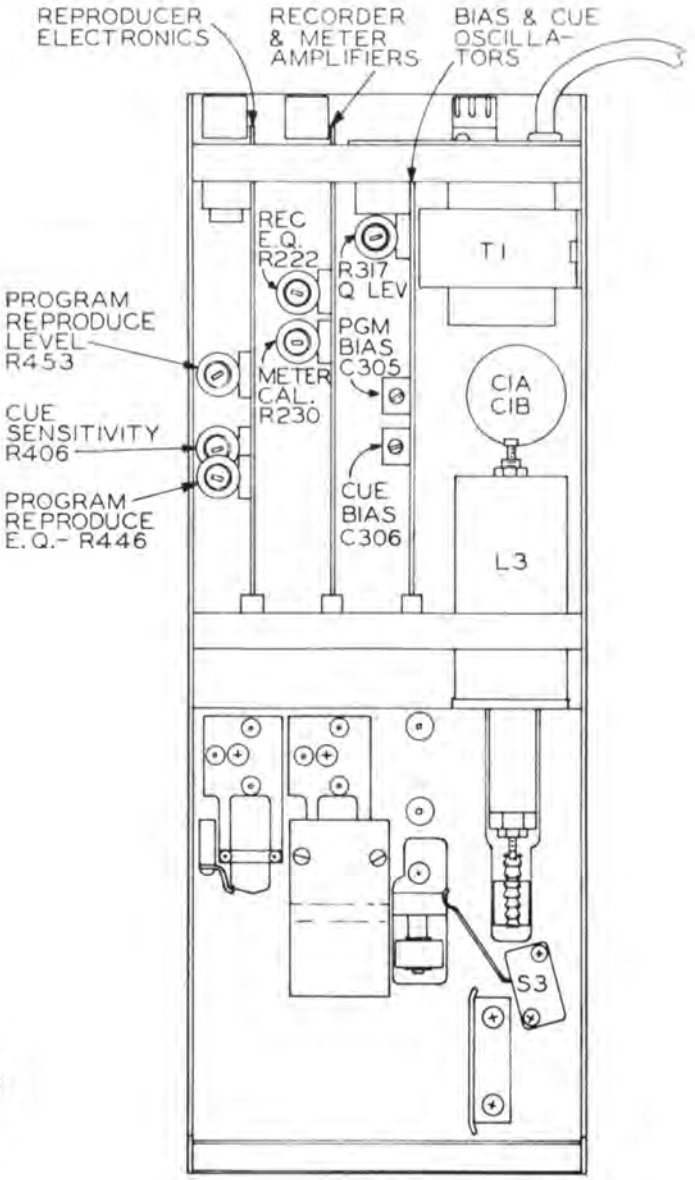
DECK – BOTTOM VIEW

FIGURE 5-6



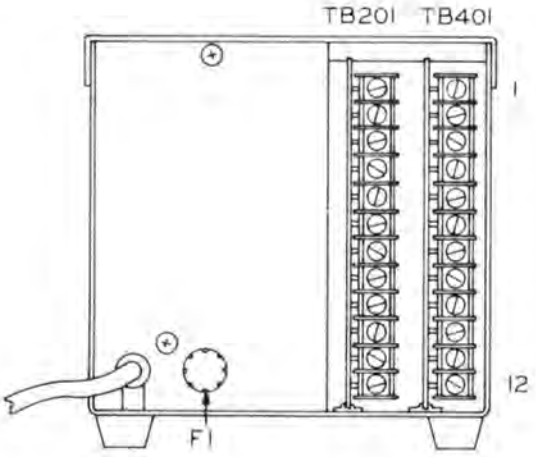
REPRODUCER - TOP VIEW

FIGURE 5-3



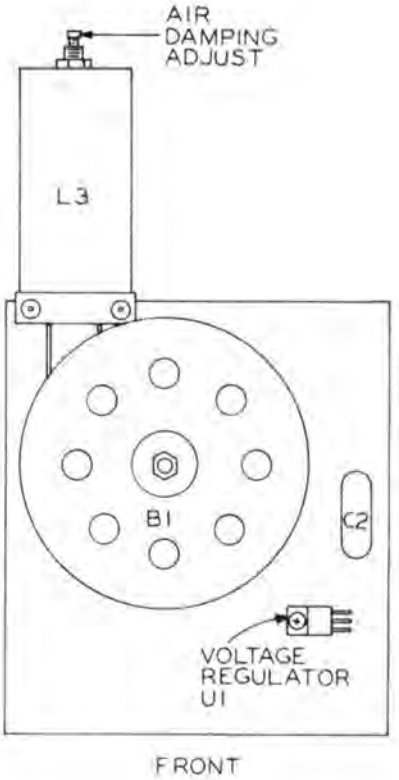
RECORDER - TOP VIEW

FIGURE 5-4



RECORDER - REAR VIEW

FIGURE 5-5



DECK - BOTTOM VIEW

FIGURE 5-6

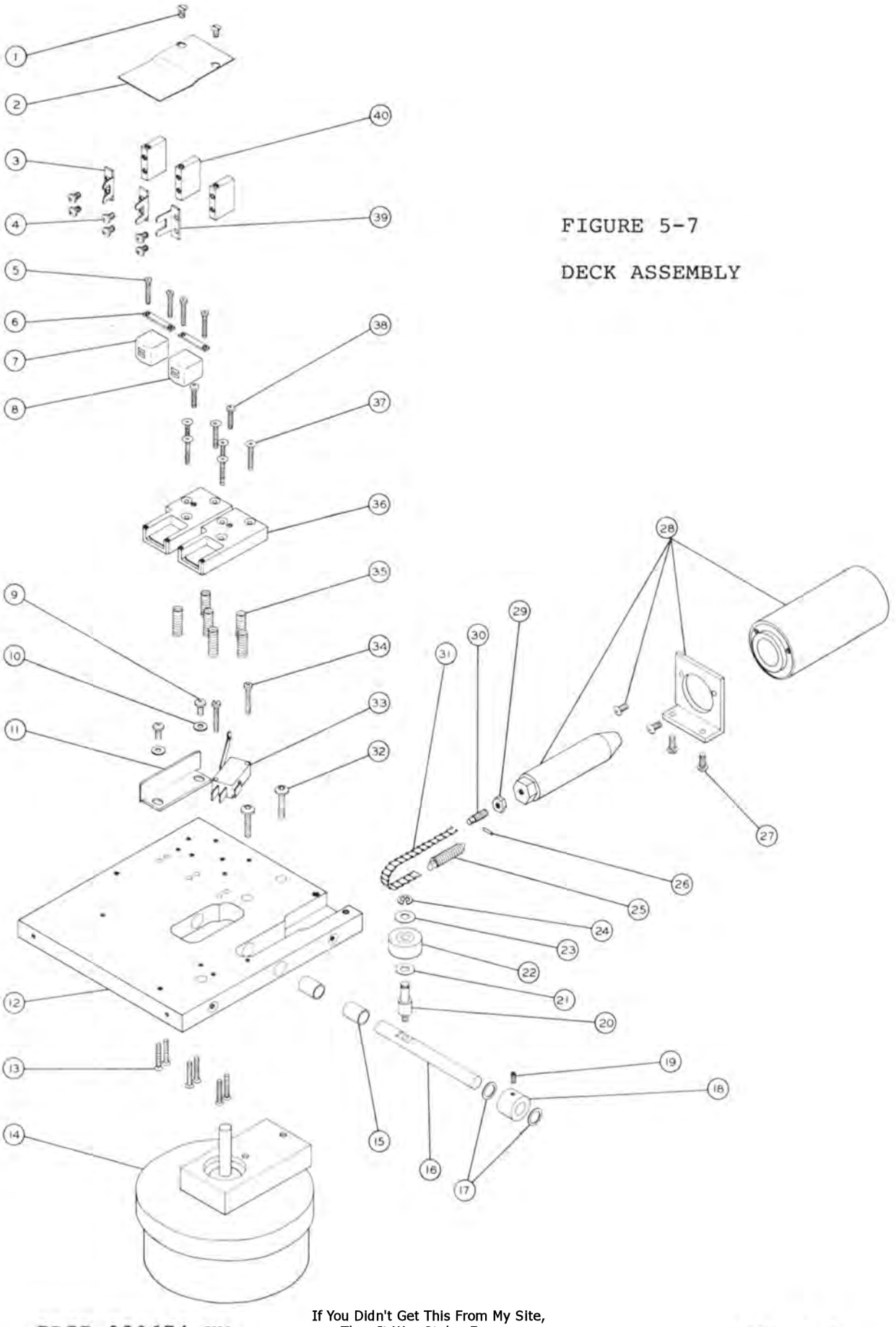


FIGURE 5-7

DECK ASSEMBLY

MECHANICAL PARTS LIST - DECK ASSEMBLY

(See Figure 5-7)

ITEM	PART NUMBER	DESCRIPTION
1	350-0402-000	Screw, 4-40 x 3/16 - flathead
2	301-0001-011	Spring, cartridge hold-down
3	272-0003-001	Guide tape (L.H.)
4	350-0403-000	Screw, 4-40 x 3/16 - Phillips panhead
5	350-0307-000	Screw, 3-48 x 5/8 - Phillips fillister
6	303-0001-001	Strap, head mounting
7	504-0023-000	Head, record monophonic
8	504-0022-000	Head, reproduce monophonic
9	350-0604-000	Screw, 6-32 x 1/4 - Phillips panhead
10	360-0601-000	Washer, flat #6 x 5/16
11	272-0001-001	Guide, cartridge
12	267-0011-004	Deck, PD-II
13	350-0418-000	Screw, 4-40 x 5/8 - Phillips flathead
14	451-0053-020	Motor, capstan 117 VAC, 60 Hz, 450 RPM
15	251-0014-000	Bearing, 5/16 I.D., 3/8 O.D. x 1/2 length
16	296-0001-001	Cross shaft
17	359-0002-000	Washer, nylon, 5/16 I.D.
18	262-0008-001	Clamp, cross shaft
19	355-0805-000	Screw, set 8-32 x 3/8 socket set
20	296-0004-001	Shaft, pressure roller
21	360-1005-000	Washer, steel
22	291-0003-001	Roller, pressure
23	359-0006-000	Washer, nylon
24	289-0002-000	Ring, shaft retaining
25	301-0021-000	Spring, solenoid return
26	282-0001-001	Pin, roll 1/16 x 5/16
27	350-1002-000	Screw, 10-24 x 3/8 Phillips panhead
28	477-0013-000	Solenoid assembly
29	370-1001-000	Nut, hex 10-32 x 3/8
30	264-0002-001	Screw, clevis
31	277-0002-000	Chain, linkage
32	353-0004-000	Screw, 10-32 x 7/8, button head socket
33	392-0002-000	Switch, Cartridge (Micro)
34	350-0417-000	Screw, 4-40 x 5/8 - Phillips panhead
35	301-0003-000	Spring, compression
36	253-0035-002	Block, head
37	353-0007-000	Screw, 4-40 x 3/4 flat head socket
38	350-0417-000	Screw, 4-40 x 5/8 Phillips panhead
39	272-0002-002	Guide, tape, center and R.H.
40	304-0001-011	Support, tape guide

SECTION VI

PRINCIPLES OF ELECTRICAL OPERATION — PD-II SERIES

A. GENERAL

The PD-II Series cartridge equipment is designed to provide long and dependable operation. Factors which contribute to this are simplicity of design, large safety factors, selection of high quality components, proper ventilation, and construction which provides ease of maintenance. Electrical stability is assured with the liberal use of feedback in discrete circuits.

B. 24 VOLT POWER SUPPLY

The secondary of transformer T1 provides low voltage AC (with the center tap grounded) to diodes CR102 and CR103 which function as a full wave rectifier. Capacitor C1A filters the DC at the input of series regulator U1. Regulator U1 is internally protected against short circuits at its output and thus does not require fusing. The output of U1 is at +24 volts DC and supplies power for the cue detector circuit, the reproducer logic, and the recorder logic on recorder models. Decoupling network R102 and C102 provides low voltage DC to the program reproduce amplifier. Silicon grease is used between the case of the regulator U1 and the chassis at the point at which it mounts to provide maximum heat dissipation.

C. SOLENOID POWER SUPPLY

Capacitor C1B is charged from the low voltage rectifier CR102, CR103, through CR101 and resistor R103. Diode CR101 is used in this circuit to allow capacitor C1B to charge to its peak no-load voltage. When the start switch is pressed and solenoid L3 is activated the peak voltage charge on capacitor C1B gives an initial boost to the solenoid in order to activate it quicker. The approximate 40 volt peak charge on capacitor C1B eventually bleeds down to the operating voltage for the solenoid, 24 volts DC.

D. CONTROL CIRCUITRY - REPRODUCER

The control circuitry is furnished with power by the low voltage DC power supply and utilizes ground switching

throughout. All switching is solid state and thus no relay contacts are used. A simple transistor "flipflop" circuit consisting of transistors Q407 and Q408 is used for control of the start and stop functions. Because of the nature of this type of flipflop only one transistor can be turned on at a time. Because either transistor in a flipflop can turn on in a power-up situation (also insertion of the cartridge) there must be a circuit component which causes the stop/ready condition to occur first. Capacitor C411 is used to slow down the action of Q407 and in so doing allows transistor Q408 to always turn on first.

Pressing the START SWITCH, S2, causes base-emitter current flow in transistor Q407 through resistor R423 to ground and in so doing removes the normal base-emitter current path through resistor R426 and R424 to ground for Q408 (the collector voltage of Q407 is now at +24 volts). A similar action occurs when the stop switch is pressed as transistor Q408 will turn on and in so doing turns transistor Q407 off.

When in a ready state transistor Q409 is normally reverse biased through diode CR403 and transistor Q408 and thus is not allowed to conduct. Pressing the start switch causes the collector voltage of Q408 to reduce and in so doing alows base-emitter current flow of transistor Q409 through R432. The collector of transistor Q409 now provides current flow for transistor Q410 through resistor R433. Transistor Q410 as a result turns on the pressure roller solenoid and the run indicating lamp. At the same time transistor Q410 is turned on, Q411, which normally turns the ready indicator lamp on, is turned off as base-emitter current no longer flows through resistor R435.

If the stop switch is pressed or a 1 kHz cue tone is detected the state of the flipflop Q407 and Q408 is changed as transistor Q408 is biased on through resistor R429, diode CR402, resistor R430 to ground. In addition to the run solenoid being turned off, the run lamp I2 is also turned off and in so doing both of these components provide forward bias through resistor R435 to the base-emitter junction of Q411. With Q411 biased on, the ready lamp, I3, is illuminated and provides a visual indication of the state of the machine.

E. CONTROL CIRCUITRY - RECORDER/REPRODUCER

In addition to the control circuitry described in Section D, a combination of five transistors (Q201 through Q205) is used on the recorder portion of the machine to control the program recording amplifier, the meter amplifier, the bias oscillator, and cue oscillator circuitry.

The "record set" circuitry is composed of transistors Q201 and Q202. These transistors can be activated only when the machine is in a ready state as the record set switch is in series with the collector-emitter junctions of transistor Q411 (i.e. the collector of Q411 is at ground only when the machine is in a ready state). Pressing the record set switch when the machine is in a ready state causes base-emitter current flow in transistor Q202 through resistor R202 and transistor Q411 in the reproducer logic section. When transistor Q202 is turned on it in turn provides base-emitter current for transistor Q201 and in so doing, causes both transistors to latch on. With transistor Q202 turned on, +24 volts DC is supplied from the collector to the record lamp, the program recording amplifier, and the meter amplifier circuits. And it also sets up a potential current path through resistor R207 for the base-emitter junction of transistor Q203.

When the start switch is pressed the emitter of transistor Q203 is taken to ground through the reproducer logic and is turned on as previously described through resistor R207. Q203 in turn causes transistor Q204 to turn on and this transistor supplies voltage to the bias oscillator circuit. Transistor Q205 is also turned on at this time through capacitor C202 and resistor R211 and causes the 1 kHz cue oscillator to turn on. When capacitor C202 is fully charged, base-emitter current ceases in Q205 and thus the 1 kHz cue tone oscillator is turned off.

F. CUE CIRCUITRY

The cue tone detector circuit is located on a plug-in printed circuit card and consists of a pre-amplifier, a tone protection circuit, and a frequency selective switching circuit. Transistor Q401, a common emitter amplifier, serves as the cue pre-amplifier and is stabilized through feedback resistor R401 to prevent performance variations due to temperature instability. The output of this amplifier is connected through the sensitivity control of the 1 kHz detector and also to the remote connector TB401. This output may be used to provide an input to a remote secondary or tertiary cue tone detector.

The frequency selective driver section of the cue circuit consists of transistors Q402, Q403, Q405, and Q406. Transistor Q402 is a conventional common emitter amplifier stage with the response made selective by the use of small coupling and emitter bypass capacitors. Capacitor C404 further reduces frequencies above 1 kHz. Frequency selectivity is further increased by the use of direct coupled transistor stage Q403. When a 1 kHz signal is

present on the tape and is amplified through the cue amplifier, negative half cycles on the base of transistor Q405 cause it to conduct (Q405 is normally reverse biased through resistor R417). Positive half cycles on the collector of transistor Q405 are then filtered through capacitor C410 and provide base emitter current flow for transistor Q406. The collector of transistor Q406 then performs the same function as the stop switch and causes tape motion to cease.

Because the 1 kHz cue tone is present on the tape for the first half second after tape motion begins, a protection circuit is required to prevent the cue detector from turning the machine off for the duration of the 1 kHz cue tone. This action is performed by transistor Q404 which prohibits the turn off switch Q406 from operating by removing any potential base emitter current flow. Transistor Q404 turns on only during the first two seconds after tape motion begins while capacitor C408 is charging. Once capacitor C408 is fully charged, base emitter current is removed from Q404 and the normal action of transistor Q406 can thus occur when a 1 kHz cue tone is present.

G. PROGRAM REPRODUCE AMPLIFIER

The program reproduce circuit is located on the same PC card as the cue detector and reproducer logic (See Figure 8-3.) The circuit consists of an equalized pre-amplifier, an LDR attenuator and a two stage output section. Transistors Q412 and Q413 serve as a pre-amplifier which is stabilized to prevent performance variations with widely varying temperatures. This is accomplished with DC negative feedback from the emitter of Q413 to the base of Q412 and also with direct coupling from the collector of Q412 to the base of Q413. Variable feedback equalization through capacitor C418, R446, and R444 is used to raise the input impedance and reduce gain variations. LDR401 is in series with the output of the pre-amplifier and is used to attenuate the audio at all times except when a cartridge is actually being played. When the transport mechanism is started the LDR receives current through resistor R452, CR406, and Q410 and thus turns audio on at this point. At the moment tape motion ceases this current path is removed and thus audio is no longer allowed to pass through to the final amplifier stages.

Level control R453 provides a variable input to the final two amplifier stages Q414 and Q415. The output of these stages is connected through a transformer T401 to the out-

put terminal strip TB401 and provides a balanced 600 ohm output.

H. RECORDER CIRCUITS

Transformer T201 provides a balanced 600 ohm input impedance through the level control R1 to the input of the recording amplifier circuitry. The output of common emitter amplifier Q206 is coupled through high pass filter R221 and C207 to the base of transistor Q207. RC network C209 and R223 provide mid and upper range contouring with variable high frequency equalization controlled by R222 and C208. Output amplifier Q207 further boosts high frequencies through the use of small emitter bypass capacitor C211. Bias trap network L201 and C212 reduce IM distortion caused by mixing of the audio and bias currents at the recording head L1.

Recorder input signals from transformer T201 are also coupled through the input level control R1 and variable calibration control R230 to the base of Q208. The meter amplifier is composed of direct coupled transistors Q208 and Q209 and a flat frequency response is provided to full wave bridge rectifier CR203, CR204, CR205, and CR206. The front panel VU meter M1 is then driven from DC signals available from the full wave bridge rectifier.

The bias oscillator circuit consists of a single transistor oscillator and two variable outputs, one going to the program recording head and the other to the cue recording head.

The frequency of the bias oscillator is determined by paralleled capacitor C303 and inductor L301 with feedback provided to the base of Q301 through capacitor C302. LDR301 and LDR302 are used as gates to the program and cue recording heads. When recording a tape 24 volts DC is supplied through pin 11 of connector J2 to the bias oscillator circuit. This voltage turns on LDR302 and also the bias oscillator through CR301 and R306. LDR301 is turned on for approximately ½ second at the beginning of the recording process through the control circuitry described under Section E and allows bias current to pass through the LDR to the cue recording head at which point it is mixed with the cue tone oscillator. External cue tones may be recorded at any time and thus the bias oscillator must incorporate a means of turning only the cue bias on. The combination of diodes CR301, CR302, CR303, and CR304 provide this means. If 24 volts DC is applied to pin number 2 of TB201, this voltage will cause the bias oscillator to turn on through diode CR304 and CR302. Diode CR301 blocks this voltage from the program LDR302 so that

the program track is not effected and diode CR303 blocks the voltage from the cue oscillator so that it is not keyed on. An external 150 Hz or 8 kHz cue tone may thus be recorded at any time on a cartridge by simultaneously introducing the cue tone at pin 3 of TB201 with the DC voltage (+24 volts) at pin 2 of TB201.

The kHz cue tone oscillator consists of a single transistor oscillator Q302 and buffer amplifier stage Q303. The frequency and level of this cue tone are variable. The frequency is determined by paralleled network L302 and capacitor C309. The inductance of L302 is variable over a range of 475 to 525 mHys. The 1 kHz oscillator is keyed when 24 volts is applied through pin 9 of connector J2 from the previously described record logic circuit. The output level of the cue oscillator is variable with resistor R317 and is coupled to the cue recording head through bias trap network L303 and C311 and through series resistor R320. External cue tones may be mixed through resistor R321 from the barrier strip TB201 pin number 3.

SECTION VII

ELECTRICAL ADJUSTMENTS — PD-II SERIES

A. GENERAL

The following electrical controls are adjusted at the factory to provide optimum operation of the PD-II unit. At the time of installation, the only controls which may require adjustment are program levels. See Figure 7-1 and 7-2 for location of these controls.

It is suggested that electrical adjustments be checked as part of a monthly maintenance schedule. An NAB test cartridge number 3 will be required and is available from ITC. If this test cartridge is to be used to test several machines on a monthly basis, the short wave length sensitivity will be degraded by repeated playing. This loss is a direct result of wear products adhering to the tape which cause poor contact with the reproduce head. If one is aware of the cause of the signal loss, then by carefully using the tape and by keeping the tape, heads, and guides clean, you can minimize this loss. The ideal method to maintain test cartridges is to record your own test cartridges and compare them with the NAB test cartridge each six months. It is important that all test cartridges contain the same type of tape that is to be used for routine recording.

B. PROGRAM REPRODUCE LEVEL

The output level of the program reproduce amplifier is factory adjusted for zero dBm. This means of adjustment is provided with resistor R453 (Figure 7-1). If the output level must be reduced below -10 dBm, it is suggested that an external pad be installed to maintain the best possible signal to noise ratio. Use the 400 Hz reference tone on the test cartridge to establish the required level.

C. PROGRAM REPRODUCE EQUALIZATION

Equalization of the program reproduce amplifier is factory adjusted to conform with the NAB equalization curve. The reproduce equalization control R446 (Figure 7-1) is used to compensate for head wear and for small variation in heads

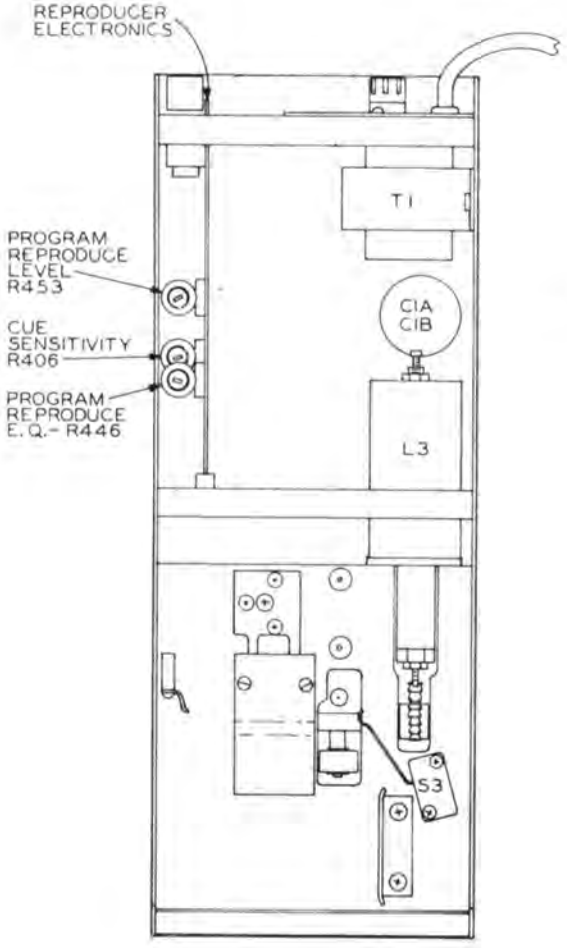


FIGURE 7-1

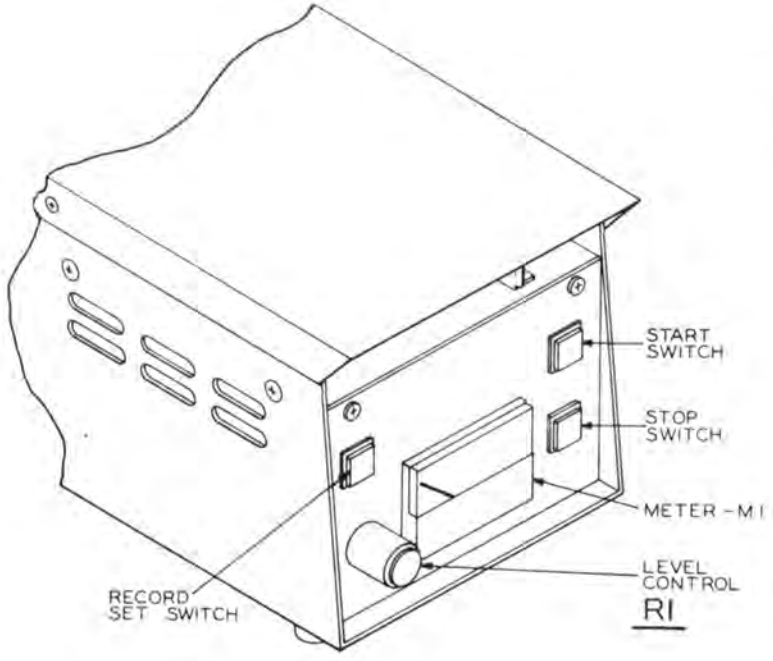


FIGURE 7-2

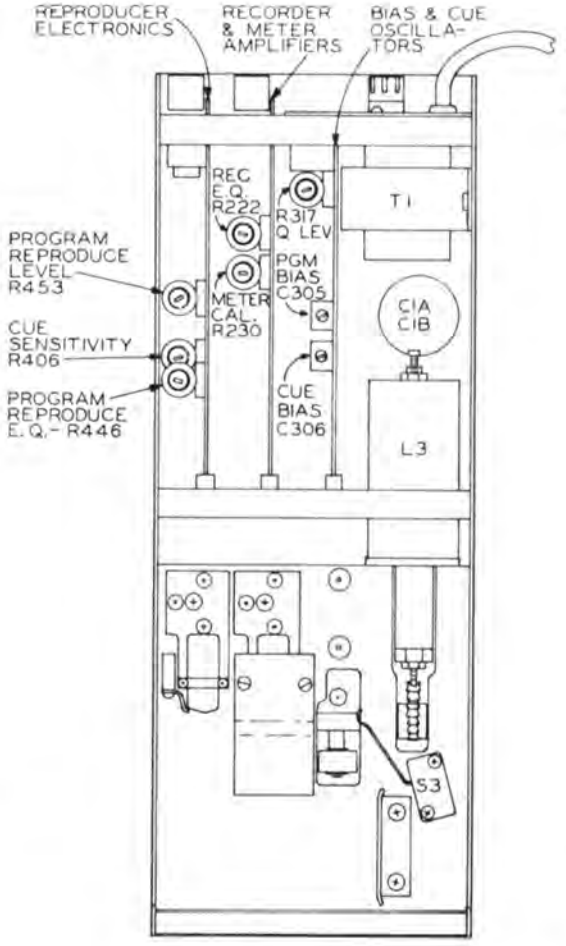


FIGURE 7-3

when replacement is required. While playing the NAB test cartridge measure the playback level of 12 kHz and 400 hz tones and adjust the high frequency equalization so that these two frequencies are equal in output level. It should be noted that both head alignment and head wear can effect the upper frequency equalization characteristics. Refer to Section IV - F before adjusting the equalization.

D. PRIMARY (1 kHz) CUE SENTIVITY

The sensitivity of the 1 kHz primary cue detector is adjusted with R406 (Figure 7-1). This control is normally set to respond to a cue tone 8 dB below the NAB cue level. To adjust the sensitivity properly, first a cartridge should be made with 1 kHz cue tones recorded 8 dB below the normal NAB cue tone level. The sensitivity should then be set to a point of just tripping while playing this special test cartridge back. This adjustment will then provide 8 dB of excessive cue gain when a cartridge with normal cue level is played.

E. RECORDER PROGRAM LEVEL

The input recording level is adjusted with R1 which is a front panel control and can be adjusted to accept an input level between -20 and 0 dBm. (See Figure 7-2.)

F. RECORD EQUALIZATION

The record equalization is factory adjusted and should normally not require further adjustment upon installation. If the ultimate of overall record/play response is to be maintained, a very slight adjustment may be required when the record head is replaced. If the record bias is slightly miscalibrated, the high record equalization will appear to be out of adjustment. Before changing the record equalization, double check the bias adjustment. Using the NAB test cartridge also recheck the playback head alignment and playback equalization. Select a 3½ minute cartridge and check record head alignment (see Section IV - F). Record the same tones as recorded on the NAB test cartridge and compare the playback of these tones with the test cartridge. If the playback levels differ, adjust R222 (see Figure 7-3).

G. RECORD METER CALIBRATION

Control R230 (Figure 7-3) changes the input level to the meter amplifier transistors Q208 and Q209. Record a 400 Hz tone at

a normal "0" level and compare the playback level of this tone with the 400 Hz tone recorded on the NAB test cartridge. If an adjustment is required, recalibrate the meter sensitivity by adjusting R230. Reset the input level to "0"; again record and compare levels with the NAB test cartridge.

H. RECORDED CUE TONE FREQUENCY AND LEVEL

The frequency of the primary cue tone should be 1 kHz and is adjustable with variable inductor L302. The level of the tone recorded can best be measured by reversing the playback head leads and measuring the output of the program reproduce amplifier. After reversing the head leads, play the NAB test cartridge and establish a level. Insert an erased 3 1/2 minute cartridge and record a cue tone. Since the playback head leads are reversed, the recorded tone can be measured as it passes the reproduce head. The recorded tones should be at the same level as the 1 kHz cue tones on the NAB test cartridge. If an adjustment is required, the cue tone record level is adjustable with R317 (Figure 7-3).

I. PROGRAM AND CUE BIAS

Variable capacitor C305 is used to adjust the program bias and variable capacitor C306 is used to adjust the cue bias. Select a properly erased 3½ minute cartridge and feed a 1500 Hz tone into the recording amplifier and adjust the front panel level control for a "0" meter reading. While measuring the playback output, adjust C305 to cause an exact peak of playback level. It is important to note that there may be minor peaks on either side of the major peak. Care should be exercised to adjust the major peak. The exact peak is ideal as a very slight amount of over-bias will destroy the high end response. As a new head "wears in" the amount of bias required declines and it is therefore recommended that a very slight under adjustment be made after installing a new head. See Figure 7-3 for location of bias trimmer capacitors.

In order to adjust the cue bias it is necessary to cause the cue tone oscillator to oscillate continuously. This is best accomplished by running a clip lead from the 24 volt regulated supply to pin 9 of connector J2. Reverse the playback head leads and monitor the output of the program reproduce amplifier. Insert an erased 3 1/2 minute

cartridge, press the record/set button and start the machine. With the above mentioned clip lead in place, a continuous 1 kHz tone will be recorded. Adjust C306 for an exact peak of playback output level (see Figure 7-3 for location of C306).

SECTION VIII

ELECTRICAL PARTS LIST — PD-II SERIES

A. MOTHER BOARD (831-0077-003 Reproducer - Figure 8-1)
(831-0077-013 Recorder - Figure 8-2)

SYMBOL	PART NUMBER	DESCRIPTION
		CAPACITORS
C101	687-0004-000	Capacitor, 22 mfd. 50 v, electrolytic
C102	687-0006-000	Capacitor, 220 mfd. 25 v, electrolytic
		DIODES
CR101	575-0007-000	Diode, 1N4005
CR102	575-0007-000	Diode, 1N4005
CR103	575-0007-000	Diode, 1N4005
		CONNECTORS
J1, J2, J3	380-0039-000	Socket, card edge - 22 conductor
		RESISTORS
R101	626-0231-000	Resistor, 47 ohms, ½ watt
R102	626-0239-000	Resistor, 100 ohms, ½ watt
R103	628-0181-000	Resistor, 20 ohms, 8 watt

FIGURE 8-1

MOTHER BOARD - REPRODUCER

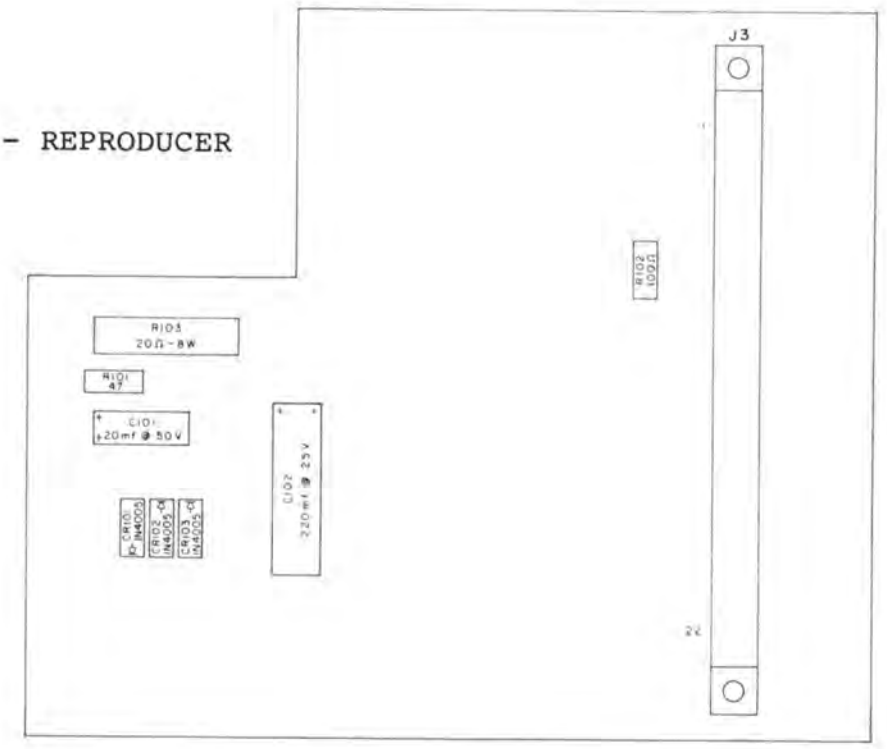
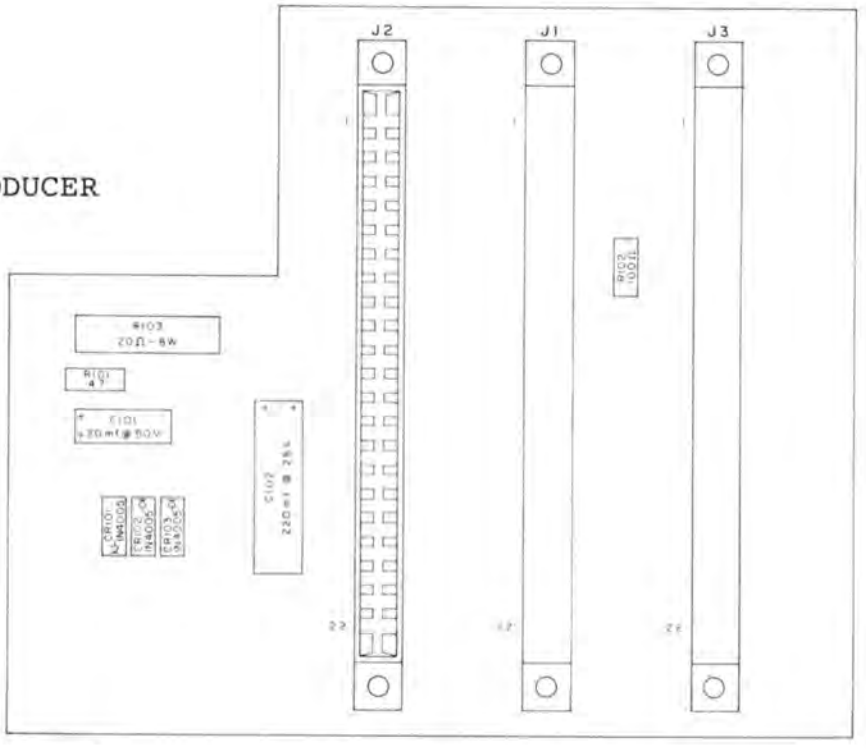


FIGURE 8-2

MOTHER BOARD
RECORDER/REPRODUCER



B. REPRODUCER FUNCTIONS PC BOARD (831-0078-003 - Figure 8-3)

SYMBOL	PART NUMBER	DESCRIPTION
		CAPACITORS
C401	694-0003-000	Capacitor, 4.7 mfd, 35v, tantalum
C402	694-0003-000	Capacitor, 4.7 mfd, 35v, tantalum
C403	681-0060-000	Capacitor, .15 mfd, 200v, paper
C404	681-0060-000	Capacitor, .15 mfd, 200v, paper
C405	694-0003-000	Capacitor, 4.7 mfd, 35v, tantalum
C406	682-0002-000	Capacitor, .22 mfd, 100v, mylar
C407	694-0003-000	Capacitor, 4.7 mfd, 35v, tantalum
C408	696-0117-000	Capacitor, 10 mfd, 25v, electrolytic
C409	694-0004-000	Capacitor, .47 mfd, 35v, tantalum
C410	694-0005-000	Capacitor, 1 mfd, 35v, tantalum
C411	694-0003-000	Capacitor, 4.7 mfd, 35v, tantalum
C412	681-0058-000	Capacitor, .1 mfd, 200v, paper
C413	681-0058-000	Capacitor, .1 mfd, 200v, paper
C414	696-0124-000	Capacitor, 100 mfd, 25v, electrolytic
C415	694-0003-000	Capacitor, 4.7 mfd, 35v, tantalum
C416	677-0003-000	Capacitor, 300 pfd, 300v, silver mica
C417	677-0003-000	Capacitor, 300 pfd, 300v, silver mica
C418	681-0048-000	Capacitor, .015 mfd, 200v, paper
C419	696-0078-000	Capacitor, 100 mfd, 12v, electrolytic
C420	694-0003-000	Capacitor, 4.7 mfd, 35v, tantalum
C421	694-0003-000	Capacitor, 4.7 mfd, 35v, tantalum
C422	694-0002-000	Capacitor, 10 mfd, 20v, tantalum
C423	694-0002-000	Capacitor, 10 mfd, 20v, tantalum
		DIODES
CR401	575-0007-000	Diode, 1N4005
CR402	575-0007-000	Diode, 1N4005
CR403	575-0007-000	Diode, 1N4005
CR404	575-0007-000	Diode, 1N4005
CR405	575-0007-000	Diode, 1N4005
CR406	575-0007-000	Diode, 1N4005
		LIGHT DEPENDENT RESISTOR
LDR401	650-0003-000	LDR, 301T1-12A1 Sigma
		TRANSISTORS
Q401	590-0017-000	Transistor, 2N5816 NPN
Q402	590-0017-000	Transistor, 2N5816 NPN
Q403	590-0017-000	Transistor, 2N5816 NPN
Q404	590-0017-000	Transistor, 2N5816 NPN
Q405	590-0018-000	Transistor, 2N5817 PNP
Q406	590-0017-000	Transistor, 2N5816 NPN
Q407	590-0018-000	Transistor, 2N5817 PNP

SYMBOL	PART NUMBER	DESCRIPTION
Q408	590-0018-000	Transistor, 2N5817 PNP
Q409	590-0018-000	Transistor, 2N5817 PNP
Q410	590-0016-000	Transistor, 2N4922 NPN
Q411	590-0017-000	Transistor, 2N5816 NPN
Q412	590-0013-000	Transistor, 2N5089 NPN
Q413	590-0013-000	Transistor, 2N5089 NPN
Q414	590-0017-000	Transistor, 2N5816 NPN
Q415	590-0017-000	Transistor, 2N5816 NPN
		RESISTORS
R401	626-0311-000	Resistor, 100k ohms, ½ watt
R402	626-0295-000	Resistor, 22k ohms, ½ watt
R403	626-0279-000	Resistor, 4.7k ohms, ½ watt
R404	626-0261-000	Resistor, 820 ohms, ½ watt
R405	626-0255-000	Resistor, 470 ohms, ½ watt
R406	636-0002-000	Potentiometer, 10k ohms, ¼ watt
R407	626-0295-000	Resistor, 22k ohms, ¼ watt
R408	626-0287-000	Resistor, 10k ohms, ¼ watt
R409	626-0279-000	Resistor, 4.7k ohms, ¼ watt
R410	626-0287-000	Resistor, 10k ohms, ¼ watt
R411	626-0271-000	Resistor, 2.2k ohms, ¼ watt
R412	626-0275-000	Resistor, 3.3k ohms, ¼ watt
R413	626-0277-000	Resistor, 3.9k ohms, ¼ watt
R414	626-0307-000	Resistor, 68k ohms, ¼ watt
R415	626-0263-000	Resistor, 1k ohm, ¼ watt
R416	626-0287-000	Resistor, 10k ohms, ¼ watt
R417	626-0279-000	Resistor, 4.7k ohms, ¼ watt
R418	626-0239-000	Resistor, 100 ohms, ¼ watt
R419	626-0279-000	Resistor, 4.7k ohms, ¼ watt
R420	626-0287-000	Resistor, 10k ohms, ¼ watt
R421	626-0279-000	Resistor, 4.7k ohms, ¼ watt
R422	626-0279-000	Resistor, 4.7k ohms, ¼ watt
R423	626-0279-000	Resistor, 4.7k ohms, ¼ watt
R424	626-0279-000	Resistor, 4.7k ohms, ¼ watt
R425	626-0287-000	Resistor, 10k ohms, ½ watt
R426	626-0287-000	Resistor, 10k ohms, ½ watt
R427	626-0279-000	Resistor, 4.7k ohms, ½ watt
R428	626-0279-000	Resistor, 4.7k ohms, ½ watt
R429	626-0263-000	Resistor, 1k ohm, ½ watt
R430	626-0239-000	Resistor, 100 ohms, ½ watt
R431	626-0271-000	Resistor, 2.2k ohms, ½ watt
R432	626-0279-000	Resistor, 4.7k ohms, ½ watt
R433	626-0455-000	Resistor, 470 ohms, 1 watt
R434	626-0263-000	Resistor, 1k ohm, 1 watt
R435	626-0279-000	Resistor, 4.7k ohms, 1 watt
R436	626-0279-000	Resistor, 4.7k ohms, 1 watt
R437	626-0455-000	Resistor, 470 ohms, 1 watt
R438	628-0092-000	Resistor, 620 ohms, 1 watt
R439	628-0092-000	Resistor, 620 ohms, 1 watt
R440	628-0455-000	Resistor, 470 ohms, 1 watt
R441	626-0287-000	Resistor, 10k ohms, 1 watt
R442	630-0303-000	Resistor, 47k ohms, ½ watt-film

SYMBOL	PART NUMBER	DESCRIPTION
R443	630-0247-000	Resistor, 220 ohms, ½ watt-film
R444	626-0269-000	Resistor, 1.8k ohms, ½ watt
R445	626-0311-000	Resistor, 100k ohms, ½ watt
R446	636-0002-000	Potentiometer, 10k ohms, ¼ watt
R447	626-0271-000	Resistor, 2.2k ohms, ½ watt
R448	626-0245-000	Resistor, 180 ohms, ½ watt
R449	626-0267-000	Resistor, 1.5k ohms, ½ watt
R450	626-0255-000	Resistor, 470 ohms, ½ watt
R451	626-0295-000	Resistor, 22k ohms, ½ watt
R452	626-0263-000	Resistor, 1k ohm, ½ watt
R453	636-0002-000	Potentiometer, 10k ohms, ¼ watt
R454	626-0307-000	Resistor, 68k ohms, ½ watt
R455	626-0287-000	Resistor, 10k ohms, ½ watt
R456	626-0271-000	Resistor, 2.2k ohms, ½ watt
R457	626-0251-000	Resistor, 330 ohms, ½ watt
R458	626-0299-000	Resistor, 33k ohms, ½ watt
R459	626-0287-000	Resistor, 10k ohms, ½ watt
R460	626-0259-000	Resistor, 680 ohms, ½ watt
R461	626-0231-000	Resistor, 47 ohms, ½ watt

MISCELLANEOUS

TB401	376-0016-000	Barrier strip, 12 terminal
T401	532-0001-020	Transformer, audio NT1277
	613-0001-000	Socket, transistor

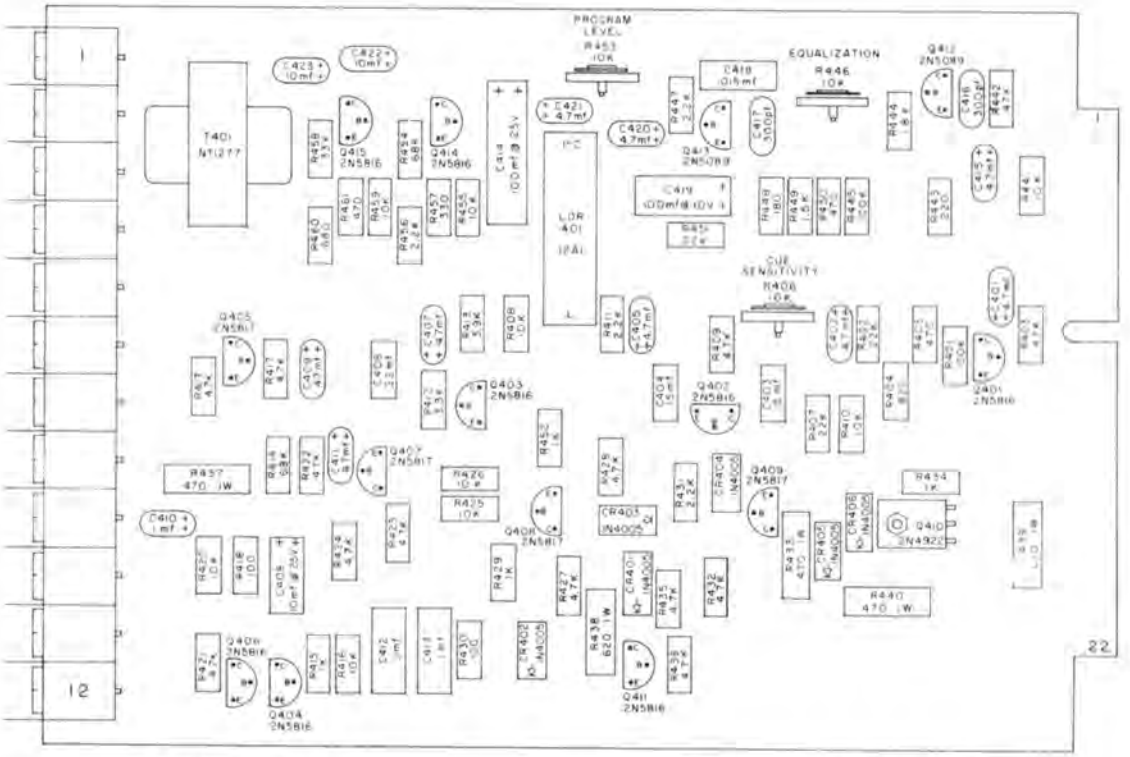


FIGURE 8-3 REPRODUCER FUNCTIONS P C BOARD

C. RECORDER FUNCTIONS PC BOARD (831-0079-003 - Figure 8-4)

SYMBOL	PART NUMBER	DESCRIPTION
		CAPACITORS
C201	694-0003-000	Capacitor, 4.7 mfd, 35v, tantalum
C202	687-0001-000	Capacitor, 10 mfd, 25v, electrolytic
C203	694-0003-000	Capacitor, 4.7 mfd, 35v, tantalum
C204	677-0001-000	Capacitor, 100 pfd, 300v, silver mica
C205	694-0005-000	Capacitor, 1 mfd, 35v, tantalum
C206	696-0122-000	Capacitor, 50 mfd, 25v, electrolytic
C207	681-0042-000	Capacitor, .0047 mfd, 200v, paper
C208	681-0050-000	Capacitor, .022 mfd, 200v, paper
C209	694-0004-000	Capacitor, .47 mfd, 35v, tantalum
C210	694-0005-000	Capacitor, 1 mfd, 35v, tantalum
C211	681-0052-000	Capacitor, .033 mfd, 200v, paper
C212	681-0031-000	Capacitor, 560 pfd, 200v, paper
C213	687-0006-000	Capacitor, 220 mfd, 25v, electrolytic
C214	694-0005-000	Capacitor, 1 mfd, 35v, tantalum
C215	681-0030-000	Capacitor, 470 pfd, 200v, paper
C216	687-0003-000	Capacitor, 100 mfd, 10v, electrolytic
C217	681-0034-000	Capacitor, .001 mfd, 200v, paper
C218	694-0003-000	Capacitor, 4.7 mfd, 35v, tantalum
		DIODES
CR201	575-0007-000	Diode, 1N4005
CR202	575-0007-000	Diode, 1N4005
CR203	575-0001-000	Diode, 1N295
CR204	575-0001-000	Diode, 1N295
CR205	575-0001-000	Diode, 1N295
CR206	575-0001-000	Diode, 1N295
		INDUCTORS
L201	512-0001-000	10 mh (bias trap)
		TRANSISTORS
Q201	590-0017-000	Transistor, 2N5816 NPN
Q202	590-0018-000	Transistor, 2N5817 PNP
Q203	590-0017-000	Transistor, 2N5816 NPN
Q204	590-0020-000	Transistor, 2N4918 PNP
Q205	590-0018-000	Transistor, 2N5817 PNP
Q206	590-0017-000	Transistor, 2N5816 NPN
Q207	590-0017-000	Transistor, 2N5816 NPN
Q208	590-0017-000	Transistor, 2N5816 NPN
Q209	590-0017-000	Transistor, 2N5816 NPN

SYMBOL	PART NUMBER	DESCRIPTION
		RESISTORS
R201	626-0279-000	Resistor, 4.7k ohms, ½ watt
R202	626-0269-000	Resistor, 1.8k ohms, ½ watt
R203	626-0255-000	Resistor, 470 ohms, ½ watt
R204	626-0279-000	Resistor, 4.7k ohms, ½ watt
R205	626-0299-000	Resistor, 33k ohms, ½ watt
R206	626-0271-000	Resistor, 2.2k ohms, ½ watt
R207	626-0287-000	Resistor, 10k ohms, ½ watt
R208	626-0279-000	Resistor, 4.7k ohms, ½ watt
R209	626-0279-000	Resistor, 4.7k ohms, ½ watt
R210	626-0463-000	Resistor, 1k ohm, 1 watt
R211	626-0279-000	Resistor, 4.7k ohms, ½ watt
R212	626-0279-000	Resistor, 4.7k ohms, ½ watt
R213	626-0239-000	Resistor, 100 ohms, ½ watt
R214	626-0239-000	Resistor, 100 ohms, ½ watt
R215	626-0239-000	Resistor, 100 ohms, ½ watt
R216	626-0311-000	Resistor, 100k ohms, ½ watt
R217	626-0287-000	Resistor, 10k ohms, ½ watt
R218	626-0287-000	Resistor, 10k ohms, ½ watt
R219	626-0239-000	Resistor, 100 ohms, ½ watt
R220	626-0263-000	Resistor, 1k ohm, ½ watt
R221	626-0287-000	Resistor, 10k ohms, ½ watt
R222	636-0002-000	Potentiometer, 10k ohms, ¼ watt
R223	626-0273-000	Resistor, 2.7k ohms, ½ watt
R224	626-0309-000	Resistor, 82k ohms, ½ watt
R225	626-0287-000	Resistor, 10k ohms, ½ watt
R226	626-0283-000	Resistor, 6.8k ohms, ½ watt
R227	626-0263-000	Resistor, 1k ohm, ½ watt
R228	626-0271-000	Resistor, 2.2k ohms, ½ watt
R229	626-0263-000	Resistor, 1k ohm, ½ watt
R230	636-0002-000	Potentiometer, 10k ohms, ¼ watt
R231	626-0267-000	Resistor, 1.5k ohms, ½ watt
R232	626-0287-000	Resistor, 10k ohms, ½ watt
R233	626-0307-000	Resisoor, 68k ohms, ½ watt
R234	626-0265-000	Resistor, 1.2k ohms, ½ watt
R235	626-0287-000	Resistor, 10k ohms, ½ watt
R236	626-0285-000	Resistor, 8.2k ohms, ½ watt
R237	626-0279-000	Resistor, 4.7k ohms, ½ watt
R238	626-0277-000	Resistor, 3.9k ohms, ½ watt
		MISCELLANEOUS
TB201	376-0016-000	Barrier strip, 12 terminal
T201	532-0001-020	Transformer, audio NT1277
	613-0001-000	Socket, transistor

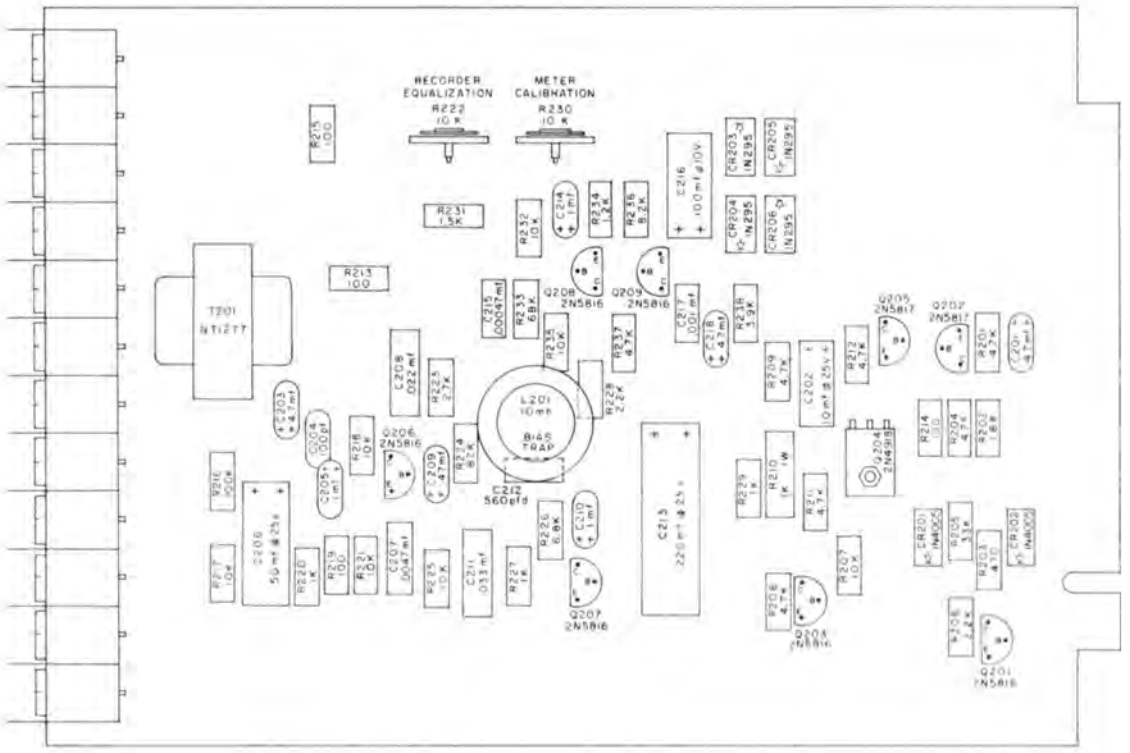


FIGURE 8-4 RECORDER FUNCTIONS P C BOARD

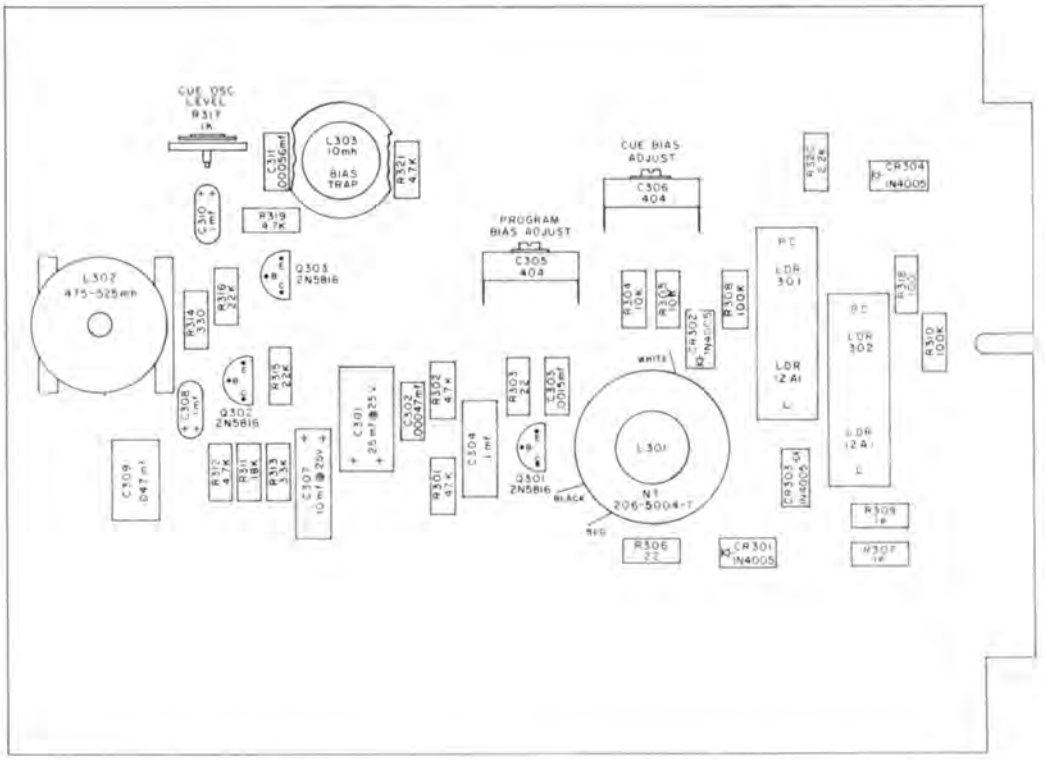


FIGURE 8-5 OSCILLATOR P C BOARD

D. OSCILLATOR PC BOARD (831-0081-003 - Figure 8-5)

SYMBOL	PART NUMBER	DESCRIPTION
		CAPACITORS
C301	696-0119-000	Capacitor, 25 mfd, 25v, electrolytic
C302	831-0030-000	Capacitor, 470 pfd, 200v, paper
C303	681-0036-000	Capacitor, .0015 mfd, 200v, paper
C304	681-0058-000	Capacitor, .1 mfd, 200v, paper
C305	688-0007-000	Capacitor, 7-65 pfd, adjustable
C306	688-0007-000	Capacitor, 7-65 pfd, adjustable
C307	696-0117-000	Capacitor, 10 mfd, 25v, electrolytic
C308	694-0005-000	Capacitor, 1 mfd, 35v, tantalum
C309	681-0054-000	Capacitor, .047 mfd, 200v, paper
C310	694-0005-000	Capacitor, 1 mfd, 35v, tantalum
C311	681-0031-000	Capacitor, 560 pfd, paper
		DIODES
CR301	575-0007-000	Diode, 1N4005
CR302	575-0007-000	Diode, 1N4005
CR303	575-0007-000	Diode, 1N4005
CR304	575-0007-000	Diode, 1N4005
		INDUCTORS
L301	511-0004-000	Toroid, NT206-5004-7
L302	513-0002-000	Adjustable, 475-525 mh
L303	512-0001-000	Inductor, 10 mh (bias trap)
		LIGHT DEPENDENT RESISTORS
LDR301	650-0003-000	LDR, 301T1, Sigma
LDR302	650-0003-000	LDR, 301T1, Sigma
		TRANSISTORS
Q301	590-0017-000	Transistor, 2N5816 NPN
Q302	590-0017-000	Transistor, 2N5816 NPN
Q303	590-0017-000	Transistor, 2N5816 NPN
		RESISTORS
R301	626-0303-000	Resistor, 47k ohms, ½ watt
R302	626-0279-000	Resistor, 4.7k ohms, ½ watt
R303	626-0223-000	Resistor, 22 ohms, ½ watt

SYMBOL	PART NUMBER	DESCRIPTION
R304	626-0287-000	Resistor, 10k ohms, ½ watt
R305	626-0287-000	Resistor, 10k ohms, ½ watt
R306	626-0223-000	Resistor, 22 ohms, ½ watt
R307	626-0263-000	Resistor, 1k ohm, ½ watt
R308	626-0311-000	Resistor, 100k ohms, ½ watt
R309	626-0263-000	Resistor, 1k ohm, ½ watt
R310	626-0311-000	Resistor, 100k ohms, ½ watt
R311	626-0293-000	Resistor, 18k ohms, ½ watt
R312	626-0279-000	Resistor, 4.7k ohms, ½ watt
R313	626-0275-000	Resistor, 3.3k ohms, ½ watt
R314	626-0251-000	Resistor, 330 ohms, ½ watt
R315	626-0295-000	Resistor, 22k ohms, ½ watt
R316	626-0295-000	Resistor, 22k ohms, ½ watt
R317	636-0008-000	Potentiometer, 1k ohm, ¼ watt
R318	626-0239-000	Resistor, 100 ohms, ½ watt
R319	626-0279-000	Resistor, 4.7k ohms, ½ watt
R320	626-0271-000	Resistor, 2.2k ohms, ½ watt
R321	626-0279-000	Resistor, 4.7k ohms, ½ watt

E. CHASSIS ELECTRICAL PARTS

MOTOR

B1	451-0053-020	Motor, capstan

CAPACITORS

C1	698-0004-000	Capacitor, dual 1000 mfd, 50 v, electrolytic
C2	685-0010-000	Capacitor, 1.5 mfd

FUSE

F1	417-0002-000	Fuse, lamp, slo-blo 3AG

LAMPS

I1, I2, I3	415-0006-000	Lamp, bi-pin 7387

INDUCTORS

L1	504-0023-000	Head, monophonic record
L2	504-0022-000	Head, monophonic reproduce
L3	477-0013-000	Solenoid, pressure roller

METER

M1	554-0002-000	Meter, VU scale

SYMBOL	PART NUMBER	DESCRIPTION
	POTENTIOMETER	
R1	636-0003-000	Potentiometer, 500 ohms, 2 watt
	SWITCHES	
S1	391-0009-000	Switch, record (red)
S2	391-0008-000	Switch, start (green)
S3	392-0002-000	Switch, cartridge sensing
S4	391-0007-000	Switch, stop (yellow)
	TRANSFORMER	
T1	526-0002-000	Transformer, power NT1117
	VOLTAGE REGULATOR	
U1	605-0004-000	I.C., LM340-24

ALL COMPONENTS TO THE LEFT SIDE OF DASHED LINE ARE ON RECORDER UNITS ONLY.

RECORDER LOGIC

PROGRAM RECORDING AMPLIFIER

METER AMPLIFIER

BIAS OSCILLATOR

CUE OSCILLATOR

CUE DETECTOR

REPRODUCER LOGIC

PROGRAM REPRODUCE AMPLIFIER

NOTES:
1. ALL RESISTORS 1/2 WATT UNLESS OTHERWISE NOTED.
2. ALL CAPACITOR VALUES IN MICROFARADS UNLESS OTHERWISE NOTED.
3. ALL POINTS MARKED ▷ ARE AT +24 VDC.
4. ALL POINTS MARKED ▶ ARE AT +40 VDC.
5. ⊣ INDICATES CHASSIS GROUND.
6. COMPONENT VALUES ARE SUBJECT TO CHANGE WITHOUT NOTICE IN ORDER TO OPTIMIZE CIRCUIT PERFORMANCE.

FIGURE 8-6

TITLE	
SCHEMATIC, PD-II SERIES RECORDER & REPRODUCER	
INTERNATIONAL TAPETRONICS CORPORATION BLOOMINGTON, ILL. 61701	893-0056-004 DRAWING NUMBER — REV.

SECTION IX

MAINTENANCE SCHEDULE — PD-II SERIES

A. GENERAL

International Tapetronics has designed the PD-II Series equipment with excellent reliability and minimum maintenance as primary design goals. Stark simplicity and mechanical strength is an important factor in reducing mechanical maintenance. Electronic dependability is assured through the use of negative feedback and other technigues which stabilize circuits which are subjected to widely varying ambient conditions.

B. MECHANICAL MAINTENANCE

1. Weekly Maintenance:

   a. Clean the capstan and pressure roller with a cloth dipped in alcohol. Remove all traces of lubricant and oxide from both the capstan and pressure roller.

   b. Clean the heads with a soft cloth or cotton swab dipped in a head cleaning solution.

2. Monthly Maintenance:

   a. Capstan motor - since the capstan motor is a 450 RPM, direct drive, hystersis synchronous device, there are no belts, pulleys, or flywheel assembly to cause speed variables. The bearings in this motor are permanently sealed ball bearings which need no lubrication. Any effort to lubricate the motor bearings will result in oil seeping into the motor windings.

   b. Check the pressure roller pressure using ITC pressure roller gauge 830-0006-001 (see Section IV-D).

   c. Check the head alignment (see Section IV-F).

   d. The PD-II equipment requires no lubrication.

C. ELECTRICAL MAINTENANCE

The electrical maintenance is to be conducted monthly and takes the form of measuring electrical parameters and

making corrective adjustments if required. Approximately 5 minutes is required to test a record/play unit and 3 minutes on a play unit.

Using the procedures outlined in Section VII, check the playback cue sensitivity, program play level and equalization, recorded program level and equalization, and the recorded cue tone level.

SECTION X

WARRANTY

PD-II SERIES

Seller warrants to purchaser that the equipment sold is free of defects of workmanship or material and conforms to the specifications referred to or set out herein. This warranty extending only to the original user is for a period of one year from date of shipment and no claim shall be maintained hereunder unless written notice is received by Seller within thirty days after discovery of the facts giving rise to the claim. The sole or exclusive liability of seller for breach of warranty shall be to refund the purchase price of the item sold, or at its option, to replace or repair the item or part concerned FOB its factory, or such other place as it may designate. Seller's liability shall arise only if purchaser causes the defective part or item to be delivered to Seller for inspection upon Seller's request at Purchaser's expense. Items manufactured by persons other than Seller shall bear the warranty given by such other persons and no other warranty. This warranty shall not be effective if the alleged defect is due to maltreatment, exposure, excessive moisture, or any other use of the equipment other than the use for which the manufacturer prescribed.

No other warranties expressed or implied shall be applicable to any equipment sold hereunder, and the foregoing shall consitute the Buyer's sole right and remedy under the agreements in this paragraph contained. In no event shall International Tapetronics Corporation have any liability for consequential damages, or for loss, damage, or expense directly or indirectly arising from the use of the products, or any inability to use them either separate or in combination with other equipment or materials, or from any other cause.

This Seller's Warranty is given solely to the original user and only to the extent above described. No dealer or agent is authorized to make any other or additional guaranty or warranty.