

SERVICE MANUAL

CARAMATE

SERIES 4000

PROJECTORS

TELEX[®]

TELEX COMMUNICATIONS, INC.

9600 Aldrich Ave. So., Minneapolis, MN 55420 U.S.A.

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PREFACE

This Service Manual is for the use of service representatives and technical personnel engaged in servicing and maintaining the Telex Caramate Series 4000 Projectors. Every effort is to be made to keep this manual current by issuing addenda pages reflecting design changes in the device.

INTRODUCTION

This Service Manual is divided into six major sections. Section I, GENERAL DESCRIPTION, contains a brief operational description and design center specifications. A list of tools and materials required for servicing is also included in this section. Section II, THEORY OF OPERATION, provides more specific information on mechanical and electrical operation of the system. Section III, MECHANICAL MAINTENANCE, presents general preventive techniques, internal and external adjustments and disassembly procedures. Section IV, ELECTRICAL MAINTENANCE, provides information on alignment and test procedures. The schematic diagrams are located at the end of this section. Section V, TROUBLESHOOTING, contains information to assist in mechanical and electrical fault isolation. Section VI, ILLUSTRATED PARTS LIST, contains exploded views of the various assemblies, circuit board diagrams, and detailed information to be used when ordering replacement parts. The circuit board diagrams in this section may also be useful for part locating when troubleshooting the unit.

SERVICE AND REPAIR

All equipment returned for Telex repair must be accompanied with documentation stating your return address and telephone number along with information regarding the nature of the problem. In lieu of this, you may obtain a Return Authorization Form by writing to:

Customer Service Department
Telex Communications, Inc.
9600 Aldrich Avenue South
Minneapolis, Minnesota 55420 U.S.A.

Do not return equipment to above address, but to an address listed below.

Warranty - If in warranty, no charge will be made for the repairs; however, proof of date of purchase must accompany the returned equipment. Equipment being returned for in-warranty repair must be sent prepaid and will be returned prepaid, or may be taken to the nearest Authorized Warranty Service Station.

Non-Warranty - Equipment that is not under warranty must be sent to the Telex plant prepaid. If requested, an estimated cost will be issued prior to service. Once your approval for repair has been received, and repair of equipment is completed, the equipment will be returned on a collect basis.

Return equipment to:

Eastern Region:

1406 Bergen Road
Ft. Lee, NJ 07024 U.S.A.
Phone: (201) 947-0666

Telex Factory:

West First Street
Blue Earth, MN 56013 U.S.A.
Phone: (507) 526-3205

Telex Communications, Ltd.

705 Progress Avenue, Unit 10
Scarborough, Ontario M1H-2X1 Canada
Phone: (416) 431-4975

REPLACEMENT PARTS

Authorized Telex Service Centers stock commonly needed replacement items. Parts not available locally may be ordered from our Parts Department. When ordering, please include the Model and Serial numbers, Part Description and Part Number and mail to:

Parts Department
Telex Communications, Inc.
9600 Aldrich Avenue South
Minneapolis, Minnesota 55420 U.S.A.

16128894051

REVISION STATUS

Periodically this manual will be reprinted to reflect current design and manufacturing. During the interim, production design modifications shall be issued in the form of Service Bulletins, Addenda, or revised insert pages. Upon receipt of such information, insert the material in the manual and enter the issue date and initials in the Record of Revisions.

When the manual is reprinted in its entirety all previously released temporary information shall be incorporated in the current printing and recorded in the Record of Revisions.

RECORD OF REVISIONS

REVISION NUMBER	ISSUE DATE	EFFECTIVE PAGES	PURPOSE OF REVISION	BY

SECTION I

GENERAL DESCRIPTION

1.1 INTRODUCTION

The Telex Caramate Series 4000 Projectors are designed for applications that require self-contained screen (rear screen) and wall screen projection capabilities accompanied by sound or by personal narrative.

1.2 SPECIFICATIONS

GENERAL

Power Requirement: Domestic Models: 120 volts, 60 Hz, 2.2 amps. International Models: 220/240 volts, 50 Hz, 1.6 amps.

Power Cord: 8-foot (2.44 m), 3-wire, grounded. International models supplied with a power cord receptacle.

Slide Acceptance: All 2-inch (50 mm) by 2-inch (50 mm) slides (135 mm, 126 mm, and super slides). Card-board, plastic, and metal slide mounts (with or without glass) may generally be used and mixed in 80-capacity slide trays.

Slide Trays: Accepts all Kodak® stack loaders and Carousel® and Ektographic® 80- or 140-capacity slide trays as well as similar trays manufactured by others for Carousel projectors.

Projection Lenses: Standard Lens: 75 mm f/3.5. Magna-Frame Lens: 56 mm f/3.0.

Projection Lamp: ANSI code DDM, 19-volt, 80-watt (Quartz-Halogen Integral Specular Reflector).

Table 1.1 Caramate Series 4000 Features

Model Number	Image-Lok™ (AUTO-FOCUS)	Audio Control Panel Door*	Pause/Restart	Record Audio and Advance Pulses**	Record Audio and Stop Pulses**	Playback Audio and Senses Advance Pulses	Playback Audio and Senses Advance and Stop Pulses	Voltage Requirements	
								120	220/240
4320		*				X		X	
4324		*				X			X
4340		*		X		X		X	
4344		*		X		X			X
4460	X	*				X		X	
4464	X	*				X			X
4470	X	*	X			X	X	X	
4474	X	*	X			X	X		X
4480	X	X		X		X		X	
4484	X	X		X		X			X
4490	X	X	X	X	X	X	X	X	
4494	X	X	X	X	X	X	X		X

* Control panel door is available as a dealer-installed option.

** Pulse controls are located on both the projector and the remote control.

Note: Models 4120 and 4124 are also included in the Caramate 4000 Series. These models offer most of the Series 4000 features with the exception of audio components.

Projection Lamp Life:	Approximately 1200 hours with lamp switch in LO position and 125 hours with lamp switch in HI position.
Amplifier Output:	5 watts rms continuous with maximum THD of 5% (except 4120 and 4124 models).
Speaker:	Oval 3-inch (75 mm) by 5-inch (125 mm) (except 4120 and 4124 models).
Auxiliary Speaker Jacks:	Standard ¼-inch (6.25 mm). Use 8-ohm speaker (except 4120 and 4124 models).
Headphone Jacks:	Standard ¼-inch (6.25 mm). Use 8-ohm to 2000-ohm headphones (except 4120 and 4124 models).
Projector Screen Dimensions:	9-inch (229 mm) by 9-inch (229 mm). Diagonal 12-inches (305 mm).
Projector Dimensions:	13¾-inches (344 mm) high by 13-inches (325 mm) wide by 12¾-inches (319 mm) deep.
Projector Weight:	Approximately 18 pounds (8 kg) to 20 pounds (9 kg).
Projector Color:	Two-tone silver gray.

TAPE DECK (Except 4120 and 4124 models)

Cassette Acceptance:	Accepts all cassette tapes recorded in accordance with the "Separate Track System" as per ANSI Standard PH 7.4 (1975) and IEC Standard 574-10 (Audio Cassette System).
Audio Track Configuration:	Tracks 1 and 2 combined, one direction only, monaural.
Cue Pulse Track Configuration:	Tracks 3 and 4 combined.
Tape Speed:	1-7/8 ips (4-3/4 cm/s) $\pm 3\%$, electronically governed automatic stop at end of tape in any mode.

Wow and Flutter:	0.45%
Advance Cue Frequency:	1000 Hz $\pm 5\%$
Advance Cue Duration:	0.45-second ± 0.07 -second.
Advance Cue Spacing:	1.5 seconds minimum between the start of two advance cues.
Advance Cue Level:	-6 dB ± 3 dB (ref to 250 nWb/m at 315 Hz).
Stop Pulse Frequency:	150 Hz $\pm 5\%$.
Stop Pulse Duration:	0.45-second ± 0.07 -second.
Stop Pulse Spacing:	2.0 seconds minimum between the end of a stop cue and the start of recorded material.
Stop Pulse Level:	-6 dB ± 3 dB (ref to 250 nWb/m at 315 Hz).
Cassette Rewind Time:	90 seconds nominal (C-60).

1.3 TOOLS

19-711 Test Tapes (SS-345)
 19-708 Alignment slide
 19-714 Torque Cassette, Hartak No. X-87
 Head Alignment Cassette (local purchase)
 Tape Head Demagnetizer (local purchase)
 Slide Tray with Slides (glassless, film-mounted and glass, film-mounted)
 General Hand Tools
 Multimeter
 Oscilloscope
 VTVM
 SS-368 Exciter Lamp Alignment Slide

1.4 MATERIALS

39479-P9: DC-44 Light Consistency Silicone Grease, Dow Corning Corp., Midland, Michigan, 2 oz.

39479-P16: Extreme Pressure Lube No. 3, Evans Product Co., 4 oz.

39479-P1: Glyptal 7526 (Blue), General Electric Co., Schenectady, N.Y.

39479-P2: Glyptal 1276 (Clear), General Electric Co., Schenectady, N.Y.

46464-P1: Tape, 3M Co., No. 4416, 9 yd roll.

Local Purchase: Denatured (isopropyl) alcohol.

Local Purchase: Dry Neolube, Huron Industries, Port Huron, Michigan.

Local Purchase: Plastic cleaner.

Local Purchase: Glass cleaner.

Local Purchase: Cotton swabs.

Local Purchase: Mobil Oil No. 1.

SECTION II

THEORY OF OPERATION

2.1 INTRODUCTION

The following paragraphs describe the mechanical and electrical principles of operation. All electronic functions described in this section are based upon the schematic diagrams provided in Section IV of this manual. Component reference designators, U1, Q1, R1, C1 and so forth, used in the following text are keyed to both the relevant schematic diagram and associated parts list.

2.2 MECHANICAL DESCRIPTION

2.2.1 SLIDE MECHANISM

2.2.1.1 Drive Clutch

When the main power switch is on, torque from the motor, through the neoprene drive belt, to the pulley and worm gear will drive the cam worm gear (Figure 2.1).

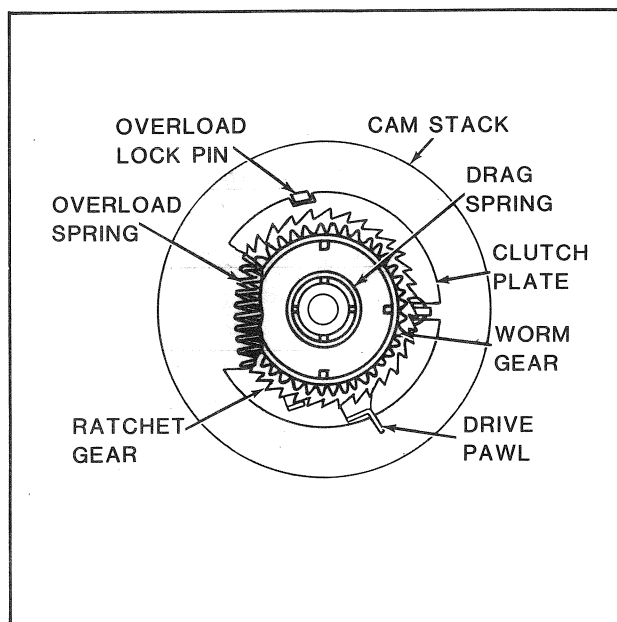


Figure 2.1 Drive Clutch

In the idle condition, the cam worm gear is driven, but the drag spring allows it to slip on its shaft. The drive pawl is held "open" by the escapement lever (Figure 2.2) and the cam stack does not turn.

In the drive condition, the escapement lever, which is linked to the solenoid, is pulled to release the drive pawl which swings "closed" (Figure 2.3) to engage the ratchet gear. The cam worm gear, coupled through the clutch plate and the overload lock pin, turns the cam stack one revolution or one slide change cycle.

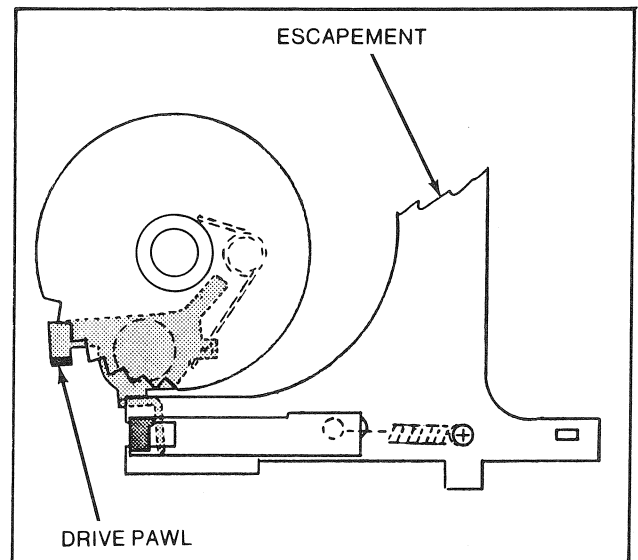


Figure 2.2 Drive Pawl In Idle Condition

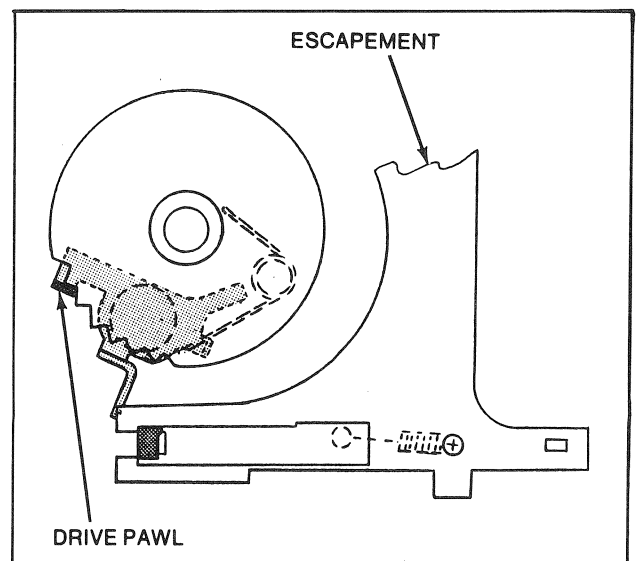


Figure 2.3 Drive Pawl In Drive Condition

If the slide or tray become jammed, it will obstruct the lever movement and cause a binding load on the cam stack. This causes the clutch plate to compress the overload spring and release from the overload lock pin and then the gear assembly and clutch plate complete the cycle to the idle condition, eliminating any further damage. (The gear assembly is a single piece containing the ratchet gear and worm gear.)

NOTE

Timing of cams, levers or drive gears in this mechanism is not required.

In the forward operation the drive pawl is released (Figure 2.3) and the cam stack rotates to drive the tray index arm forward (Figure 2.4). The tray index pin guides along the "front V" of the forward/reverse cam to advance the slide tray to the next slide.

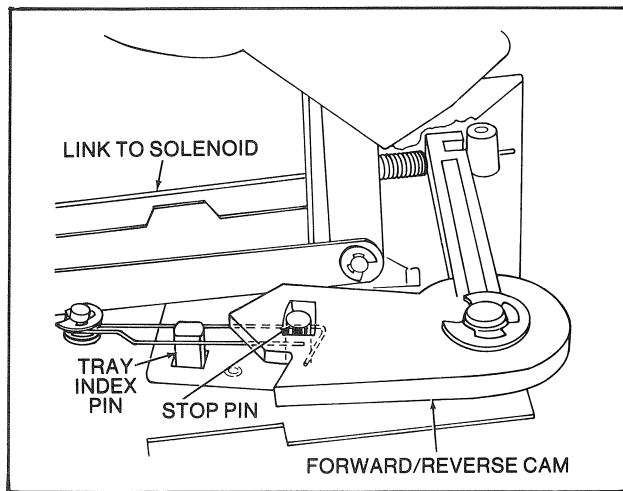


Figure 2.4 Forward Operation

In the reverse operation the drive clutch is released and the cams rotate 120 degrees while the solenoid holds the forward/reverse cam back for 400 milliseconds (Figure 2.5). The cam follower pin drives the tray index arm and its pin to guide along the "rear V" of the forward/reverse cam to reverse the slide tray rotation to the previous slide.

In the select slide operation (Figure 2.6) the solenoid is energized which pulls the escapement allowing the select pawl to drop. The select pawl will then catch the drive pawl after the cams rotate 180 degrees. It will remain in the hold position as long as the solenoid is energized by the SELECT button switch being closed.

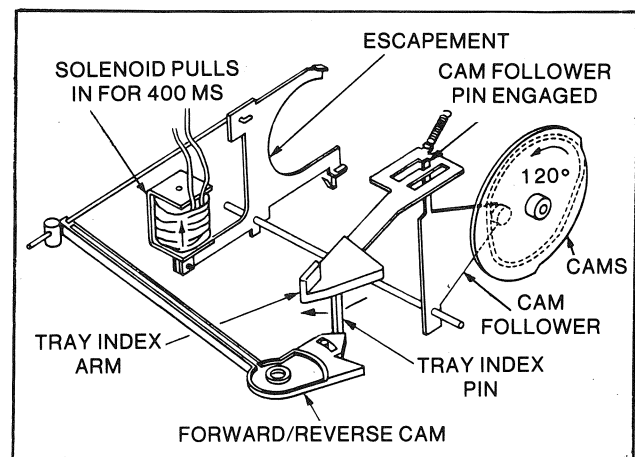


Figure 2.5 Reverse Operation

The SELECT button presses the select arm to pull the link and select lever forward so that the cam follower pin is disengaged, inactivating the tray index. The slide lifter will lift and hold at the top of its stroke. The tray detent will be held back, allowing the slide tray to be manually rotated.

2.2.1.2 Shutter And Slide Clamps Figure 2.7

The cam follower lever controls shutter closure and cams the face clamps open. Coil springs control the face edge clamps and provide a lever override.

The slide is registered toward the center by the edge clamp. The slide in the gate releases the latch (1) and allows the springs to pull the cam follower (2) and open the shutter blades (3). At the same time, the slide face clamps are spring loaded against the slide.

When the slide is ejected, the cam follower is driven up to close the shutter blades and open the side clamps. The face clamps are closed until the slide is about 80 percent up in the tray. Then the cam cams the face clamps open and holds to receive the next slide. If there is no next slide, the cam follower drops a bit to close the face clamps and latch on the edge clamp.

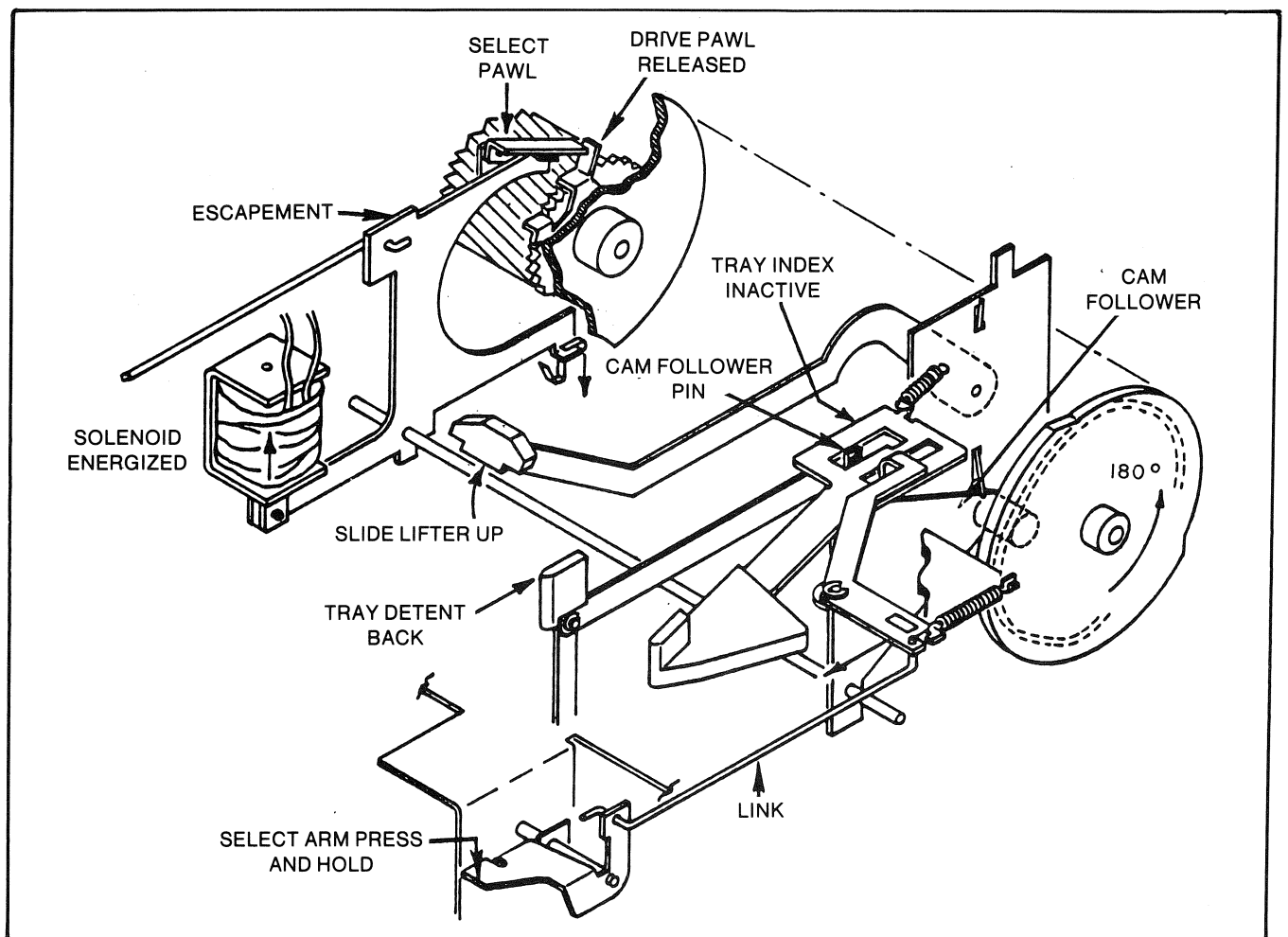


Figure 2.6 Select Operation

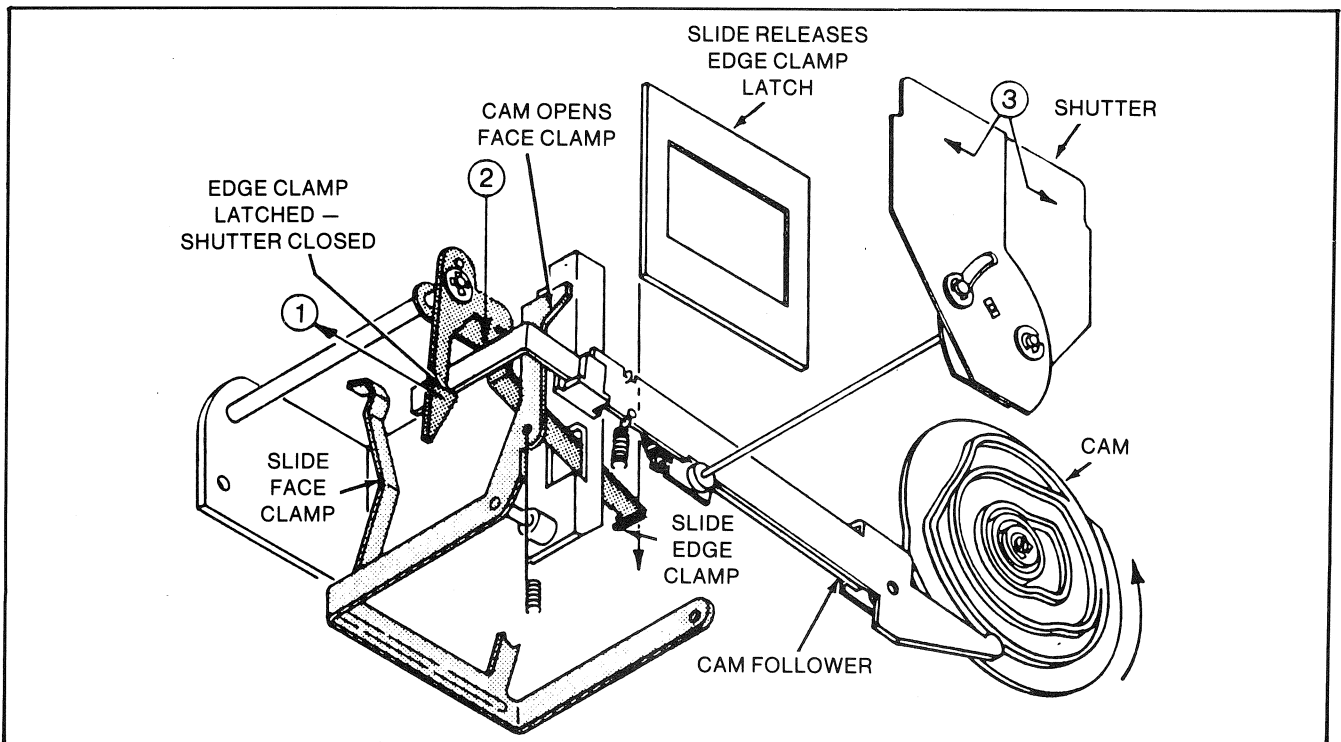


Figure 2.7 Shutter and Slide Clamp Operation

2.2.1.3 Detent (Slide Tray Lock)

Figure 2.8

The detent locates and locks the slide tray slot over the mechanism slide guides assuring that the slide will drop by gravity into the project position.

The cam, cam follower and levers provide drive to the detent. The cam assembly is designed so that the detent locks the tray until the lifter is up and the slide is 80 percent within its tray slot. Then the detent pulls back until the tray is indexed. The detent locks the tray before the lifter drops the next slide. There is no adjustment of this function.

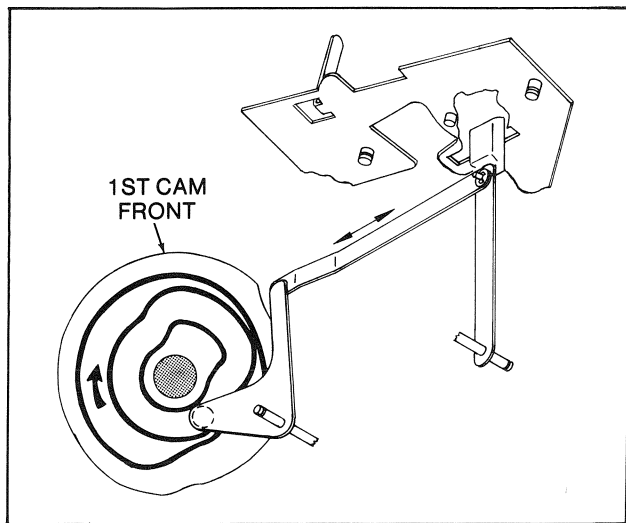


Figure 2.8 Detent or Slide Tray Lock

2.2.1.4 Slide Lifter

Figure 2.9

The slide lifter is a cam driven lever having an adjustable fulcrum point which changes high-lift position of the slide pad.

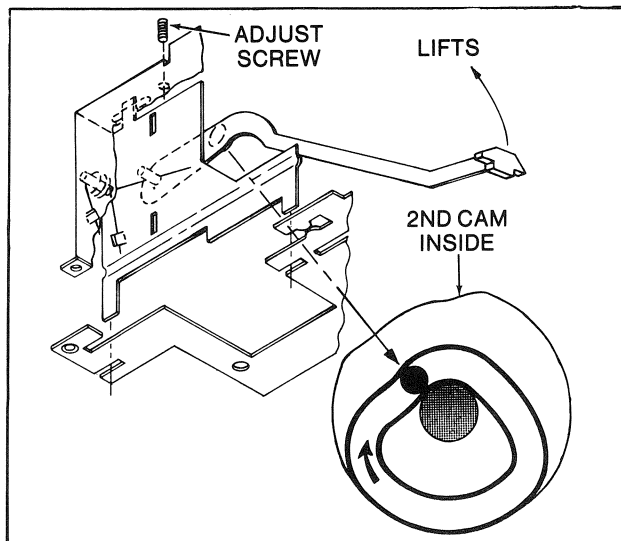


Figure 2.9 Slide Lifter

2.2.2 TAPE DECK ASSEMBLY

With only minor differences, the principles of operation are the same for all tape decks used in the Series 4000 Projectors.

2.2.2.1 Play Mode

Depressing the PLAY button pushes the brake lever back, closing the leaf switch to apply power to the motor and releasing the brake arm to allow the supply reel and the take-up reel to turn (Figure 2.10). At the same time, the head panel assembly is pushed toward the tape cassette allowing the tape heads and the pressure roller to engage the tape in the cassette. The entire mechanism locks in this position due to the action of the push lever lock plate (Figure 2.11).

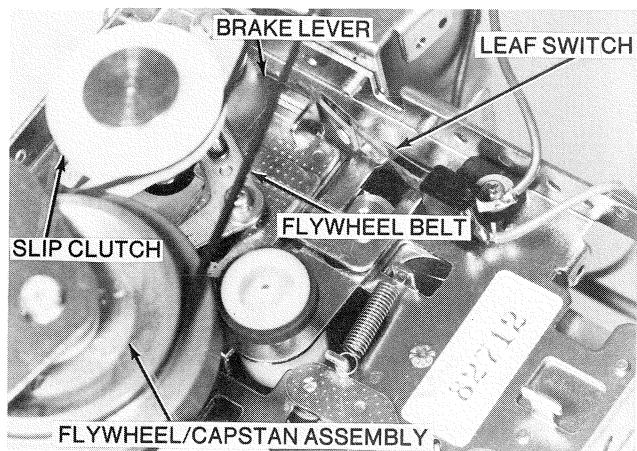


Figure 2.10 Play Mode - Bottom View

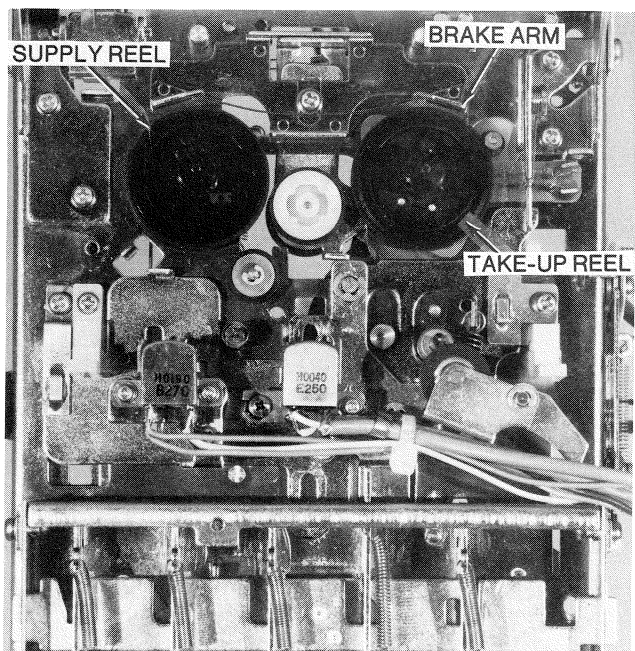


Figure 2.11 Play Mode - Top View

When the head panel assembly is moved toward the tape cassette, the cam follower pin on the slip clutch follows the cammed right edge of the head panel assembly bottom plate. This allows the drive spindle of the clutch to engage the take-up reel (Figure 2.12).

The leaf switch closes first to apply power to the motor before any other event takes place. This permits the motor to come up to speed before the full load is applied. The motor drives the slip clutch and the flywheel/capstan assembly with the flywheel belt. The brake arm then releases and, almost at the same time, the slip clutch drive spindle engages the take-up reel assembly to take up any slack in the tape.

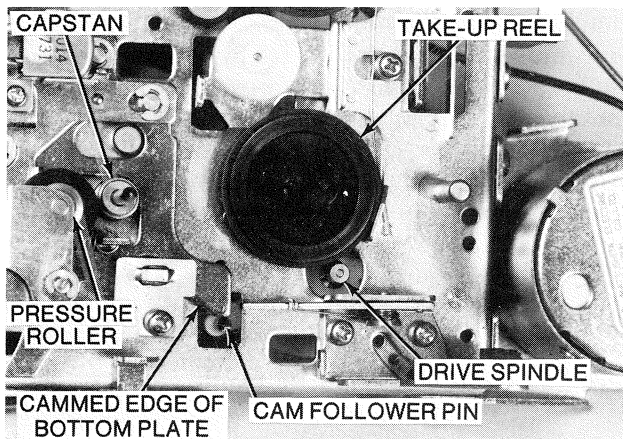


Figure 2.12 Reel Engagement

2.2.2.2 Record Mode Figure 2.13

Recording with the tape decks used in the Telex projectors is accomplished by depressing both the PLAY and RECORD buttons simultaneously (4340, 4480 and 4490 only).

NOTE

The RECORD button cannot be depressed unless the breakout lugs are left intact in the back of the tape cassette.

When the tape cassette is inserted in the cassette holder, breakout lugs intact, the breakout lug on the bottom engages the erase prevent latch and causes it to rock back and lift its lower tab out of the way of the rear tab of the erase prevent latch. A push plate, mounted to the bottom of the erase prevent latch, operates the record switch.

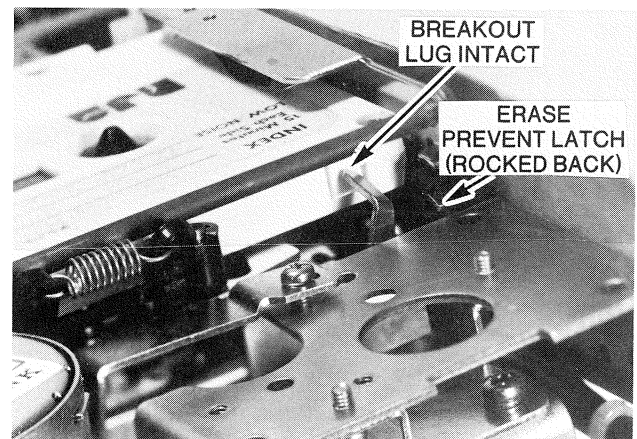


Figure 2.13 Erase Prevent Latch

2.2.2.3 Fast Forward Mode Figures 2.14 and 2.15

The brake lever, rewind lever, and fast forward arm are all pushed toward the back of the tape deck when the FORWARD (fast forward) button is depressed. The rewind lever allows the fast forward idler arm assembly to move over and engage the flywheel. The fast forward arm causes the fast forward tension arm to pivot and draw the fast forward idler arm assembly over further so the upper wheel can engage the take-up reel assembly. Rapid movement of tape through the tape deck in a forward direction results since the flywheel has been connected directly to the take-up reel assembly through the fast forward idler arm assembly. The tape heads and pressure roller are prevented from engaging the tape during this operation.

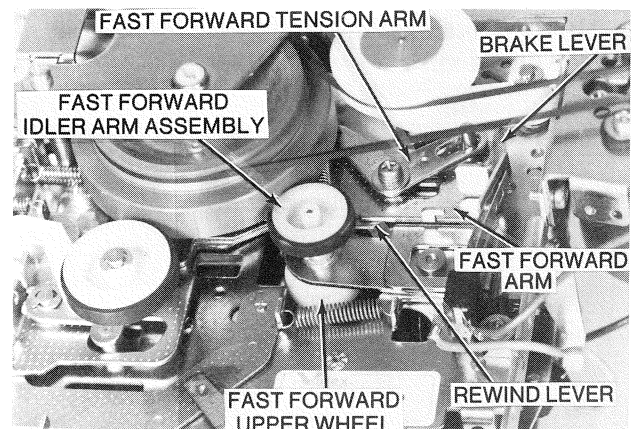


Figure 2.14 Fast Forward Operation - Bottom View

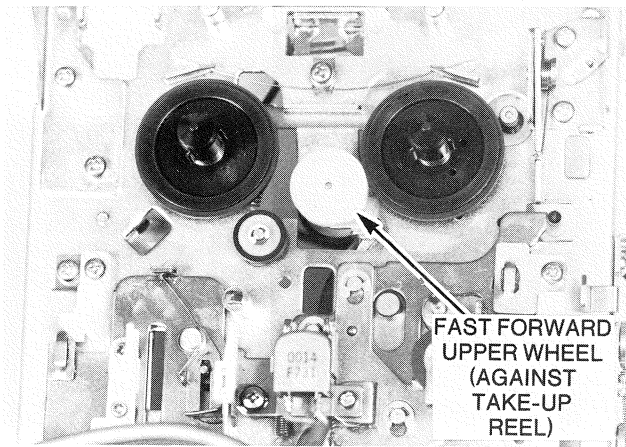


Figure 2.15 Fast Forward Operation - Top View

2.2.2.4 Rewind Mode

Figure 2.16

When the REWIND button is depressed, the flywheel is directly connected to the supply reel through the fast forward idler arm assembly and the rewind idler. The fast forward arm does not move far enough to engage the take-up reel assembly; however, the rewind idler arm assembly does move toward the back of the tape deck resulting in the rewind idler engaging the top roller of the fast forward idler arm assembly and the supply reel assembly simultaneously. Direct drive from the flywheel to the supply reel assembly is accomplished, and the tape will be transported rapidly through the tape deck in a reverse direction.

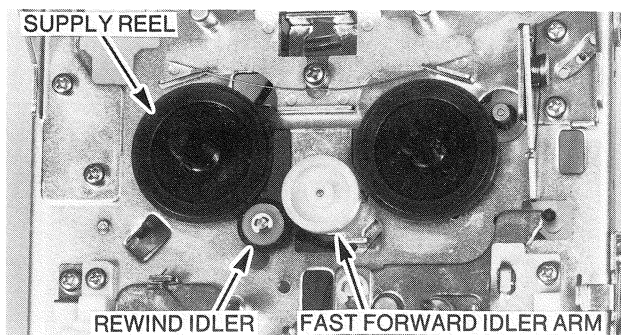


Figure 2.16 Rewind Operation

2.2.2.5 Auto-Stop Function

Figures 2.17 and 2.18

An electro-mechanical auto-stop is used to disengage the transport, in any mode, at the end of a tape.

A segmented pcb sensor switch and slider are used to detect tape motion. These two components are mounted under the take-up reel assembly. When the take-up reel turns, the slider intermittently shorts the segments of the pcb sensor switch. The sensor switch is connected to electronic circuitry which detects the opening and closing of the switch. If the take-up reel stops turning, the electronic circuitry recognizes that the switch is no longer opening and closing and causes the auto-stop solenoid to operate. The auto-stop solenoid pulls the link rod which pulls the auto-idler support towards the flywheel forcing the auto-idler into the flywheel.

An eccentric pin on the auto-idler strikes the auto-lever causing it to pivot. A notch in the end of the auto-lever pushes on a pin on the push lever lock plate assembly causing the lock plate assembly to slide sideways releasing the tape deck buttons.

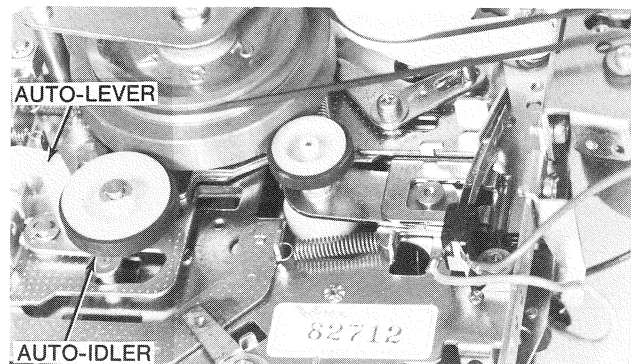


Figure 2.17 Auto-Stop Operation

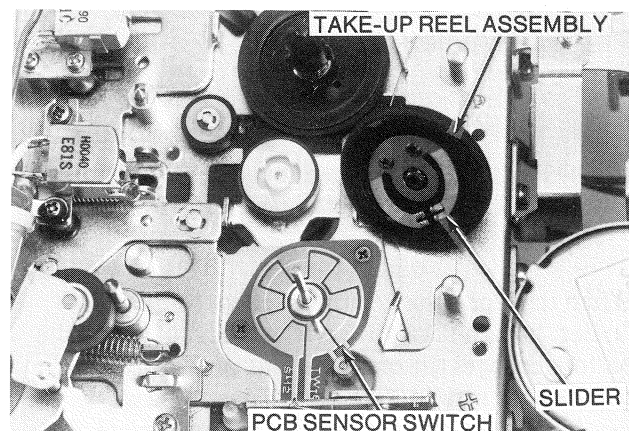


Figure 2.18 Sensor Switch Location

2.3 ELECTRICAL DESCRIPTION

This section uses a block diagram approach (Figures 2.26-2.31) to explain the operation of the cue detection circuits and the tray and tape control circuits. Where it is thought to be useful, additional details are provided in the text. Other circuits are explained based on their operation in the Model 4490, and these explanations can be adapted to other models. The schematics for all models are located in Section IV.

2.3.1 ADVANCE OPERATION

The slide tray may be advanced manually on all models, and under program control on models with tape decks.

For manual operation, the user presses the FORWARD button, and this action causes a high to be output from the advance logic. This logic high is not coupled directly to the tray control solenoid transistor, but rather, is coupled through an RC time constant circuit. The RC time constant ensures that no matter how long the advance logic output is high, bias current will only flow to the solenoid control transistor for approximately 120 milliseconds for correct advance operation of the slide mechanism.

When advancing the slide tray under program control, 1000 Hz cue pulses on tape tracks 3 and 4 are picked up by the tape head, amplified, filtered and converted to a single logic high pulse using a ramp generator (Figure 2.19). This logic high is not a clean square wave, but the only requirement is that the pulse rise (ramp) above one half the supply voltage - all voltages above this level will appear as logic high to the CMOS gates in the advance logic circuit.

2.3.2 REVERSE OPERATION

When the operator presses the REVERSE button, a logic high is output from the reverse latch. This logic high is not coupled through an RC time constant as for advance operation - reverse timing is accomplished by the cam switch (S5). This normally closed switch is operated by a cam in the slide mechanism to open approximately 400 milliseconds into any cycle, and it always recloses at the end of the cycle. When S5 opens, it causes the reverse latch to be reset, and a logic low reappears at the latch output. The on time for the tray control solenoid transistor is therefore 400 milliseconds for reverse operation.

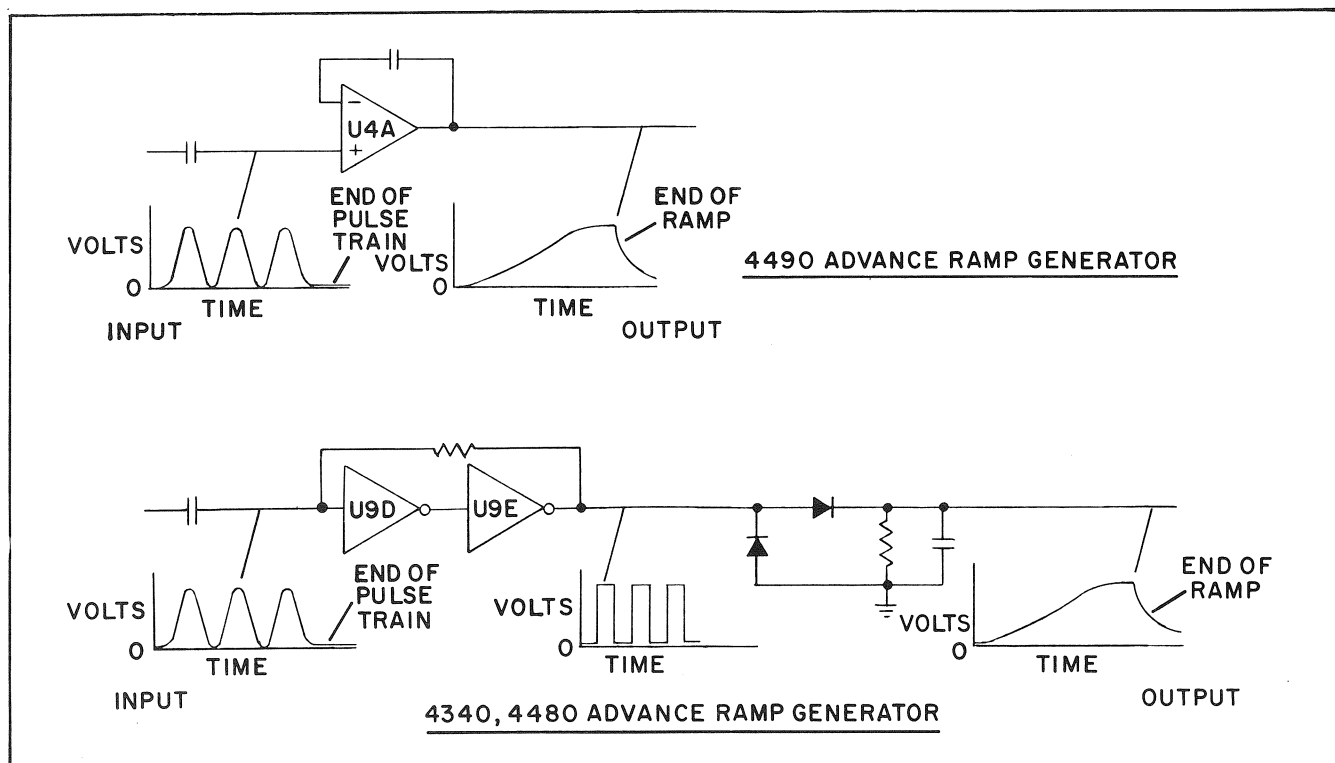


Figure 2.19 Ramp Generator Operation

2.3.3 REPEAT OPERATION

In order to accomplish convenient advance repeat operation, the output of S5 is coupled to the advance logic. When S5 opens during an advance cycle, the advance logic is reset to a low output. This causes the RC time constant circuit to discharge. Thus, if the operator continuously presses the FORWARD button, the slide tray should advance repeatedly until the button is released. Since the reverse latch is also reset by S5, continuously pressing the REVERSE button will cause repeated reverse cycles.

2.3.4 POWER UP PRECONDITIONING

Set-reset latches are used extensively in the Caramate Series 4000 Projectors. When power is first applied to the unit, the preconditioning circuitry ensures that these latches start out with the logic voltage levels indicated in the schematics. If this were not done, the projector could function erratically when first turned on.

2.3.5 PAUSE/RESTART AND RECORD PAUSE OPERATION

On the Models 4470 and 4490, the tape deck motor may be stopped (during playback) either manually using the PAUSE/RESTART button, or under program control. In addition, on all models with record capability, the tape deck may be paused with the switch on the recording microphone.

2.3.5.1 Stop/Restart Latch

Note that there are two outputs from the stop/restart latch. At any given time, one of these outputs will be high, and the other should be low. For normal playback, the high output is provided to the tape deck motor control block, this is defined as the reset condition for the stop/restart latch. When the tape deck motor is stopped in playback mode, it is because the latch has been "set" as described in the following paragraphs. In the set condition, the latch provides the high output to the dc control block instead of the tape deck motor control block.

To manually stop the tape deck in playback mode, the user presses the PAUSE/RESTART button. This action sets the stop/restart latch. When stopping the tape deck under program control, 150 Hz cue pulses, prerecorded on tape tracks 3 and 4, are picked up by the tape head, amplified, filtered and converted to a single logic pulse by the stop ramp generator. The stop ramp generator output is then used to set the stop/restart latch.

To resume operation of the tape deck after it has been stopped in playback mode, the operator presses the PAUSE/RESTART button which causes the latch to reset.

2.3.5.2 Mic-Remote Switching

Pause operation is featured on the Models 4340, 4480 and 4490. On the 4490, the pause feature operates by setting the stop/restart latch when the mic switch is on the off position. When the mic switch is returned to the on position the latch is reset and motor operation is resumed. In the case of the 4340 or 4480, turning the mic switch off simply disconnects the ground from the motor.

2.3.5.3 Auto-Stop Override

The auto-stop override circuit provides a positive voltage to the auto-stop detection circuit when the tape deck motor is stopped in playback mode. This prevents the auto-stop solenoid from operating to disengage the tape transport.

2.3.5.4 Filter Cutoff

The filter cutoff block prevents any unusually long stop pulses on the program tape from immediately restopping the tape deck motor after operation has been resumed. It does this by providing a positive voltage (derived from the dc control transistor Q7) to saturate the stop pulse filter. This voltage also charges the capacitor shown in the filter cutoff block. The charge on the capacitor is maintained briefly to hold the filter cutoff after the tape deck is restarted.

2.3.6 GENERATING CUE PULSES (4340, 4480, 4490)

On all models with record capability, it is possible to generate 1000 Hz advance signals, and record them on tracks 3 and 4. With the Model 4490 alone, it is also possible to generate and record 150 Hz stop signals. Both types of signal may be recorded while the audio narrative is being recorded, or later, while listening to the audio narrative being replayed.

2.3.6.1 Cue Record Preconditioning

When the record switch (S2) is closed (RECORD button on tape deck depressed) a low is applied to the control input (pin 11) of transmission gate U5A. This causes the record/play head to be connected through pin 14 to pin 12. Closing S2 also turns on electronic switch Q3, which supplies power to several circuits as shown by the triple arrows in Figure 2.31. Some of these circuits are described later in this section.

2.3.6.2 Filter/Oscillator Switching

Advance pulses are recorded by pressing the FORWARD button. The resulting high output from the advance latch still advances the slide tray as previously described. At the same time, this high is routed to the control input of transmission gate U5B (pin 9). While this control input is low, pin 4 is internally connected to pin 5, but when it goes high, U5B internally switches to connect pin 4 to pin 3 causing the advance filter output to be fed back to the filter input. This feedback drives the filter into oscillation at a frequency of 1000 Hz. These oscillations are tapped off, amplified (Q4), mixed with a dc bias voltage, and then fed to the record/play head.

Stop pulses are recorded by pressing the PAUSE/RESTART button. The resulting high output from the stop pulse latch is used to switch transmission gate U5C to generate and record 150 Hz stop pulses.

2.3.6.3 Shunt Operation

The shunt diodes actually have no effect on circuit operation in record mode; however, they are mentioned here because they are used in play mode to prevent the filter/oscillator switching operation just described. When the tape deck is not in record mode, S2 remains open, and Q3 does not provide +12 volts at its collector. As a result, the cathodes of the shunt diodes (D11, D21) are at ground potential. When a gating pulse arrives from the advance latch or the stop pulse latch it is therefore shunted to ground - the voltage at the control inputs of U5B and U5C never reaches the 6 volt minimum level required to cause switching.

2.3.6.4 Stop/Restart Latch Override

Note that when recording stop pulses, pressing the PAUSE/RESTART button does not cause the tape deck to stop. This is because a positive voltage from Q3 through D20 prevents the stop/restart latch from setting.

2.3.6.5 Preamp Cutoff

In record mode, the cue preamp is not used, and its input is left floating. In order to prevent noise from being introduced into the filter(s), a positive voltage is applied to the preamp to hold its output at ground potential.

2.3.6.6 Timer Operation

The timer circuit is used to ensure that cue pulses being recorded will be of sufficient duration to be properly detected during playback. This timer is triggered by pressing either the FORWARD button or the PAUSE/RESTART button, and provides a logic high output to momentarily override the normal resetting action of cam switch (S5). The timer returns to a low output condition approximately 500 milliseconds after the FORWARD or PAUSE/RESTART button is released. Thus all cue pulses recorded on the program tape should be a minimum of 500 milliseconds in duration.

2.3.7 AUTO-STOP CIRCUIT

Auto-stop operation is described for the 4490; however, operation is the same on all units, and only component designations differ.

In either fast-wind mode or playback the takeup reel rotates causing the spindle switch (SW4) to continuously open and close. The resulting square wave is amplified (Q10) and half-wave rectified (D19). The signal from D19 charges C74 and causes Q9 to be held in continuous conduction. While Q9 conducts, Q8 is held in cutoff, and the auto-stop solenoid does not operate.

If the take-up reel stops rotating, conduction through D9 ceases due to the dc blocking action of C75. C74 slowly discharges through R108 and the base emitter junction of Q9, and the collector of Q9 begins to go positive (toward cutoff). Eventually Q8 begins to receive bias current through R111 and R110. Q8 then turns on to operate the auto-stop solenoid, which disengages the tape deck as described in paragraph 2.2.2.5.

2.3.8 START UP TORQUE CIRCUIT (4320, 4460)

On these two models, Q8 is used to develop starting torque for the tape deck motor. Once the motor starts, Q8 shuts off and motor current flows through R90.

2.3.9 AUDIO SECTION

2.3.9.1 Integrated Circuit Preamplifier Figure 2.20

An electronically switched integrated circuit preamplifier (U1) is used on all models with record capability. This chip contains all the necessary circuitry to accommodate the microphone input, tape playback input, playback preamplifier output, record amplifier output, and the automatic level control required for the record function. It also contains the electronic control logic which automatically changes its function from a playback preamplifier to a record preamplifier when the microphone is plugged into the microphone jack and the tape deck RECORD button is depressed.

In the playback mode, a positive voltage is connected to the Record/Play control input, Pin 3, to condition the preamplifier chip to function as a playback preamplifier. This positive voltage is derived from the +12 volt power supply through the audio erase head (H2, CH1) and resistors R22 and R2.

When the microphone is plugged into the microphone (MIC) jack and the tape deck RECORD button is depressed, the projector is conditioned to record audio. These two actions cause record relay K1 to operate because of the ground connected to it through S1 contacts on the microphone jack, and S2, a leaf switch mounted on the tape deck chassis which operates when the record button is depressed.

Operation of the record relay K1 places a ground at the junction of R2, R20 and R22 which conditions three circuits to function as follows:

1. Ground is coupled through R2 to the record/play control input, pin 3 of the electronically switched preamplifier. This conditions the preamplifier to function as a record amplifier and also supplies a ground on pin 2 for the tape head (H1, CH1) and for terminating the playback tape input.
2. Ground is connected to the bottom of R20 to allow the bias oscillator Q1 to produce its bias frequency of approximately 55 kHz.

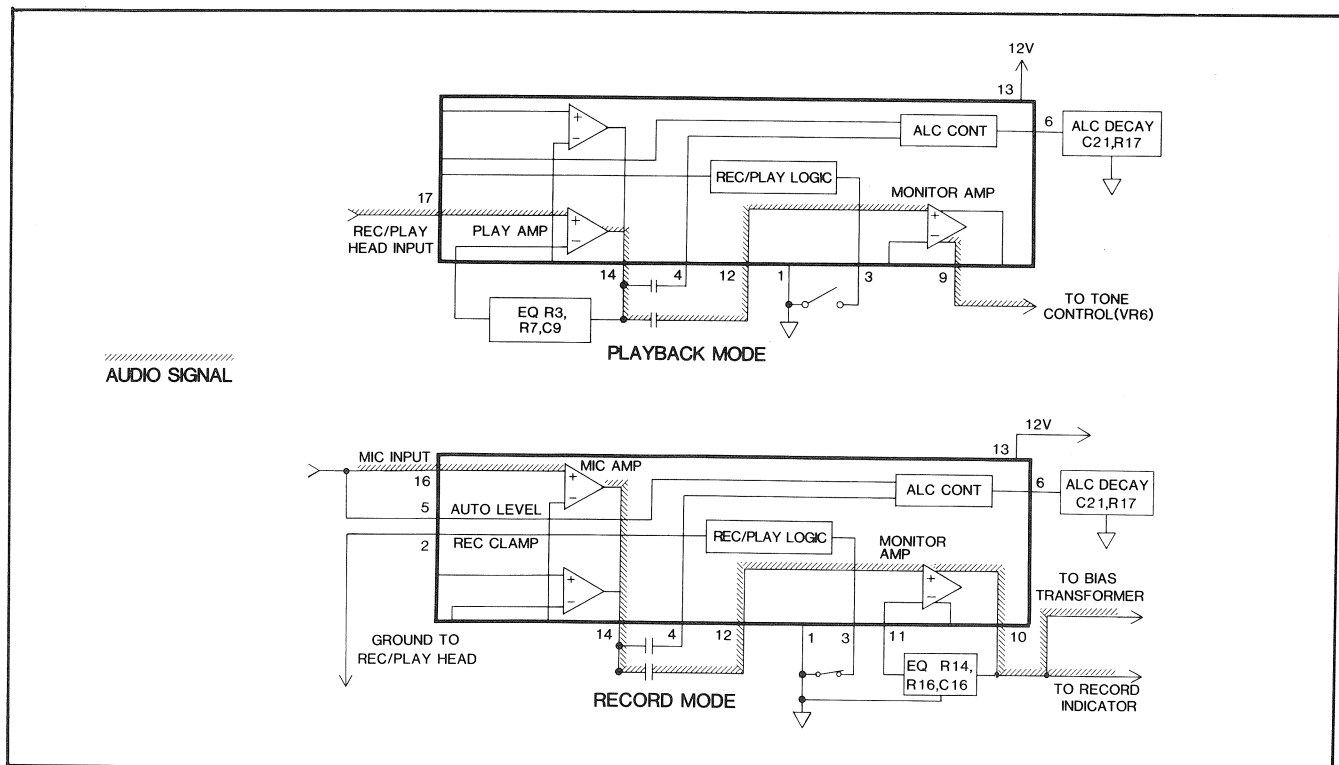


Figure 2.20 IC Preamplifier Block Diagram

3. Ground establishes the conduction for the audio erase head (H2, CH1) through R22 and the erase head to the +12 volt supply.

2.3.9.2 Power Amplifier Muting

The muting circuit is described for the Models 4340, 4480 and 4490; however, operation is the same for all other models.

Muting is accomplished by simply shorting out the feedback loop of the integrated circuit power amp when the tape deck is inoperative (tape deck switch S3 open).

When the tape deck is not running, the base of Q12 is held at ground potential through R126 causing Q12 to be cut off. The resulting positive potential on the collector is coupled through D23 to the gate of FET Q11 causing it to conduct and short out R34. This produces a high degree of negative feedback in power amplifier U2, preventing it from producing any output.

When the tape deck is running (S3 closed) +25 volts is connected to R125 to produce a positive voltage at the base of Q12 causing it to conduct. The resulting drop in its collector voltage cuts off Q11 so it no longer shorts out R34. The negative feedback to U2 is decreased and the amplifier is able to produce its rated output of 5 watts.

2.3.10 AUTO-FOCUS

Figure 2.21

The auto-focus system is designed to focus accurately on all slides whether the slides are mounted in standard plastic, cardboard, metal, or glass mounts. It does this by continuously monitoring the distance between the front film surface of the slide and the projection lens once the picture has been manually focused. If the distance should change due to variations in slide mounts or slides "popping" from the heat of the projection lamp, an infrared sensor detects the distance change and causes the auto-focus motor to drive the projection lens and the sensor in or out until the distance is the same as that originally established for correct focus.

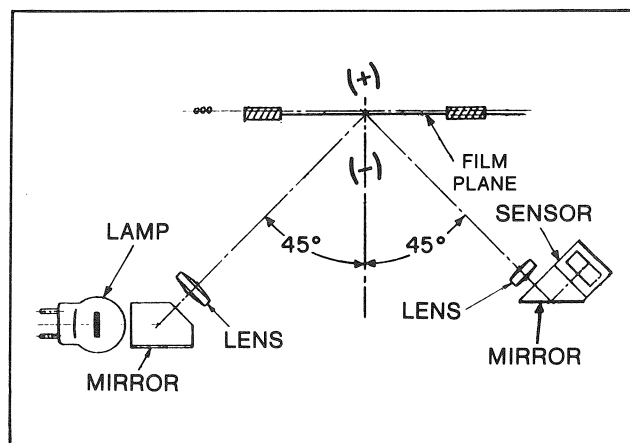


Figure 2.21 Distance Monitoring System

The distance monitoring system consists of an exciter lamp which directs a beam of light towards the front surface of the slide, and a dual-section infrared sensor which detects the infrared portion of the exciter lamp beam reflected from the surface of the slide.

2.3.10.1 General Circuit Operation

Figures 2.22 and 2.23

The electronic circuit uses two preamplifiers, each one being driven by one half of the dual section infrared sensor. Preamplifier A is linear over its entire operating range. Preamplifier B, however, is only linear when operated below the "knee" voltage (the "knee" is the equilibrium point when a glass slide is being projected).

If the gain characteristics for preamplifiers A and B were compared, two conclusions could be arrived at. First, the gain of preamplifier B is twice that of preamplifier A when sensor currents are small (film only slides), and the output of preamplifier B is the same as the output of preamplifier A with only half as much sensor current.

Second, the gain of preamplifier A is greater than that of preamplifier B when sensor currents are large, and the output of preamplifier A is the same as the output of preamplifier B with considerably less sensor current.

When the output voltages of the two preamplifiers are equal, the voltage on pin 14 of the differential amplifier is approximately half the 25V supply. The emitters of Q2 and Q3 are also at one half the supply voltage; therefore, neither transistor conducts and the motor does not operate; the circuit is at equilibrium.

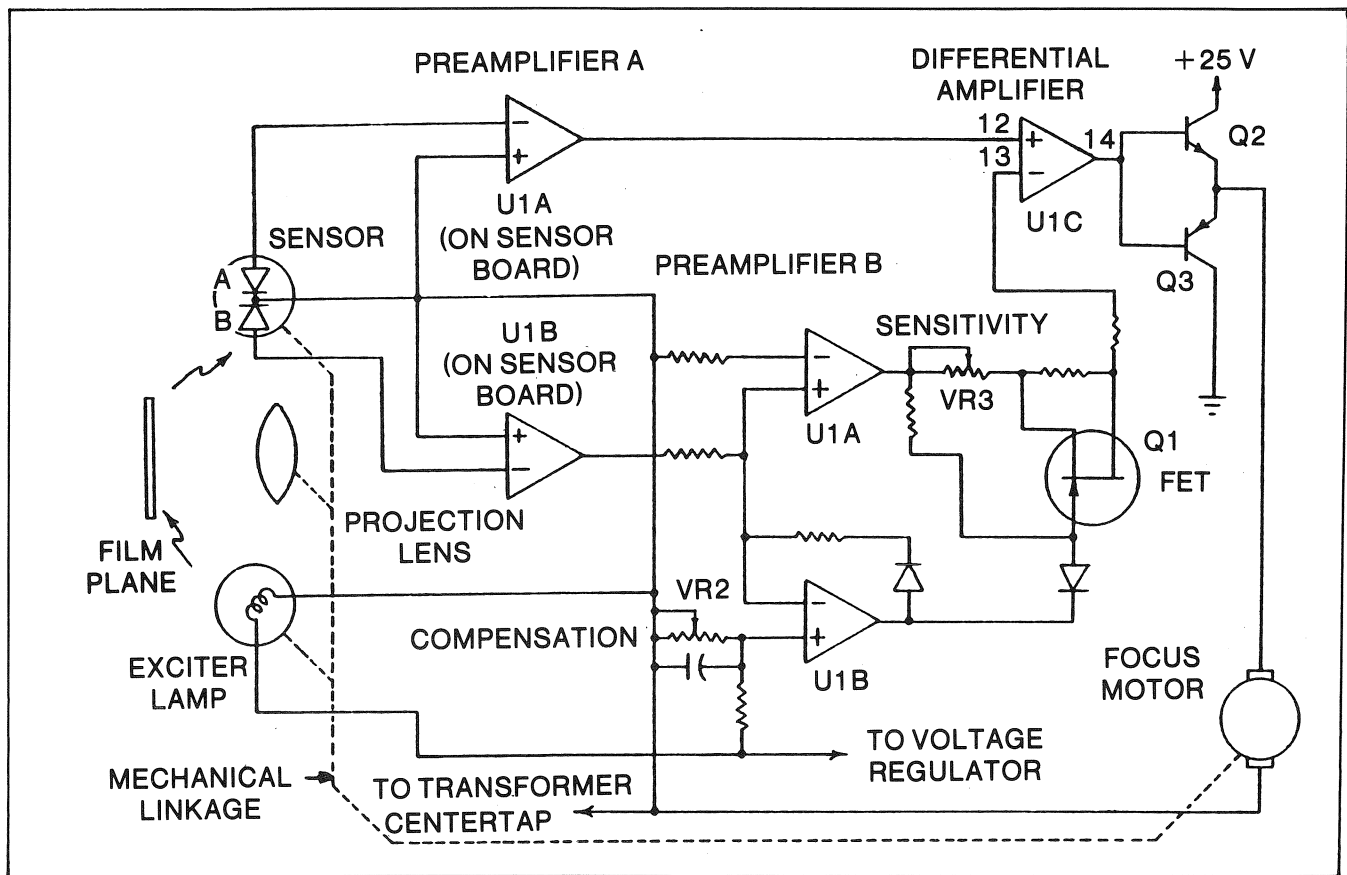


Figure 2.22 Auto-Focus Circuit Block Diagram

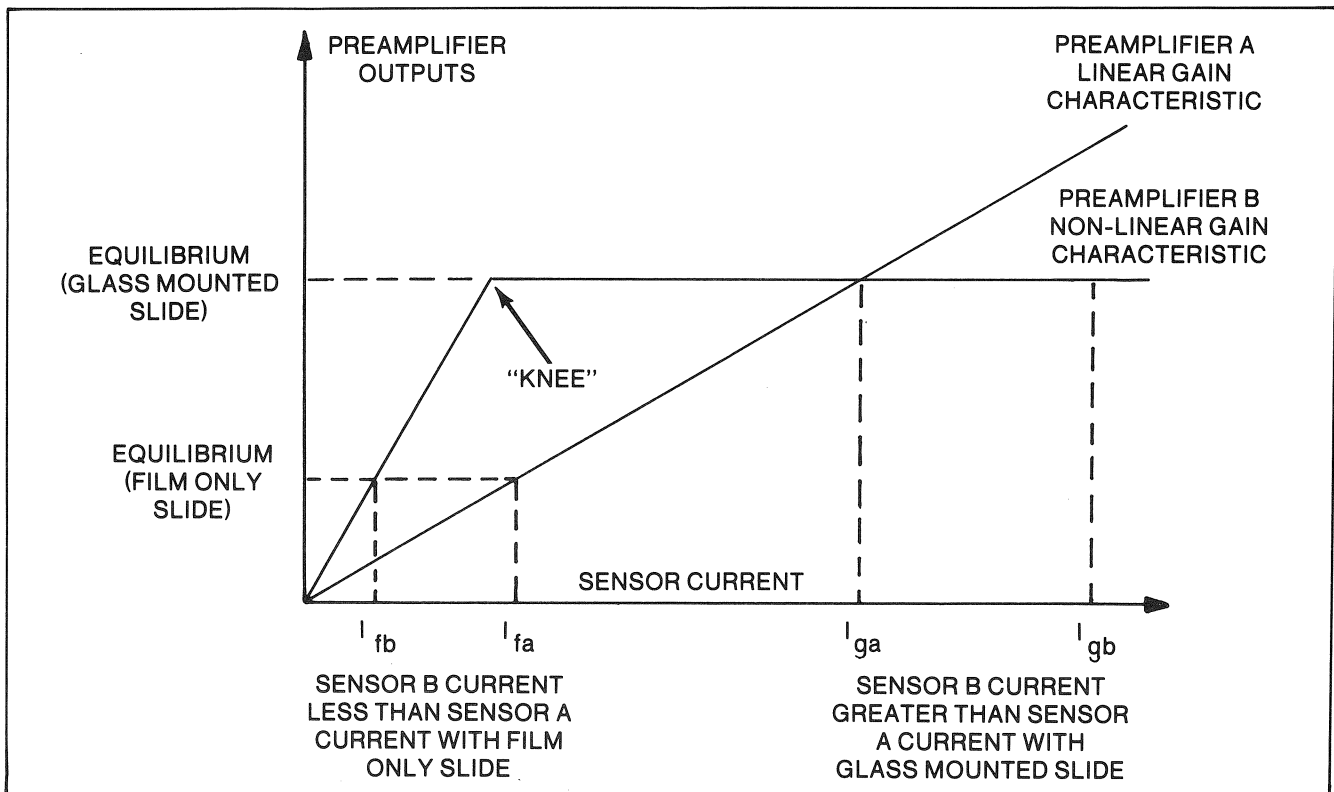


Figure 2.23 Superimposed Gain Characteristics

2.3.10.2 Standard Mounts

Figure 2.24

In the case of slides mounted in standard plastic, cardboard or metal mounts, the exciter lamp light reflected from the surface of the slide is low level and preamplifier B functions below the “knee” of its gain characteristic. Since its gain is approximately twice that of preamplifier A, only half as much light is required on the B portion to produce equal outputs from the two preamplifiers. Equilibrium is established when most of the reflected light strikes sensor A.

2.3.10.3 Glass Mounts

Figure 2.25

When a glass mounted slide appears in the slide gate, the exciter lamp light reflected from the surface of the glass is high level, causing an increased output from

both preamplifiers. However, the output of preamplifier B increases only to the point of the “knee” of its gain curve, after which very large changes in sensor current produce no change in preamplifier B output. Preamplifier A still produces a proportionately changing output with changing amounts of light striking the A portion of the sensor.

This means that most of the reflected light from the glass slide must strike the B portion of the sensor to produce equal outputs from the two preamplifiers, and preamplifier A is the controlling portion of the circuit. The glass slide compensation adjustment (VR2) shifts the “knee” of the B preamplifier curve to the point where the A preamplifier output establishes equilibrium with the glass mounted slide in focus.

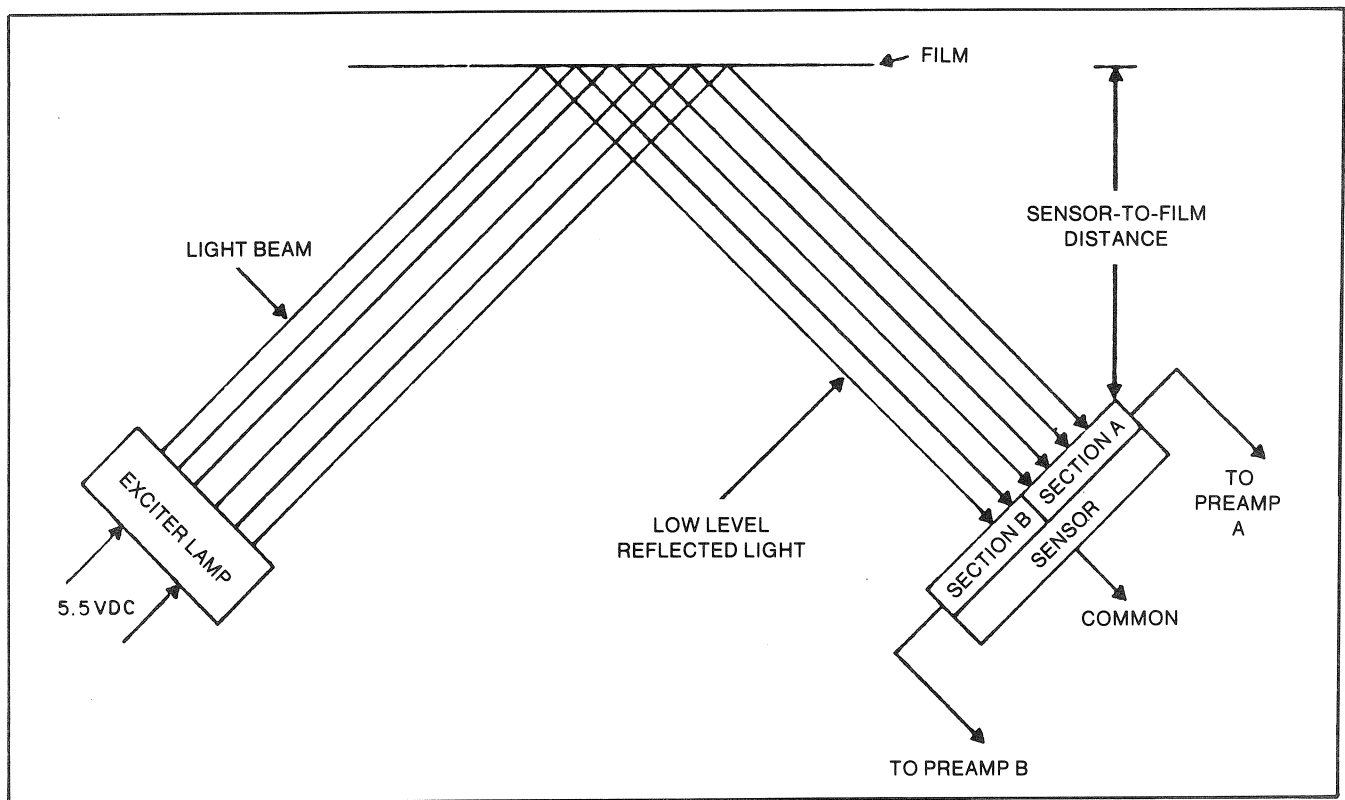


Figure 2.24 Light Ratio With Film Only Slide

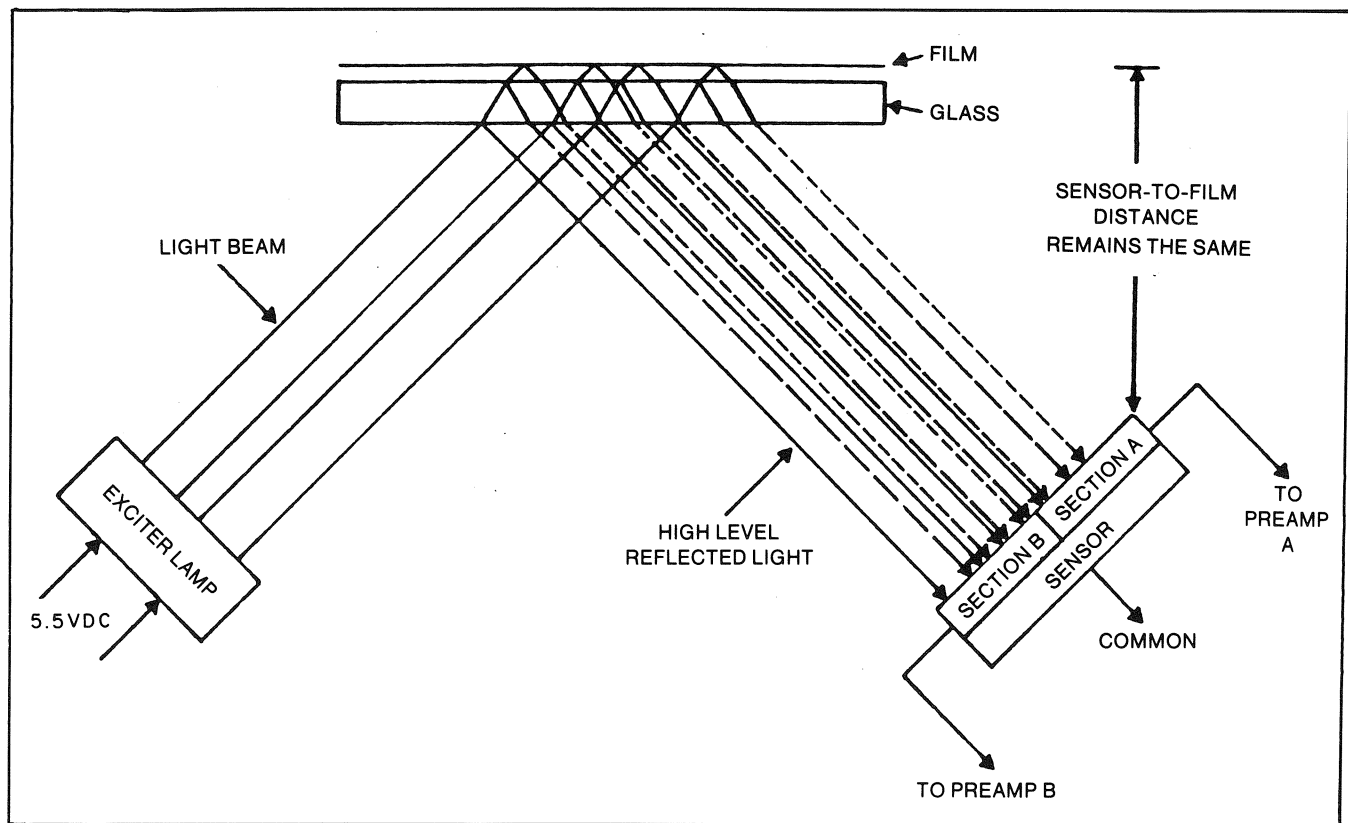


Figure 2.25 Light Ratio With Glass Mounted Slide

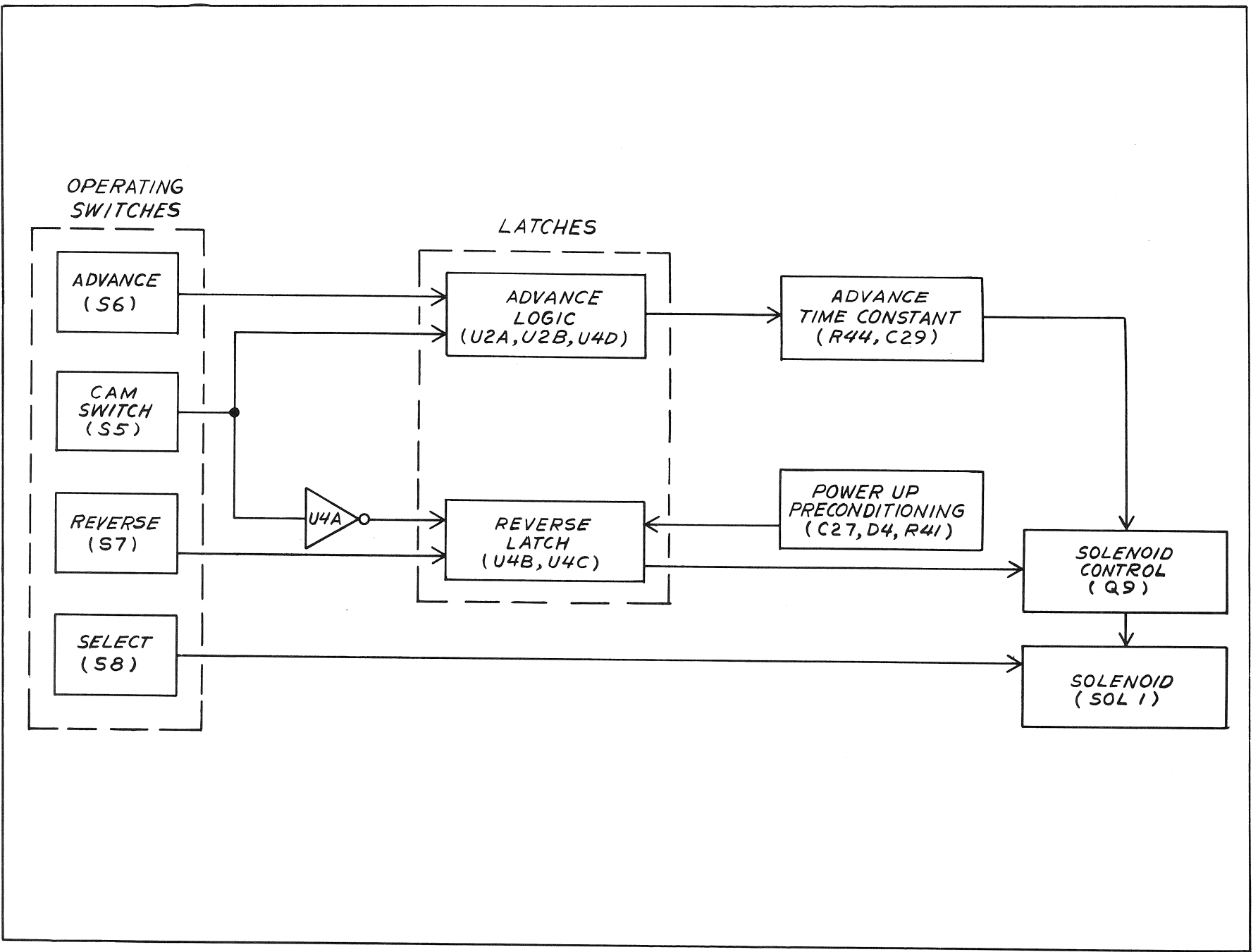


Figure 2.26 Tray Control Block Diagram (4120)

Figure 2.27 Tray and Tape Control Block Diagram (4320, 4460, 4470)

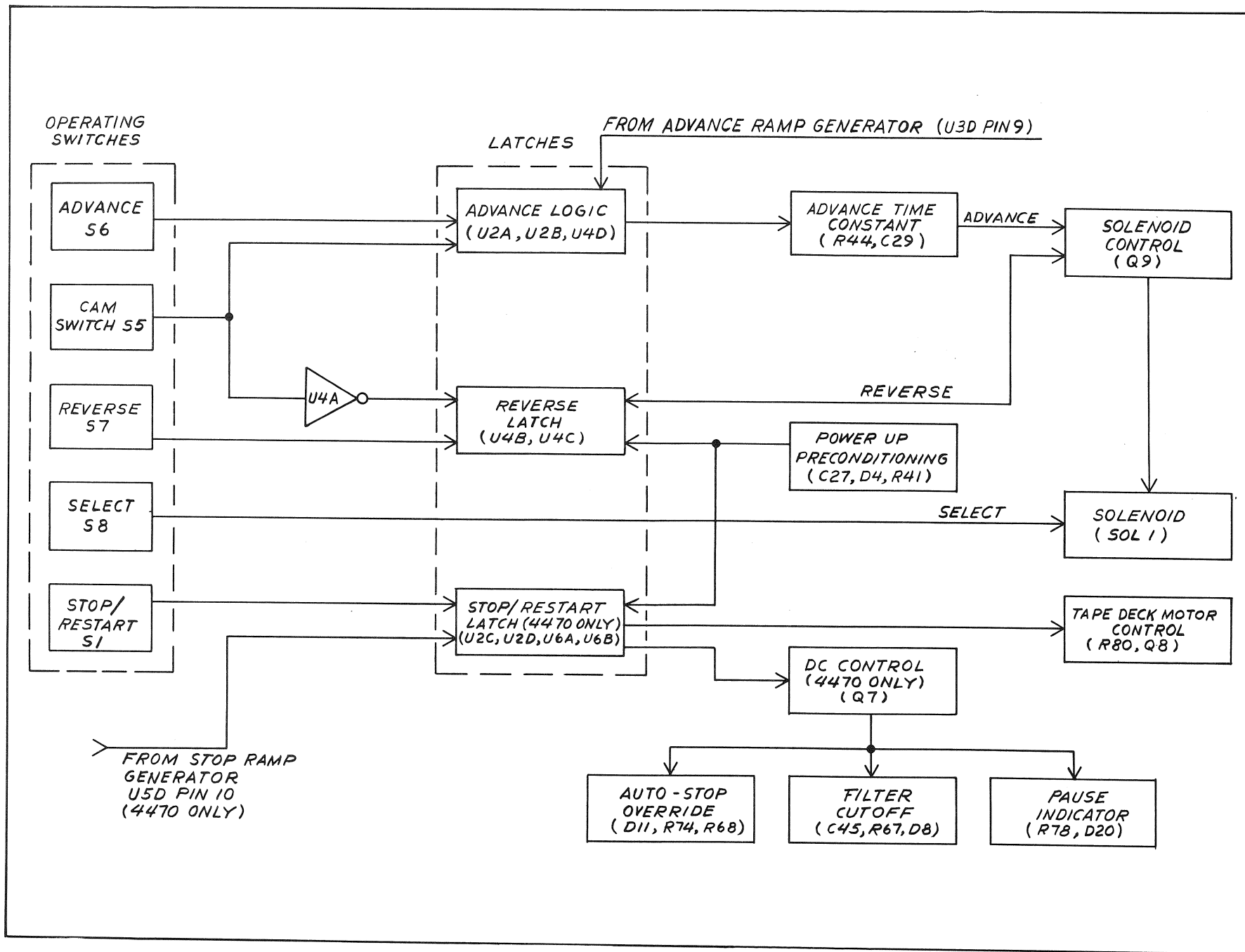
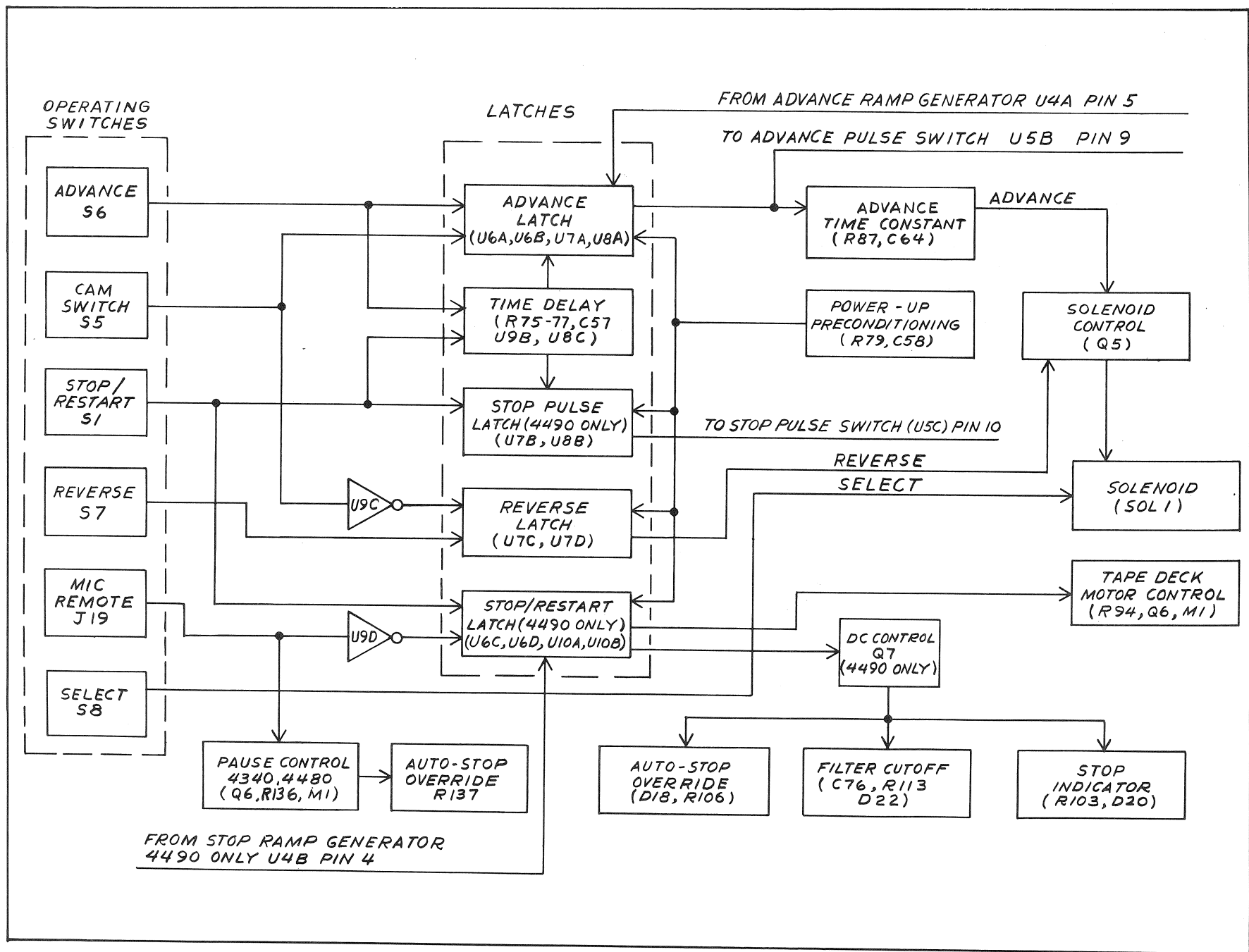


Figure 2.28 Tray and Tape Control Block Diagram (4340, 4480, 4490)

2-17



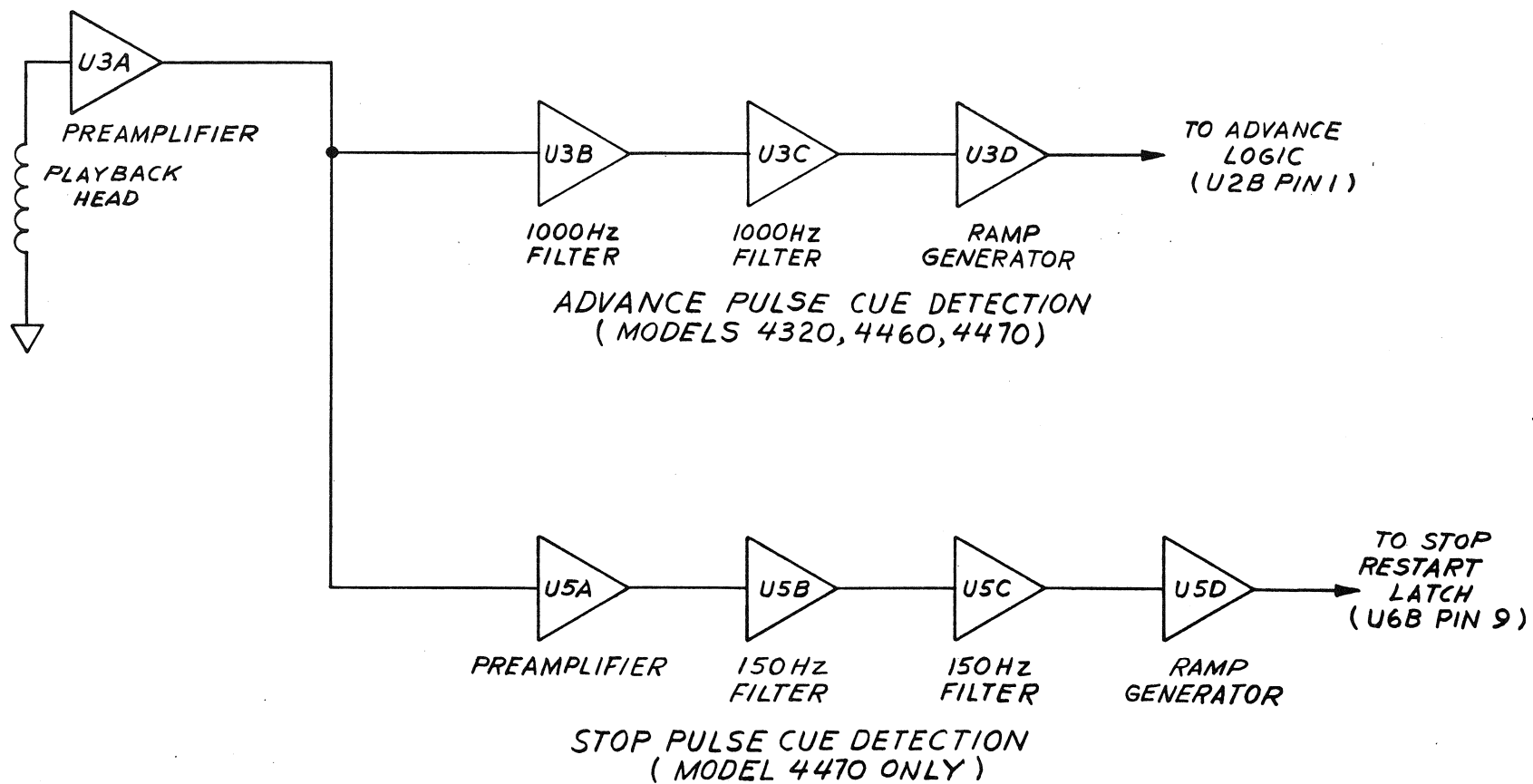


Figure 2.29 Cue Detection Block Diagram (4320, 4460, 4470)

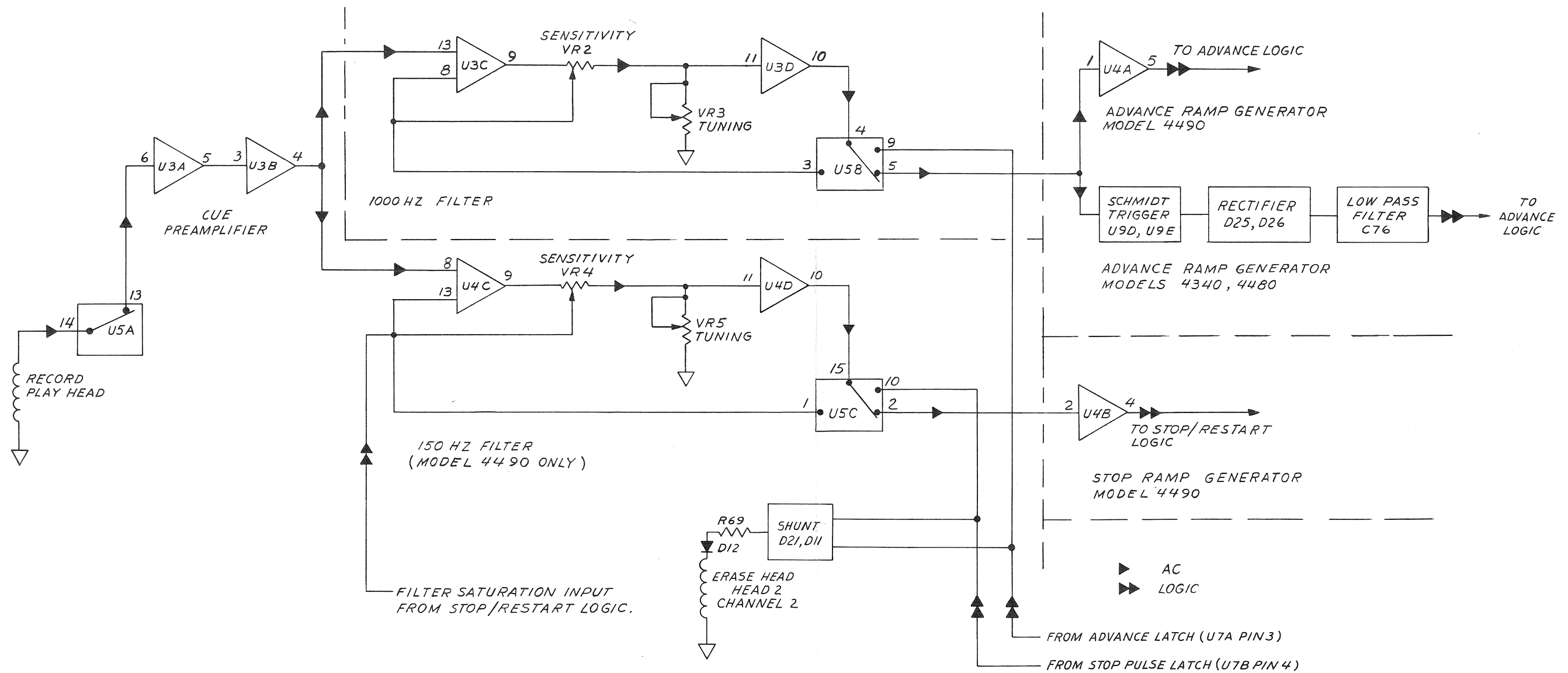


Figure 2.30 Cue Detection Block Diagram - Playback Mode (4340, 4480, 4490)

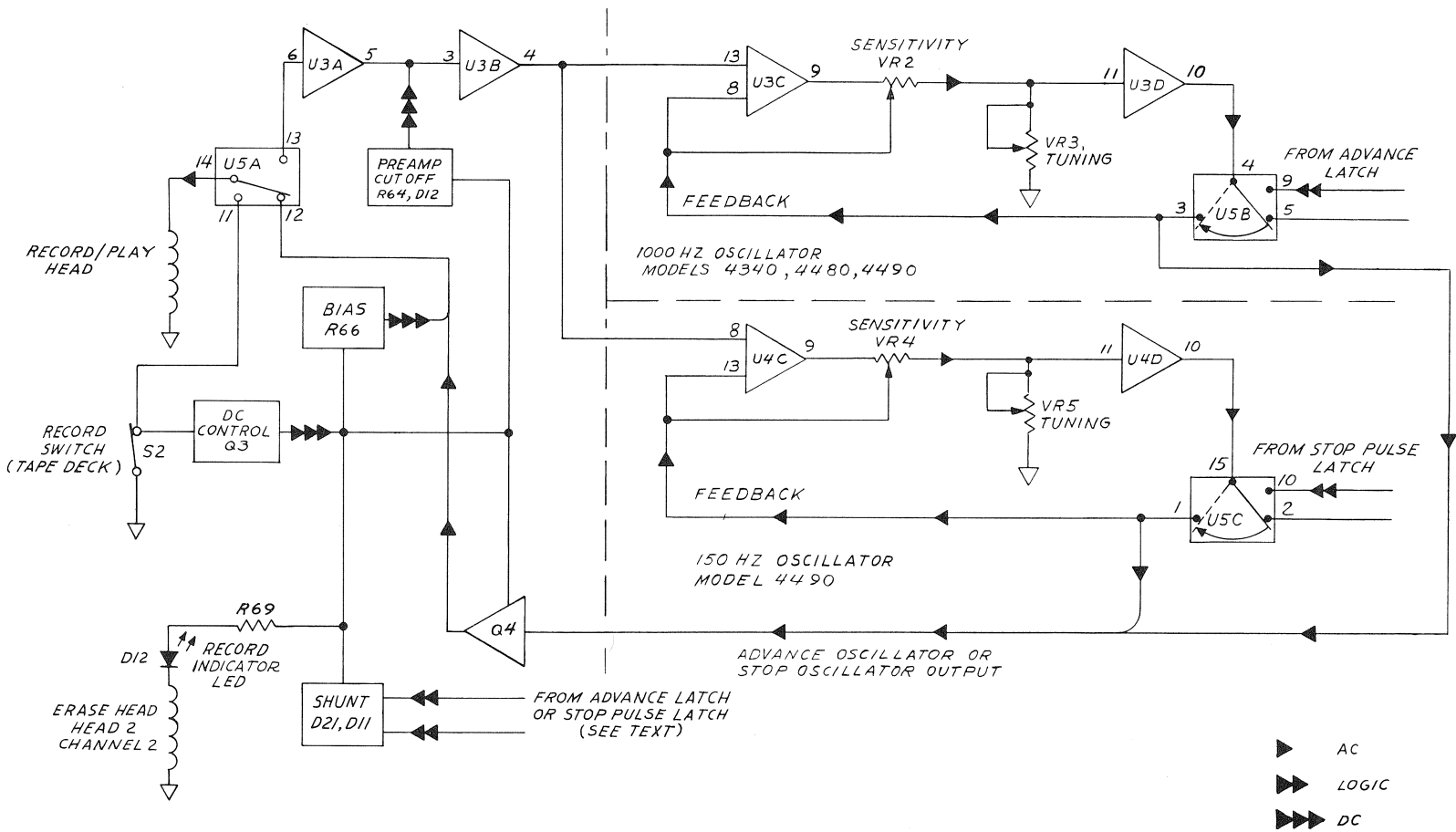


Figure 2.31 Cue Detection Block Diagram - Record Mode (4340, 4480, 4490)

SECTION III

MECHANICAL MAINTENANCE

3.1 INTRODUCTION

This section describes the routine preventive maintenance procedures as well as mechanical adjustments and disassembly procedures.

This section is best utilized by identifying the paragraph heading which most closely describes the existing malfunction, then performing the procedure given. Standard practice is to disassemble until the assembly to be serviced is accessible. Assembly is simply a reversal of the disassembly process and is not discussed separately. In some instances notes to aid assembly are included at the end of this section.

3.2 PREVENTIVE MAINTENANCE AND EXTERNAL ADJUSTMENTS

Most operating adjustments can be made externally, without disassembly. Preventive maintenance requires some disassembly to clean the inside screen and mirrors.

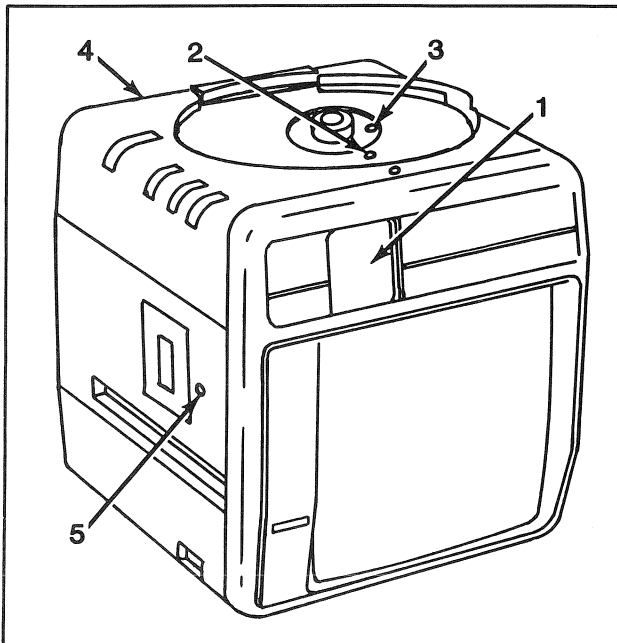


Figure 3.1 External Adjustment Locations

3.2.1 REAR SCREEN IMAGE POSITION ADJUSTMENT

Figure 3.1, Item 1

1. Slide the front projection door open about 1/2-inch (13 mm) to make it easier to grasp the door handle.
2. Push down on the handle and pull or swing the top of the handle out to unlatch (Figure 3.2).
3. Slide the cover to the right and use the handle to move the mirror door to the left. The adjusting screws are exposed.

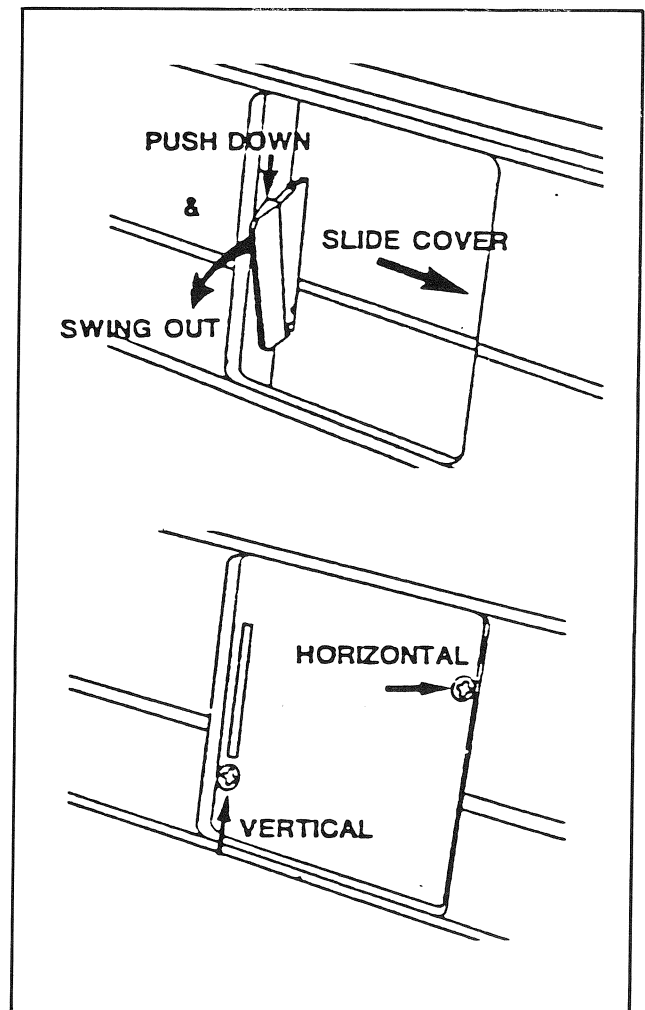


Figure 3.2 Projector Screen Alignment

4. Place the Telex alignment slide (catalog no. 19-708) or a normal 35 mm slide in the slide gate and center the image with the horizontal adjustment screw.
5. Remove the slide, turn it 90 degrees and reinsert it in the slide gate. Center the image with the vertical adjustment screw.

NOTE

Do not turn alignment screws more than three turns in either direction.

3.2.2 MAGNA-FRAME™ ALIGNMENT

1. Move the Magna-Frame lever to the lower-most position.
2. Remove the dust cap to expose the alignment screw (Figure 3.1, item 2).
3. Place the Telex alignment slide (catalog no. 19-708) in the slide gate.
4. Using a 3/32-inch Allen wrench, turn the screw to center the image on the screen horizontally.

NOTE

Do not turn the screw more than three times in either direction.

If the alignment slide is not available, it will be necessary to make a substitute by marking the center 3/4-inch (19.5 mm) area of an old slide.

3.2.3 SLIDE LIFTER HEIGHT ADJUSTMENT

To adjust slide lifter height, use a loaded 80 slide tray.

1. Remove the dust cap (Figure 3.1, item 3) using pointed tweezers to expose the adjustment screw.
2. Position loaded slide tray on projector and turn projector on.
3. Press and hold the SELECT button to raise the slide lifter, and rotate to slide no. 18 so that adjustment screw is accessible (Figure 3.3).

NOTE

Slide no 18 should be raised about 1/16-inch (1.7 mm) above adjacent slides.

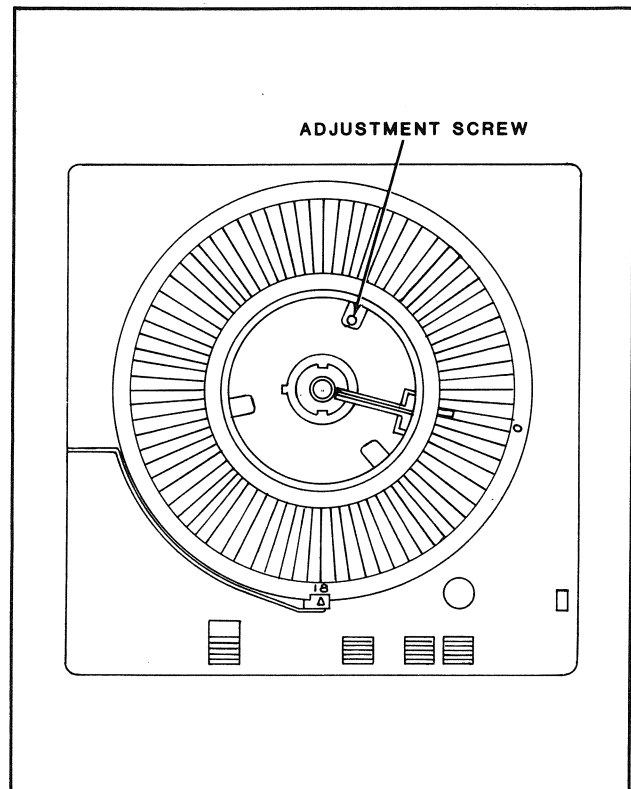


Figure 3.3 Lifter Height Adjustment

4. Turn adjustment screw with a 0.0500-inch socket screw wrench.
5. Check rotation with 80- and 140-slide loaded trays. If too high, the 140 slide tray may rotate roughly. Readjust the height slightly and recheck with both trays.

3.2.4 LAMP MIRROR ALIGNMENT

Figure 3.1, Item 4

The mirror position is adjusted horizontally and vertically to center the lamp illumination with the optical projection axis for rear or front screen projection.

1. Slide the front screen projection door open.
2. Trip the slide edge clamp to open the shutter (insert an empty slide frame or cardboard cutout in the slide gate).
3. Move the Magna-Frame lever to the uppermost position.
4. Cut an index card to 1-3/4-inch x 6-inch (45 x 150 mm). Fold the card to form a 1-3/4-inch square at one end.



Figure 3.4 Checking Illumination Centering

5. Insert square end of card in contact with front window (Figure 3.4). The lamp filament should be a dark spot approximately in the center of a bright circle.
6. Open the lamphouse door and loosen the horizontal lock screw (Figure 3.5) using a 3/16-inch socket wrench.
7. Adjust the horizontal position by wedging the blade of a 5/16-inch flat screwdriver in the horizontal adjust key.
8. Adjust the vertical position by turning the vertical adjust screw using a 3/16-inch socket wrench. Apply locking cement to the screw head when finished.
9. Close and secure the lamp door to observe adjustment.
10. Repeat steps 6 through 9 until lamp filament image is centered in window.

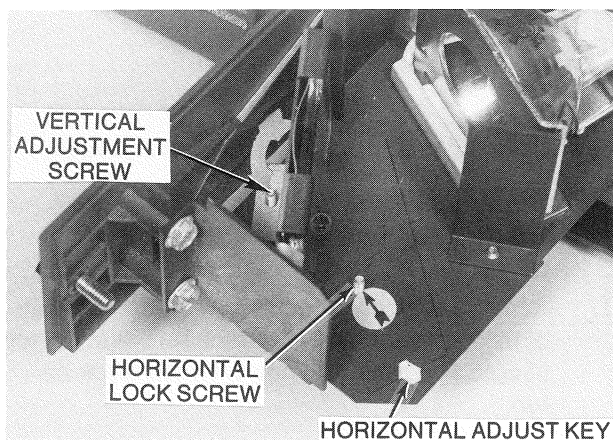


Figure 3.5 Lamp Mirror Adjustments

3.2.5 TAPE HEAD AZIMUTH ADJUSTMENT

Figure 3.1, Item 5

The azimuth adjustment is most easily made before disassembling any part of the Caramate 4000 Projectors by using a test speaker or dummy 8-ohm load.

Proceed as follows:

1. Insert an azimuth test tape (Philips TC-A 6.3 Azimuth Test 6300 Hz or equivalent) in the tape deck.
2. Plug an 8-ohm test speaker (or 8-ohm dummy load) into the speaker jack on the left side of the projector.
3. Connect an ac VTVM or an oscilloscope across the test speaker.
4. Remove the plug from the left side panel exposing the azimuth adjusting screw.
5. Depress the PLAY button on the front of the projector.
6. Adjust the volume and tone controls for comfortable audio output from the test speaker.
7. Using a number 0 Phillips screwdriver, adjust the azimuth screw for a maximum reading on the VTVM or oscilloscope. After adjustment, apply a drop of Glyptal (part no. 39490-P1) to the head of the azimuth screw to lock it in place.
8. Replace the plug removed in step 4.

3.2.6 OPTICAL SYSTEM CLEANING

The mirrors and screen should be cleaned with a soft cotton cloth and a commercial lens or window cleaner or a mild solution of detergent and water.

Static on plastic screen, mirrors, lenses and even the slides can be eliminated by using a commercially available anti-static gun. The static charge will build up by normal handling and it will be necessary to repeat the treatment.

3.2.6.1 Mirrors

CAUTION

DO NOT USE SILICONE TREATED LENS TISSUES ON MIRRORS OR COATED LENS OPTICS.

1. Disassemble projector as required (see paragraph 3.3.1).
2. Dust mirrors lightly to remove dust particles.
3. To remove smog, clean with a soft, lint-free cloth dampened with a commercial lens cleaner.

3.2.6.2 Front Project Window

Clean as for mirrors, and in this case only it is permissible to use silicone treated lens tissue for final wipe.

3.2.6.3 Lenses

CAUTION

THE LENSES ARE SEALED IN THE HOLDER AND SHOULD NOT BE REMOVED OR ADJUSTED.

Use cue tip or soft, clean cotton cloth moistened with a commercial lens cleaner or a mild solution of detergent and water.

3.2.7 TAPE DECK CLEANING AND DEMAGNETIZING

For best performance, and to prevent tape damage, the tape heads, capstan and pressure roller should be cleaned after every 8 hours of operation. The tape heads should also be demagnetized if poor sound quality is noted, or prior to performing any tests or adjustments of the audio and cue circuits.

3.2.7.1 Cleaning

1. To gain access to the tape head(s), capstan and pinch roller, open the tape deck door and remove the cassette tape.
2. Gently push down on the PLAY button until resistance to further pushing is felt, and then slowly push down on the tape deck door until the PLAY button can be pressed down all the way.
3. Release the tape deck door, allowing it to pop open again. The tape head(s), capstan and pressure roller should now be visible along the front edge of the tape deck opening.

4. Wipe clean the head(s), capstan and pressure roller using a clean cotton swab moistened with isopropyl alcohol or a commercially available head cleaning solution.

3.2.7.2 Demagnetizing

CAUTION

TURN THE PROJECTOR OFF DURING THIS PROCEDURE. USE A DEMAGNETIZER WITH AN INSULATED TIP TO AVOID SCRATCHING TAPE HEADS.

1. Gain access to the tape head(s) using steps 1 through 3 in the previous section.
2. Starting at least a foot away from the tape head(s), turn on the demagnetizing tool and slowly move it into contact with each tape head.
3. Move the demagnetizing tool slowly over the surface of each tape head.
4. While the demagnetizing tool is still on, slowly withdraw it from the tape head(s) to a distance of at least 12-inches (30.5 mm), then shut off the demagnetizer.

3.3 DISASSEMBLY PROCEDURES

3.3.1 BEZEL

Remove one 5/8-inch screw at the bottom-front, two 5/8-inch screws near the front of each side, and one 7/8-inch screw at the top.

NOTE

Mirrors and lenses may be cleaned at this time.

3.3.2 UPPER HOUSING

Figure 3.6

1. Remove center 5/8-inch screw on the top edge of the back panel, two 5/8-inch screws at the top of each side panel and one 7/8-inch screw on top.
2. Turn the top over and rest it on the base, being careful not to rest it on the side mirror.

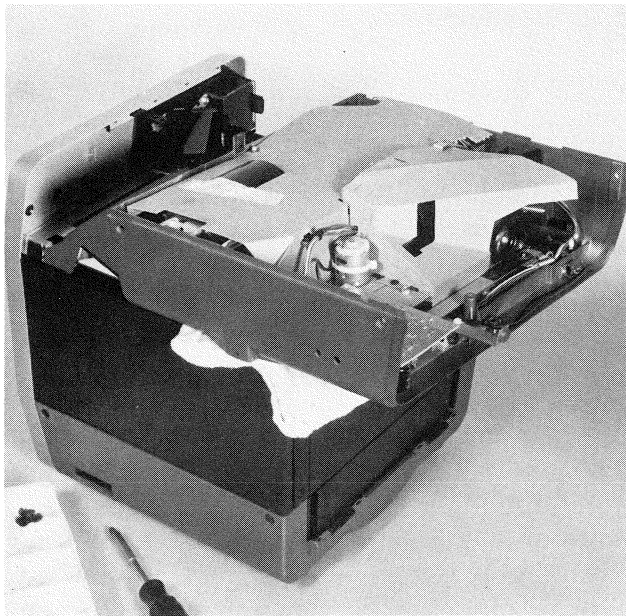


Figure 3.6 Upper Housing Positioned for Service

NOTE

In this position it is possible to insert test slides from the bottom.

Dust and clean lenses, mirrors and screen before reassembly.

Check rear screen image centering after reassembly.

3.3.3 REAR PANEL AND LEFT PANEL

Figure 3.7

1. Remove seven 5/8-inch screws securing the inside rear panel.
2. Pull out the rear panel.
3. Slide the left panel back approximately 1-1/8-inches (28 mm) and swing panel down and out.

NOTE

It may be necessary to loosen the four screws above and below the left panel to free the panel; however, do not remove any of these screws at this time.

4. Lay the left panel on the rear panel for convenient troubleshooting (Figure 3.8).

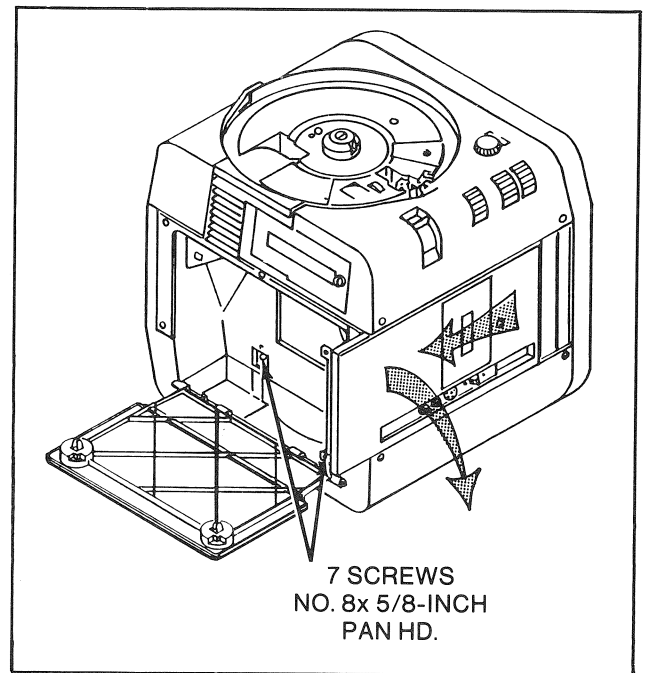


Figure 3.7 Rear Panel and Left Panel Removal

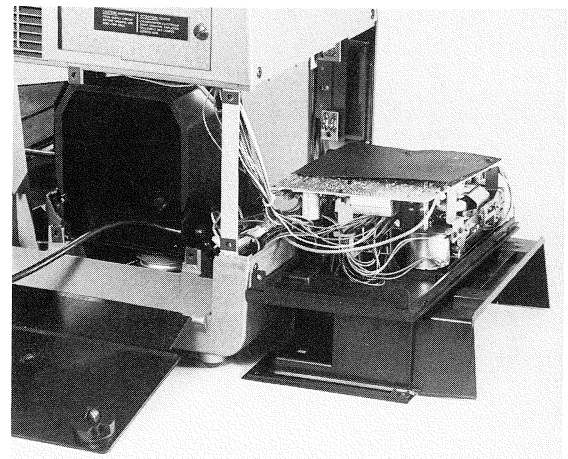


Figure 3.8 Setup for Amplifier Troubleshooting

3.3.4 AUTO-FOCUS

3.3.4.1 Drive Arm

Figure 3.9

1. Remove upper housing (section 3.3.2).
2. Disconnect the auto-focus drive arm (1) secured by an E ring and washer (2).
3. Remove the light shield (3) secured by two screws.

NOTE

To eliminate unnecessary adjustment later:

1. DO NOT operate the auto-focus system with the drive arm disconnected.
2. DO NOT loosen the hex head screw in the auto-focus drive arm limit plate.
3. DO NOT loosen the exciter lamp or the exciter lamp socket.
4. DO NOT loosen the sensor mount or the sensor printed circuit board.
5. DO NOT bend the mirror bracket. A special lamp alignment gage is needed to position the lamp image on the film plane.

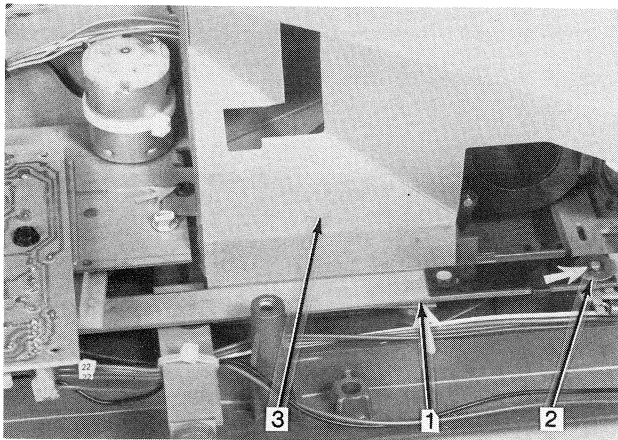


Figure 3.9 Drive Arm and Light Shield Removal

3.3.4.2 Motor Assembly Removal

Figure 3.10

After the drive arm has been removed:

1. Remove short screw (2) and long screw and spacer below board (1).
2. Lift the board out of the back corner clip.
3. Disconnect the electrical plugs on the front edge of the board.
4. Disconnect the motor plug.
5. Remove the four mounting screws (3).
6. Lift the motor assembly from the unit.

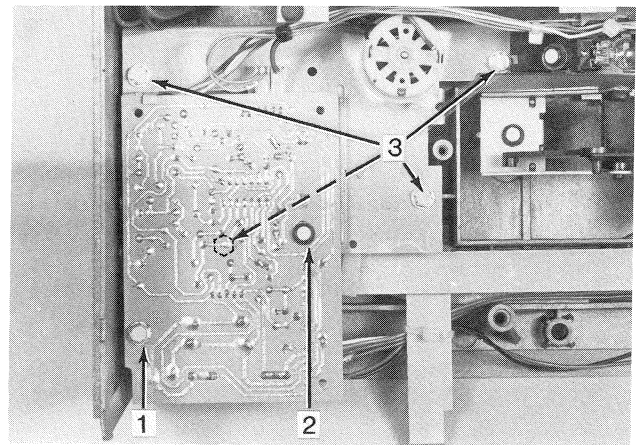


Figure 3.10 Auto-Focus Motor Removal

NOTE

Any required adjustments to this assembly may be made at this time (paragraph 3.4.1).

3.3.4.3 Auto-Focus Base

1. Remove the drive arm and light shield (paragraph 3.3.4.1).
2. Remove the retainer ring connecting the lens crank to the lens shift actuator link (Figure 3.11, item 1).
3. Unplug the sensor and lamp wires from the auto-focus circuit board (Figure 3.11, item 2).
4. Remove the 1/4-inch hex head screw (Figure 3.11, item 3) from the center lens bracket and swing the lens assembly up and out of the way.
5. Move the lens assembly forward by turning the manual focus knob.
6. Unhook the backlash spring located below the right lens bracket (Figure 3.12, item 1).
7. Remove two E rings and the washers that hold the auto-focus base on the right lens bracket (Figure 3.12, item 2).
8. Lift the auto-focus base assembly. Move it forward so that the guide rod is out of the slide mechanism.

NOTE

DO NOT bend or adjust the exciter lamp mirror.

If this assembly is removed, adjustment of the lamp and the sensor may be required upon reassembly (paragraphs 3.4.2 and 3.4.3).

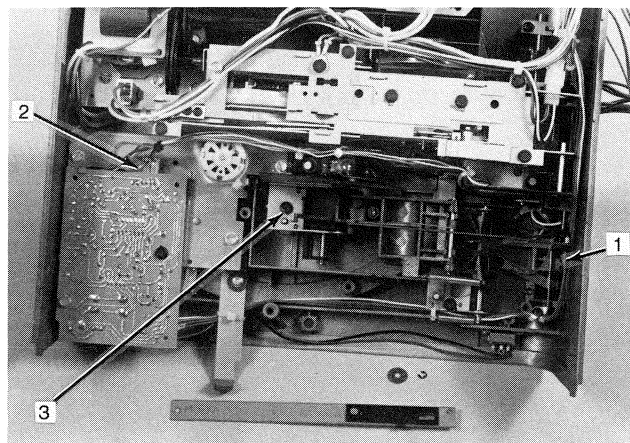


Figure 3.11 Auto-Focus Base Removal - Step One

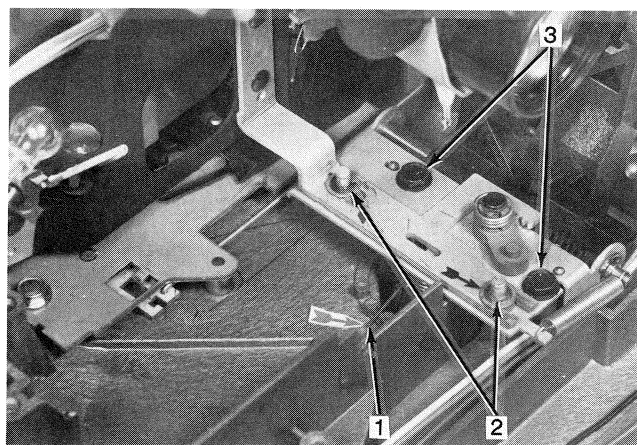


Figure 3.12 Auto-Focus Base Removal - Step Two

3. Remove the two screws (Figure 3.12, item 3).
4. Lift out the lens assembly.

NOTE

This procedure should only be necessary if the lens assembly must be replaced.

3.3.5 LENS MOUNT ASSEMBLY

1. Remove upper housing (paragraph 3.3.2).
2. Remove the auto-focus base (paragraph 3.3.4.3).

3.3.6 SLIDE MECHANISM REMOVAL

Figure 3.13

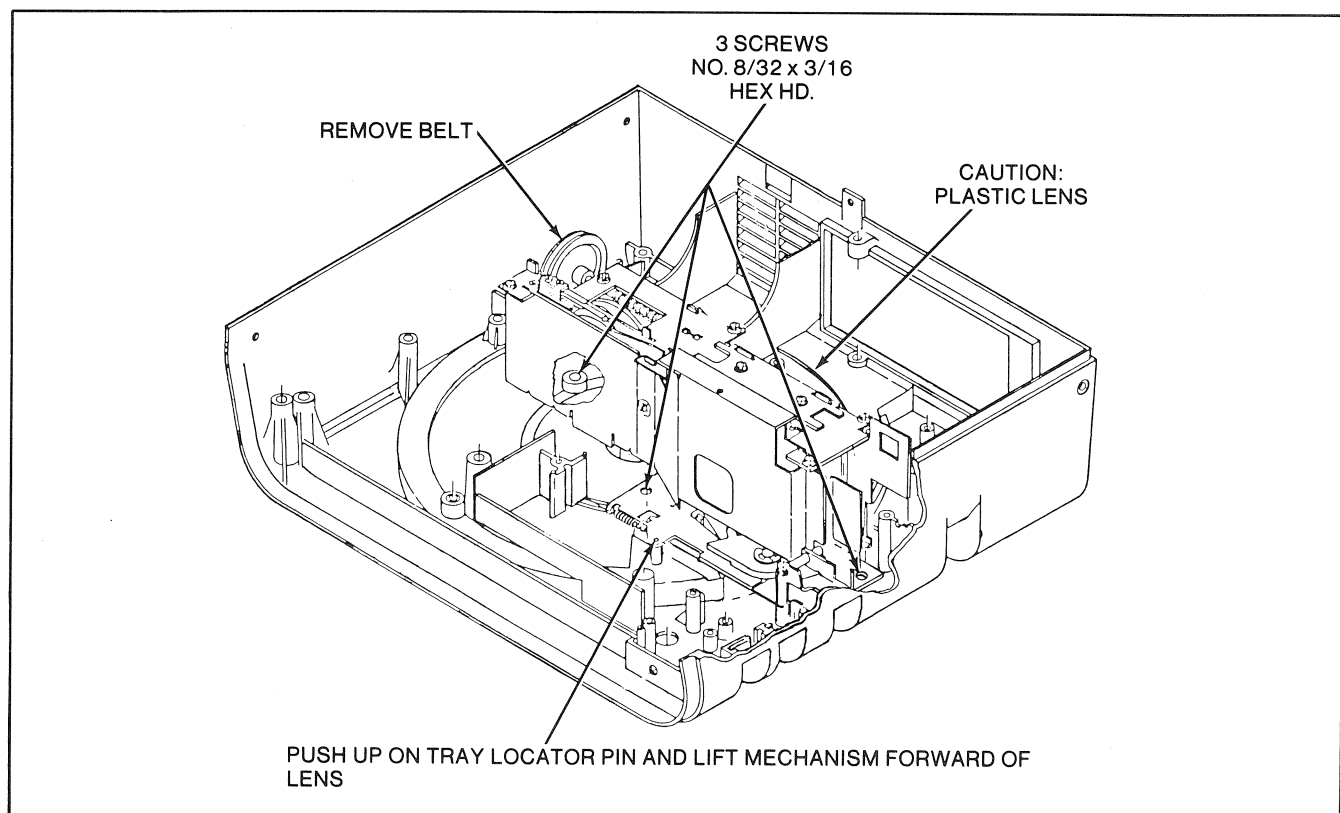


Figure 3.13 Slide Mechanism Removal

CAUTION

WHEN REMOVING THE MECHANISM ASSEMBLY, DO NOT BUMP IT AGAINST THE PLASTIC CONDENSER LENS. MARKS ON THIS LENS WILL PROJECT AS DARK SPOTS ON THE REAR SCREEN.

1. Remove upper housing (paragraph 3.3.2).
2. Remove drive arm (paragraph 3.3.4.1).
3. Remove the auto-focus base (paragraph 3.3.4.3).
4. Unhook the cardboard shield covering the slide mechanism and swing it toward the back of the unit.
5. Clip the plastic cable tie and untwist the wire tie securing the blower motor wires to the slide mechanism. Disconnect four-pin jack for cam switch and solenoid.
6. Remove the 3/16-inch hex head screw securing the ground wires to the slide mechanism. Be sure and replace these securely upon reassembly.
7. Remove the three 3/16-inch hex head screws securing the slide mechanism to the upper housing, and remove drive belt.
8. Shift the slide mechanism forward as needed to avoid touching the condenser lens and lift out mechanism.

NOTE

See paragraph 3.4.4 for service and adjustments.

3.3.7 BLOWER MOTOR REMOVAL

1. Remove upper housing (paragraph 3.3.2).
2. Disconnect four-pin connector at blower motor base plate.
3. Remove one machine screw at corner of fan housing cover and remove cover.
4. Remove four 1/2-inch hex head screws at blower motor base plate.
5. Detach drive belt from motor pulley and remove motor assembly.

3.3.8 MIRROR DOOR REMOVAL

1. Remove bezel (paragraph 3.3.1).
2. Remove four screws securing guide plate and remove mirror door.

3.3.9 ELEVATION FOOT ASSEMBLIES

The right foot assembly may be accessed by removing the bezel only (paragraph 3.3.1).

The left foot assembly may be accessed by removing the rear panel and left panel only (paragraph 3.3.3).

3.4 INTERNAL ADJUSTMENTS AND SERVICING

3.4.1 AUTO-FOCUS MOTOR ASSEMBLY

Figure 3.14

After disassembly (paragraph 3.3.4), inspect for backlash and jack shaft end play as follows:

1. Move the arm gear (1) back and forth, and observe possible end play in the jack shaft (2) and engagement of the arm gear with the jack shaft worm.
2. Adjust the L jack shaft bracket for full, but not binding, engagement between the jack shaft and the arm gear. Then adjust the jack shaft end play by tightening the lock nut and backing off about 1/8th turn to obtain about 0.003-inch (0.07 mm) end play.
3. On models without separate end play adjustment, the L jack shaft bracket must be adjusted to accommodate both sector gear/worm engagement and jack shaft end play.
4. Press down on the motor worm (3) gear and rock the jack shaft engaging gear back and forth.
5. If there is noticeable movement, move the motor for deeper engagement of the gears.
6. Rotate the worm gear. It must turn smoothly without binding at any position.
7. Lubricate gears with a thin coat of DC-44 grease.

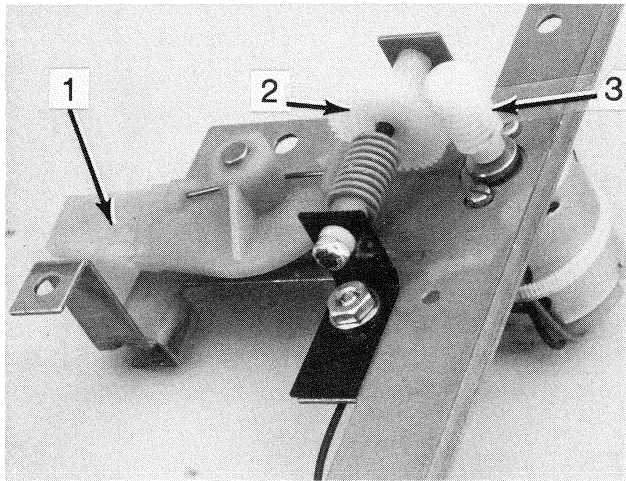


Figure 3.14 Inspecting Gear Engagement

3.4.2 EXCITER LAMP

Figure 3.15, Item 1

Whenever the exciter lamp is removed from its socket, lamp alignment gage (catalog no. SS 368) must be used to recenter the lamp beam after replacement.

3.4.2.1 Lamp Replacement

To replace the lamp, remove the original GE silastic sealer. Then apply fresh sealer and immediately insert the new lamp full depth under the contact clips and tighten the screw.

3.4.2.2 Lamp Adjustment

The lamp bracket is positioned after the auto-focus base, lenses, and motor have been reassembled in the projector.

1. Insert the exciter lamp gage (catalog no. SS 368) into the slide gate.
2. Hold the shutter blades open by hooking a rubber band over the shutter pin and then hook the rubber band over the upper housing rear mounting tab.
3. Slightly loosen the socket screw (1).
4. Turn the projector ON.
5. Look through the projection lens and observe the filament position.
6. Position the image within the alignment gage target and tighten the screw.

7. Proceed to the next section and check the sensor alignment.

3.4.3 SENSOR ASSEMBLY

Adjustment may be required after lamp or sensor replacement, or in the event that the auto-focus base is removed.

1. Insert a film slide.
2. Turn the auto-focus switch ON and allow the system to drive to the rest position.
3. Turn the sensitivity potentiometer (VR3) clockwise to its maximum sensitivity.

NOTE

VR3 may be accessed through the hole farthest from the front of the projector in the right side upper housing.

4. The auto-focus motor must not run to its limit in either direction. The guide pin (Figure 3.15, item 2) should stop at about the center of the drive arm slot.
5. Tip the slide back and release to check motor response and observe where the system comes to rest. Observe the guide pin location in the drive arm slot.
6. If necessary, slightly loosen the socket screw (3) and reposition the sensor so that the guide pin is centered in the drive arm slot when steps 4 and 5 are repeated.

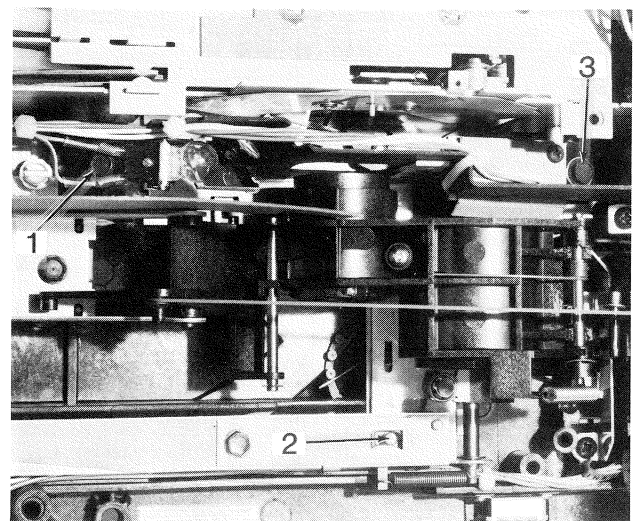


Figure 3.15 Auto-Focus Base Adjustments

7. If the limit plate has been removed, position the plate so that it is centered on the guide pin when the system is focused on a normal film slide. This will provide a focus range of about -0.040-inch (1.02 mm) forward and +0.070-inch (1.78 mm) back of the film rails. A normal slide is considered as being in an open frame mount that is flat and about 0.040-inch (1.02 mm) thick.
8. Recheck the lamp alignment (paragraph 3.4.2).
9. After reassembly of the unit, proceed to paragraph 4.8 and readjust VR3 to the correct operating point.

3.4.4 SLIDE MECHANISM

The slide mechanism must be removed from the upper housing for servicing. See paragraph 3.3.6 for removal procedure.

3.4.4.1 Clutch Service

1. To remove the cam shaft (Figure 3.16) hold a thin blade screwdriver in the clutch and cam shaft slot and squeeze the split end closed enough to push the shaft through the frame hole.

CAUTION

BE CAREFUL NOT TO BREAK THE END OF THE SHAFT.

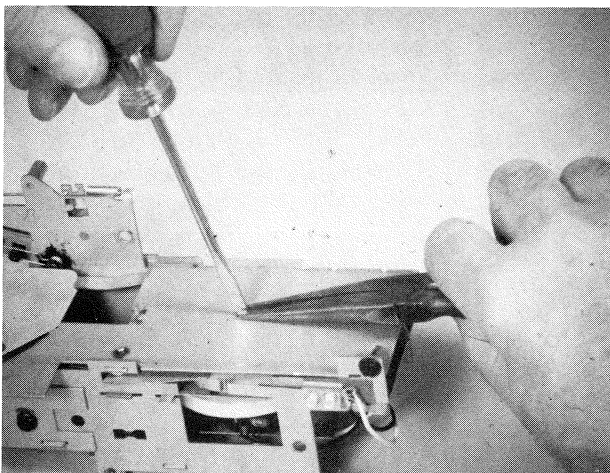


Figure 3.16 Removing Cam Shaft

2. Remove and clean the worm and pulley assembly, and the clutch assembly (Figure 3.17).

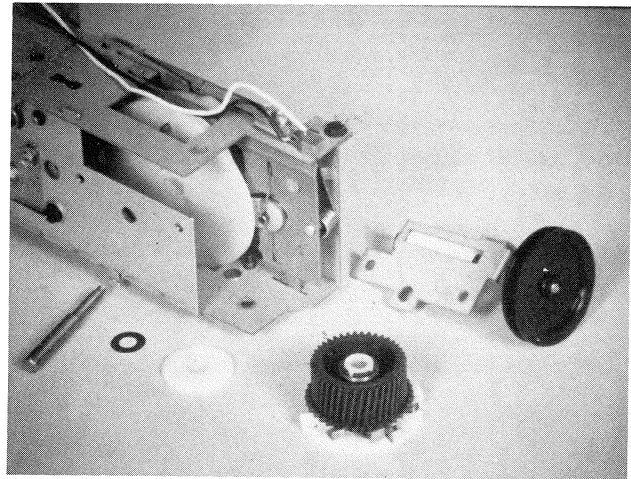


Figure 3.17 Worm Drive and Clutch

3. Lubricate the worm gear by brushing DC-44 grease into the teeth.
4. Wipe all the excess lubricant off the pawl and its mounting stud with a cotton swab.
5. Check for signs of fatigue where the overload spring mounts to the clutch plate. Replace clutch if cracking or wear is evident (Figure 3.18).
6. Put one drop of Mobile 1 Oil on the pawl where it rubs on the nylon clutch and the head of the mounting stud.
7. Move the pawl back and forth several times to work the oil in. When the pawl is moved against the spring tension and quickly released, it should snap back rapidly and freely showing no signs of sluggishness. If working the Mobil 1 Oil in does not free up the pawl, replace the clutch plate assembly.

NOTE

A sluggish pawl will cause the mechanism to make a slight whirring or chattering noise or hang up as if in the Select Mode when the Reverse button is pressed. It may also cause the mechanism to change slowly or to go part way through a cycle and jam.

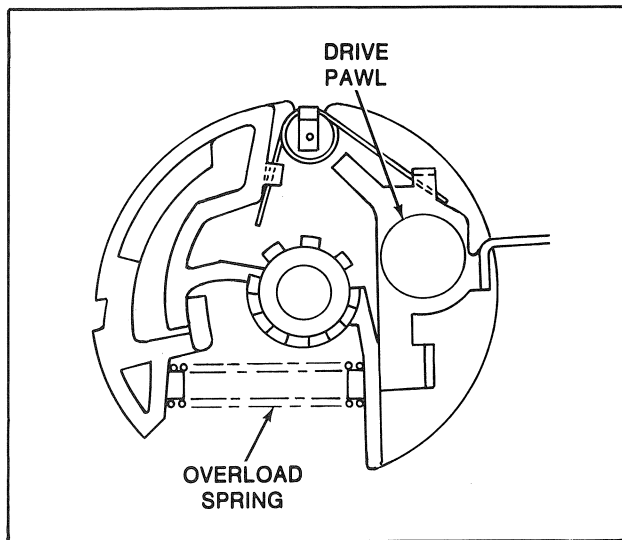


Figure 3.18 Override Clutch Inspection

8. Make sure the drag spring is positioned 0.10-inch (2.54 mm) to 0.150-inch (3.81 mm) below the face of the gear assembly (Figure 3.19).
9. Push the worm gear along its shaft in a direction which will result in 0.005-inch (0.13 mm) to 0.020-inch (0.50 mm) end play between the E ring and the bearing near the pulley (Figure 3.20).

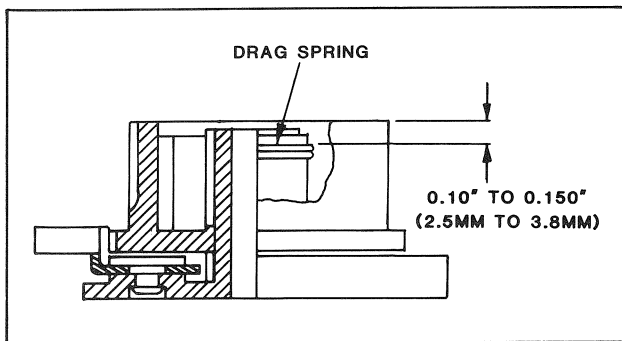


Figure 3.19 Positioning Drag Spring

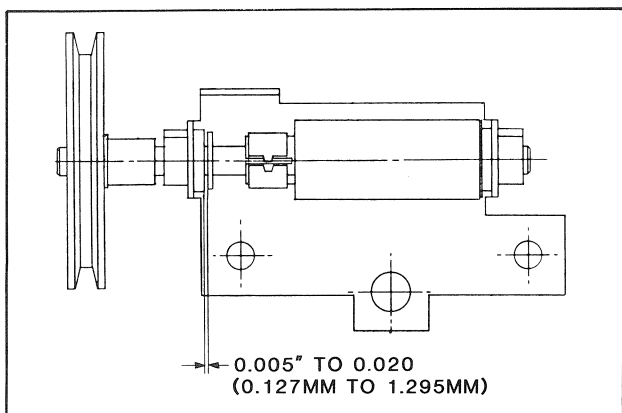


Figure 3.20 Worm End Play

3.4.4.2 Frame Disassembly and Servicing

NOTE

DO NOT loosen the screws on the slide adjuster plate (Figure 3.21). This plate controls the perpendicularity of the slide in the optical path and is carefully positioned on a factory assembly fixture.

1. Remove the four screws which hold the mechanism frame cover to the frame and remove the cover with the slide adjuster plate intact.
2. Replace the solenoid or other worn parts and reassemble.

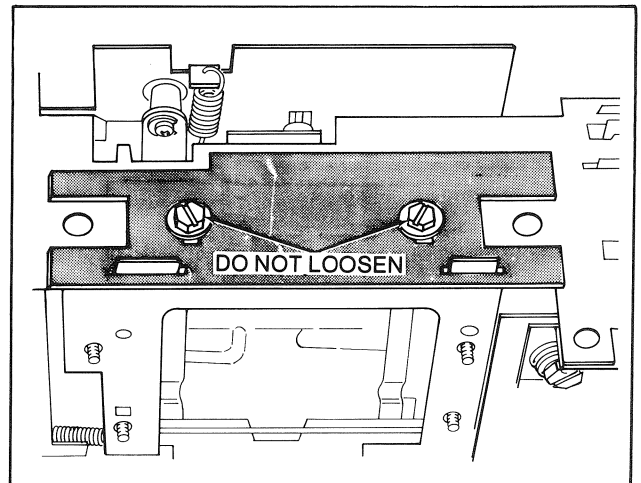


Figure 3.21 Slide Adjuster Plate

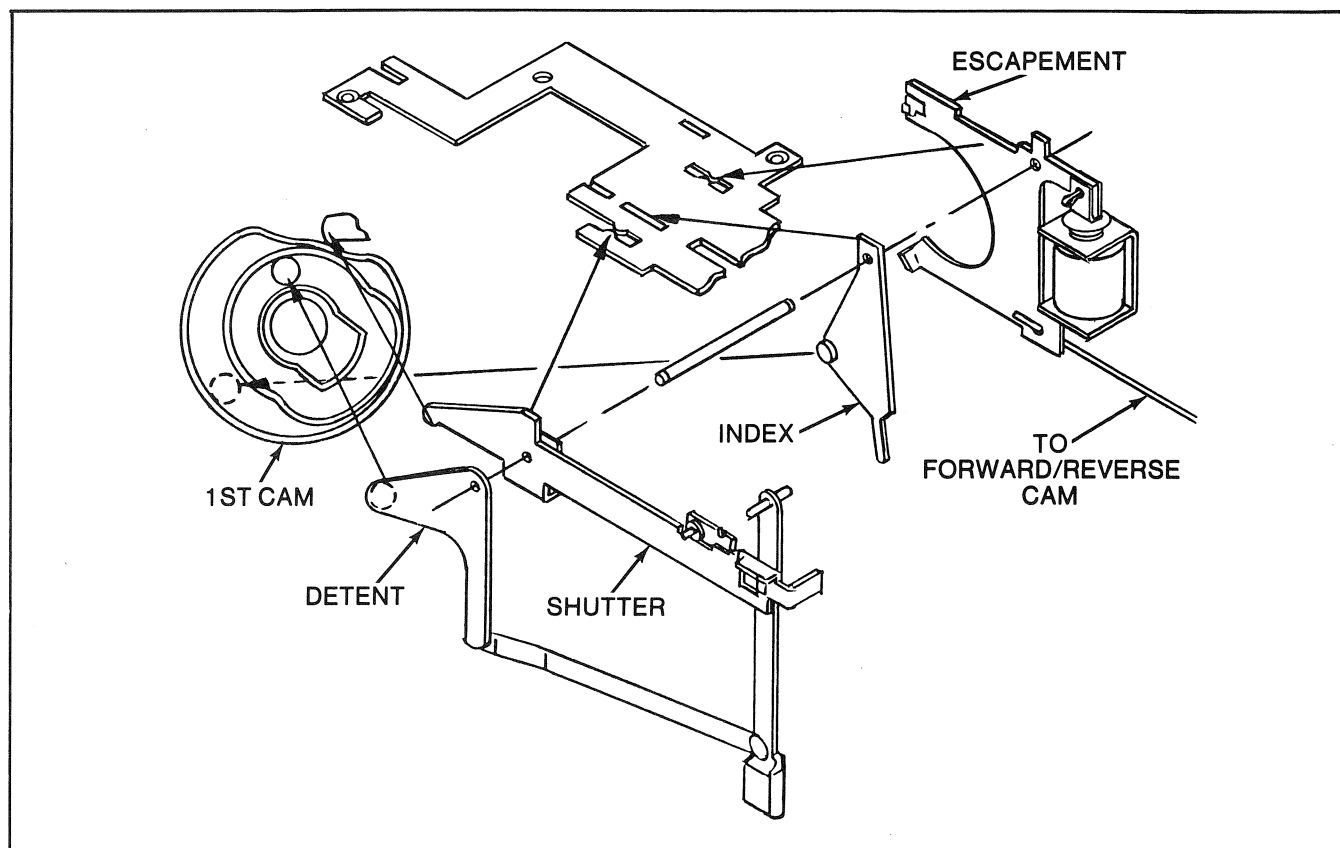


Figure 3.22 Lever Assemblies

3.4.4.3 Reassembly

1. This composite drawing (Figure 3.22) shows the position of shutter, detent and index cam

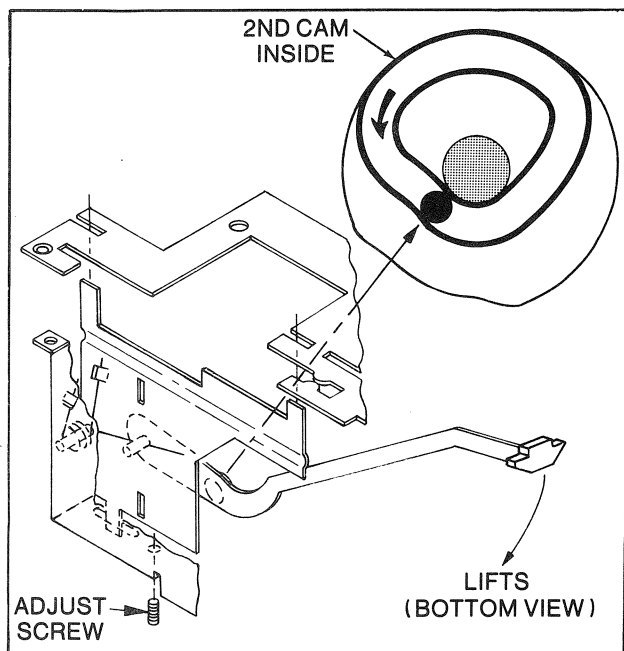


Figure 3.23 Lifter Assembly

follower arms on the front and inside surfaces of the first cam. Make sure the edges of the various cam follower arms slip into the correct guide slots in the cover when the cover is assembled.

2. Assemble the slide lifter cam follower arm (Figure 3.23) so the pin on the arm rides in the slot in the inside surface of the second cam. Make sure the aperture plate tabs slip into the slots in the slide adjuster plate when the cover is assembled.
3. Assemble index guide spring (part number 45344-P2) as shown in Figure 3.24.

3.4.4.4 Forward Adjustment

Figure 3.24

With the mechanism relaxed, the front/rear cam will rest against the stop pin and the link rod to the solenoid will be pushed to the right as illustrated. In this condition, check, and adjust if necessary, the clearance between the adjustment nut and the extended arm of the forward/reverse cam. Snap the forward/reverse cam several times and recheck to be sure that the 0.005-inch (0.13 mm) to 0.020-inch (0.50 mm) clearance is holding.

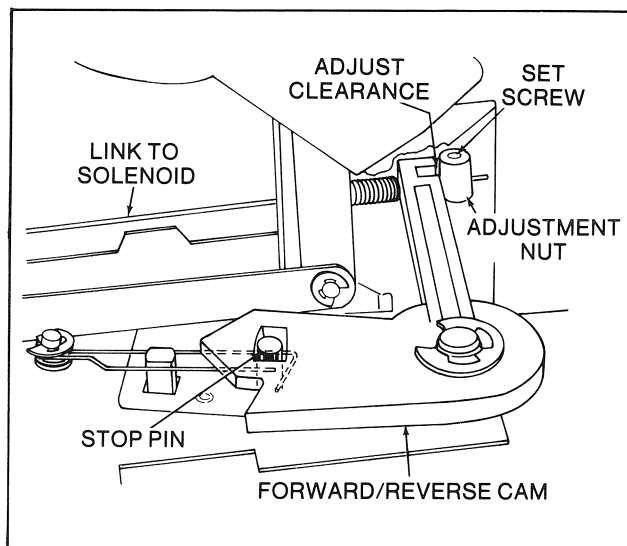


Figure 3.24 Guide Spring Positioning and Forward Adjustment

3.4.4.5 Reverse Adjustment

The solenoid position for reverse operation is adjusted after the advance operation is verified.

1. Energize the 12 Vdc solenoid, or press and hold the armature in using a 1/16-inch allen driver.
2. Observe the stop pin clearance and back edge of the slot in the forward/reverse cam (Figure 3.25). This clearance must be 0.005-inch (0.13 mm) to 0.020-inch (0.50 mm).

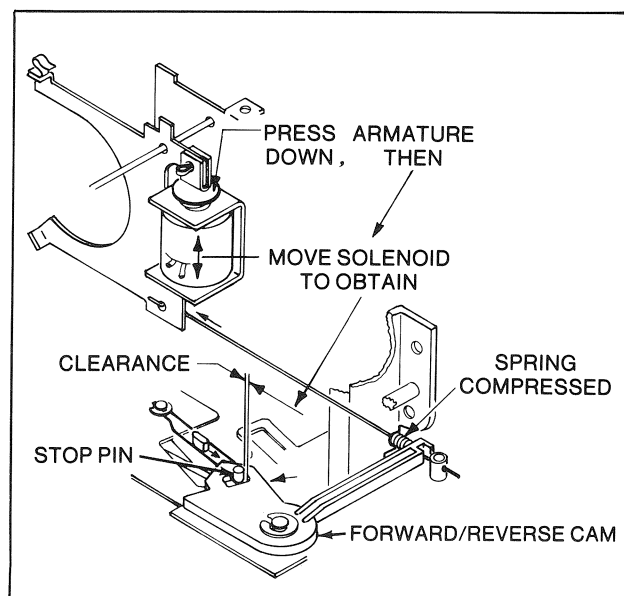


Figure 3.25 Reverse Adjustment

3. Move solenoid (Figure 3.26) up to decrease pin clearance if necessary. This will cause the tray index arm pin to follow the rear "V" of the forward/reverse cam.

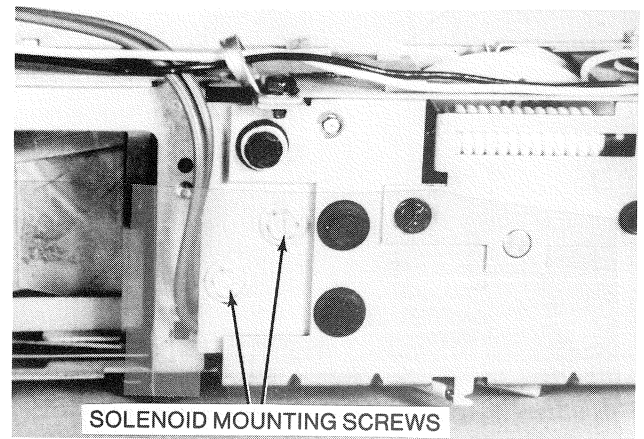


Figure 3.26 Solenoid Adjustment Screws

3.4.4.6 Slide Clamp Springs and Face Clamp Figure 3.27

When the slide doesn't drop in correct film plane and causes an out-of-focus condition, check slide clamp springs. Replace if necessary.

Also check the face clamp adjustment as follows (Figure 3.28):

1. Hold SELECT button depressed.
2. Check for 0.145-inch (3.68 mm) to 0.160-inch (4.06 mm) clearance between knee of slide clamp and face of slide gate.
3. Adjust by forming clamp near bottom bend.

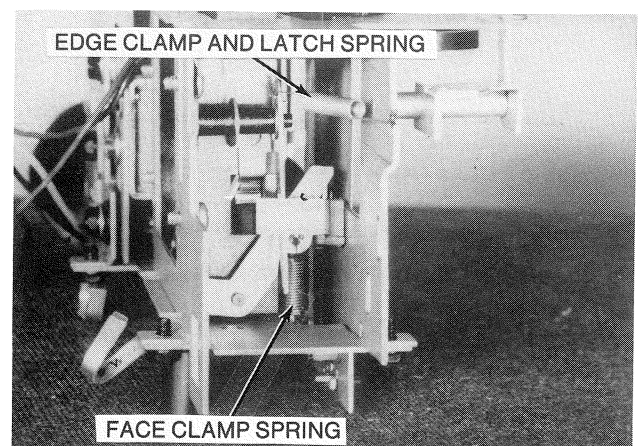


Figure 3.27 Slide Clamp Springs

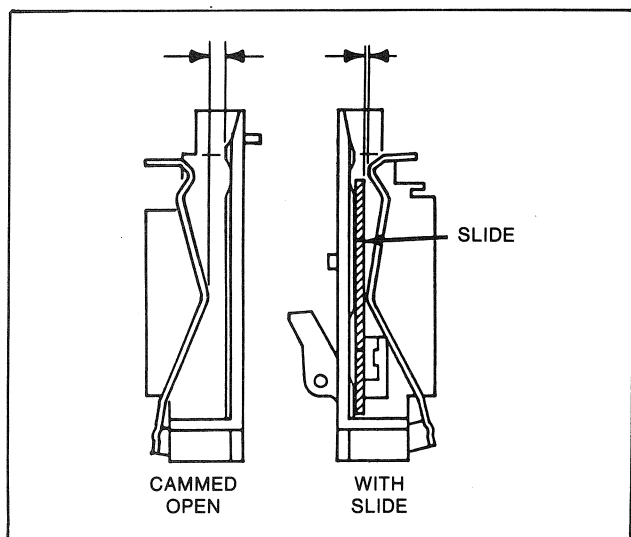


Figure 3.28 Slide Clamp Clearance

4. With 0.040-inch (1.02 mm) thick slide in gate, check for 0.000-inch to 0.010-inch (0.25 mm) clearance between top of slide clamps and slide.

3.4.4.7 Shutter Cam Follower Springs

Figure 3.29

1. When shutter fails to close or bounces when closing, check springs.
2. Failure of shutter to open and close properly could be caused by grease or oil on the blades. Clean to correct condition.

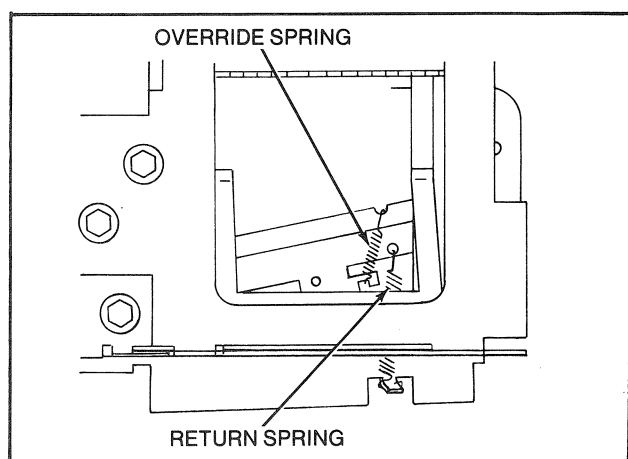


Figure 3.29 Cam Follower Lever Springs

3.4.4.8 Detent Arm Alignment

Figure 3.30

If a slide jams or hits the tray when entering due to thick slides or a 140-slide tray that is not indexed to

the exact position, use feeler gages to check the clearance between the detent finger and slide guide. Adjust by finger pressure on the detent finger or lower on its vertical arm.

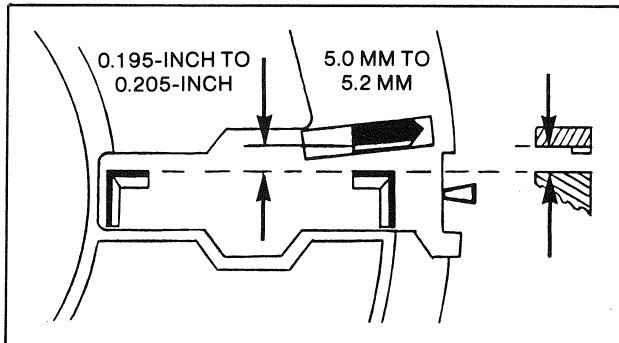


Figure 3.30 Detent Arm Alignment

3.4.5 TAPE DECK

3.4.5.1 Take-Up Torque

Using Telex torque cassette (catalog no. 19-714) check that the reading is between 45 and 75 grams/centimeter, with fluctuations of no more than ± 5 grams/centimeter.

Adjust by:

1. Move the tail of the slip-clutch spring to a different hole in the tape deck main chassis (Figure 6.12, item 10).
2. Replace the slip-clutch.
3. Replace the slip-clutch spring.

3.4.5.2 Rewind Torque

The tape deck should rewind a C-60 cassette in 95 seconds or less.

There is no adjustment for rewind torque. Simply check to see if this requirement can be met. If not, examine the flywheel belt, the fast forward idler, the supply reel assembly, and the rewind idler for grease or wear. Also check and replace, if necessary, the fast forward arm spring and/or the rewind idler spring.

3.4.5.3 Fast-Forward Torque

The tape deck should advance a C-60 cassette in less than 120 seconds.

There is no adjustment for the fast forward torque. Simply check to see if this requirement can be met. If not, examine the flywheel belt, the fast forward idler, and the take-up reel assembly for grease or wear. Also check and replace, if necessary, the fast forward arm spring.

3.4.6 REASSEMBLY NOTES

3.4.6.1 Slide Mechanism

Figure 3.31

Hold select pawl in position while the mechanism is turned over for reassembly and snap a rubber band around the mechanism and over the select pawl. Be sure to remove the rubber band after the mechanism is secured.

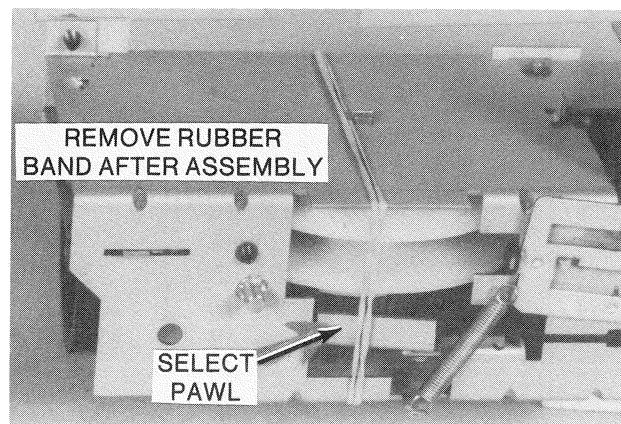


Figure 3.31 Holding Select Pawl for Reassembly

3.4.6.2 Lens Assembly

Figure 3.32

Assemble the right lens bracket. Be sure the anti-backlash spring terminal is projecting up through the bracket hole.

Wipe DC-44 grease on the washers that will be positioned on each side of the auto-focus base.

To assemble the auto-focus base, move the lens assembly forward.

3.4.6.3 Auto-Focus Base

Figure 3.32

1. Insert the guide pin through the hole in the slide mechanism.
2. Rotate the blue clutch gear so the front tooth meshes with the front tooth of the sensor rack teeth.

3. Use a spring tool to guide the vertical terminal of the antibacklash spring through the center slot of the auto-focus base arm.
4. Assemble two top washers and E rings.
5. Using a spring hook, reach under the lens assembly and pull the backlash spring out and hook behind the second post on the top housing.

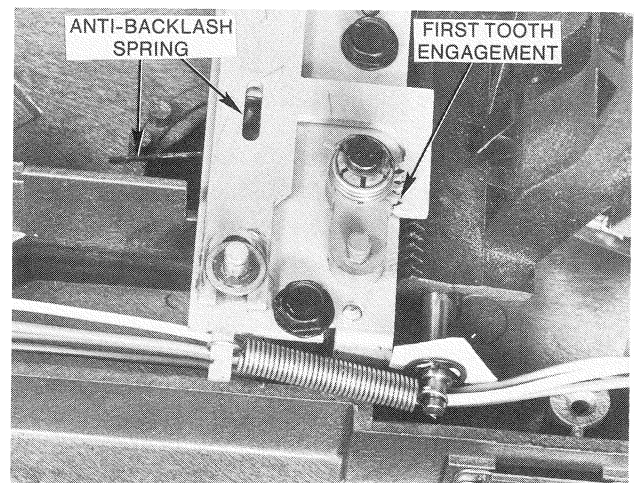


Figure 3.32 Reassembling Lenses and Auto-Focus Base

3.4.6.4 Left Panel

Shift the Magna-Frame lever to the lower most position to eliminate possible contact between the tape deck and Magna-Frame linkage when the left panel is reinstalled.

SECTION IV

ELECTRICAL MAINTENANCE

4.1 INTRODUCTION

This section describes the electrical adjustments and tests which may be required after repairs or to verify correct operation.

Component designators and circuit board references are keyed to the schematic diagrams located at the end of this section.

Before proceeding with audio or cue pulse tests and adjustments, always make sure that the tape heads are clean and demagnetized and that the tape deck is in proper working order (see paragraph 3.2.7).

For best results when adjusting or checking the operation of the audio and cue pulse circuits, the special Telex test tapes called out in the text should be used. These tapes are available in a kit from Telex (catalog no. 19-711). When adjusting the tape head azimuth, any good head alignment cassette may be used (this is a local purchase item and is not included in the Telex tape kit).

Refer to Tables 4.1 and 4.2 for additional information on track usage when making adjustments.

Table 4.1 SS345C Track Utilization

Step	Track	Freq (Hz)	Level	Duration
1	1 & 2	50	-6 dB	10 sec
2			-10 dB	10 sec
3			-18 dB	180 sec
4	3 & 4	1000	-10 dB	180 sec
5		150	-10 dB	120 sec
6		1000	-6 dB	20 sec
7	1 & 2	150	-6 dB	20 sec
8		150	-6 dB	20 sec
9		1000	-6 dB	20 sec
10		315	-4 dB	20 sec
11		50	-10 dB	20 sec
12		50	-6 dB	20 sec

Table 4.2 SS345A Track Utilization

Step	Track	Freq (Hz)	Level	Duration
1	3 & 4	1000	-6 dB	10 sec
2			-10 dB	10 sec
3	1 & 2	315	-4 dB	10 sec
4		1000	-3 dB	440 ms
5			-9 dB	
6			-12 dB	
7			-15 dB	
8			-18 dB	
9			-21 dB	
10			-27 dB	
11			-27 dB	
12			-30 dB	
13			-3 dB	
14			-3 dB	520 ms
15			-6 dB	380 ms
16			-9 dB	
17		950	-10 dB	
18		1050	-10 dB	
19		150	-3 dB	520 ms
20			-9 dB	380 ms
21			-30 dB	520 ms
22		142	-10 dB	380 ms
23		158	-10 dB	380 ms
24		1000	-10 dB	20 sec
25		150	-10 dB	20 sec
26		150	-6 dB	20 sec
27	1 & 2	315	-4 dB	20 sec
28	3 & 4	1000	-6 dB	10 sec

NOTE

Steps 4 through 23 - Pulse is repeated 3 times.

4.2 ADVANCE CUE PULSE TUNING AND SENSITIVITY ADJUSTMENT

(Models 4340, 4480, 4490 only)

METHOD 1

Use this method when Telex Test Tape No. SS345C is available.

1. Turn off the projector.
2. Connect an ac vtvm or an oscilloscope between ground and pin 10 of IC U3.
3. Check the connections made in step 2 and apply power to the projector.
4. Insert Telex Test Tape No. SS345C into the tape deck and advance the tape to the 180-second, 1000 Hz (-10 dB) signal recorded on tracks 3 and 4.
5. Put the projector in playback mode.
6. Adjust VR2 on A1 main board for a minimum reading on the vtvm or oscilloscope.
7. Adjust VR3 on A1 main board for a maximum reading on the vtvm or oscilloscope.
8. Adjust VR2 on A1 main board for a reading of 2.8 volts rms (8.4 volts p-p) on the vtvm or oscilloscope.
9. Proceed to paragraph 4.4 for testing.

METHOD 2

Use this method when the Telex Test Tape No. SS345C is not available. A frequency meter is required.

1. Turn off the projector.
2. Connect a jumper from pin 5 of plug P11 to ground.
3. Connect a frequency meter and an oscilloscope or vtvm between pin 10 of IC U3 and ground.
4. Check the connections made in step 2 and 3 and turn on the projector.
5. Insert a blank cassette and put the tape deck in record mode.

6. Depress and hold the FORWARD button on the upper left side of the projector.
7. Adjust VR2 on A1 main board for a minimum reading on the vtvm or oscilloscope.
8. Adjust VR3 on A1 main board for a reading of 1000 Hz on the frequency meter.
9. Adjust VR2 for a reading of 3.2 volts rms (10 volts p-p) on the vtvm or oscilloscope.
10. Remove the jumper and proceed to paragraph 4.4 for testing.

4.3 STOP PULSE TUNING AND SENSITIVITY ADJUSTMENT

(4490 only)

METHOD 1

Use this method when Telex Test Tape No. SS345C is available.

1. Turn off the projector.
2. Connect a vtvm or oscilloscope between ground and pin 10 of IC U4 (150 Hz filter output).
3. Connect a jumper from pin 2 of IC U10 to the +12V supply.
4. Check the connections made in step 2 and 3 and apply power to the projector.
5. Insert Telex Test Tape No. SS345C into the tape deck and advance the tape to the 120-second, 150 Hz (-10 dB) signal recorded on tracks 3 and 4.
6. Put the tape deck in playback mode.
7. Adjust VR4 on A1 main board for a minimum reading on the vtvm or oscilloscope.
8. Adjust VR5 on A1 main board for a maximum reading on the vtvm or oscilloscope.
9. Adjust VR4 for a reading of 2.8 volts rms (8.4 volts p-p) on the vtvm or oscilloscope.
10. Remove the jumper.
11. Proceed to paragraph 4.4 for testing.

METHOD 2

Use this method when the Telex Test Tape No. SS345C is not available. A frequency meter is required.

1. Turn off the projector.
2. Connect a jumper from pin 6 of IC U8 to ground.
3. Connect a frequency meter and a vtm or oscilloscope between pin 10 of IC U4 and ground.
4. Check the connection made in step 2 and 3 and turn on the projector.
5. Insert a blank cassette and put the tape deck in record mode.
6. Adjust VR4 on A1 main board for a minimum reading on the vtm or oscilloscope.
7. Adjust VR5 on A1 main board for a reading of 150 Hz on the frequency meter.
8. Adjust VR4 for a reading of 3.2 volts rms (10 volts p-p) on the vtm or oscilloscope.
9. Remove the jumper and proceed to the next paragraph for testing.

4.4 STEP LEVEL EVALUATION TESTS

(All Models except 4120, 4124)

Perform these tests after any repairs or adjustments to the tape deck or advance cue and stop cue circuits or to verify correct operation.

NOTE

If the appropriate test tapes are not available, and alignments are made using a frequency meter, simply check that the projector will properly record and playback cue pulses. Keep in mind that adjustments made with a frequency meter will only be as accurate as the meter itself - in some cases this may mean that the projector works fine when recording and playing back its own cue pulses, but may not work correctly with preprogrammed tapes.

1. Insert Telex Test Tape No. SS345A into the tape deck and rewind the tape.
2. Put the tape deck in playback mode.
3. The first two signals are ten-second 1000 Hz reference signals recorded on tracks 3 and 4. Check that the projector advances once on each of these signals.

NOTE

The next ten-second signal (315 Hz) is not used at this time. The information after this is a series of 1000 Hz pulses, each 440 milliseconds long but decreasing in level, and recorded on tracks 3 and 4. There are 3 pulses recorded at -3 dB, three at -9 dB, three at -12 dB and so on in 3 dB steps down to -30 dB. These pulses are followed by another 3 pulses at -3 dB. Caramate Series 4000 projectors should advance one slide on all pulses through the -21 dB level but should not advance from -24 dB to -30 dB.

4. Refine the adjustment of VR2 on A1 main board if the projector advances on any 1000 Hz pulses from -24 dB to -30 dB. This may require rewinding and playing the tape several times and adjusting VR2 in increments until this requirement is met. (This step applies to models with record capability only.)

NOTE

Following the 1000 Hz pulses at -3 dB to -30 dB, are fifteen pulses which check the projector's marginal operating characteristics. These are three "long-strong" pulses of -3 dB for 520 milliseconds, three nominal level, short duration pulses of -6 dB for 380 milliseconds and three "short-weak" pulses of -9 dB for 380 milliseconds, followed by six pulses, three of 950 Hz at -10 dB for 380 milliseconds and three of 1050 Hz at -10 dB for 380 milliseconds, which check the bandwidth of the 1000 Hz cue pulse detecting circuitry. Caramate Series 4000 projectors should advance once for each of the fifteen pulses.

5. Check that the projector advances on all of the pulses summarized in the preceding note.

NOTE

The next fifteen pulses are 150 Hz and are used to check the sensitivity and bandwidth of the stop pulse detecting circuitry only (the projector will

not advance with these pulses). The first 3 pulses are “long-strong” pulses of 150 Hz at -3 dB for 520 milliseconds. These are followed by three “short-weak” pulses of 150 Hz at -9 dB for 380 milliseconds. Following these are three pulses of 150 Hz at -30 dB for 520 milliseconds. After these are three pulses of 142 Hz at -10 dB for 380 milliseconds and three pulses of 158 Hz at -10 dB for 380 milliseconds. Caramate 4000 projectors should stop on each one of these pulses except the three 150 Hz pulses at -30 dB for 520 milliseconds.

6. Check that the tape deck stops on all pulses except those at -30 dB as summarized in the preceding note.

NOTE

The next three signals on the tape are 1000 Hz at -10 dB, 150 Hz at -10 dB, and 150 Hz at -6 dB, each 20 to 30 seconds in duration, recorded on tracks 3 and 4. These signals may be used for checking the advance and stop circuits. The last two signals are ANSI Standard reference signals of 315 Hz at -4 dB recorded on tracks 1 and 2 and 1000 Hz at -6 dB recorded on tracks 3 and 4. These may be used for a final verification of the audio and advance circuits respectively.

4.5 AUDIO TESTS

(All Models except 4120, 4124)

Perform these tests after any repairs or adjustments to the tape deck or audio circuits.

1. Insert Telex Test Tape No. SS345C into tape deck and locate the 20-second, 1000 Hz (-6 dB) signal on track 1.
2. Plug an 8-ohm test speaker or dummy load into the speaker jack.
3. Connect an ac vtvm or oscilloscope across the speaker or dummy load.
4. Put the projector in playback mode.
5. Check that the 1000 Hz signal produces an undistorted output of 6.4 to 7.1 volts rms (18 to 20 volts p-p) from the speaker or dummy load. This output level should be within the adjustment range of the tone and volume controls.

NOTE

The next signal on the tape should be 315 Hz (-4 dB).

6. Check that the 315 Hz signal produces an undistorted output as in step 5.

4.6 BIAS OSCILLATOR LEVEL ADJUSTMENT

(4340, 4480 and 4490)

1. Turn off the projector.
2. Connect a vtvm or oscilloscope between ground and P1-4.
3. Check the connections made in step 2 and turn on the projector.
4. Insert a blank cassette and put the projector in record mode.
5. Insert a dummy microphone plug into the microphone jack (the plug should be shorted to prevent noise from being introduced into the amplifier).
6. Adjust VR1 on A1 main board for a reading of approximately 11.5 volts rms (32.5 volts p-p) on the vtvm or oscilloscope.

4.7 EXCITER LAMP VOLTAGE ADJUSTMENT

(4460, 4470, 4480, 4490)

If the auto-focus exciter lamp or one of its circuit components has been replaced, proceed as follows.

1. Turn off the projector.
2. Connect a dc meter to the A6 circuit board (Auto-Focus Driver) as shown in Figure 4.1. Connect the positive lead to the positive terminal of C1. Connect the negative lead to the emitter of Q4.
3. Check the connections made in step 2 and turn on the projector.
4. Adjust VR1 for a reading of 5.5 volts dc on the meter.

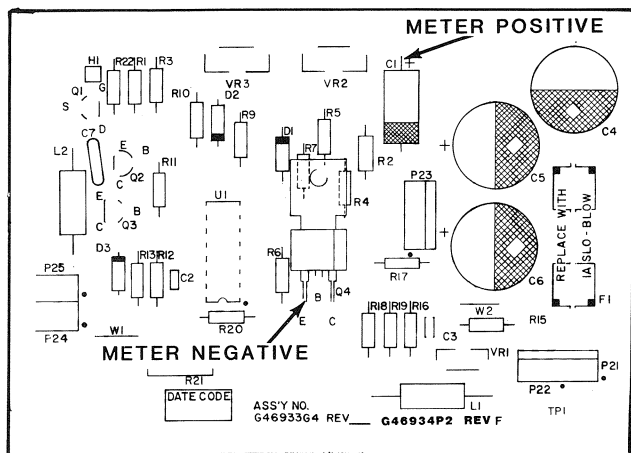


Figure 4.1 A6 Board Meter Connect Points

4.8 AUTO-FOCUS ADJUSTMENT

Figure 4.2

1. Remove the dust cover from the auto-focus adjusting access holes on the right side of the upper housing.
2. Turn the projector on and insert a non-glass mounted slide in the slide gate.
3. Move the auto-focus ON-OFF switch to ON and, after allowing the auto-focus to respond to the slide, focus it manually for the sharpest picture.
4. With a 7/64-inch Allen wrench, adjust the sensitivity potentiometer (VR3) maximum clockwise. VR3 is accessed through the hole farther from the front of the projector.
5. With your finger, push the top of the slide toward the back of the projector. The auto-focus should respond to the change of position of the slide (evidenced by a slight movement of the manual focusing knob accompanied by the sound of the auto-focus motor running).
6. Release the backward pressure on the slide and allow it to return to its proper position in the slide gate. Observe the manual focusing knob and listen for the auto-focus motor running. The motor should return the lens to proper focus without hunting. Hunting is evident if the focusing knob continues to oscillate back and forth after the slide comes to rest. One overshoot and return is allowed.

7. To correct for hunting, adjust the sensitivity potentiometer (VR3) counterclockwise in increments while intermittently pushing on and releasing the slide as described in steps 5 and 6. Adjust the sensitivity until the requirement in step 6 is met.
8. Turn the auto-focus switch OFF, remove the slide and insert a glass mounted slide.
9. Turn the auto-focus switch ON and note that the auto-focus system does respond to the glass slide (the manual focusing knob on the top of the projector will move slightly).
10. With a number 0 phillips screwdriver, adjust the glass slide compensation potentiometer (VR2) for the sharpest picture. This potentiometer is accessed through the hole closer to the front of the projector.

NOTE

When the glass slide compensation adjustment (VR2) is complete, the auto-focus system will focus properly on any slide mounted in a glass mount with the same thickness glass. (Most current glass mounts use glass about 0.026-inch [0.66 mm] in thickness). However, older glass mounts may use glass up to 0.040-inch (1.02 mm) thick and may be slightly out of focus as a result. To correct for this condition, adjust the glass slide compensation potentiometer (VR2) to a compromise position to provide acceptable focus for each one. The compensation potentiometer may also require adjustment to provide acceptable focus for both black-and-white and Ektachrome slides if they are used together in the same program.

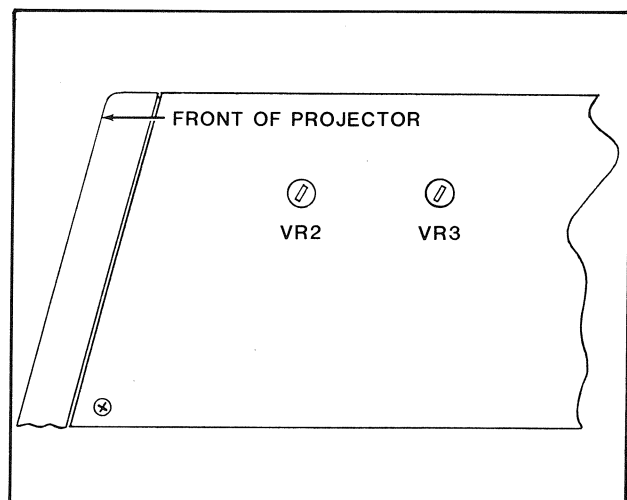
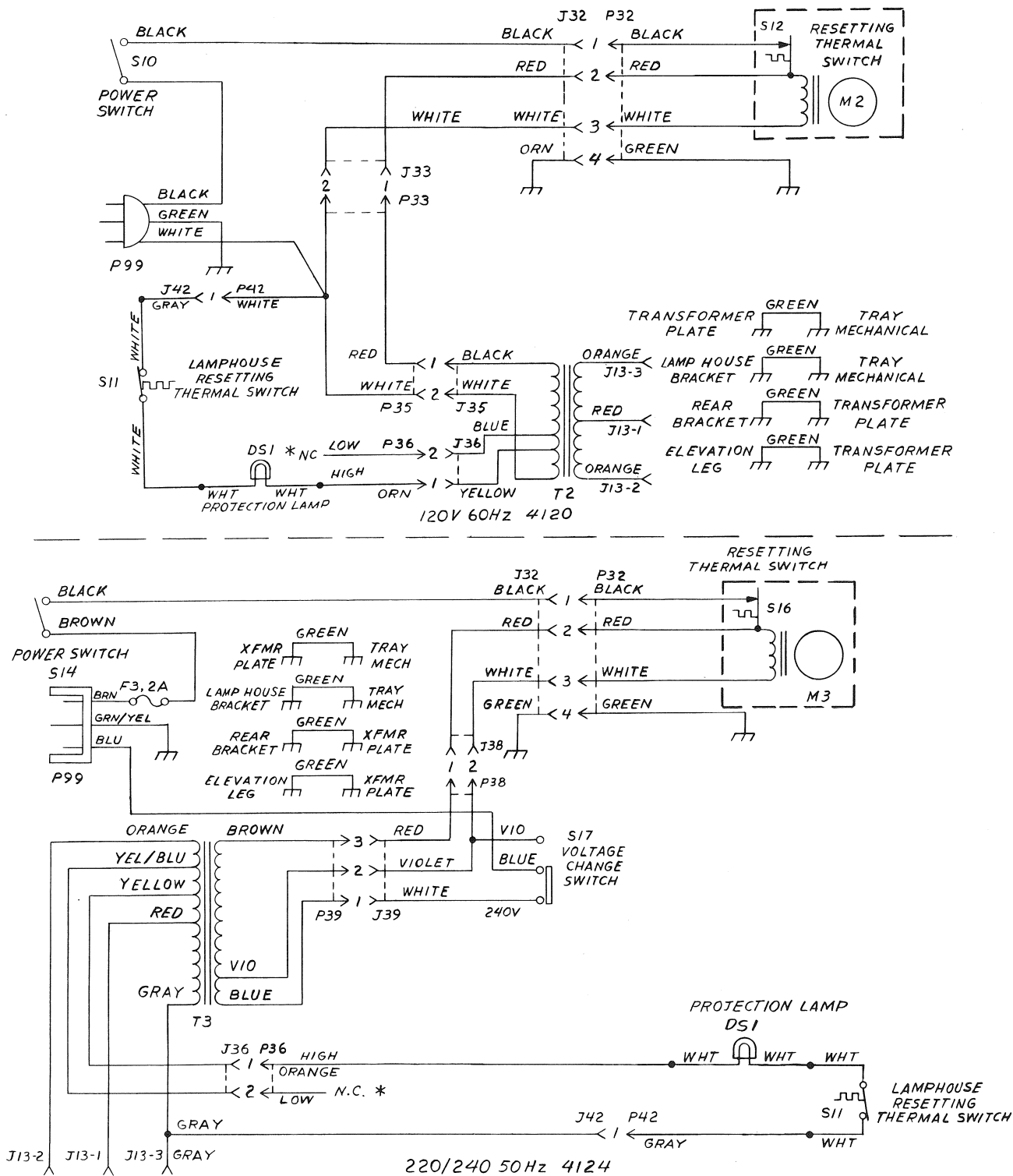


Figure 4.2 Auto-Focus Adjustment



* FOR LOW VOLTAGE LAMP SETTING, MOVE THE ORANGE WIRE TO THE "2" POSITION IN PLUG P36 (4120, 4124 ONLY).

Figure 4.3 Transformer Wiring Diagram (4120)

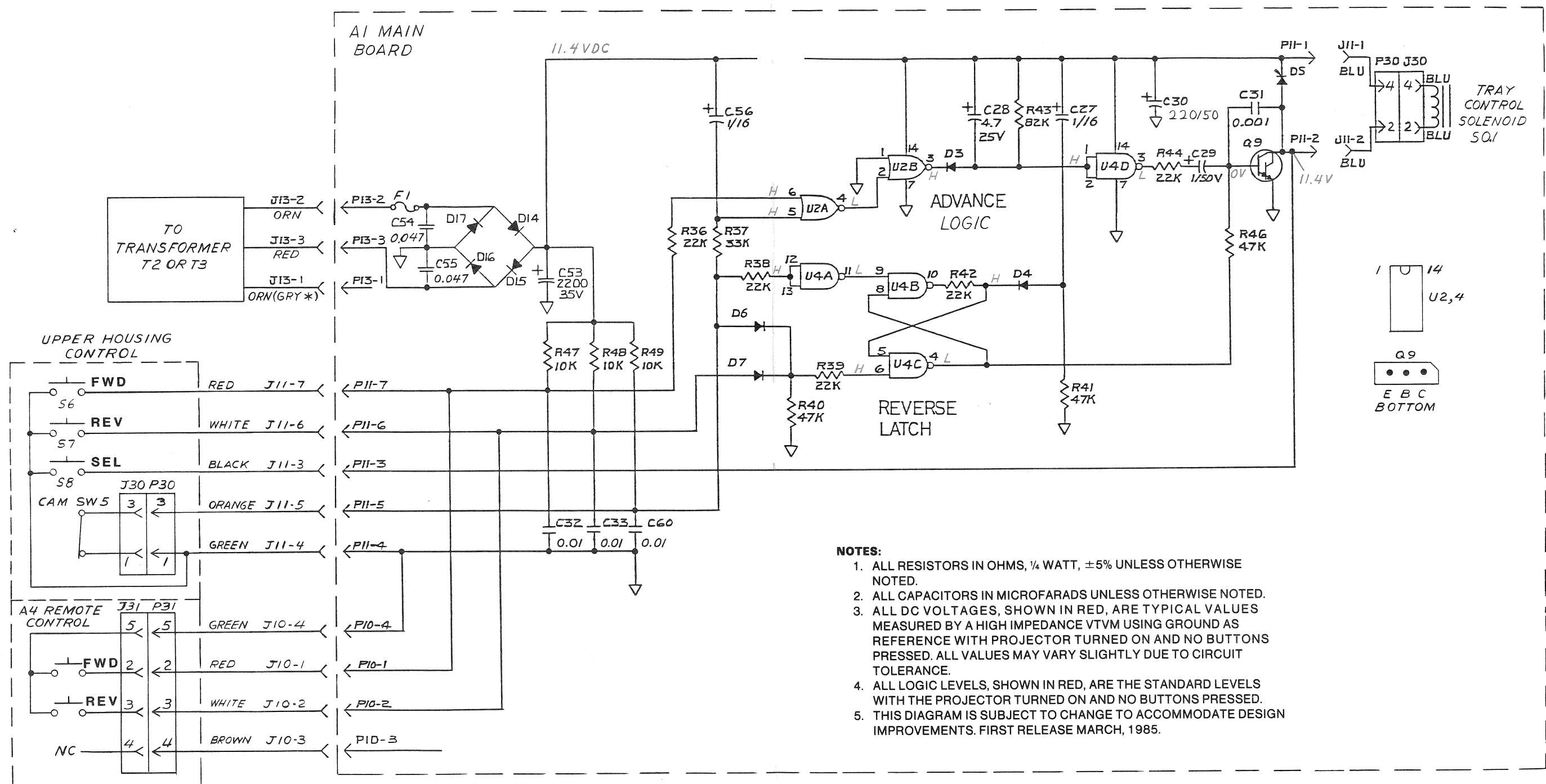


Figure 4.5 Projector Schematic Diagram (4120)

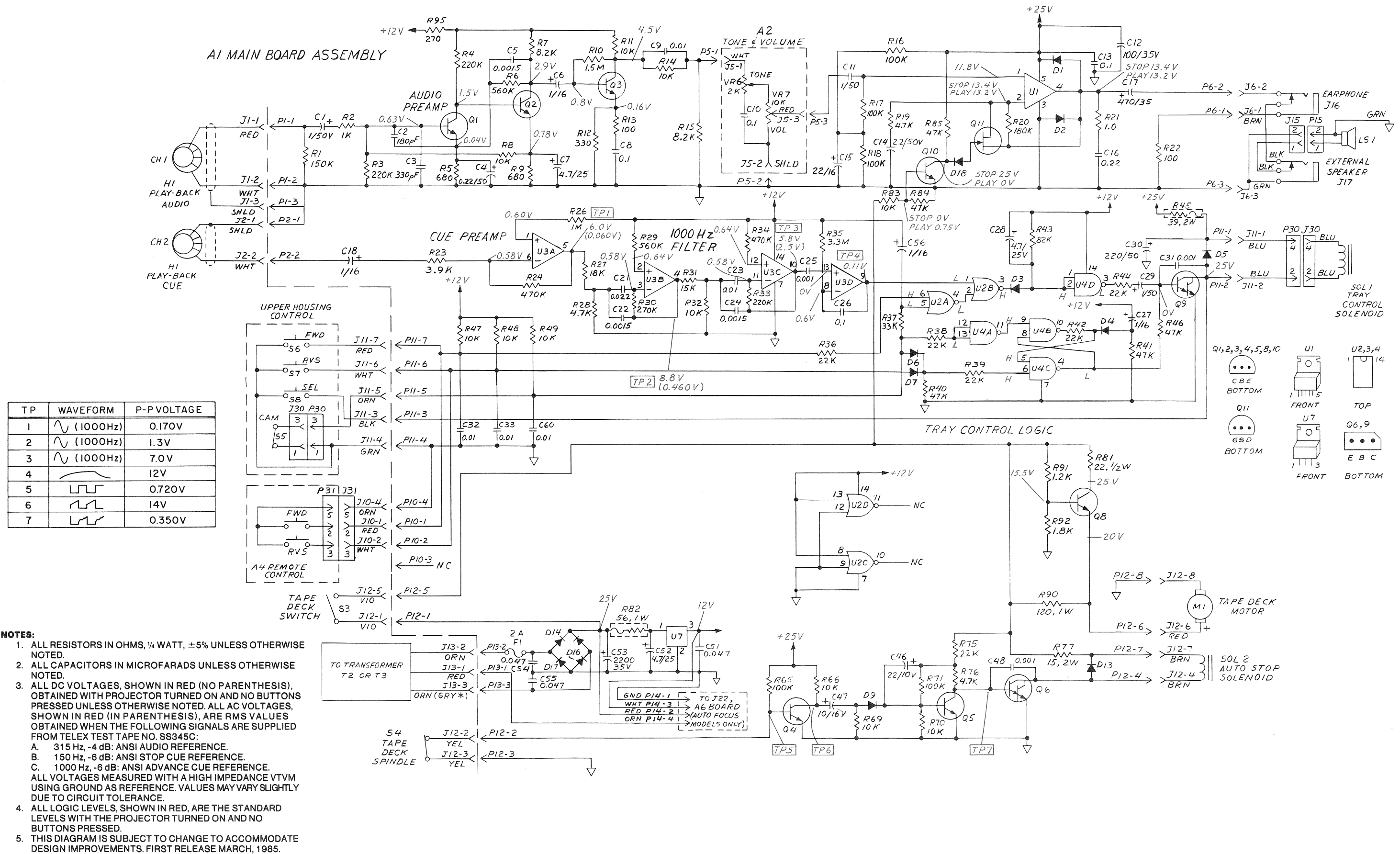
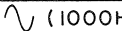
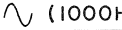
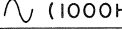
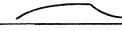
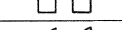
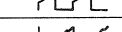
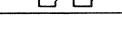


Figure 4.6 Projector Schematic Diagram (4320, 4460)

TP	WAVEFORM	P-P VOLTAGE
1		0.170V
2		1.3V
3		7.0V
4		12V
5		0.720V
6		14V
7		0.350V

NOTES:

- ALL RESISTORS IN OHMS, 1/4 WATT, $\pm 5\%$ UNLESS OTHERWISE NOTED.
- ALL CAPACITORS IN MICROFARADS UNLESS OTHERWISE NOTED.
- ALL DC VOLTAGES, SHOWN IN RED (NO PARENTHESIS), OBTAINED WITH PROJECTOR TURNED ON AND NO BUTTONS PRESSED UNLESS OTHERWISE NOTED. ALL AC VOLTAGES, SHOWN IN RED (IN PARENTHESIS), ARE RMS VALUES OBTAINED WHEN THE FOLLOWING SIGNALS ARE SUPPLIED FROM TELEX TEST TAPE NO. SS345C:
A. 315 Hz, -4 dB: ANSI AUDIO REFERENCE.
B. 150 Hz, -6 dB: ANSI STOP CUE REFERENCE.
C. 1000 Hz, -6 dB: ANSI ADVANCE CUE REFERENCE.
ALL VOLTAGES MEASURED WITH A HIGH IMPEDANCE VTVM USING GROUND AS REFERENCE. VALUES MAY VARY SLIGHTLY DUE TO CIRCUIT TOLERANCE.
- ALL LOGIC LEVELS, SHOWN IN RED, ARE THE STANDARD LEVELS WITH THE PROJECTOR TURNED ON AND NO BUTTONS PRESSED.
- THIS DIAGRAM IS SUBJECT TO CHANGE TO ACCOMMODATE DESIGN IMPROVEMENTS. FIRST RELEASE MARCH, 1985.

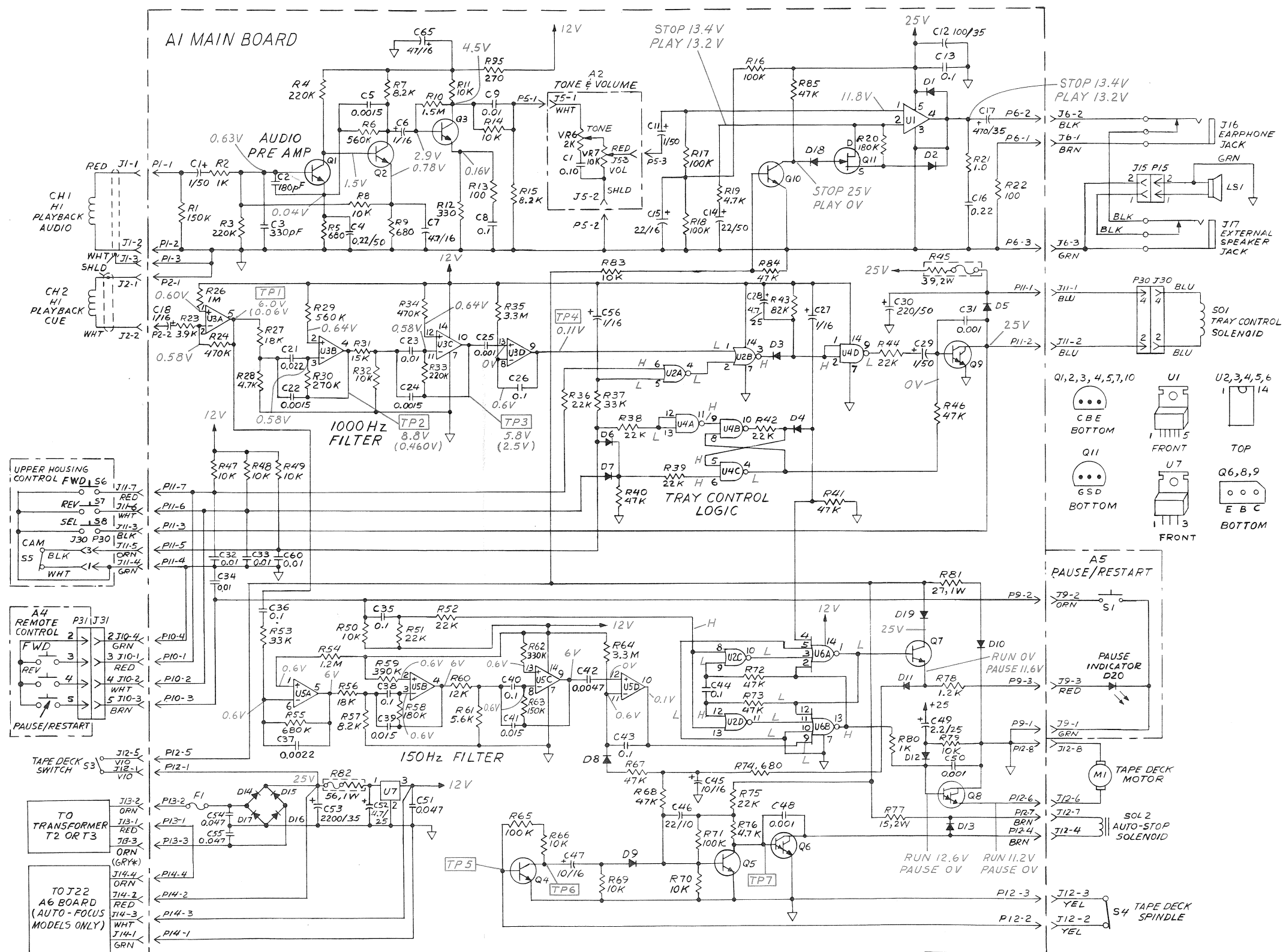


Figure 4.7 Projector Schematic Diagram (4470)

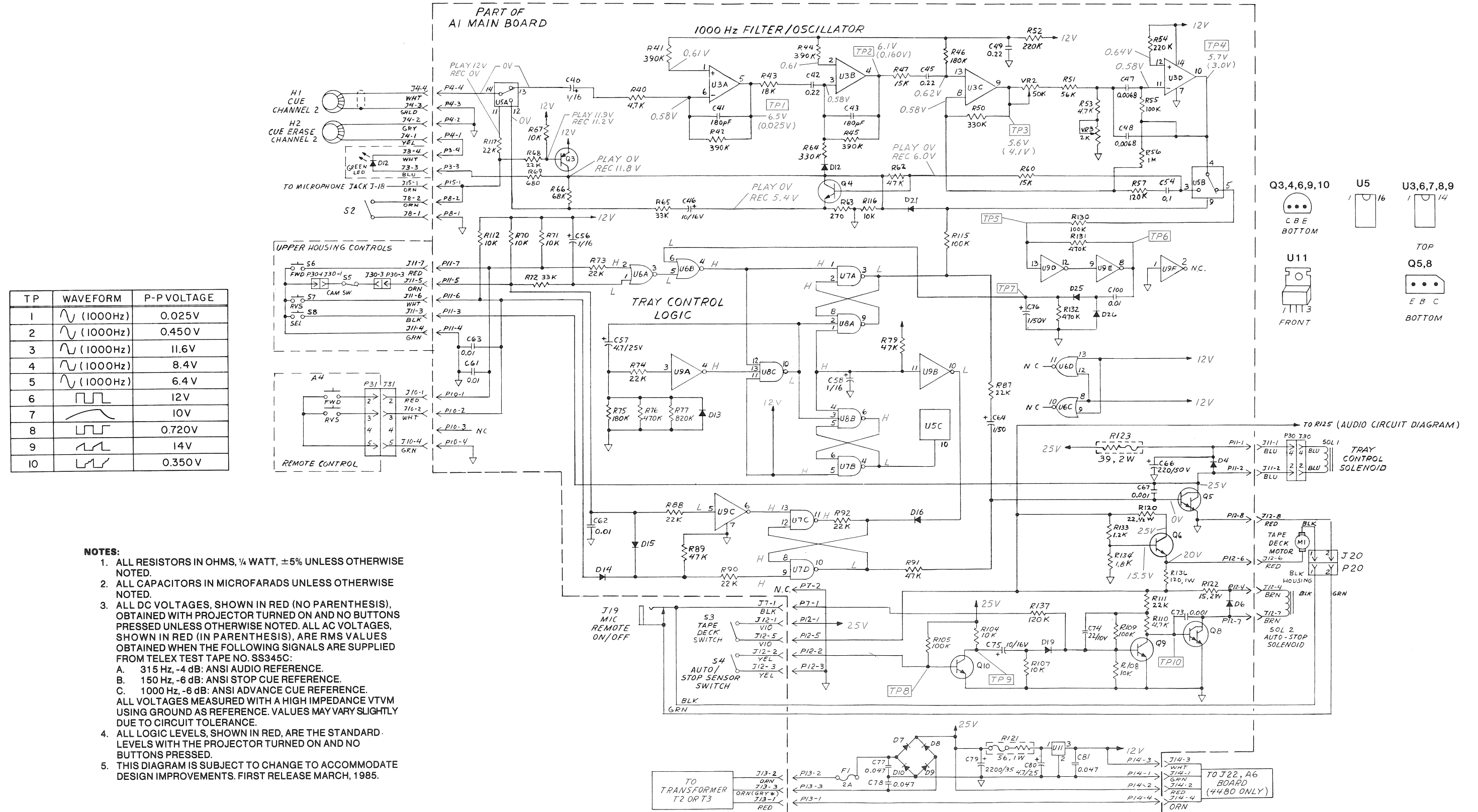


Figure 4.8 Projector Schematic Diagram - Part One (4340, 4480)

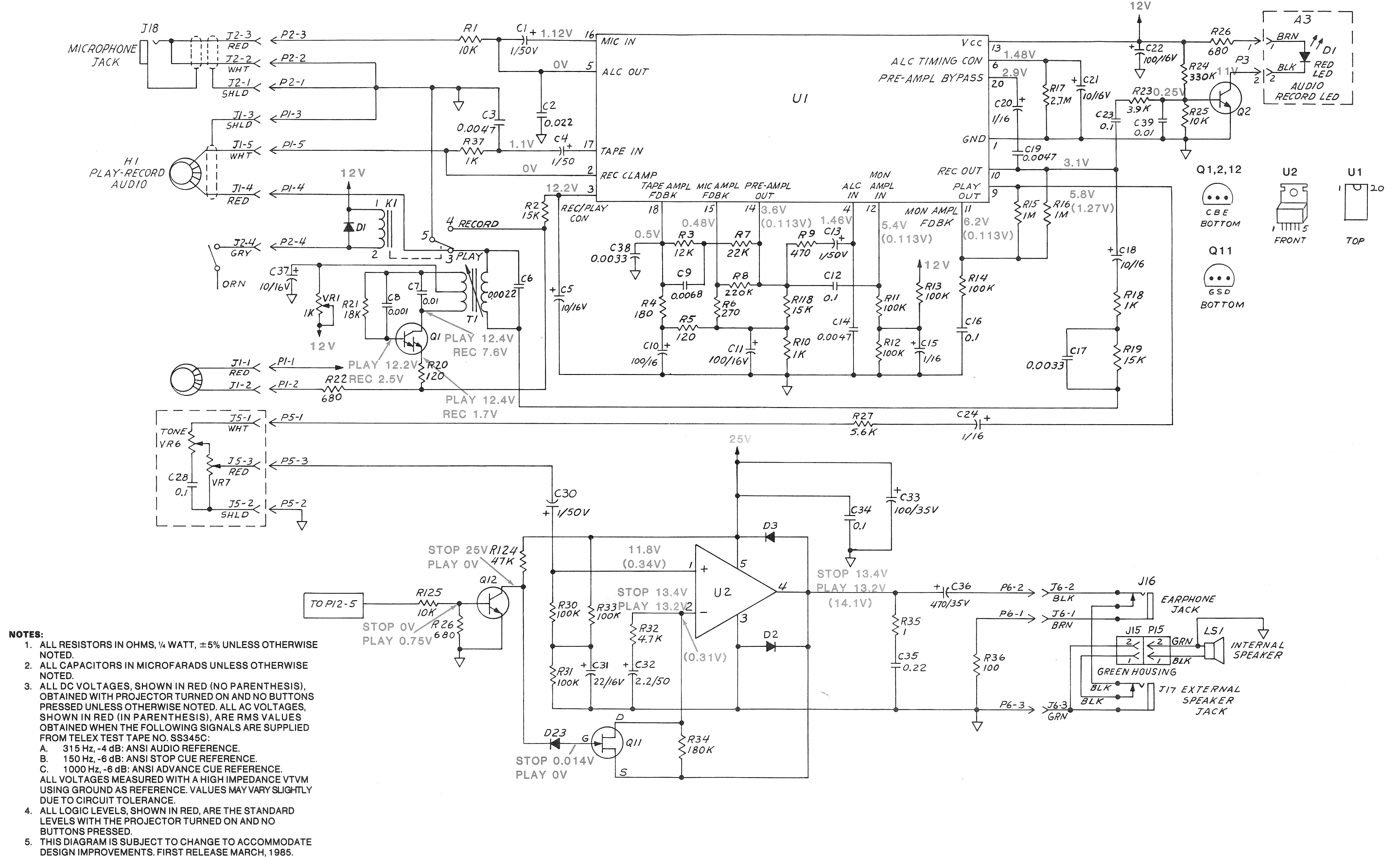
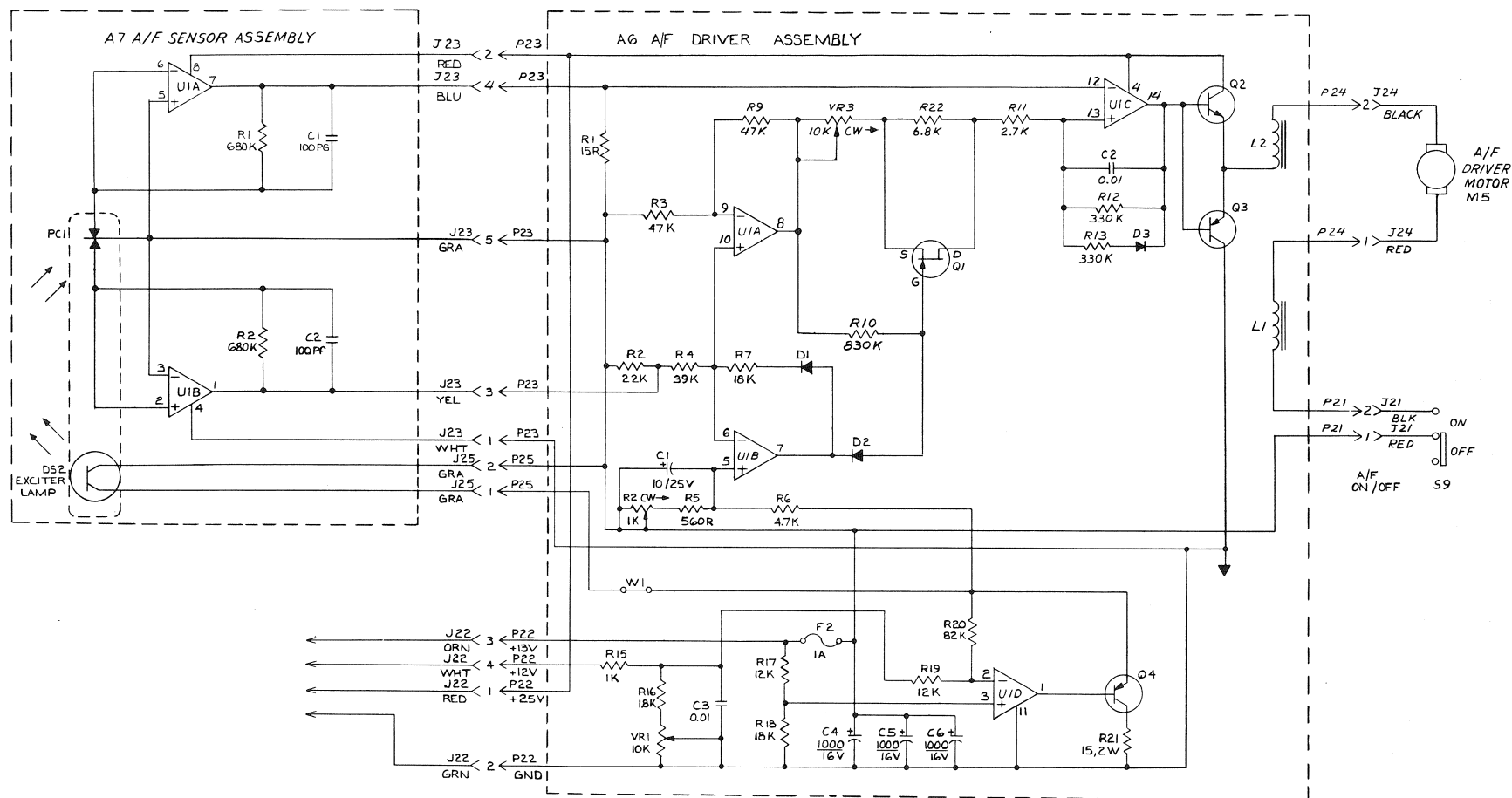


Figure 4.11 Auto-Focus Schematic Diagram



NOTES:

1. ALL RESISTORS IN OHMS, 1/4 WATT, $\pm 5\%$ UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS IN MICROFARADS UNLESS OTHERWISE NOTED.
3. THIS DIAGRAM IS SUBJECT TO CHANGE TO ACCOMMODATE DESIGN IMPROVEMENTS. FIRST RELEASE MARCH, 1985.

SECTION V

TROUBLESHOOTING

5.1 INTRODUCTION

The purpose of this section is to list commonly encountered troubles and to indicate corrective repairs and adjustments. Disassemble only as far as needed for repair.

Before troubleshooting the Caramate 4000 Projector, make sure the following conditions exist.

1. The tape deck will transport a general purpose cassette without binding or damaging tape. (This will insure against damaging an expensive test tape.)
2. The tape head is clean and demagnetized.
3. The azimuth adjustment is correct.
4. The tape contains the proper cue pulse frequencies.

5. There are no loose or missing screws or parts that are binding because of misalignment or lack of lubrication.
6. All plugs and connectors are making good contact, and all dc supply voltages are correct.

5.2 TROUBLE AND REMEDY TABLES

The following two tables classify commonly encountered problems under the general headings of electrical or mechanical. If a check of Table 5.1 does not indicate that the cause of a problem is electrical, then consult Table 5.2 for possible mechanical causes.

Table 5.1 Electrical Troubleshooting

TROUBLE	POSSIBLE CAUSE	REMEDY
1. All functions inoperative.	Circuit breaker shut off or tripped (line fuse blown).	Turn circuit breaker on (replace line fuse).
	Power switch defective.	Replace.
	Power cord defective.	Replace.
	Connector loose or disconnected.	Reconnect.
	Thermal cutoff, in fan motor or lamp housing defective.	Replace.
	Thermal cutoff open due to overheating.	Check operation of fan motor. Check for air flow obstruction. Check for high line voltage.

Table 5.1 Electrical Troubleshooting (Continued)

TROUBLE	POSSIBLE CAUSE	REMEDY
2. Lamp does not light.	Defective lamp. Defective lamp switch. Connector loose or disconnected.	Replace. Replace. Reconnect.
3. No audio, all other functions okay.	Defective board component	Insert 315 Hz signal from test tape. Trace signal and replace defective component.
4. No audio, all other functions okay.	Defective speaker. Defective muting circuit.	Replace. Replace Q11. All Models. Q10. Models 4320, 4460, 4470. Q12. Models 4340, 4480, 4490
5. No audio, no advance cue or stop cue. Lamp and blower okay.	Tape head dirty. Azimuth out of adjustment. Blown fuse. Defective cassette.	Clean. Adjust. Replace. Replace.
6. Tape not being transported.	Play switch S3 defective. Defective board component. Defective tape drive motor. Defective cassette. Loose or defective connector.	Replace. Replace. Replace. Replace. Replace.
7. Low audio output.	Tape head dirty. Azimuth out of adjustment. Volume control dirty or defective. Defective board component. Defective tape head.	Clean. Adjust. Clean or replace. Insert 315 Hz test signal from test tape. Trace signal and replace defective parts. Replace.
8. No advance from cue pulses on tape, audio okay.	Azimuth out of adjustment. Tape head dirty.	Adjust. Clean.

Table 5.1 Electrical Troubleshooting (Continued)

TROUBLE	POSSIBLE CAUSE	REMEDY
	Defective board component.	See paragraph 5.3.
	Defective tape head.	Replace.
9. No tone control.	Tone/Volume control plug reversed.	Remove plug from board, turn plug around and plug back in.
	Azimuth out of adjustment.	Adjust.
	Defective tone control.	Replace.
10. Slide tray remains in select.	Defective board component.	Replace Q9, U4 (Models 4320, 4460, 4470). Q5, U7 (Models 4340, 4480 and 4490).
	Mechanical bind in slide advance mechanism.	Repair.
11. Auto-Stop inoperative.	Defective board component.	Replace Q6, Q5, Q4, D13 or SO2 (Models 4320, 4460, 4470). Q8, Q9, Q10, D6, Q7 or SO2 (Models 4340, 4480, & 4490).
12. Auto-Stop trips when tape stops with stop pulses or PAUSE/RESTART button.	Defective board component.	Replace Q7, D10 (Models 4320, 4460, 4470). Q7, D18 (Models 4340, 4480, 4490).
13. No stop from cue pulse on tape, audio seems okay, advance cue okay.	Azimuth out of adjustment.	Adjust.
	Tape head dirty.	Clean.
14. No record, playback okay.	Record and/or mic switch out of adjustment.	Adjust.
	Defective or dirty contacts on record switch or mic switch.	Clean contacts or replace switch.
	Defective solder connection.	Repair.
	Defective microphone.	Replace.
	Breakout tabs out of cassette.	Use cassette with breakout tabs intact.
15. Noisy playback.	Record/playback head dirty or scratched.	Clean or replace.
	Record/playback head connections open or intermittent.	Repair.
	Dirty Volume Control.	Clean or replace.

Table 5.2 Mechanical Troubleshooting

TROUBLE	POSSIBLE CAUSE	REMEDY
1. Screen illuminated when no slide is in projector.	Shutter out of adjustment.	Adjust.
	Shutter dirty.	Clean.
2. Screen is not illuminated when slide is in projector, projection lamp okay.	Shutter not opening.	Check springs or operation interference.
3. Screen illumination weak or low.	Projection lens, mirrors or projection screen dirty.	Clean.
4. Projected image not centered on rear screen.	Primary mirror out of adjustment.	Adjust.
	Defective slide, not dropping.	Remount slide.
5. Projector does not cycle.	Solenoid out of adjustment.	Adjust.
	Clutch spring broken.	Replace.
	Slides jammed.	Replace slide mounting.
	Side clamp interference at top of frame.	Adjust.
	Drive belt off or broken.	Reinstall or replace.
6. Slide tray will not rotate manually when select is depressed.	Lifter out of adjustment.	Adjust.
7. Slide tray will not advance.	Index arm jammed.	Adjust forward or reverse cam.
	Tray defective.	Replace.
	Defective board component.	Refer to paragraph 5.3.
8. Magna-Frame binds or will not shift.	Mechanical interference or disconnected.	Repair.
9. Projector continues to cycle.	Solenoid SOL 1 misaligned.	Adjust.
10. Take-up fails or erratic.	Defective cassette.	Replace cassette.
	Pressure roller worn, dirty, wobbles, incorrect tension.	Clean or replace roller, replace pressure roller spring.
	Head panel binding or bent.	Clear binding or replace bent part.
	Supply reel binding.	Clear binding, replace supply reel assembly, check brake arm.

Table 5.2 Mechanical Troubleshooting (Continued)

TROUBLE	POSSIBLE CAUSE	REMEDY
	<p>Bent push button rods.</p> <p>Flywheel/capstan binding or bent.</p> <p>Flywheel belt broken or slipping.</p> <p>No power to motor.</p> <p>Brake rubbing on supply reel.</p> <p>Pause button operated.</p> <p>Defective motor.</p>	<p>Straighten rods.</p> <p>Clear binding, replace flywheel/capstan.</p> <p>Clean or replace belt.</p> <p>Check projector power supply. Check for loose or broken wires or defective switch.</p> <p>Adjust.</p> <p>Release pause feature.</p> <p>Replace motor.</p>
11. Rewind fails or erratic.	<p>Defective cassette.</p> <p>Take-up reel binding.</p> <p>Supply reel binding or slipping.</p> <p>Rewind idler slipping or binding.</p> <p>Fast forward idler slipping or binding.</p> <p>Rewind idler arm bent or broken.</p>	<p>Replace cassette.</p> <p>Clear binding or replace take-up reel.</p> <p>Clean supply reel. Clear binding or replace supply reel.</p> <p>Clean rewind idler, check rewind idler arm spring. Replace idler or spring as necessary.</p> <p>Clean fast forward idler or clear binding. Replace idler or spring if necessary.</p> <p>Check arm and replace if necessary.</p>
12. Fast forward fails or erratic	<p>Defective cassette.</p> <p>Take-up reel binding or slipping.</p> <p>Supply reel binding.</p> <p>Fast forward idler binding or slipping.</p> <p>Rewind arm bent or broken.</p> <p>Brake arm bent or broken.</p> <p>Bent push button rods.</p> <p>No power to motor.</p>	<p>Replace cassette.</p> <p>Clean take-up reel. Clear binding or replace take-up reel.</p> <p>Clear binding or replace supply reel.</p> <p>Clean fast forward idler or clear binding. Replace idler or spring if necessary.</p> <p>Straighten or replace defective arm.</p> <p>Straighten or replace defective arm.</p> <p>Straighten or replace defective rods.</p> <p>Check projector power supply. Check for loose or broken wires or defective switch.</p>

Table 5.2 Mechanical Troubleshooting (Continued)

TROUBLE	POSSIBLE CAUSE	REMEDY
	Defective motor. Flywheel/capstan bent or binding.	Replace motor. Clear binding or replace flywheel/capstan.
13. Tape transported by pressure roller but not taken up by take-up reel.	Defective cassette. Take-up reel binding or slipping. Play idler slipping or tension incorrect. Defective slipclutch. Brake arm bent or broken. Head panel binding or bent.	Replace cassette. Clean take-up reel. Clear binding or replace take-up reel. Clean play idler. Check play idler spring. Replace clutch. Check slipclutch spring. Straighten or replace defective arm. Clear binding or replace bent part.
14. Wow and flutter.	Defective cassette. Pressure roller worn, slipping or pressure incorrect. Supply reel binding. Flywheel/capstan bent or binding. Bent push button rods. Head panel bent or binding. Drive belt slipping. Defective motor.	Replace cassette. Clean or replace pressure roller. Check pressure roller spring. Clear binding or replace supply reel. Clear binding or replace flywheel/capstan. Straighten or replace defective rods. Clear binding or replace bent part. Clean or replace. Replace motor.
15. No auto-stop.	Auto-stop idler defective or slipping. Defective solenoid. Fast forward idler clutch binding.	Clean auto-stop idler or replace defective idler. Replace solenoid. Replace fast forward idler.
16. Premature or intermittent auto-stop.	Defective cassette. Supply reel binding. Brake arm bent or binding. Segment switch dirty or defective.	Replace cassette. Clear binding or replace supply reel. Clear binding or replace brake arm. Clean switch or replace switch.

Table 5.2 Mechanical Troubleshooting (Continued)

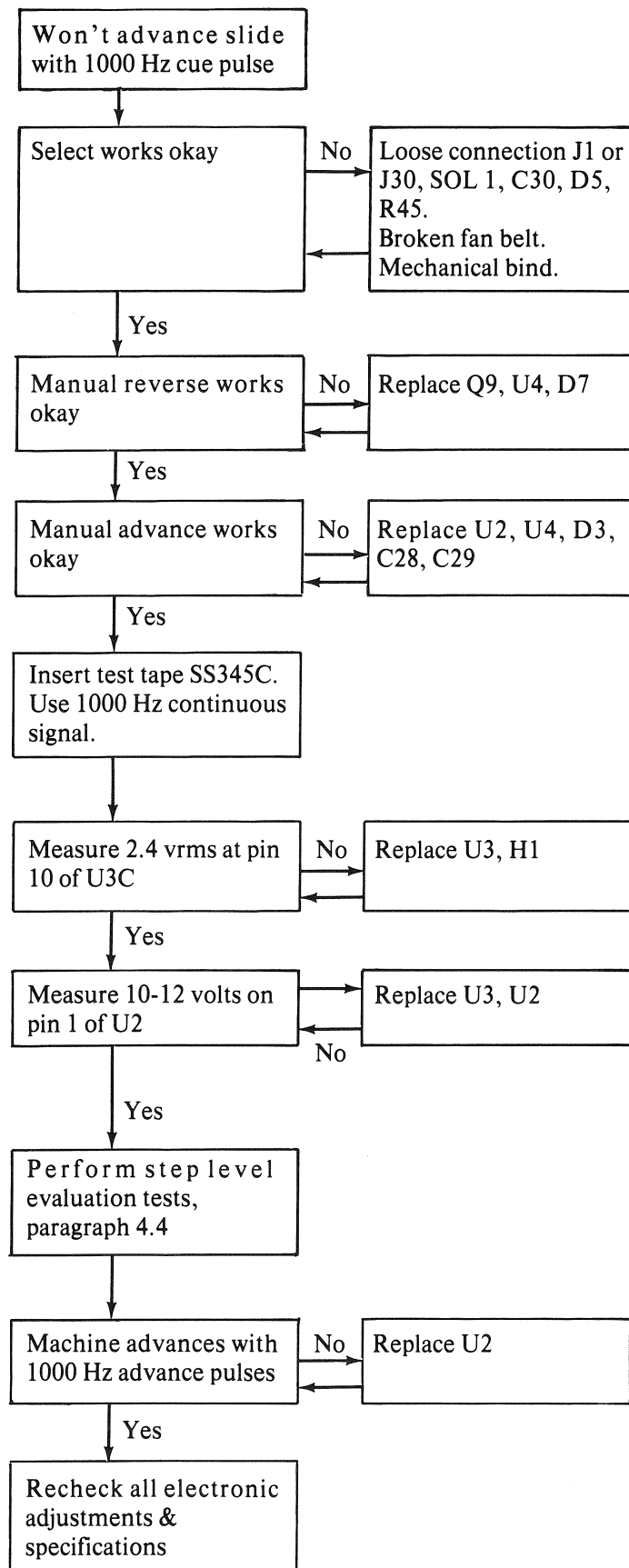
TROUBLE	POSSIBLE CAUSE	REMEDY
	Take-up reel binding. Slipclutch not driving or defective. Solenoid defective.	Clear binding or replace take-up reel. Clean slipclutch. Check slipclutch tension spring. Replace slipclutch or spring as necessary. Replace solenoid.
17. Push buttons fail to lock down when depressed.	Head panel bent. Push button levers bent. Brake arm bent or broken. Push lever lock plate binding or bent. Push lever lock plate spring broken or missing.	Straighten or replace head panel. Straighten or replace levers. Straighten or replace brake arm. Clear binding, straighten or replace the push lever lock plate. Replace spring.
18. Damages tapes.	Defective cassette. Take-up clutch slipping or inoperative. Pressure roller or capstan binding or bent. Supply reel binding. Brake rubbing on supply or take-up reel. Play idler slipping or tension incorrect.	Replace cassette. Repair take-up clutch. Clear binding or replace defective part. Clear binding or replace defective part. Adjust. Clean play idler, check play idler spring.

5.3 TRAY AND TAPE CONTROL MALFUNCTIONS

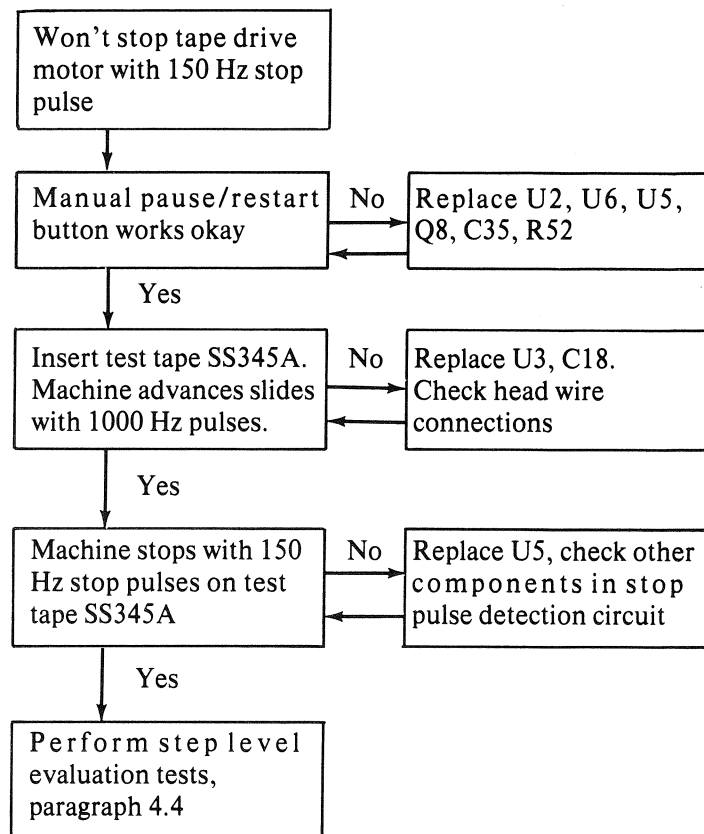
The following troubleshooting sequence charts are included as a logical approach to correcting a cue pulse or stop pulse malfunction. They are by no means the final word on how troubles should be

traced, but they are designed to eliminate as much duplication of effort as possible. Simply follow the direction of the arrow describing the condition existing during any given test. Suggested component replacement represents components most likely to fail. If following arrows results in a closed loop, then a trouble most likely exists in that circuit and further testing of other components in that circuit is recommended.

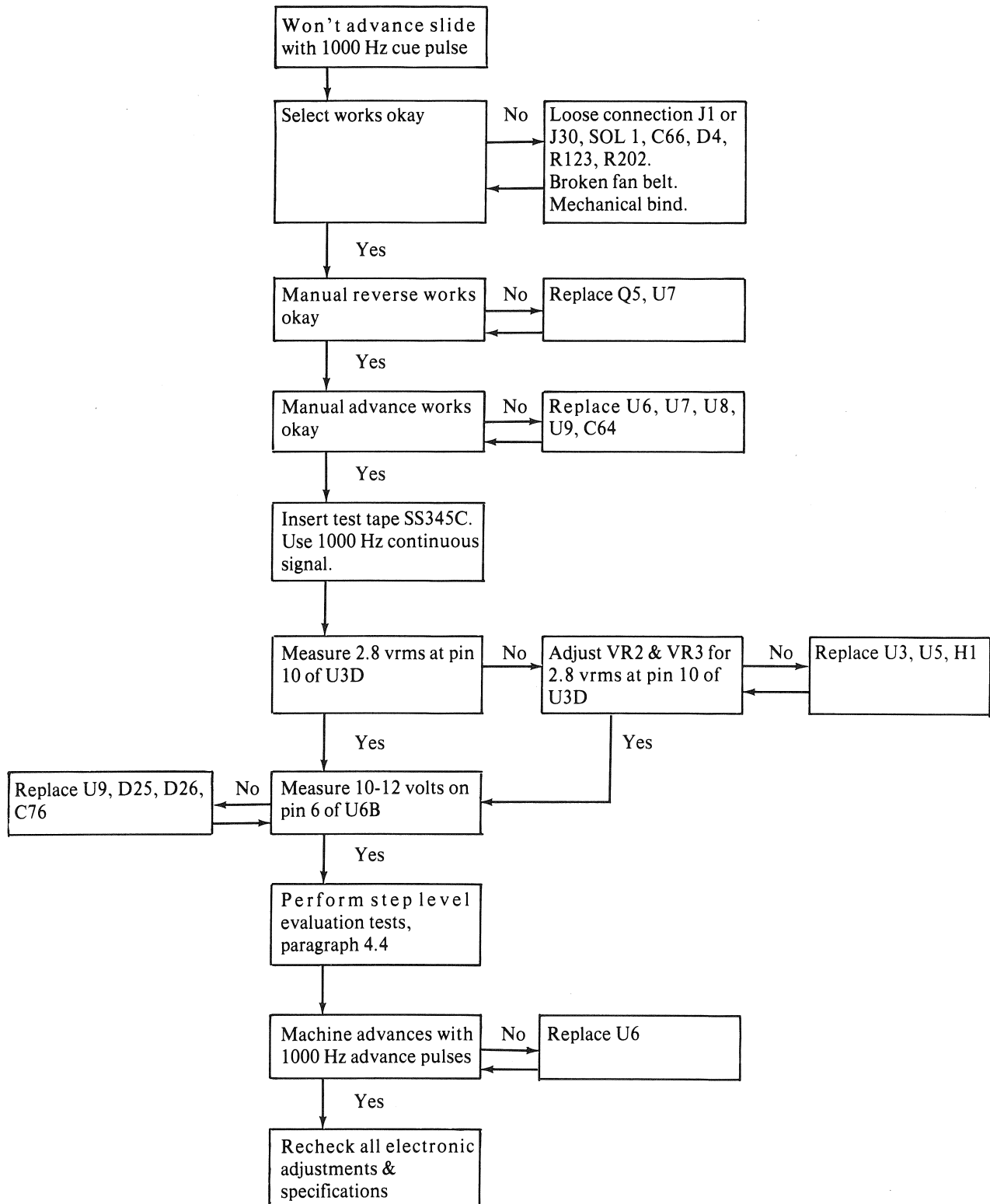
4320, 4460, 4470 Tray Control Troubleshooting Sequence



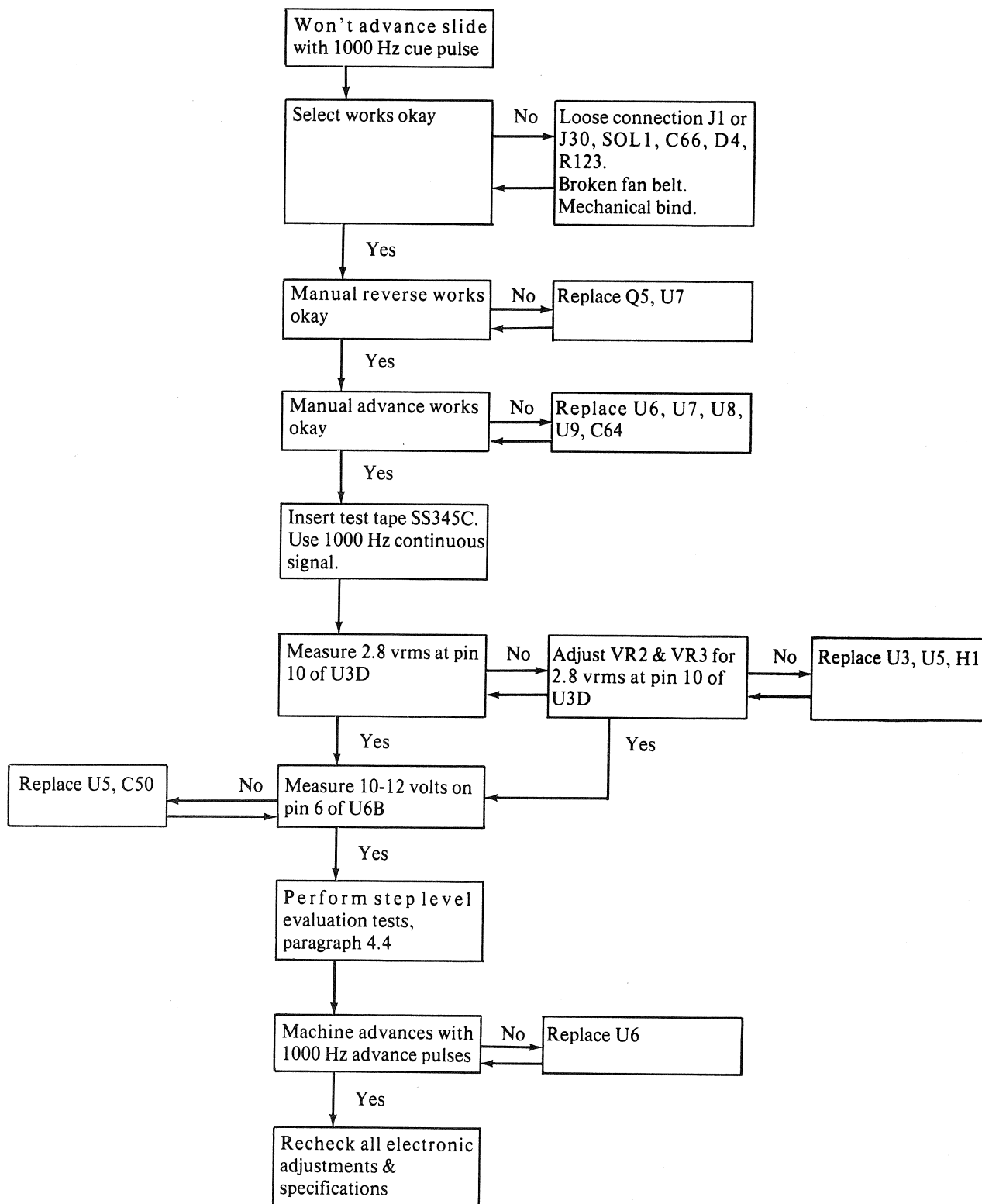
4470 Tape Control Troubleshooting Sequence



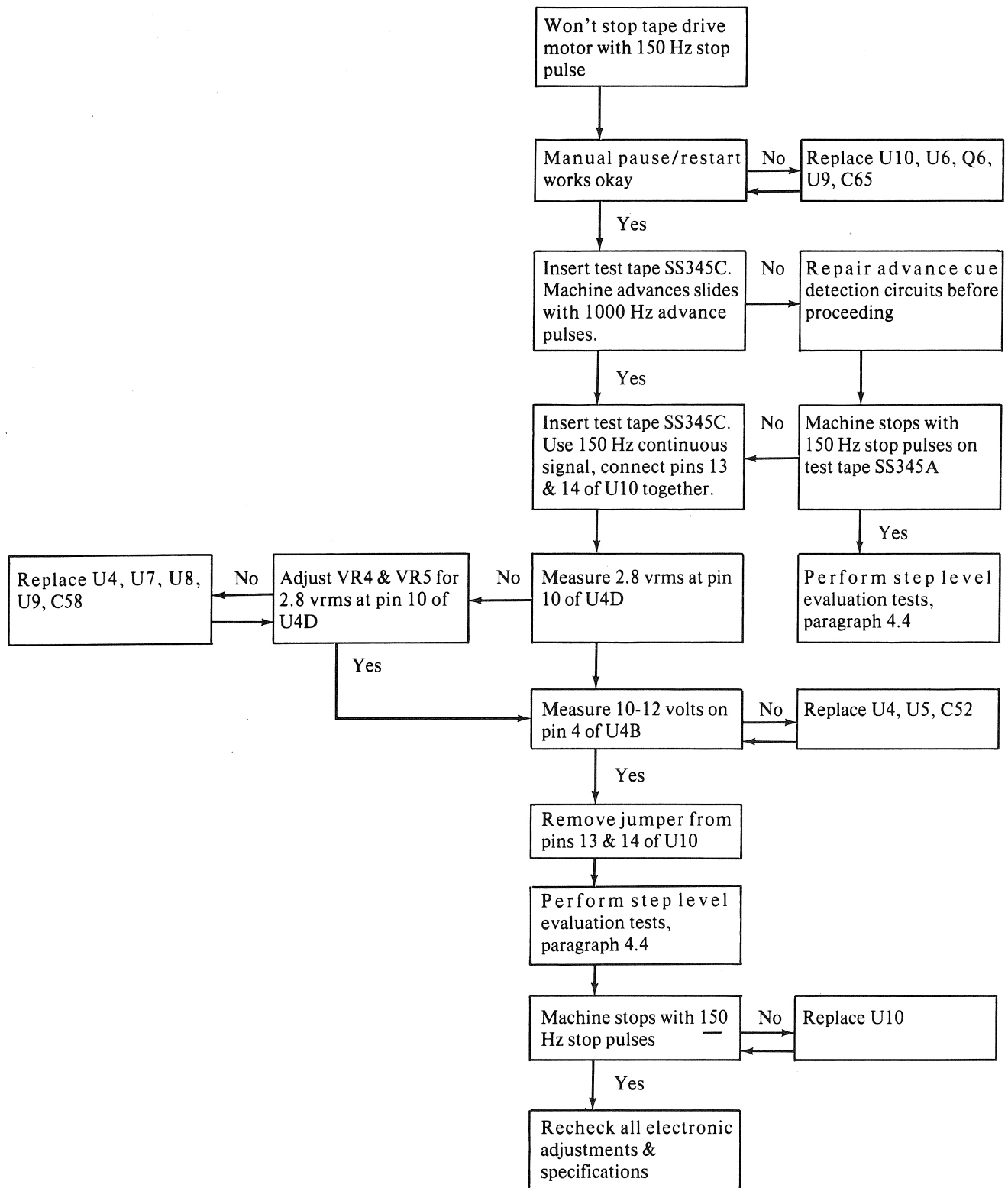
4340 & 4480 Tray Control Troubleshooting Sequence



4490 Tray Control Troubleshooting Sequence



4490 Tape Control Troubleshooting Sequence



SECTION VI

ILLUSTRATED PARTS LIST

6.1 INTRODUCTION

To find a part number, if appearance of part is known:

1. Turn to the appropriate exploded view.
2. Locate the part and its item number on the exploded view.
3. Find the item number in the Detailed Parts List to determine the part number and nomenclature.

To order a replacement part:

1. Do not use the figure and index number.
2. Specify the part number and the description of the part, and the quantity required.

6.2 DETAILED PARTS LIST

1. The column entitled "FIGURE AND ITEM NO." contains the index number of the item illustrated. In the case of electronic components, this number is the same as the schematic designation. For mechanical components, items are generally listed in the order of disassembly. Do not use this number when ordering replacement parts.
2. The "PART NUMBER" column contains the number which should be used when ordering replacements.
3. The "DESCRIPTION" column lists the item name for mechanical parts, and the component type and value for electronic parts. Include this information when ordering parts.

NOTE

Indention dots are used in the mechanical assembly parts lists to indicate the relation of each part to the next higher assembly. All parts common to a given assembly or subassembly are indented one space and listed directly under the

item. Indention dots are not used for circuit board parts lists. In this case, the next higher assembly for all components is simply the final circuit board assembly.

Attaching parts are listed immediately following the parts they attach.

Unless otherwise noted, all resistors are $\frac{1}{4}$ watt $\pm 5\%$ tolerance, and all capacitor values are given in microfarads.

4. The column entitled "QTY" indicates the total number of a particular item used per assembly. Occasionally a code may be used instead of a number as follows: the code "AR" indicates the quantity "as required" to meet dimensional or operational requirements; the code "REF" indicates a "reference" only item. Items marked REF are not supplied as complete assemblies by Telex; the code "LP" indicates a "local purchase" item.
5. The "MODELS USED ON" column indicates which projectors a particular item applies to. Model numbers may be used here or, to simplify the listing, usage may be indicated according to features as follows:

Silent	4120, 4124
PO	Play Only
R/P	Record/Play
AF	Auto-Focus
SP	Stop-Pulse
Dom	Domestic (Models ending in 0)
Int	International (Models ending in 4)

For further information on features see Table 1.1.

NOTE

A blank space in this column indicates that the item applies to all models having the next higher assembly or, in the case of attaching parts, the item has the same usage as the part it attaches.

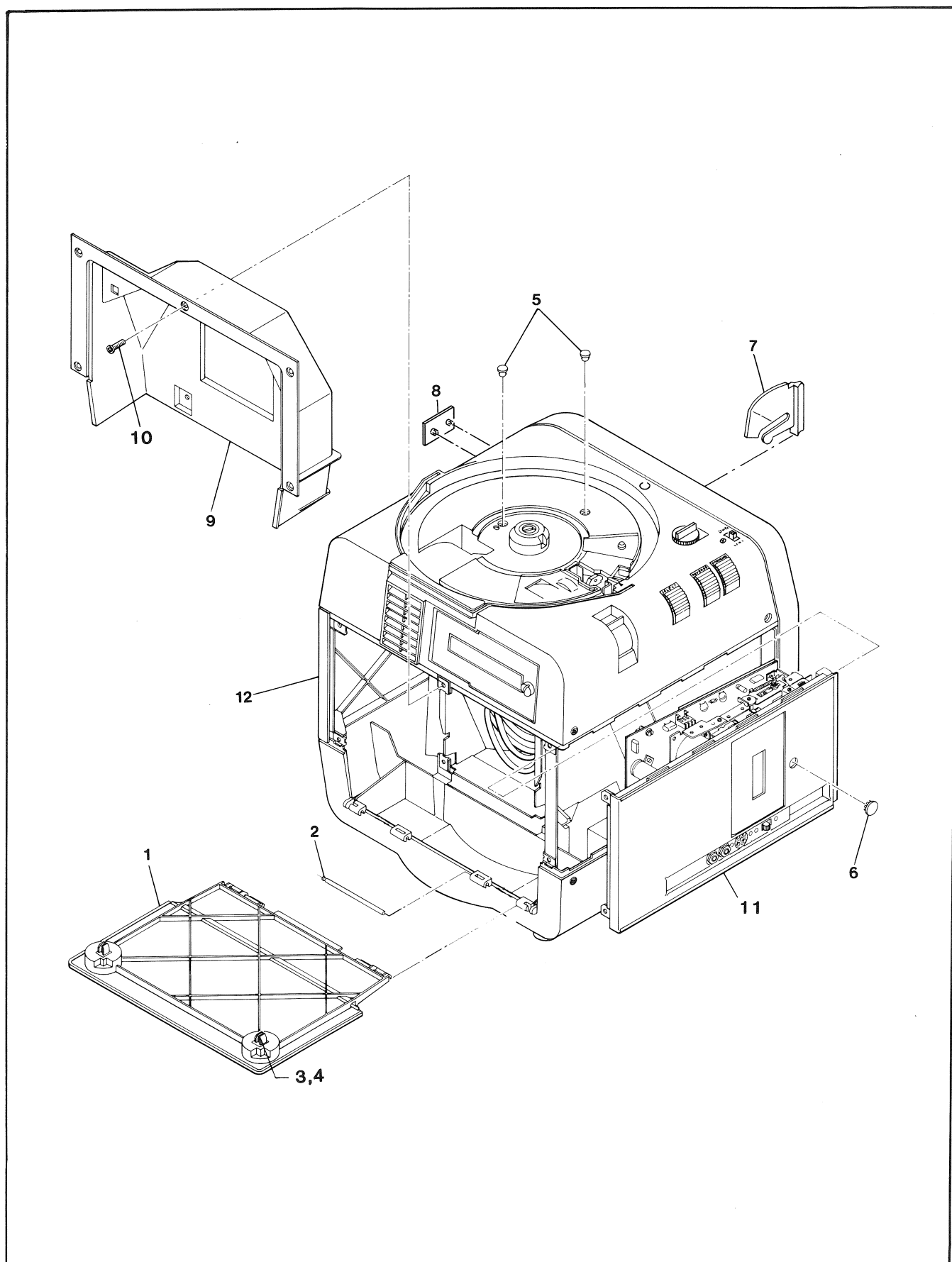


Figure 6.1 Projector Complete, Stage I

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.1 -	47020-G9	PROJECTOR COMPLETE, Stage I		
	47021-G9	PROJECTOR COMPLETE (Dom, Silent)	REF	4120
	47020-G2	PROJECTOR COMPLETE (Int, Silent)	REF	4124
	47021-G2	PROJECTOR COMPLETE (Dom, PO)	REF	4320
	47020-G1	PROJECTOR COMPLETE (Int, PO)	REF	4324
	47021-G1	PROJECTOR COMPLETE (Dom, R/P)	REF	4340
	47020-G6	PROJECTOR COMPLETE (Int, R/P)	REF	4344
	47021-G6	PROJECTOR COMPLETE (Dom, PO, AF)	REF	4460
	47020-G8	PROJECTOR COMPLETE (Int, PO, AF)	REF	4464
	47021-G8	PROJECTOR COMPLETE (Dom, PO, AF, SP)	REF	4470
	47020-G4	PROJECTOR COMPLETE (Int, PO, AF, SP)	REF	4474
	47021-G4	PROJECTOR COMPLETE (Dom, R/P, AF)	REF	4480
	47020-G3	PROJECTOR COMPLETE (Int, R/P, AF)	REF	4484
	47021-G3	PROJECTOR COMPLETE (Dom, R/P, AF, SP)	REF	4490
	47020-G3	PROJECTOR COMPLETE (Int, R/P, AF, SP)	REF	4494
- 1	47409-G1	. DOOR, Rear	1	
		ATTACHING PARTS		
- 2	45386-P1	. PIN, Hinge	2	
		---***---		
- 3	45627-P2	. LATCH	2	
- 4	45627-P3	. HANDLE	2	
- 5	245-11	. PLUG	2	
- 6	42677-P4	. PLUG	1	4320-4494
- 7	47012-P1	. HANDLE	1	
- 8	45709-P2	. PLATE, Cover	1	4460-4494
- 9	45520-P6	. PANEL, Back	1	Dom
	45520-P1	. PANEL, Back	1	Int
		ATTACHING PARTS		
- 10	121-8R-8L	. SCREW	7	
		---***---		
- 11		. PANEL COMPLETE, Left (Figure 6.4a)	REF	4120, 4124
		. PANEL COMPLETE, Left (Figure 6.4b)	REF	4320-4494
- 12		. PROJECTOR ASSY (Figures 6.2 & 6.3)	REF	
	46156-G1	. MICROPHONE SET (not shown)	1	R/P Models

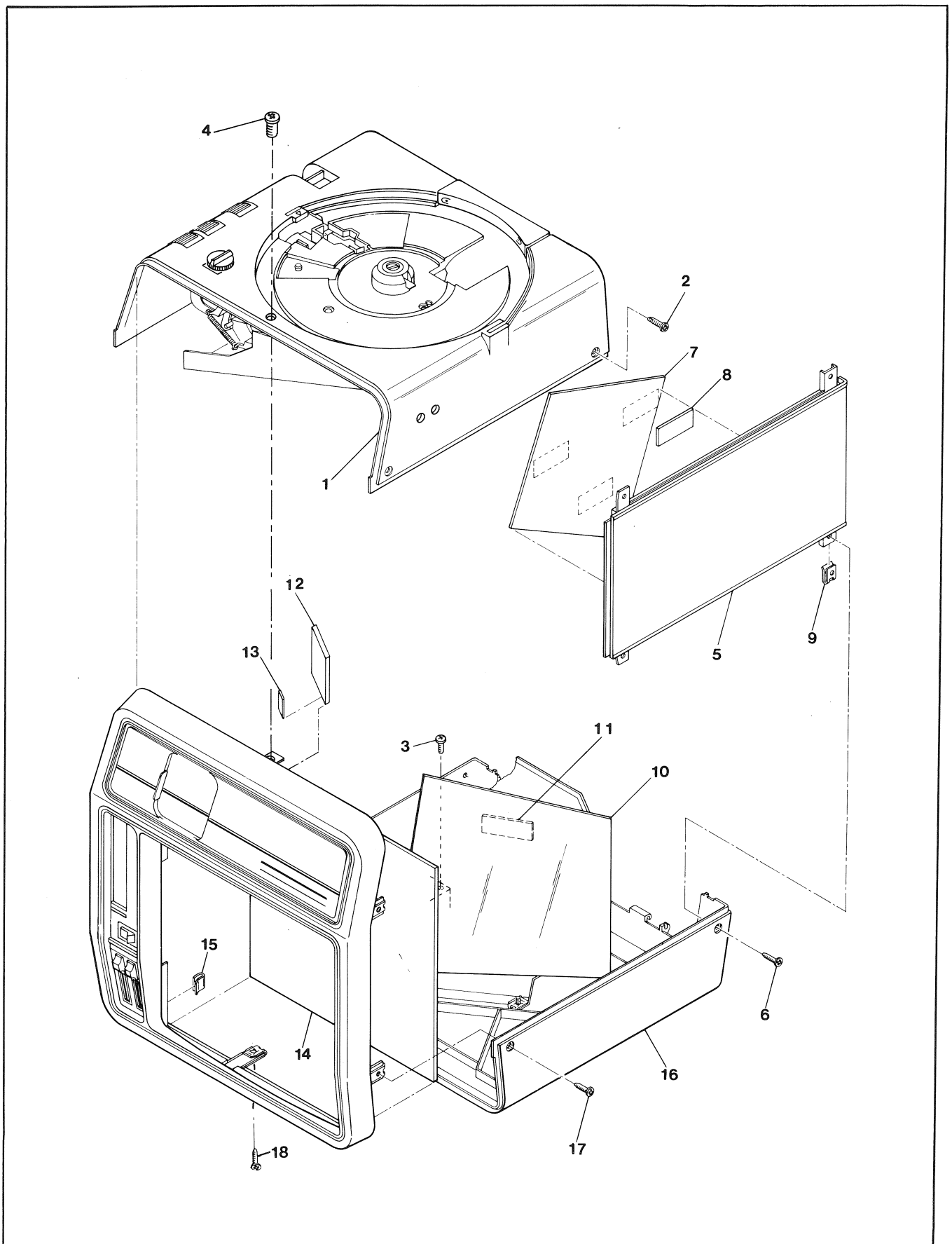


Figure 6.2 Projector Complete, Stage II

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.2-		PROJECTOR COMPLETE, Stage II		
-1		. HOUSING COMPLETE, Upper (Figure 6.5)	REF	
		ATTACHING PARTS		
-2	121-8R-8L	. SCREW, Thread-forming, No. 8 x 5/8 Pan Head	4	
-3	148-6-6X	. SCREW, Thread-forming, No. 6 x 3/8 Hex Head	1	
-4	121-8R-14L	. SCREW, Thread-forming, No. 8 x 7/8 Pan Head	1	
		---***---		
-5	45463-G4	. PANEL ASSEMBLY, Right	1	
		ATTACHING PARTS		
-6	121-8R-8L	. SCREW, Thread-forming, No. 8 x 5/8 Pan Head	1	
		---***---		
-7	45477-P1	.. MIRROR	1	
-8	461-6	.. TAPE (4416, 3M Co)	AR	
-9	45476-P1	.. NUT, Spring	4	
-10	45480-P1	. MIRROR, Final	1	
		ATTACHING PARTS		
-11	461-6	. TAPE (4416, 3M Co)	AR	
		---***---		
-12	45498-P1	. MIRROR, First	1	
		ATTACHING PARTS		
-13	461-6	. TAPE (4416, 3M Co)	1	
		---***---		
-14	43846-P1	. SCREEN, Viewing	1	
		ATTACHING PARTS		
-15	43847-P1	. CLIP	8	
		---***---		
-16		. HOUSING, Lower (Figure 6.6)	REF	
		ATTACHING PARTS		
-17	121-8R-8L	. SCREW, Thread-forming, No. 8 x 5/8 Pan Head	2	
-18	121-8R-8L	. SCREW, Thread-forming, No. 8 x 5/8 Pan Head	1	

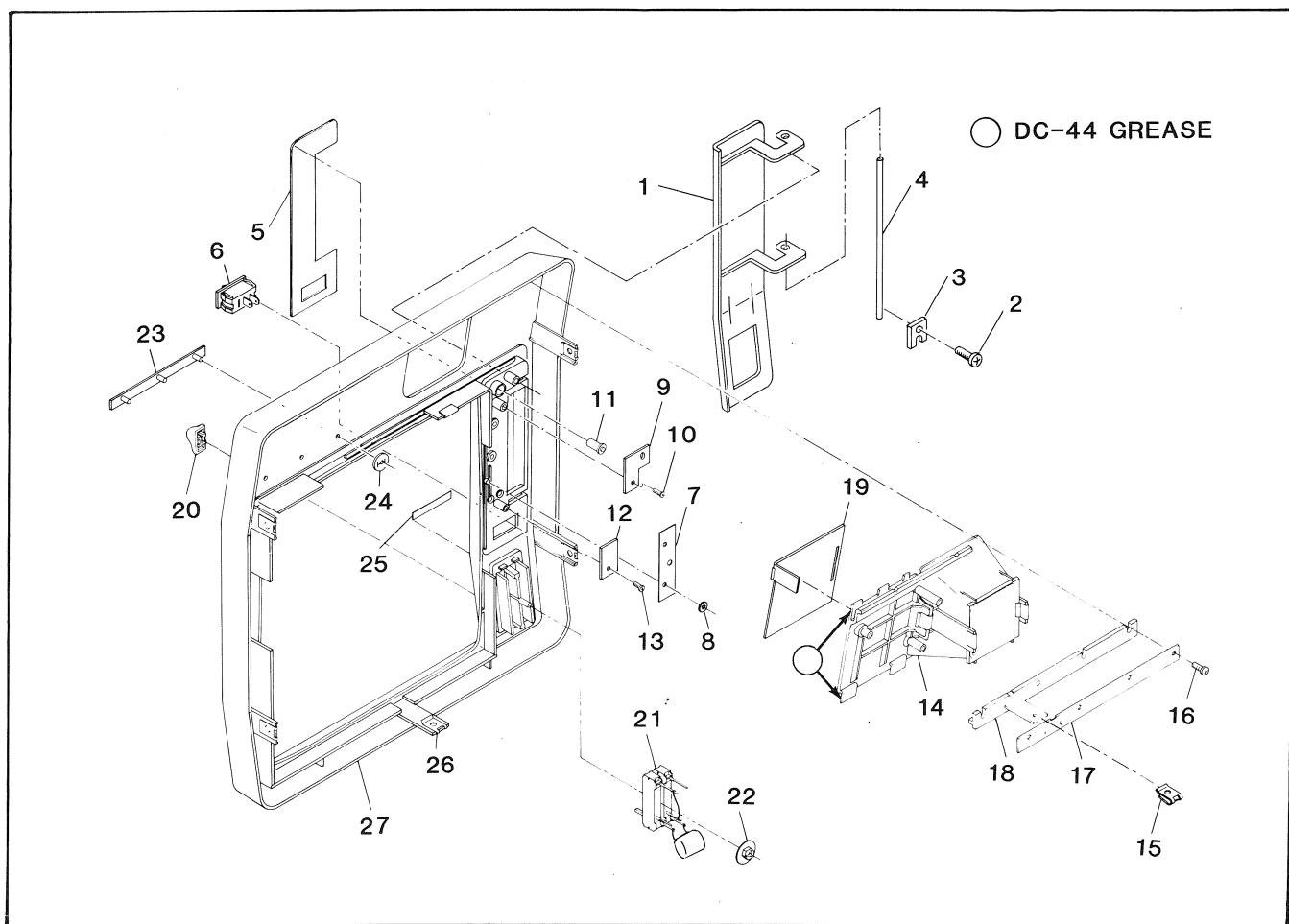


Figure 6.3 Projector Complete, Stage III

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.3-		PROJECTOR COMPLETE, Stage III		
-1	47000-P1	. DOOR, Controls	1	R/P Models
	47273-G1	. PLATE ASSY, Bezel	1	4120, 4124
		ATTACHING PARTS		
-2	40921-P15	. SCREW, Self-threading, No. 15 x 5/16 Pan Head	2	
-3	47004-P1	. CLIP	2	
-4	30172-P46	. PIN	1	
		---***---		
-5	47007-P1	. PLATE, Control Data	1	4340
	47007-P2	. PLATE, Control Data	1	4320, 4324
	47007-P3	. PLATE, Control Data	1	4490
	47007-P4	. PLATE, Control Data	1	4480
	47007-P5	. PLATE, Control Data	1	4344
	47007-P7	. PLATE, Control Data	1	4494
	47007-P8	. PLATE, Control Data	1	4484
	47007-P19	. PLATE, Control Data	1	4460
	47007-P20	. PLATE, Control Data	1	4464
	47007-P22	. PLATE, Control Data	1	4470
	47007-P23	. PLATE, Control Data	1	4474

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.3-		PROJECTOR COMPLETE, Stage III (Continued)		
-6	46141-P1	. SWITCH, Rocker Type	1	Dom except 4120
	46141-P2	. SWITCH, Rocker Type	1	4120, 4124
	45679-P1	. SWITCH, Rocker Type	1	Int except 4124
-7	47064-P1	. COVER, Wire	1	4490, 4494
		ATTACHING PARTS		
-8	45307-P2	. FASTENER	1	
		----*--		
-9	47024-G1	. BOARD ASSY, Stop Pulse (Figure 6.29)	1	4490, 4494
		ATTACHING PARTS		
-10	146-4R-6L	. SCREW, Thread-forming, No. 4 x 3/8 Pan Head	2	
		----*--		
-11	45958-P2	. BUTTON	1	
-12		. BOARD ASSY, Record LEDs (Figure 6.28)	1	4340, 4344, 4480-4494
		ATTACHING PARTS		
-13	146-4R-6L	. SCREW, Thread-forming, No. 4 x 3/8 Pan Head	1	
		----*--		
-14		.. DOOR ASSEMBLY, Mirror (Figure 6.7)	REF	
		ATTACHING PARTS		
-15	45476-P1	.. NUT, Spring	1	
-16	146-6R-7L	.. SCREW, Thread-forming, No. 6 x 7/16 Pan Head	4	
-17	45475-P1	.. PLATE	1	
-18	45499-P1	.. GUIDE	1	
		----*--		
-19	47011-P3	.. COVER, Adjusting Screws	1	
-20	43878-P2	.. CAP	2	4320-4494
-21		.. TONE & VOLUME ASSY (Figure 6.8)	1	4320-4494
		ATTACHING PARTS		
-22	44954-P1	.. RETAINER	1	
		----*--		
	47398-G2	. BEZEL ASSEMBLY	REF	4120, 4124
	47398-G3	. BEZEL ASSEMBLY	REF	4320-4494
-23	47001-P1	.. NAME PLATE (Projector)	1	
		ATTACHING PARTS		
-24	43452-P1	.. RETAINER	3	
		----*--		
-25	45486-P2	.. NAME PLATE (Volume-Tone)	1	4320-4494
-26	45476-P1	.. NUT, Spring	5	
-27	47006-P2	.. BEZEL	1	

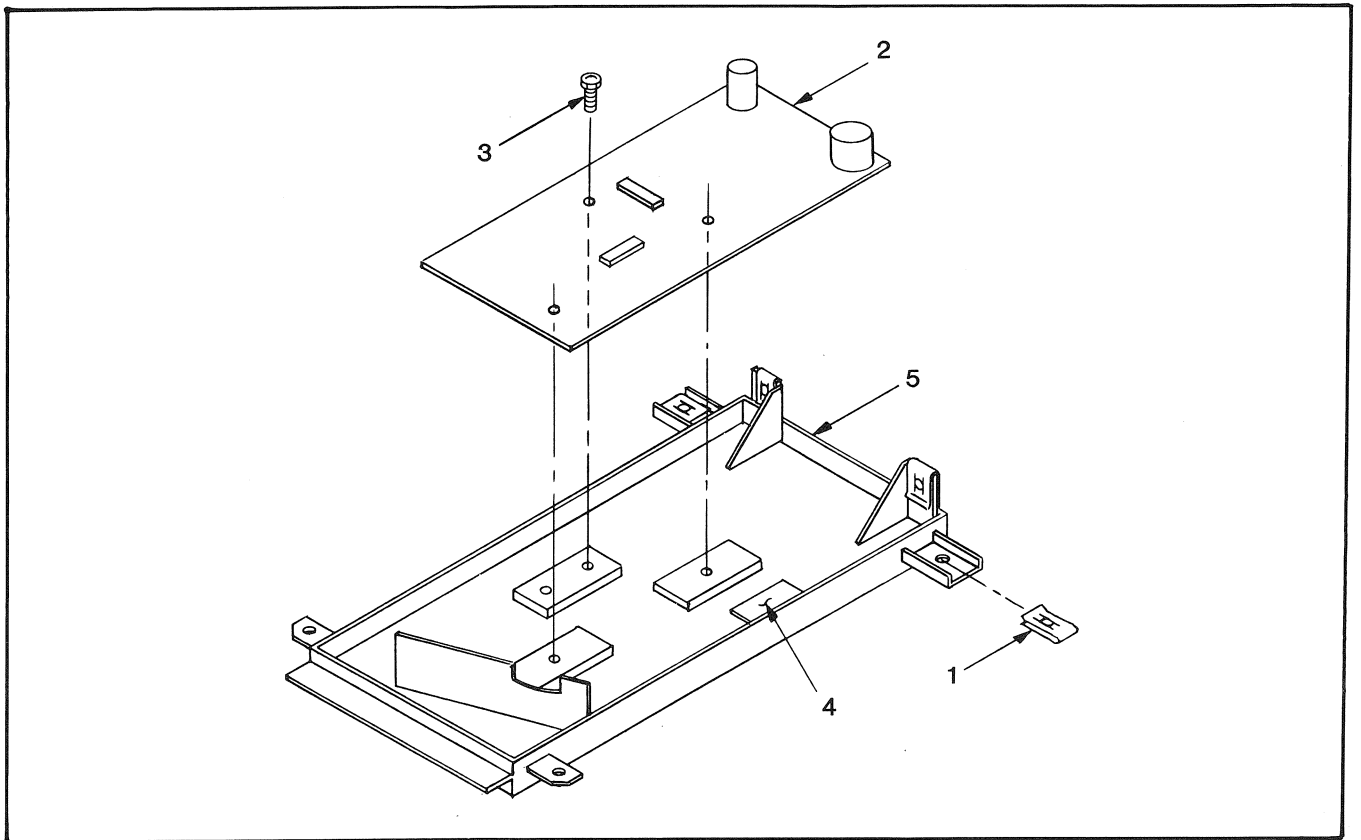


Figure 6.4A Left Panel (4120, 4124)

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.4A	47224-G1	PANEL COMPLETE, Left	REF	4120, 4124
-1	45476	. NUT, Spring	4	
-2	47223-G1	. BOARD, Circuit (Figure 6.25)	1	
		ATTACHING PARTS		
-3	139-8-6X	. SCREW, Thread-cutting, No. 8 x 3/8 Hex head ---***---	3	
-4	46974-G3	. CONNECTOR ASSEMBLY	1	
-5	47227-G1	. PANEL, Left	1	

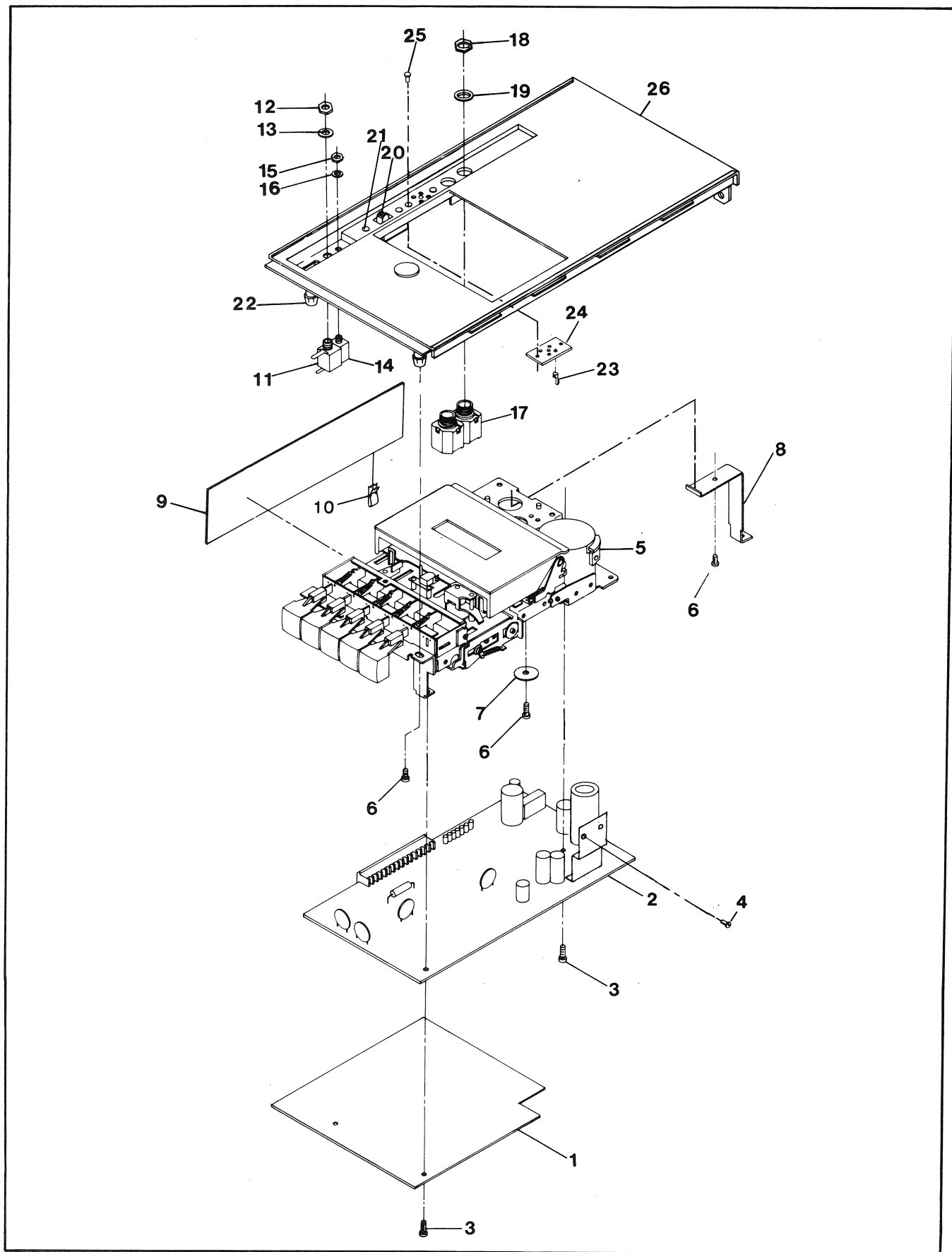


Figure 6.4B Left Panel (All Except 4120, 4124)

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.4B	47403-G8	PANEL, COMPLETE, Left	REF	4490, 4494
	47403-G7	PANEL, COMPLETE, Left	REF	4340, 4344, 4480, 4484
	47403-G6	PANEL, COMPLETE, Left	REF	4470, 4474
	47403-G5	PANEL, COMPLETE, Left	REF	4320, 4324, 4460, 4464
- 1	47049-P1	. BAFFLE	1	
- 2		. BOARD, Circuit (Figure 6.24)	1	4340, 4344, 4480-4494
		. BOARD, Circuit (Figure 6.25)	1	4320, 4324, 4460-4474
		ATTACHING PARTS		
- 3	148-6-6L	. SCREW, Thread-forming, No. 6 x 3/8 Hex head	3	
- 4	148-5-4X	. SCREW, Thread-forming, No. 5 x 1/4 Hex head	2	

- 5		. TAPE DECK COMPLETE (Figure 6.9)	REF	
		ATTACHING PARTS		
- 6	121-8R-6H	. SCREW, Thread-forming, No. 8 x 3/8 Pan head	3	
- 7	33500-P62	. WASHER, Flat, 0.500 x 0.165 x 0.032	1	

- 8	46969-P1	. BRACKET	1	
- 9	45602-P1	. BAFFLE	1	
		ATTACHING PARTS		
- 10	45115-P1	. CLIP	2	

- 11	46976-G1	. JACK ASSEMBLY (Mic)	REF	R/P Models
	46970-P2	.. JACK (J18)	1	
	441-CE24WH-02	.. HOUSING, Connector (J15)	1	
	441-CE24WH-04	.. HOUSING, Connector (J2)	1	
		ATTACHING PARTS		
- 12	46970-P3	. NUT	1	
- 13	46970-P4	. WASHER	1	

- 14	46973-G5	. JACK ASSEMBLY (Remote)	REF	4490, 4494
	441-CE24WH-02	.. HOUSING, Connector (J7)	1	
	43832-P2	.. JACK (J19)	1	
	46973-G6	. JACK ASSEMBLY (Remote)	REF	4340, 4344, 4480, 4484
	441-CE24WH-02	.. HOUSING, Connector (J7)	1	
	43832-P2	.. JACK (J19)	1	
	459-02-BK	.. HOUSING, Plug (P20)	1	
		ATTACHING PARTS		
- 15	43832-P3	. NUT	1	
- 16	43832-P4	. WASHER	1	

- 17	46982-G1	. JACK ASSEMBLY (Speaker + Ear)	REF	
	42563-P6	.. JACK (J16, 17)	2	
	445-CE180R-03	.. CONNECTOR (J6)	1	
	459-02-GN	.. HOUSING, Plug (P15)	1	
		ATTACHING PARTS		
- 18	42563-P3	. NUT	2	
- 19	43270-P12	. WASHER, Flat 0.630 x 0.380 x 0.020	2	

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.4b-		PANEL, COMPLETE, Left (Continued)		
-20	47424-G2	. PANEL ASSEMBLY, Left	1	4320-4494
	45022-P1	.. SWITCH (Hi-Lo)	1	
		ATTACHING PARTS		
-21	50015-809	.. RIVET	2	
		----***----		
-22	44932-P1	.. FASTENER	3	
	183-6-16	.. GROOVE PIN (Not Shown)	1	
-23	45802-P1	.. CONTACT, J31 x 1/5	5	
-24	46717-P1	.. PLATE, Phenolic	1	
-25	261-4K	.. EYELET	2	
-26	45503-P12	.. PANEL	1	
	46974-G3	. CONNECTOR ASSY (not shown)	REF	
	441-CE24WH-04	.. CONNECTOR (J10)	1	
	460-02-BL	. HOUSING CAP (J36) (not shown)	1	
	459-01-WH	. HOUSING PLUG (J34) (not shown)	1	
	58134-003	. LABEL (Mic) (not shown)	1	R/P Models
	58134-004	. LABEL (Blank Cover) (not shown)	1	PO Models
	58134-000	. LABEL (SPK, Ear, Remote, HI-LO) (not shown)	1	

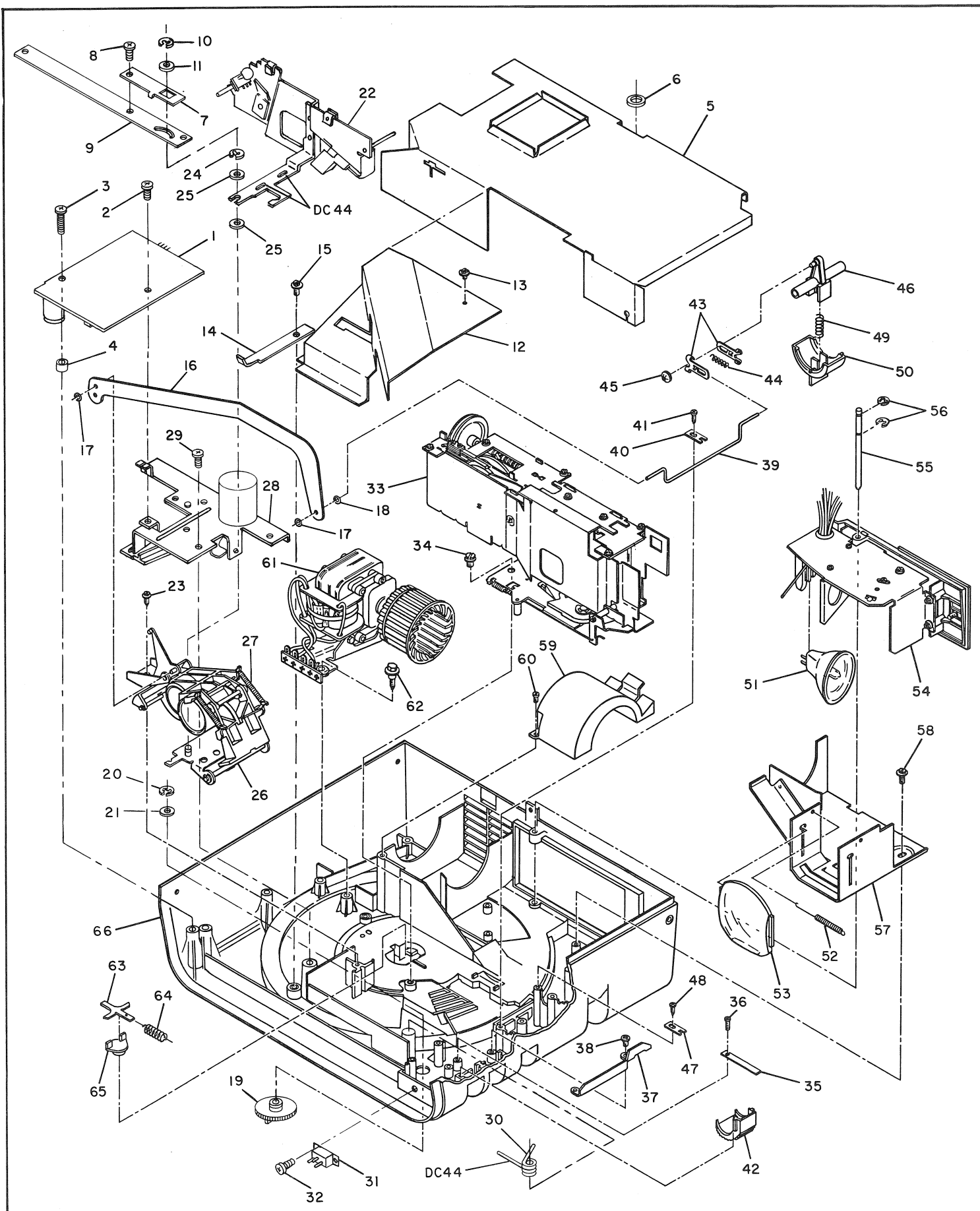


Figure 6.5 Upper Housing Complete

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.5-	47430-G3	UPPER HOUSING, Complete	REF	4120, 4320, 4340
	47430-G4	UPPER HOUSING, Complete	REF	4124, 4324, 4344
	47430-G6	UPPER HOUSING, Complete	REF	4460, 4470, 4480, 4490
	47430-G7	UPPER HOUSING, Complete	REF	4464, 4474, 4484, 4494
- 1		. BOARD ASSY, Auto-Focus Driver (Figure 6.26)	1	4460-4494
		ATTACHING PARTS		
- 2	148-6-4X	. SCREW, Thread-forming, No. 6 x 1/4 Hex head	1	
- 3	139-8-12X	. SCREW, Thread-cutting No. 8 x 3/4 Hex head	1	
- 4	44261-P4	. SPACER	1	
		---***---		
- 5	46192-P2	. BAFFLE	1	
		ATTACHING PARTS		
- 6	254-2-1	. RING, Retaining	1	
		---***---		
- 7	46892-P1	. PLATE, A.F. Adjusting		4460-4494
		ATTACHING PARTS		
- 8	148-6-4X	. SCREW, Thread-forming No. 6 x 1/4 Hex head	1	
		---***---		
- 9	46935-P1	. ARM	1	4460-4494
		ATTACHING PARTS		
- 10	251-7-1	. RING, Retaining	1	
- 11	43270-P20	. WASHER, Flat 0.500 x 0.129 x 0.015	1	
		---***---		
- 12	46872-P1	. BAFFLE, Lens	1	
		ATTACHING PARTS		
- 13	137-6R-6L	. SCREW, Thread-cutting No. 6 x 3/8 Pan head	2	
		---***---		
- 14	46144-G3	. BUMPER ASSEMBLY	1	4460-4494
		ATTACHING PARTS		
- 15	139-8-6X	. SCREW, Thread-cutting No. 8 x 3/8 Hex head	1	
	137-8R-6X	. SCREW, Thread-cutting NO. 8 x 3/8 Pan head	1	
		---***---		
- 16	45545-P1	. LINK, Actuator	1	
		ATTACHING PARTS		
- 17	46417-P1	. RETAINER, Link	2	
- 18	261-13	. EYELET	1	
		---***---		
- 19	45626-G2	. KNOB ASSEMBLY, Focus	1	4120-4344
	46901-G1	. KNOB ASSEMBLY	1	4460-4494
		ATTACHING PARTS		
- 20	45307-P1	. RETAINER, Focus Knob	1	4120-4344
- 21	224-19	. WASHER, Spring (bowed)	1	4120-4344
		---***---		
- 22		. BASE, Auto-Focus (Figure 11)	1	4460-4494
		ATTACHING PARTS		
- 23	139-6-6L	. SCREW, Thread-cutting No. 6 x 3/8 Hex head	2	
- 24	251-7-1	. RING, Retaining	2	
- 25	30473-P79	. WASHER, Flat 0.312 x 0.130 x 0.015	4	
		---***---		
- 26		. MECHANISM ASSEMBLY, Lens (Figure 6.16)	1	
- 27	46887-P1	. SPRING	1	

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.5-		UPPER HOUSING, Complete (Continued)		
-28		. MECHANISM, Complete, Drive (Figure 6.17)	REF	4460-4494
		ATTACHING PARTS		
-29	139-8-8X	. SCREW, Thread-Cutting No. 8 x 1/2 Hex head	4	
-30	46877-P1	. SPRING, Torsion	1	
-31	46359-G3	. SWITCH ASSEMBLY	1	
		ATTACHING PARTS		
-32	121-2R-4X	. SCREW, Thread-forming No. 2 x 1/4 Pan head ---***---	2	
-33		. MECHANISM, Complete (Figure 6.18)	REF	
		ATTACHING PARTS		
-34	143-8-3X	. SCREW, Machine 8-32 x 3/16 Hex head ---***---	3	
-35	45317-P1	. SPRING, Switch	3	
		ATTACHING PARTS		
-36	137-6R-6L	. SCREW, Thread-cutting, No. 6 x 3/8 Pan head ---***---	3	
-37	45318-P1	. BRACKET, Switch	1	
		ATTACHING PARTS		
-38	137-6R-6L	. SCREW, Thread-cutting No. 6 x 3/8 Pan head ---***---	2	
-39	45555-P2	. CRANK	1	
		ATTACHING PARTS		
-40	45331-P1	. RETAINER, Crank	2	
-41	137-6R-6L	. SCREW, Thread-cutting No. 6 x 3/8 Pan head ---***---	2	
-42	45316-P1	. BUTTON, Control	3	
-43	45374-P1	. LINK, Handle	2	
-44	45625-P1	. SPRING, Link	1	
		ATTACHING PARTS		
-45	43452-P1	. RETAINER, Link ---***---	1	
-46	45587-P1	. AXLE, Handle	1	
		ATTACHING PARTS		
-47	45331-P1	. RETAINER, Axle	2	
-48	137-6R-6L	. SCREW, Thread-cutting No. 6 x 3/8 Pan head ---***---	2	
-49	45585-P1	. SPRING	1	
-50	45554-P1	. HANDLE, Actuator	1	
-51	44925-P2	. LAMP (DDM type)	1	
-52	45551-P1	. SPRING, Shield Closure	1	
-53	45423-P1	. LENS, Condenser	1	
-54		. LAMPHOUSE ASSEMBLY (Figure 6.21)	REF	
		ATTACHING PARTS		
-55	45422-P1	. PIN, Hinge	1	
-56	251-9-1	. RING, Retaining ---***---	2	
-57	45427-G1	. SHIELD ASSEMBLY, Lamp	1	4120-4344
	45427-G5	. SHIELD ASSEMBLY, Lamp	1	4460-4494
		ATTACHING PARTS		
-58	139-6-6L	. SCREW, Thread-cutting No. 6 x 3/8 Hex head ---***---	3	

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.5-		UPPER HOUSING, Complete (Continued)		
-59	46137-G1	COVER, Blower	1	Dom Models
	46137-G2	COVER, Blower	1	Int Models
		ATTACHING PARTS		
-60	116-4-4X	. SCREW, Machine 4-40 x 1/4 Pan head ---***---	1	
-61		. BLOWER MOTOR ASSEMBLY (Figure 6.22) ATTACHING PARTS	REF	
-62	139-8-8X	. SCREW, Thread-cutting No. 8 x 1/2 Hex head ---***---	4	
-63	43809-P1	. LATCH, Tray	1	
-64	43810-P1	. SPRING, Tray Latch	1	
-65	43811-P1	. CAM, Latch	1	
-66	46862-G2	. HOUSING ASSEMBLY, Upper	1	4120-4344
47355-G12	46862-G4	. HOUSING ASSEMBLY, Upper #30 - (1988)	1	4460-4490
	45308-G3	.. HANDLE ASSEMBLY (not shown)	1	
	189-5-7	.. ROLL PIN (not shown)	1	
	45312-P1	.. RETAINER (not shown)	1	
	30685-P26	.. DOWEL PIN (not shown)	1	

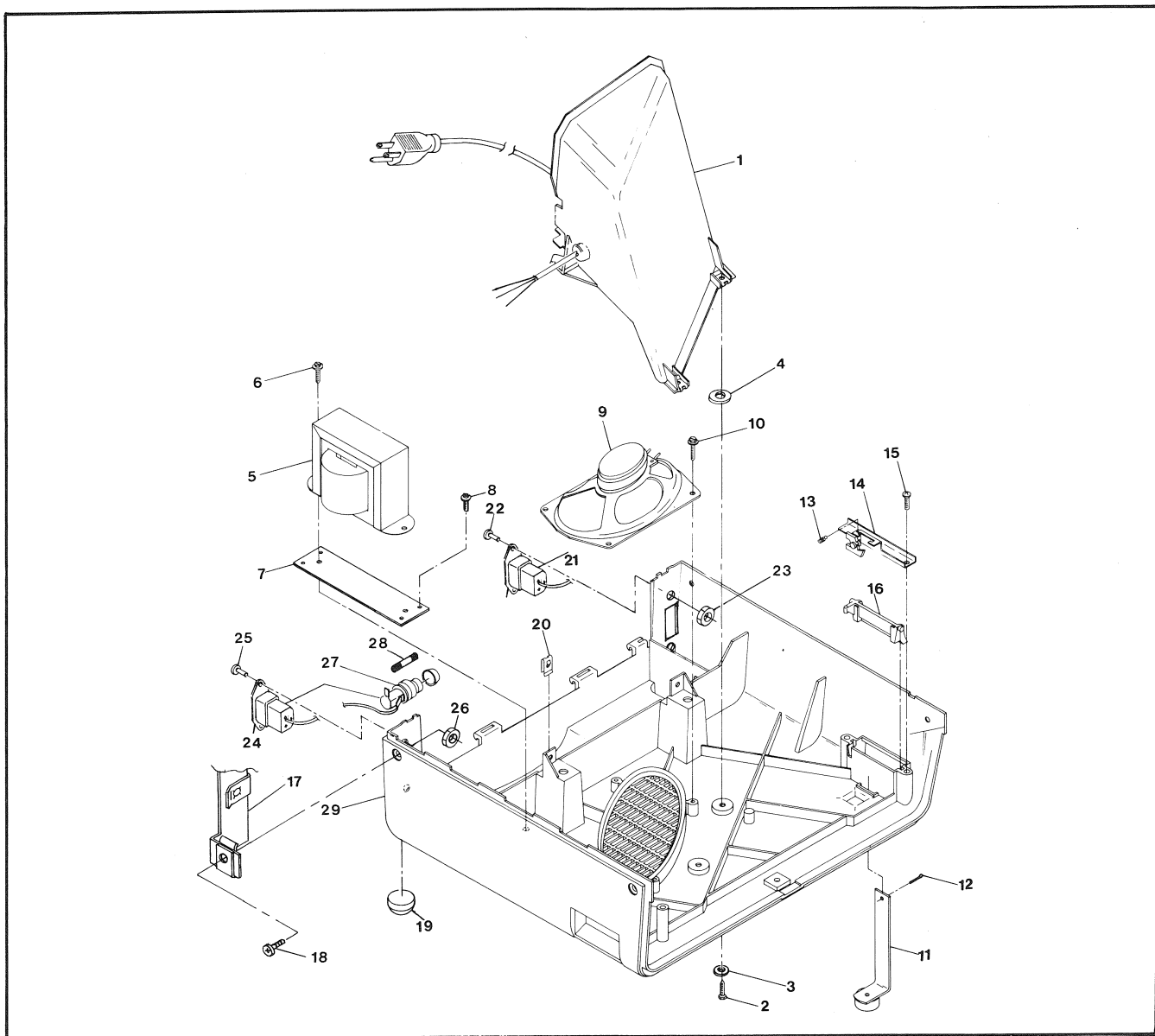


Figure 6.6 Lower Housing Assembly

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.6-	47402-G2	HOUSING ASSEMBLY, Lower	REF	Dom Models except 4120
	47402-G4	HOUSING ASSEMBLY, Lower	REF	Int Models except 4124
	47402-G3	HOUSING ASSEMBLY, Lower	REF	4120
	47402-G5	HOUSING ASSEMBLY, Lower	REF	4124
-1		. SUPPORT ASSY, Large Mirror (Figure 6.23)	REF	
		ATTACHING PARTS		
-2	40921-10L	. SCREW, Self-Threading No. 10 x 5/8 Hex head	4	
-3	38500-21X	. WASHER, Flat 0.500 x 0.196 x 0.062	4	
-4	33500-18X	. WASHER, Flat 0.625 x 0.178 x 0.064	AR	
		---***---		

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.6-		HOUSING ASSY, Lower (Continued)		
-5	46988-G1	. TRANSFORMER ASSEMBLY	1	Dom Models
	46989-G2	. TRANSFORMER ASSEMBLY	1	Int Models
		ATTACHING PARTS		
-6	147-8-8L	. SCREW, Thread-forming No 8 x 1/2 Pan head	2	
-7	47048-P1	. PLATE	1	
-8	148-6-6X	. SCREW, Thread-forming No. 6 x 3/8 Hex head		

-9	47053-G1	. SPEAKER ASSEMBLY	1	4320-4494
		ATTACHING PARTS		
-10	147-8-8L	. SCREW, Thread-forming No. 8 x 1/2 Pan head	2	

-11	41216-G4	. FOOT ASSEMBLY, Elevating	2	
		ATTACHING PARTS		
-12		. TIE, Cable (NA)	2	

-13	41195-P1	. SPRING	2	
-14	41218-G1	. GUIDE ASSEMBLY, Right	1	
	41218-G2	. GUIDE ASSEMBLY, Left	1	
		ATTACHING PARTS		
-15	146-6R-8L	. SCREW, Self-threading No. 10 x 5/8 Pan head	4	

-16	46140-P1	. ACTUATOR	2	
-17	45478-G1	. STRAP	1	4320-4494
		ATTACHING PARTS		
-18	148-6X-6X	. SCREW, Thread-forming No. 6 x 3/8 Hex head	3	

-19	45053-P2	. Foot	2	
-20	45476-P1	. NUT, Spring	2	
-21	46994-G1	. SWITCH, Line Change	1	Int Models
		ATTACHING PARTS		
-22	116-4R-8L	. SCREW	2	
-23	47327-P1	. NUT	2	

-24	46088-P2	. RECEPTACLE	1	Int Models
		ATTACHING PARTS		
-25	116-4R-8L	. SCREW	2	
-26	47327-P1	. NUT	2	

-27	46237-P3	. CARRIER, Fuse (Cap included)	1	Int Models
-28	410-17	. FUSE, 2.0 Amp	1	Int Models
-29	45464-P11	. HOUSING	1	Dom Models
	45464-P12	. HOUSING	1	Int Models

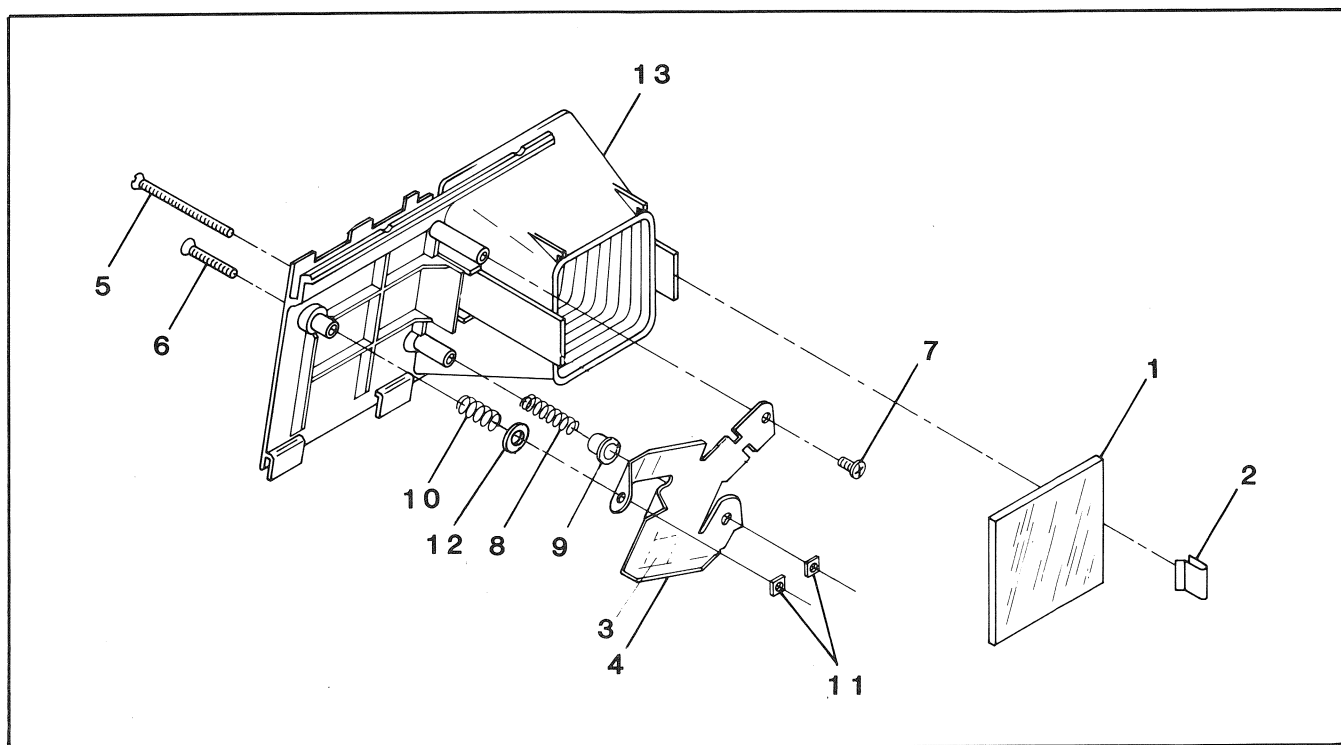


Figure 6.7 Mirror Door Complete

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.7-	45488-G3	MIRROR DOOR, Complete	REF	All
-1	45491-P1	. WINDOW	1	
		ATTACHING PARTS		
-2	45691-P1	. CLIP, Spring	2	

-3	461-1	. TAPE (No. 4416 3M Co.)	2	
-4	47013-P1	. SUPPORT	1	
		ATTACHING PARTS		
-5	100-6R-28L	. SCREW, Long	1	
-6	100-6R-14L	. SCREW, Short	1	
-7	137-8R-6X	. SCREW, Thread-cutting No. 8 x 3/8 Pan head	1	
-8	46175-P1	. SPRING, Long	1	
-9	46174-P1	. GUIDE	1	
-10	45497-P1	. SPRING, Short	1	
-11	200-6SX	. NUT	2	
-12	33500-18X	. WASHER, Flat	1	

-13	45490-P4	. DOOR	1	

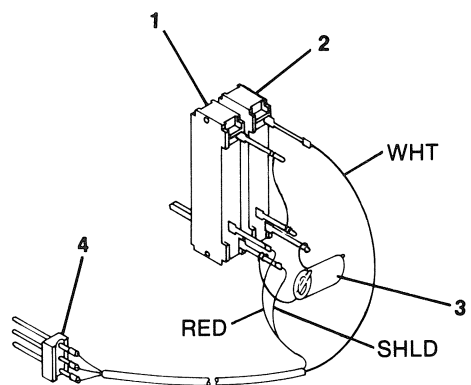


Figure 6.8 Tone and Volume Control

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.8-	46975-G1	TONE AND VOLUME CONTROL ASSEMBLY	REF	4320-4494
-1	46985-P4	POTENTIOMETER, 10K (VR7)	1	
-2	46985-P5	POTENTIOMETER, 2K (VR6)	1	
-3	455-104	CAPACITOR, (C10), Polyester, .1 μ F, 100V	1	
-4	441-CE24WH-03	HOUSING, Connector, Closed End, 3 position (J5)	1	

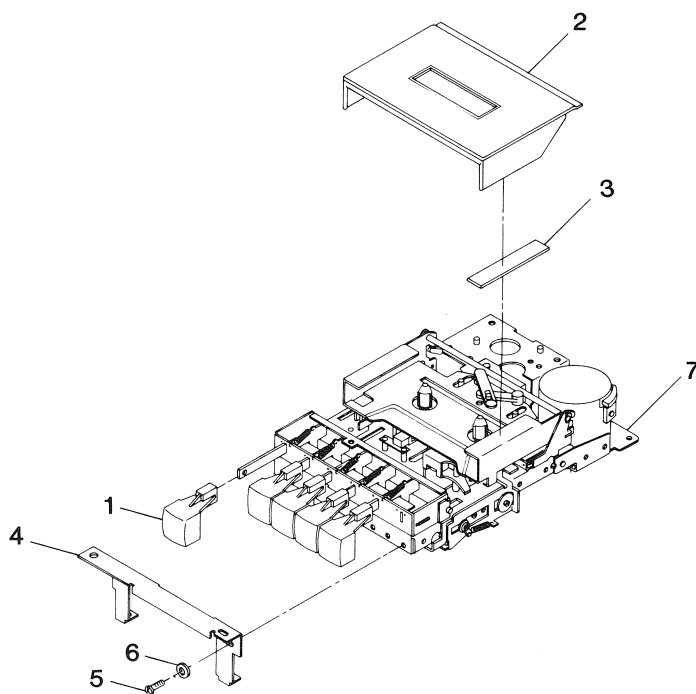


Figure 6.9 Tape Deck Complete

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.9-	45506-G4	TAPE DECK, Complete	REF	4490, 4494
	45506-G5	TAPE DECK, Complete	REF	4340, 4344, 4480, 4484
	45506-G6	TAPE DECK, Complete	REF	4320, 4324, 4460-4474
-1	45509-P3	. BUTTON	5	
-2	44037-G6	. DOOR ASSEMBLY, Cassette	1	
-3	45506-P2	. . TAPE (No. 4416 3M Co.) 9 yd roll	AR	
-4	45510-P1	. BRACKET, Mounting	1	
		ATTACHING PARTS		
-5	148-5-4X	. SCREW, Thread-forming No. 5 x 1/4 Hex head	2	
-6	220-5	. WASHER, Lock	2	
		---***---		
-7		. TAPE DECK ASSY (Figures 6.10-6.12)	REF	
	46978-G1	. CABLE ASSY, Audio/Audio Erase (J1 included) (not shown)	1	R/P Models
	46979-G1	. CABLE ASSEMBLY, Cue/Cue Erase (J4 included) (not shown)	1	R/P Models
	46980-G1	. CABLE ASSY, Audio/Cue (J1 and J2 included) (not shown)	1	PO Models
	441-CE24WH-08	. CONNECTOR, 8 position (J12) (not shown)	1	4320, 4324, 4460, 4474, 4490, 4494
	460-02-BK	. HOUSING, Cap (J20) (not shown)	1	4340, 4344, 4480, 4484
	441-CE24WH-02	. CONNECTOR, 2 position (J8) (not shown)	1	R/P Models

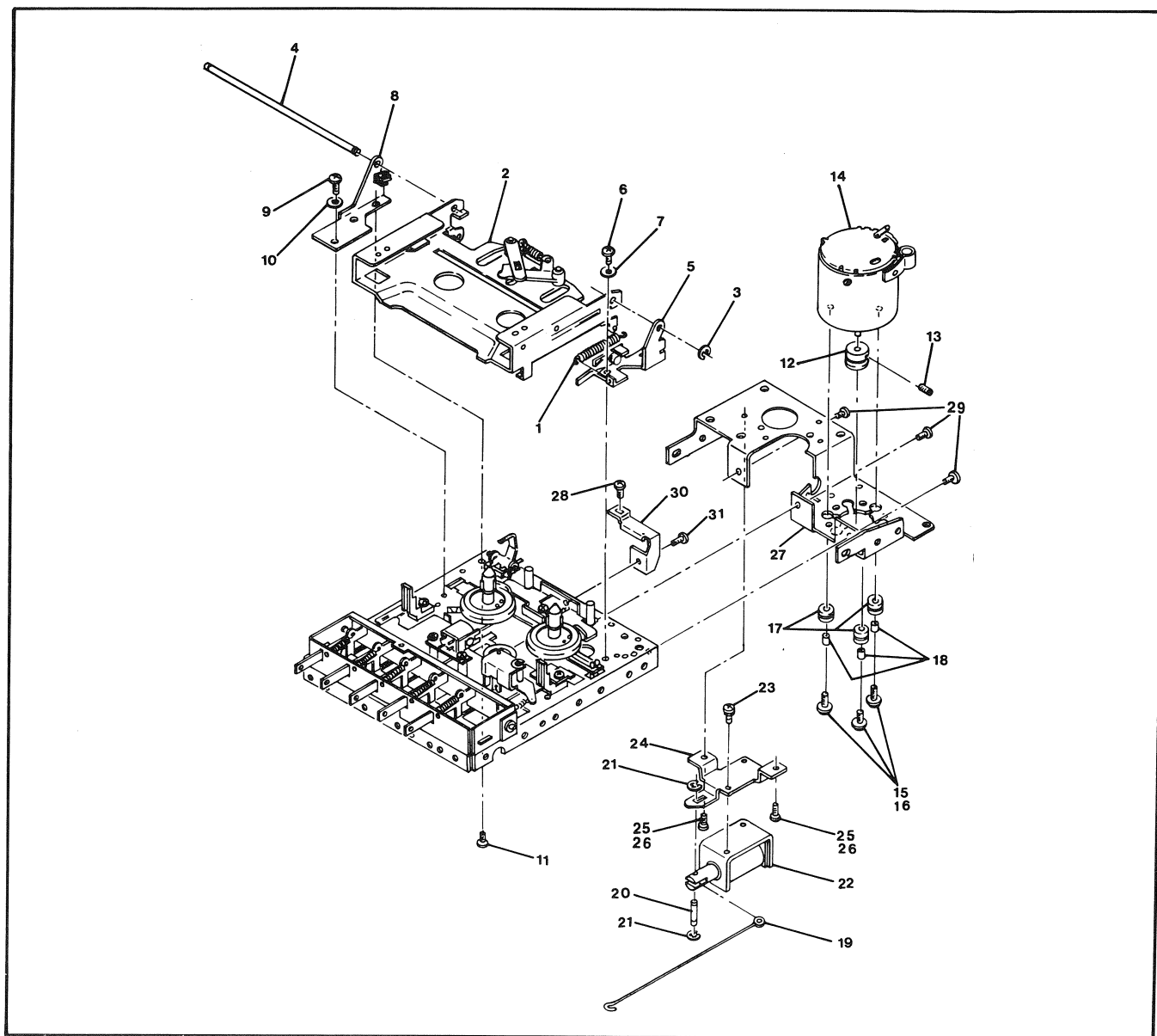


Figure 6.10 Tape Deck Assembly, Stage I

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.10-	45508-P1	TAPE DECK ASSEMBLY, Stage I	REF	PO Models R/P Models
-1	45508-P4	TAPE DECK ASSEMBLY, Stage I	REF	
-2	VO-1900-4009	. SPRING, Cassette Holder	1	
-3	VO-1900-0015	. HOLDER, Cassette	1	
-4	259-7	ATTACHING PARTS	2	
	HCS-0028	. RING, Retaining	1	
		. SHAFT, Cassette Holder		
		---***---		

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.10-		TAPE DECK ASSY, Stage I (Continued)		
-5	VO-1900-0009	. HINGE A, Cassette Holder	1	
		ATTACHING PARTS		
-6	160-20D3	. SCREW, Machine M2. 6 x 5	2	
-7	230-10	. WASHER, Lock	2	
		---***---		
-8	VO-1900-0014	. HINGE B, Cassette Holder	1	
		ATTACHING PARTS		
-9	160-20D3	. SCREW, Machine M2. 0 x 5	2	
-10	230-10	. WASHER, Lock	2	
-11	160-26D3	. SCREW, Machine M2. 6 x 3	1	
		---***---		
-12	VO-9031-2002	. PULLEY, Motor	1	
-13	160-17L2	. SCREW, Set (part of motor pulley Item 12)	1	
-14	MMI-6A2RK	. MOTOR, Tape Drive (12V)	1	
		ATTACHING PARTS		
-15	160-26D7	. SCREW, Machine M2. 5 x 7	3	
-16	42276-P9	. WASHER	3	
		---***---		
-17	VO-9000-3017	. CUSHION	3	
-18	VO-800-2016	. TUBE	3	
-19	VO-9000-4016	. ROD, Link	1	
		ATTACHING PARTS		
-20	VO-9000-2029	. SHAFT, Solenoid Link	1	
-21	259-8	. RING, Retaining	2	
		---***---		
-22	VO-089-0001	. SOLENOID	1	
		ATTACHING PARTS		
-23	160-30D4	. SCREW, MACHINE M3. 0 x 4	2	
		---***---		
-24	VO-9000-1039	. BRACKET, Solenoid	1	
		ATTACHING PARTS		
-25	160-260-5	. SCREW, Machine M2. 6 x 5	2	
-26	230-10	. WASHER, Lock	2	
		---***---		
-27	VO-9000-1009	. BRACKET C, Motor	1	
		ATTACHING PARTS		
-28	160-26D6	. SCREW, Machine M2. 6 x 6	1	
-29	160-30D5	. SCREW, Machine M3. 0 x 5	5	
		---***---		
-30	VO-1909-1002	. STOPPER, Timing Release	1	
		ATTACHING PARTS		
-31	160-30D5	. SCREW, Machine M3. 0 x 5 Pan head	1	

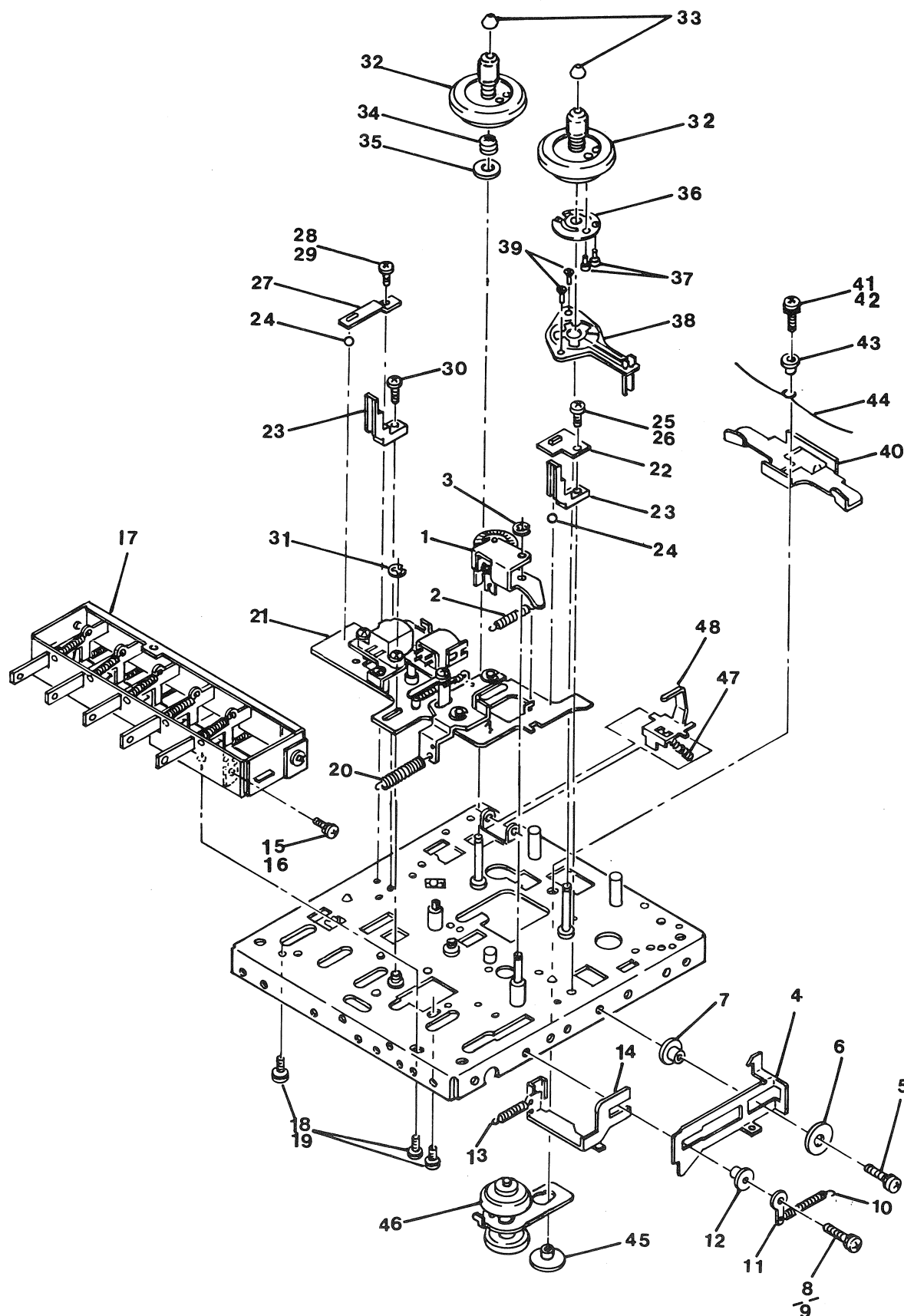


Figure 6.11 Tape Deck Assembly, Stage II

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.11 -	45508-P1	TAPE DECK ASSEMBLY, Stage II	REF	PO Models R/P Models
-1	45508-P4	TAPE DECK ASSEMBLY, Stage II	REF	
	VO-9000-0015	. PINCH ROLLER ASSEMBLY	1	
		ATTACHING PARTS		
-2	VO-9000-4024	. SPRING, Pinch Roller	1	
-3	259-3	. RING, Retaining	1	
		---***---		
-4	VO-9000-1037	. LEVER, Eject	1	
		ATTACHING PARTS		
-5	160-26D8	. SCREW, Machine M2. 6 x 8	1	
-6	VO-9000-1065	. WASHER	1	
-7	VO-9000-2045	. SPACER	1	
-8	160-26D6	. SCREW, Machine M2. 6 x 6	1	
-9	230-10	. WASHER, Lock	1	
-10	VO-1900-4004	. SPRING, Pop/Up Lever	1	
-11		. LUG (Local Purchase)	1	
-12	VO-1900-2002	. SPACER B, Pop/Up Lever	1	
		---***---		
-13	VO-9004-4012	. SPRING, Eject Lever	1	
-14	VO-5904-1006	. LEVER, Eject	1	
		ATTACHING PARTS		
-15	160-20D4	. SCREW, Machine M2. 0 x 4	1	
-16	160-230-10	. WASHER, Lock	1	
		---***---		
-17		. PUSH BUTTON ASSEMBLY (Figure 6.13)	REF	
		ATTACHING PARTS		
-18	160-26D5	. SCREW, Machine M2. 6 x 5	3	
-19	230-10	. WASHER, Lock	3	
		---***---		
-20	VO-9031-4002	. SPRING, Head Panel	1	
-21		. PANEL, Head (Figure 6.14)	REF	
		ATTACHING PARTS		
-22	VO-9000-1415	. RETAINER, Head Panel	1	
-23	VO-9000-3003	. GUIDE, Cassette	2	
-24	300-15	. BALL, Steel	2	
-25	160-26D6	. SCREW, Machine M2. 6 x 6	1	
-26	230-10	. WASHER, Lock	1	

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.11 -		TAPE DECK ASSY, Stage II (Continued)		
-27	VO-6301-1006	. RETAINER, Head Panel	1	
-28	160-26D4	. SCREW, Machine M2. 6 x 4	1	
-29	230-10	. WASHER, Lock	1	
-30	160-26D5	. SCREW, Machine M2. 6 x 5	1	
-31	259-7	. RING, Retaining ---***---	1	
-32	VT-0117	. REEL ASSEMBLY ATTACHING PARTS	2	
-33	VTC-3004	. REEL CAP ---***---	2	
-34	VO-9041-4004	. SPRING, Back Tension	1	
-35		. WASHER, M6. 0 x 0.25 (not available)	LP	
-36	VO-1501-1002	. SLIDER ATTACHING PARTS	1	
-37		. SCREW, M1. 7 x 1.8 (Local Purchase) ---***---	2	
-38	VO-1900-5001	. SWITCH, Sensor P.C.B. ATTACHING PARTS	1	
-39		. SCREW, M2 x 2.5 Flat head (Local Purchase)	2	
-40	VO-9000-1014	. ARM, Brake ATTACHING PARTS	1	
-41	160-26D8	. SCREW, Machine M2 6 x 8 Pan head	1	
-42	230-10	. WASHER, Lock	1	
-43	VO-9000-2012	. SPACER, Brake Arm	1	
-44	VO-2075-4007	. SPRING, Brake Arm	1	
-45	VO-9000-2026	. IDLER, Arm, FF	1	
-46	VO-9000-0049	. ARM ASSEMBLY, FF Idler	1	
-47	VO-9000-4008	. SPRING, Wrong Erase Preventing	1	R/P Models
-48	VO-2075-1025	. LATCH, Wrong Erase Preventing	1	R/P Models

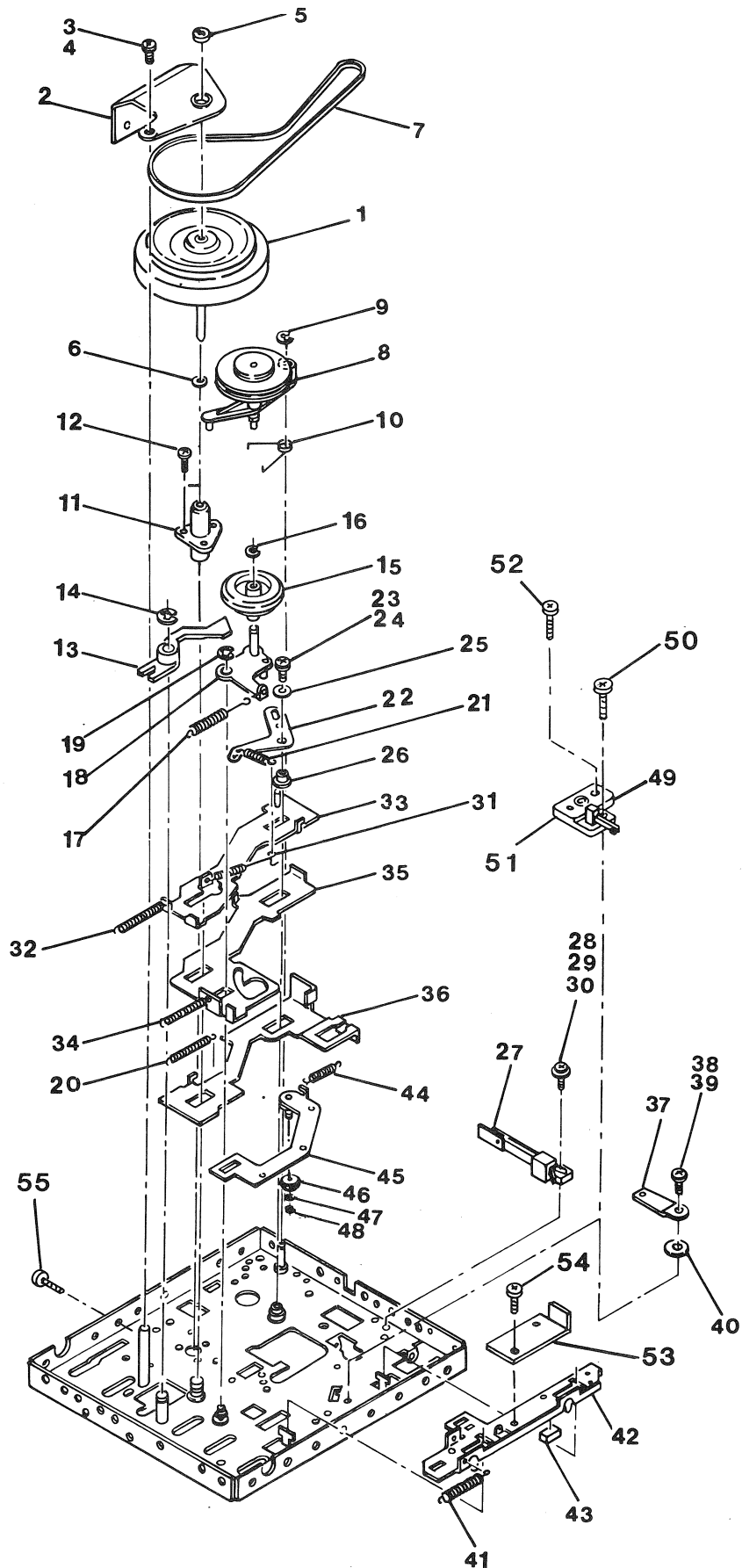


Figure 6.12 Tape Deck Assembly, Stage III

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.12-	45508-P1	TAPE DECK ASSEMBLY, Stage III	REF	PO Models
-1	45508-P4	TAPE DECK ASSEMBLY, Stage III	REF	R/P Models
	VO-6301-3001	. FLYWHEEL	1	
		ATTACHING PARTS		
-2	VO-9000-1004	. SUPPORT, Flywheel	1	
-3	160-26D5	. SCREW, Machine M2. 6 x 5	3	
-4	230-10	. WASHER, Lock	3	
-5	VO-9000-3005	. SCREW, Flywheel Adjusting	1	
-6		. WASHER, Flywheel (Nylon) (Local Purchase)	1	
-7	VO-6301-3005	. BELT, Flywheel	1	

-8	VO-0010-0004	. SLIPCLUTCH	1	
		ATTACHING PARTS		
-9	259-7	. RING, Retaining	1	
-10	VO-9000-4004	. SPRING, Slipclutch	1	

-11	VO-9000-2038	. POST, Flywheel	1	
		ATTACHING PARTS		
-12	160-20D5	. SCREW, Machine M2.5 (Washer, 230-10)	3	

-13	VO-9000-3032	. AUTO LEVER B	1	
		ATTACHING PARTS		
-14	259-2	. RING, Retaining	1	

-15	VO-2075-3006	. AUTO IDLER	1	
		ATTACHING PARTS		
-16	259-7	. RING, Retaining	1	

-17	VO-9000-4017	. SPRING, Auto Idler Support	1	
-18	VO-9000-0030	. AUTO IDLER SUPPORT	1	
		ATTACHING PARTS		
-19	259-7	. RING, Retaining	1	

-20	VO-9031-4004	. SPRING, Rewind Lever	1	
		ATTACHING PARTS		
-21	VO-9000-4005	. SPRING, Fast Forward Arm	1	
-22	VO-2075-1028	. ARM, Fast Forward Tension	1	

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.12-		TAPE DECK ASSY, Stage III (Continued)		
-23	160-26D6	. SCREW, Machine M2.6 x 6	1	
-24	230-10	. WASHER, Lock	1	
-25		. WASHER, Flat M2.6 (Local Purchase)	1	
-26	VO-9000-2013	. SPACER, Fast Forward Arm	1	
-27	VO-0050-0008	. SWITCH, Leaf (Main Switch, LSA-1139)	1	
		ATTACHING PARTS		
-28	160-26D6	. SCREW, Machine M2.6 x 6	1	
-29	230-10	. WASHER, Lock	1	
-30		. WASHER, Flat M2.6 (Local Purchase)	1	

-31	VO-9000-4006	. SPRING, Rewind Tension	1	
-32	VO-9031-4003	. SPRING, Fast Forward Arm	1	
-33	VO-9000-0034	. ARM, Fast Forward	1	
-34	VO-9031-4001	. SPRING, Brake Lever	1	PO Models
-35	VO-9000-1013	. LEVER, Rewind	1	
-36	VO-9000-1012	. LEVER, Brake	1	
-37	VTC-1036	. RETAINER, Rewind Idler Arm	1	R/P Models
		ATTACHING PARTS		
-38	160-26D4	. SCREW, Machine M2.6 x 4	1	
-39		. WASHER, Flat M2.6 (Local Purchase)	1	R/P Models
-40	230-10	. WASHER, Lock	1	

-41	VO-9000-4007	. SPRING, Erase Prevent Latch A	1	
-42	VO-2075-1024	. LATCH A, Erase Prevent	1	
		ATTACHING PARTS		
-43	VO-6301-3024	. CUSHION A	1	

-44	VO-9000-4025	. SPRING, Rewind Idler	1	
-45	VO-9000-0050	. ARM ASSEMBLY, Rewind Idler	1	
		ATTACHING PARTS		
-46	VO-6301-3009	. IDLER, Rewind	1	R/P Models
-47		. WASHER, Polyacetal M2 x .13 (Local Purchase)	1	
-48	259-8	. RING, Retaining	1	

-49	SO-990	. SWITCH, Record	1	
		All screws and washers are standard metric sizes.		

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.12-		TAPE DECK ASSY, Stage III (Continued)		
- 50	01146	. SCREW ---***---	1	
- 51	Y4830	. PLATE ATTACHING PARTS	1	R/P Models
- 52	01144	. SCREW ---***---	1	
- 53	Y4820	. PUSH PLATE ATTACHING PARTS	1	R/P Models
- 54	01144	. SCREW ---***---	1	

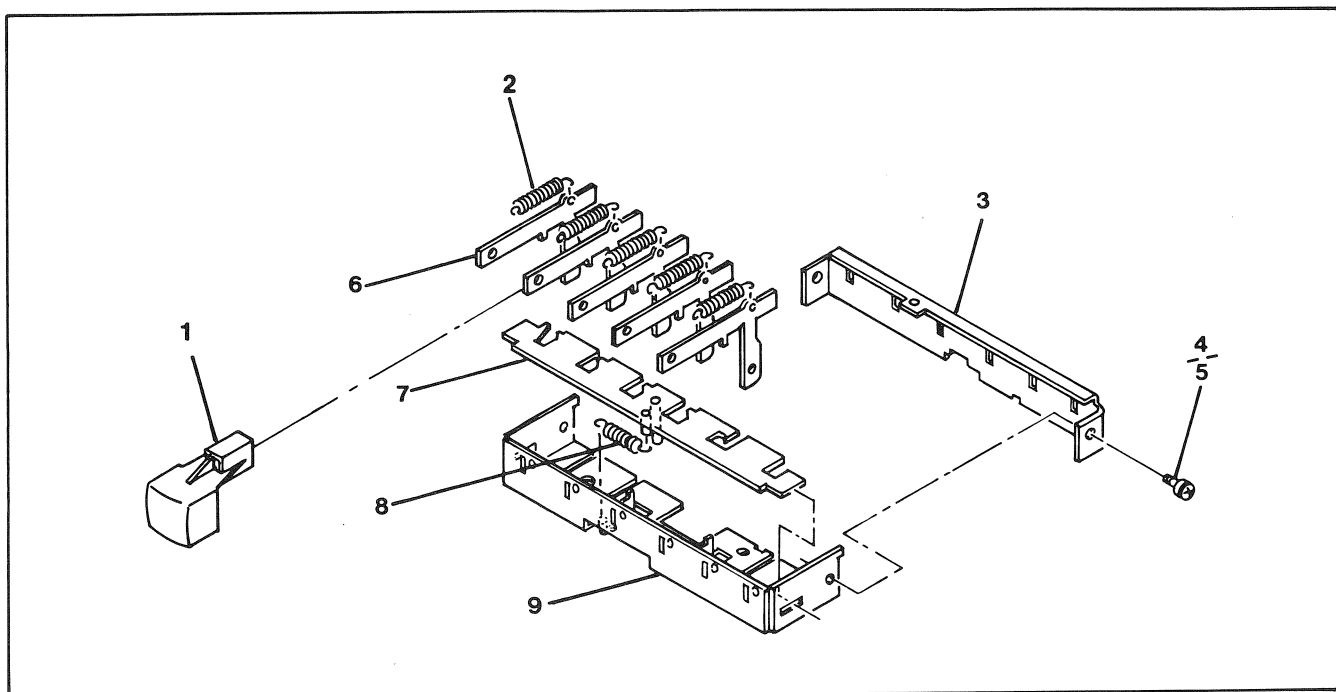


Figure 6.13 Push Button Assembly

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.13-	VO-9012-0002	PUSHBUTTON ASSEMBLY (PO)	REF	4320, 4324, 4460-4474
	VO-9013-0002	PUSHBUTTON ASSEMBLY (R/P)	REF	4340, 4344, 4480-4494
-1	45509-P3	. BUTTON	5	
-2	VO-2075-4005	. SPRING, Push Lever	5	
-3	VO-1900-1019	. FRAME, Push Lever	1	
		ATTACHING PARTS		
-4	160-26D4	. SCREW, Machine M2.6 x 4	2	
-5	230-10	. WASHER, Lock	2	
		---***---		
-6	VO-9011-1002	. LEVER, Push	5	
-7	VO-9012-0004	. LOCK PLATE ASSEMBLY, Push Lever	1	PO Models
	VO-9041-0005	. LOCK PLATE ASSEMBLY, Push Lever	1	R/P Models
-8	VO-9000-4021	. SPRING, Push Lever Lock Plate	1	
-9	VO-9000-1018	. FRAME, Push Lever	1	
		All screws and washers are standard metric sizes.		

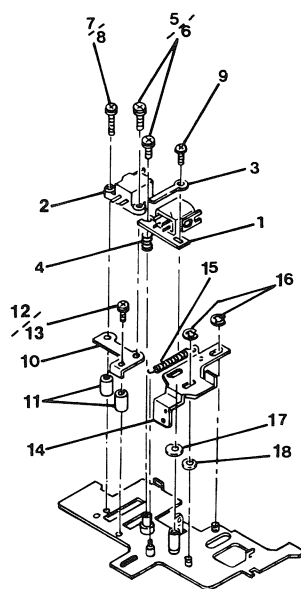


Figure 6.14 Head Panel Assembly

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.14-	VO-1915-0001	. HEAD PANEL	REF	Except 4120, 4124
-1	46207-P1	. HEAD, Record/Play	1	R/P Models
-2	HN-223801	. HEAD, Erase	1	
		ATTACHING PARTS		
-3	VO-0070-0010	. LUG	1	R/P Models R/P Models
-4	VO-1908-4001	. SPRING, R/P Head	1	
-5	160-20D4	. SCREW, Machine M2 x 4	1	
-6	230-10	. WASHER, Lock	1	
-7	160-20D6	. SCREW, Machine M2 x 5	2	
-8	230-10	. WASHER, Lock	2	
-9	160-20D4	. SCREW, Machine M2 x 4	1	
-10	VO-1900-1018	. BASE B, Erase Head	1	
-11	VT-1397-1	. STUD, Erase Head	1	
-12		. SCREW, Machine M2 x 9 (Local Purchase)	1	
-13	230-10	. WASHER, Lock	1	R/P Models

-14	VO-9000-1017	. PLATE, Head Panel Pushing	1	
		ATTACHING PARTS		
-15	VO-9000-4038	. SPRING, Link C	1	
-16	259-10	. RING, Retaining	2	
-17		. WASHER, Polyacetal 3.0 x .13 (Local Purchase)	AR	
-18		. WASHER, Polyacetal 4.0 x .13 (Local Purchase)	AR	
		All screws and washers are standard metric sizes.		

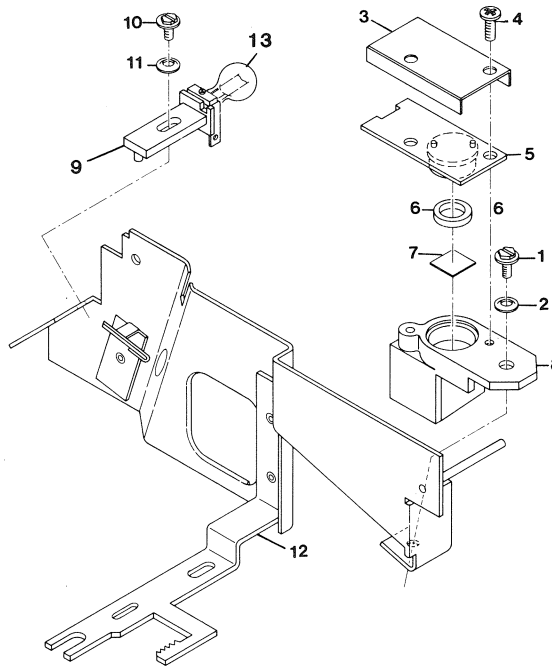


Figure 6.15 Auto-Focus Base Complete

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.15-	46906-G1	AUTO FOCUS BASE, Complete	REF	4460-4494
	46927-G1	. SENSOR, Complete	1	
		ATTACHING PARTS		
-1	148-6-6L	. SCREW, Thread-forming No. 6 x 3/8 Hex head	1	
-2	224-5	. WASHER, Spring	1	
		---***---		
-3	46905-P1	.. INSULATOR	1	
		ATTACHING PARTS		
-4	146-4R-6L	.. SCREW, Thread-forming No. 4 x 3/8 Pan Head	2	
		---***---		
-5		.. BOARD ASSEMBLY (Figure 6.27)	1	
-6	46917-P1	.. RING, Reflector	1	
-7	46924-P1	.. FILTER	1	
-8	46918-G1	.. HOUSING ASSEMBLY	1	
-9	47068-G1	.. LAMP HOLDER ASSEMBLY	1	
		ATTACHING PARTS		
-10	148-6-6L	. SCREW, Thread-forming No. 6 x 3/8 Hex head	1	
-11	224-5	. WASHER, Spring	1	
		---***---		
-12	46907-G1	. BASE ASSEMBLY	1	
-13	45767-P2	. LAMP	1	

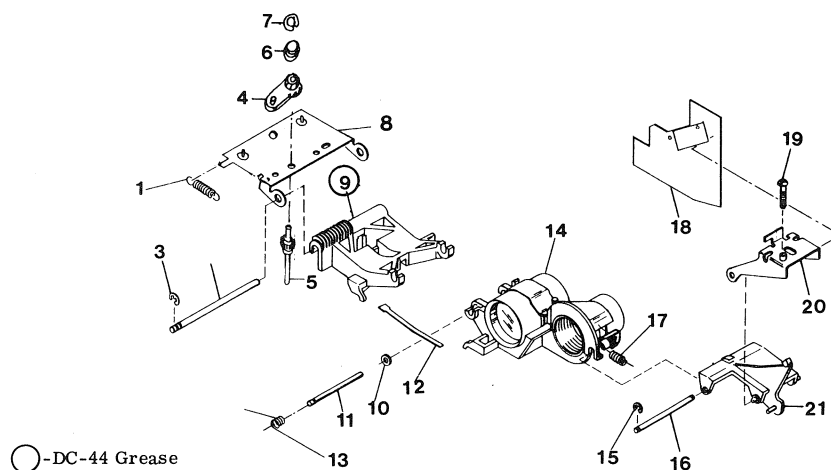


Figure 6.16 Lens Mechanism Assembly

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.16-	46878-G1	MECHANISM ASSEMBLY, Lens	REF	4460-4494
	46878-G2	MECHANISM ASSEMBLY, Lens	REF	4120-4344
-1	46900-P1	. SPRING	1	
	46882-G2	. BRACKET, Complete	1	4460-4494
	46881-P1	. BRACKET	1	4120-4344
		ATTACHING PARTS		
-2	46885-P1	. ROD, Lens Rack	1	
-3	251-10-1	. RING, Retaining	2	
		---***---		
-4	46898-P1	.. GEAR, Clutch	1	4460-4494
-5	46895-G2	.. SHAFT ASSEMBLY	1	4460-4494
		ATTACHING PARTS		
-6	46899-P1	.. SPRING, Clutch	1	
-7	250-8	.. RETAINER	1	
		---***---		
-8	46882-G1	.. BRACKET ASSEMBLY	1	4460-4494
-9	45547-P2	. RACK, Lens	1	
		ATTACHING PARTS		
-10	255-6	. RETAINER	1	
-11	46890-P1	. ROD, Lens Rack	1	
		---***---		
-12	45550-P1	. SPRING, Load	1	
-13	46891-P1	. SPRING	1	
-14	45536-G3	. PLATFORM ASSEMBLY, Lens	1	
		ATTACHING PARTS		
-15	251-7-1	. RING, Retaining	2	
-16	45543-P1	. ROD, Lens Actuator	1	
		---***---		
-17	46771-P1	. SPRING	1	Int Models
-18	46913-G1	. BAFFLE ASSEMBLY	1	4460-4494
-19	145-4-12X	. SCREW, Machine 4-40 x 3/4 Hex head	1	
-20	45540-G1	. BRACKET ASSEMBLY	1	
-21	45541-P1	. ACTUATOR	1	

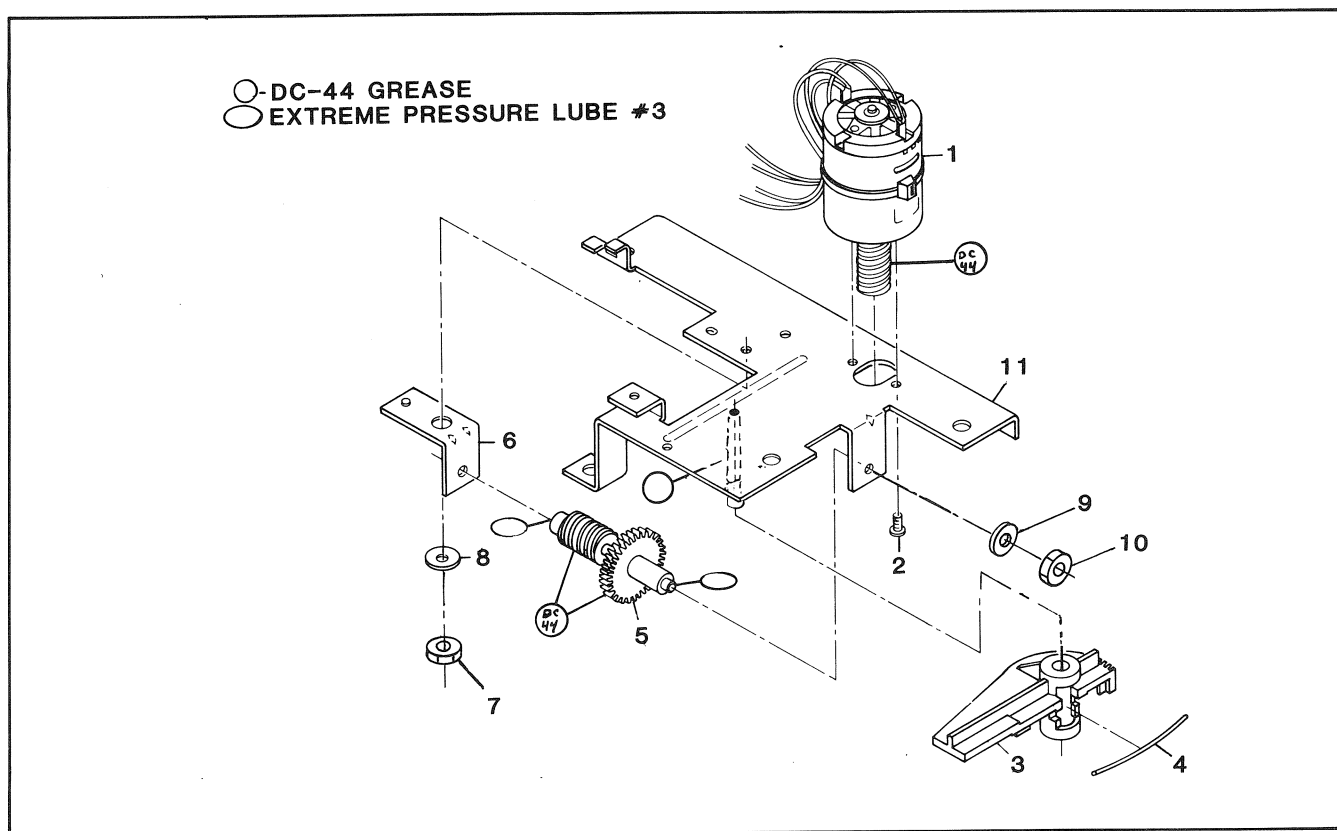


Figure 6.17 Mechanism Drive Complete

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.17-	46936-G4	MECHANISM DRIVE, Complete	REF	4460-4494
-1	46940-G2	. MOTOR, Complete	1	
		ATTACHING PARTS		
-2	160-26-S4	. SCREW, Machine M2, 6 x 4 Slotted head -----	2	
-3	46866-P1	. GEAR	1	
		ATTACHING PARTS		
-4	46871-P1	. SPRING -----	1	
-5	46863-G3	. JACKSHAFT ASSEMBLY	1	
-6	46867-P1	. BRACKET	1	
		ATTACHING PARTS		
-7	200-6HX	. NUT	1	
-8	38473-P7X	. WASHER, Flat 0.375 x 0.146 x 0.042	1	
-9	44261-P5	. SPACER	1	
-10	203-1	. NUT -----	1	
-11	46936-G3	. BRACKET ASSEMBLY	1	

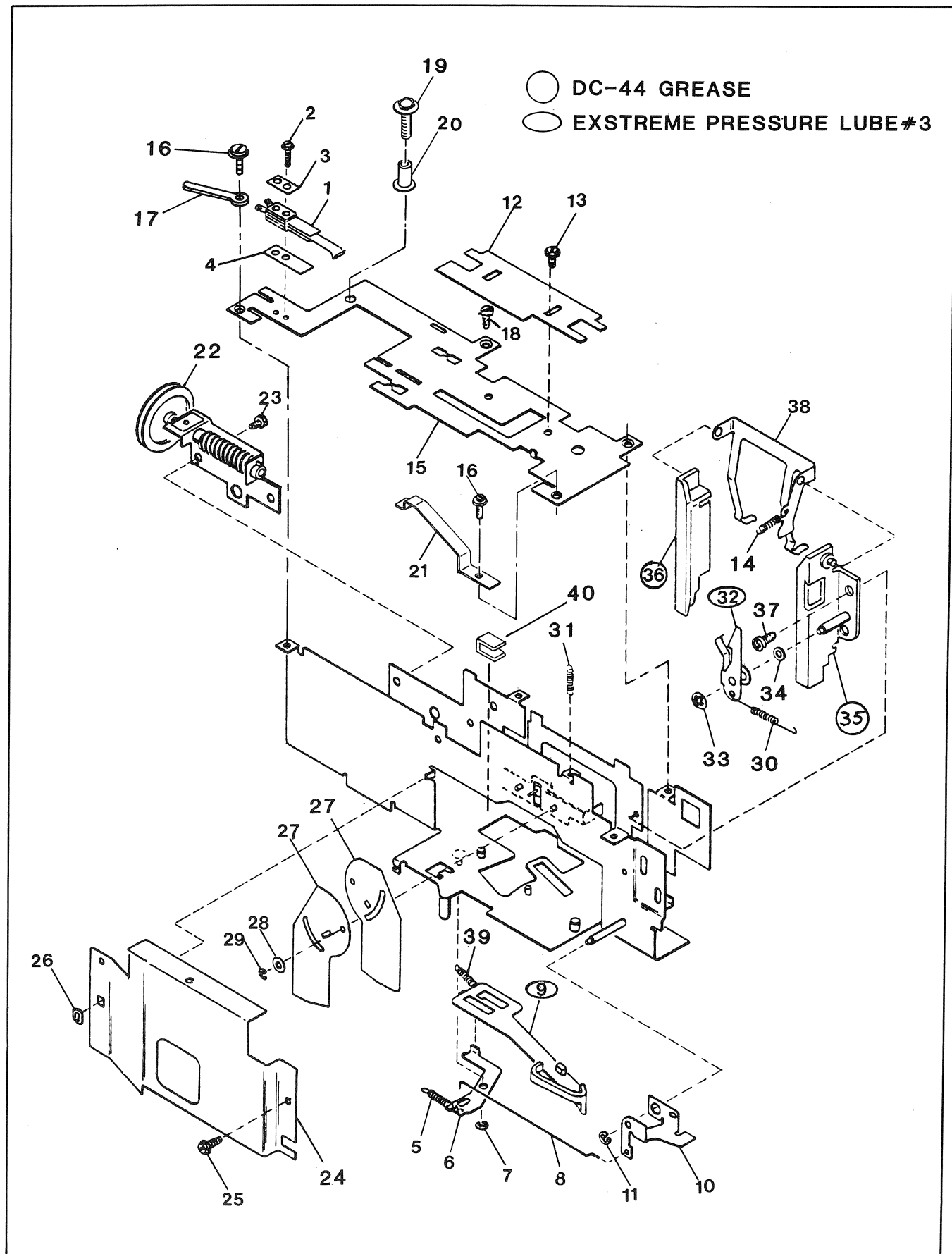


Figure 6.18 Mechanism Complete, Stage I

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.18-	45320-G4	MECHANISM COMPLETE, Stage I	REF	4460-4494
	45320-G5	MECHANISM COMPLETE, Stage I	REF	4120-4344
-1	45525-P2	. SWITCH, Cam (S5) ATTACHING PARTS	1	
-2	148-4-6X	. SCREW, Thread-forming No. 4 x 3/8 Hex head	2	
-3	45664-P1	. HEADER	1	
-4	45650-P1	. INSULATOR ---***---	1	
-5	46807-P1	. SPRING, Select Lever	1	
-6	45390-P1	. LEVER, Select ATTACHING PARTS	1	
-7	251-7-1	. RING, Retaining ---***---	1	
-8	45391-P1	. LINK, Select	1	
-9	45340-G2	. ARM ASSEMBLY, Index	1	
-10	45392-P2	. ARM, Select ATTACHING PARTS	1	
-11	251-7-1	. RING, Retaining ---***---	1	
-12	45589-P1	. PLATE, Slide Adjuster ATTACHING PARTS	1	
-13	148-6-4L	. SCREW, Thread-forming No. 6 x 1/4 Hex head ---***---	2	
-14	45383-P1	. SPRING, Face Clamp	1	
-15	45394-P3	. COVER, Mechanism Frame ATTACHING PARTS	1	
-16	148-6-6L	. SCREW, Thread-forming No. 6 x 3/8 Hex head	2	
-17	45646-G1	. LUG ASSEMBLY	2	
-18	148-6-4L	. SCREW, Thread-forming No. 6 x 1/4 Hex head	2	
-19	148-6-12X	. SCREW, Thread-forming No. 6 x 3/4 Hex head	1	
-20	260-11	. EYELET	1	
-21	46873-P1	. BRACKET ---***---	1	4460-4494
-22	45528-G1	. WORM AND PULLEY ASSEMBLY ATTACHING PARTS	1	
-23	148-6-4L	. SCREW, Thread-forming No. 6 x 1/4 Hex head ---***---	2	
-24	45359-P1	. MASK, Shutter ATTACHING PARTS	1	4120-4344
-25	148-6-4L	. SCREW, Thread-forming No. 6 x 1/4 Hex head	1	
-26	39299-P1	NUT, Spring ---***---	1	
-27	46045-P3	. BLADE, Shutter ATTACHING PARTS	2	
-28	41846-P23X	. WASHER, Flat 0.330 x 0.114 x 0.110	2	
-29	251-5-1	. RING, Retaining ---***---	2	
-30	45385-P1	. SPRING, Edge Clamp	1	
-31	38192-P2	. SPRING, Shutter Lever	1	
-32	45384-P1	. CLAMP, Slide Edge	1	

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.18-		MECHANISM COMPLETE, Stage I (Continued)		
		ATTACHING PARTS		
-33	254-6-1	. RING, Retaining	1	
-34	30473-P79	. WASHER, Flat 0.312 x 0.131 x 0.015 ---***---	1	
-35	45381-P1	. GUIDE, Slide Right	1	
-36	45380-P1	. GUIDE, Slide Left	1	
		ATTACHING PARTS		
-37	140-6R-4X	. SCREW, Thread-forming No. 6 x 1/4 Pan head ---***---	4	
-38	45382-P2	. CLAMP, Slide Face	1	
-39	45343-P1	. SPRING, Index Return	1	
-40	46182-P1	. CUSHION	1	

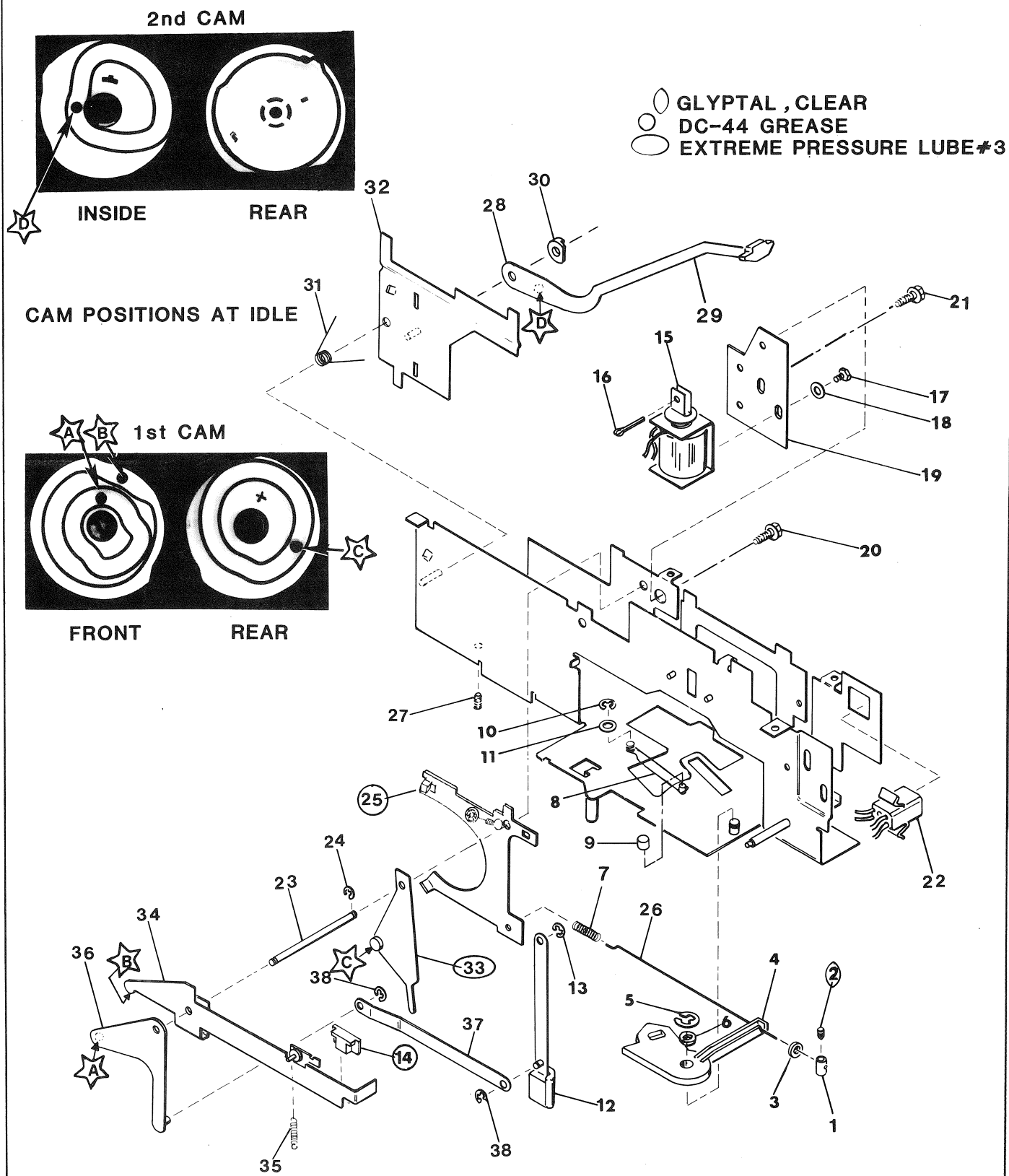


Figure 6.19 Mechanism Complete, Stage II

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.19-		MECHANISM COMPLETE, Stage II	REF	All
-1	45347-P1	. NUT, Adjusting (Forward/Reverse cam)	1	
		ATTACHING PARTS		
-2	171-6-3	. SCREW, Set ---***---	1	
-3	43270-P10	. WASHER, Flat 0.195 x 0.025 x 0.60	1	
-4	45345-P2	. CAM, Forward/Reverse	1	
		ATTACHING PARTS		
-5	251-11-1	. RING, Retaining ---***---	1	
-6	35473-P48	. WASHER, Flat 0.500 x 0.254 x 0.005	AR	
-7	45346-P1	. SPRING, Cam Return	1	
-8	45344-P2	. SPRING, Index Guide	1	
-9	46167-P1	. BUMPER	1	
		ATTACHING PARTS		
-10	251-9-1	. RING, Retaining	1	
-11	43260-P21	. WASHER, Flat 0.250 x 0.163 x 0.005 ---***---	1	
-12	45368-G1	. ARM ASSEMBLY, Detent	1	
		ATTACHING PARTS		
-13	251-7-1	. RING, Retaining ---***---	2	
-14	45349-P1	. SPACER, Shutter Lever	1	
-15	46163-G3	. SOLENOID ASSEMBLY, SOL1	1	
		ATTACHING PARTS		
-16	30523-P4X	. PIN, Cotter	1	
-17	118-6-3X	. SCREW, Machine 6/32 x 3/16 Hex head	2	
-18	38473-P7X	. WASHER, Flat 0.375 x 0.146 x 0.042 ---***---	2	
-19	45583-P2	. PLATE, Solenoid	1	
		ATTACHING PARTS		
-20	148-6-4L	. SCREW, Thread-forming No. 6 x 1/4 Hex head	1	
-21	148-6-4L	. SCREW, Thread-forming No. 6 x 1/4 Hex head ---***---	1	
-22	44505-P10	. HOUSING, Inner, 9 Connector (J30)	1	
-23	43720-P1	. SHAFT, Lever Pivot	1	
		ATTACHING PARTS		
-24	251-7-1	. RING, Retaining ---***---	1	
-25	46792-G1	. ESCAPEMENT LEVER ASSEMBLY	1	
	46795-P1	.. SPRING	1	
	46794-P1	.. STOP	1	
	254-6-1	.. RING, Retaining	1	
	30473-P79	.. WASHER, Flat 0.312 x 0.130 x 0.015	1	
	33500-P24X	.. WASHER, Flat 0.312 x 0.147 x 0.062	1	
-26	45348-P1	. LINK, Cam, Forward/Reverse	1	
-27	171-A4-6	. SCREW, Set	1	
-28	45372-G1	. LIFTER ASSEMBLY	1	
-29	45576-P1	. WIRE, Lifter	1	
-30	45575-P1	. WASHER, Lifter	1	
-31	45578-P1	. SPRING, Lifter	1	

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.19-		MECHANISM COMPLETE, Stage II (Continued)		
-32	45577-G1	. LIFTER ASSEMBLY	1	
-33	45417-G1	. LEVER ASSEMBLY, Index Follower	1	
-34	45350-G3	. LEVER ASSEMBLY, Shutter Cam	1	
-35	45354-P1	. SPRING, Shutter (no longer used)	1	
-36	45363-G1	. LEVER ASSEMBLY, Detent Follower	1	
-37	45366-P1	. CROSSBAR, Detent	1	
		ATTACHING PARTS		
-38	251-7-1	. RING, Retaining	1	
		---***---		

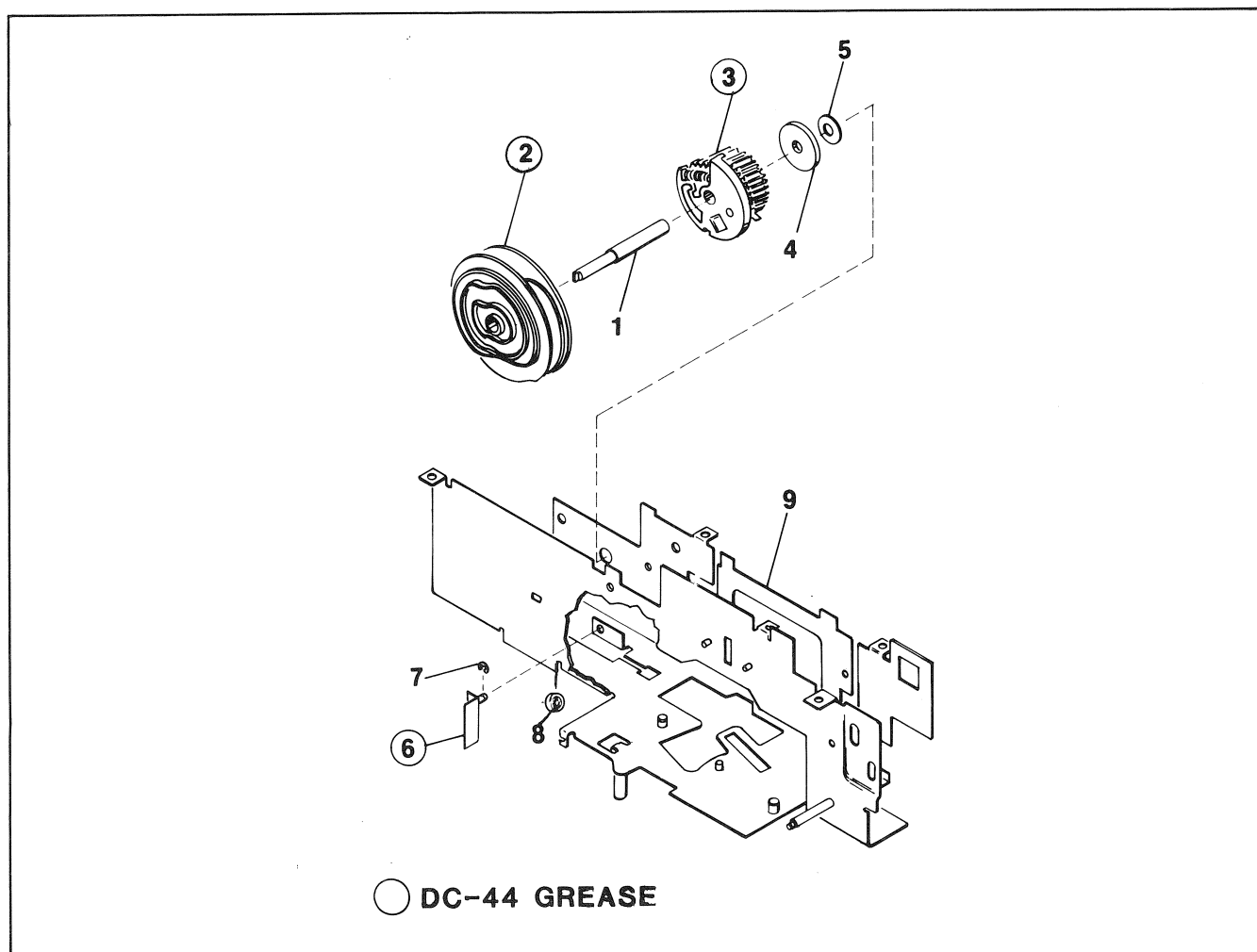


Figure 6.20 Mechanism Complete, Stage III

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.20-		MECHANISM COMPLETE, Stage III	REF	All
-1	45371-P1	. SHAFT, Cam	1	
-2	45414-G3	. CAM ASSEMBLY	1	
-3	45332-G4	. CLUTCH, Complete	1	
	45332-G3	. . PLATE ASSEMBLY	1	
	45337-P1	. . SPRING, Drive	1	
	45336-P1	. . SPRING, Overload	1	
	45339-P1	. . SPRING, Drag	1	
-4	45532-P1	. . WASHER, Clutch	1	
-5	40627-P19X	. WASHER, Flat 0.545 x 0.256 x 0.025	AR	
	30473-P68X	. WASHER, Flat 0.593 x 0.265 x 0.032	AR	
	335-00-P30X	. WASHER, Flat 0.625 x 0.257 x 0.042	AR	
-6	45387-G1	. PAWL ASSEMBLY	1	
		ATTACHING PARTS		
-7	251-7-1	. RING, Retaining	1	
		---***---		
-8	46167-P1	. BUMPER	1	
-9	45321-G4	. FRAME ASSEMBLY	1	

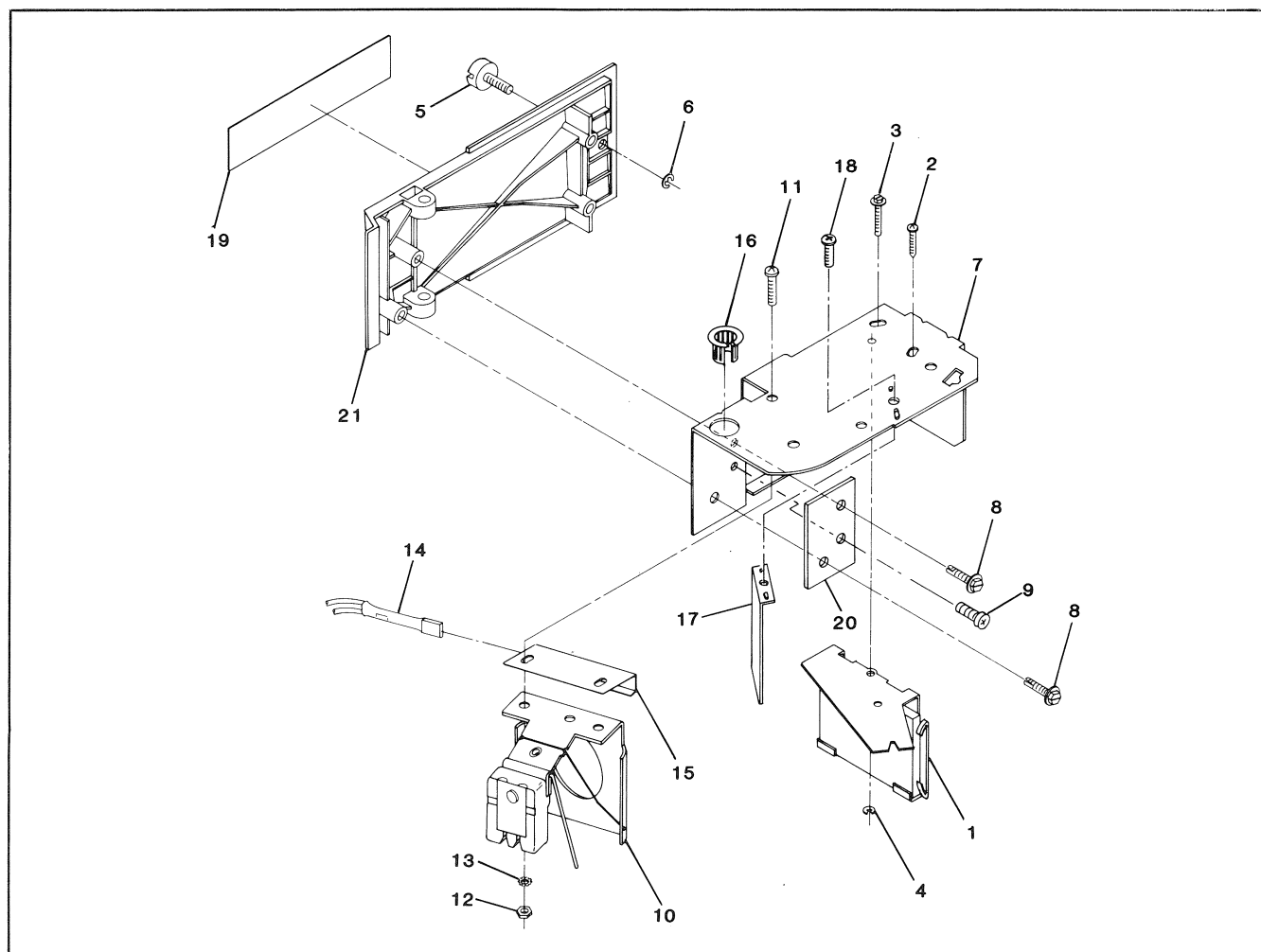


Figure 6.21 Lamphouse Assembly

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.21 -	47395-G2	LAMPHOUSE ASSEMBLY	REF	All
- 1	45406-G2	. MIRROR ASSEMBLY, Lamp	1	
		ATTACHING PARTS		
- 2	148-4-6X	. SCREW, Thread-forming NO. 4 x 3/8 Hex head	1	
- 3	148-4-10X	. SCREW, Thread-forming No. 4 x 5/8 Hex head	1	
- 4	251-7-1	. RING, Retaining	1	
		---***---		
- 5	47328-P1	. SCREW, Lamp Door	1	
		ATTACHING PARTS		
- 6	43270-P18	. WASHER	1	
		---***---		
- 7	45408-G1	. . BASE ASSEMBLY	1	
		ATTACHING PARTS		
- 8	139-8-8G	. SCREW, Thread-cutting No. 8 x 1/2 Hex head	4	
		---***---		
- 9	121-8R-6H	. SCREW, Thread-forming No. 8 x 3/8 Pan head	1	
- 10	46389-P2	. . HOLDER, Lamp	1	
		ATTACHING PARTS		
- 11	116-5R-6X	. . SCREW, Machine 5-40 x 3/8 Pan head	2	
- 12	200-5HX	. . NUT	2	
- 13	220-5	. . WASHER, Lock	2	
		---***---		
- 14	46188-G2	. . SWITCH ASSEMBLY, Thermal	1	
- 15	45121-P1	. . Clamp	1	
- 16	45600-P1	. . BUSHING	1	
- 17	45770-P1	. . BAFFLE	1	
		ATTACHING PARTS		
- 18	140-4R-4X	. . SCREW, Thread-forming No. 4 x 1/4 Pan head	1	
		---***---		
- 19	46604-P3	. LABEL, Caution	1	
- 20	45774-P1	. REFLECTOR	1	
- 21	45424-P6	. DOOR	1	

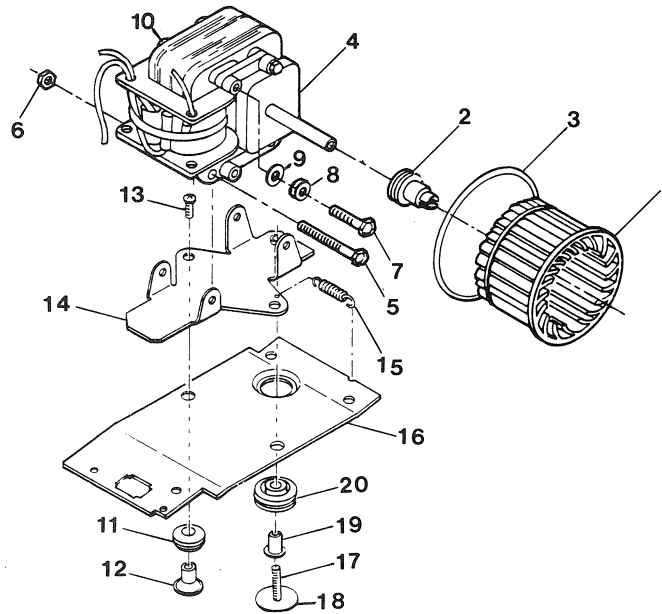


Figure 6.22 Blower Motor Assembly

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.22-	47058-G1	BLOWER MOTOR ASSEMBLY	REF	Dom Models
	47058-G2	BLOWER MOTOR ASSEMBLY	REF	Int Models
-1	45402-G1	. WHEEL ASSEMBLY	1	Dom Models
	45402-G2	. WHEEL ASSEMBLY	1	Int Models
-2	45400-G1	. PULLEY ASSEMBLY	1	Dom Models
	45400-G2	. PULLEY ASSEMBLY	1	Int Models
-3	33400-P20	. BELT	1	
-4	46191-P2	. MOTOR	1	Dom Models
	46390-P5	. MOTOR	1	Int Models
		ATTACHING PARTS		
-5	46191-P3	. SCREW, Motor Mount	2	
-6	46191-P4	NUT, Motor Mount	2	
		----*--		
-7	140-8R-8X	. SCREW, Thread-forming No. 8 x 1/2 Pan head	1	
-8	45240-P1	. SPACER	1	
-9	33500-62X	. WASHER, Flat 0.375 x 0.166 x 0.032	1	Int Models
-10	46439-P1	. STUD, Spacer	1	
	460-04-WH	. HOUSING, Wire (not shown)	1	
	47138-P1	. TERMINAL (not shown)	3	
	46134-G2	. MOUNT ASSEMBLY	1	
-11	265-14	. GROMMET	2	
-12	46128-P1	. SPACER	2	
-13	116-8R-6X	. SCREW, Machine 8/32 x 3/8 Pan head	2	
-14	46127-P1	. BRACKET	1	
-15	46139-P1	. SPRING	1	
-16	46129-P2	. PLATE	1	
-17	116-8R-12X	. SCREW, Machine 8/32 x 3/4 Pan head	1	
-18	43260-P23	. WASHER, Flat 0.750 x 0.173 x 0.042	1	
-19	46135-P3	. FERRULE	1	
-20	46135-P2	. GROMMET	1	

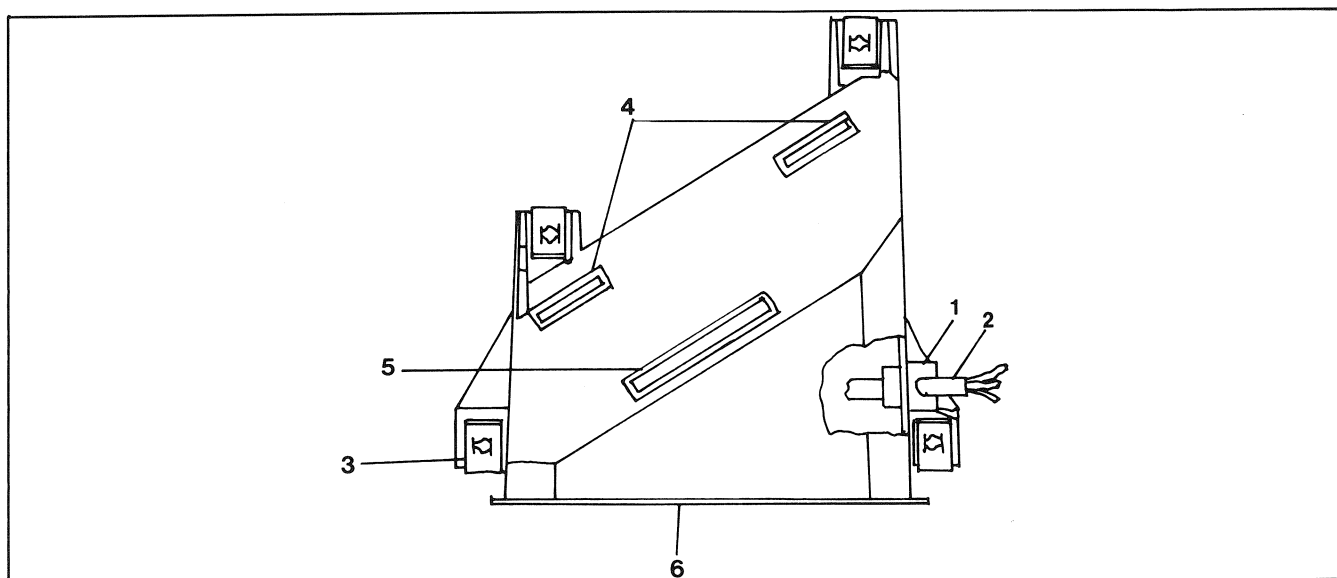


Figure 6.23 Large Mirror Support Assembly

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	QTY	MODELS USED ON
6.23-	47055-G3	LARGE MIRROR SUPPORT ASSY	REF	Dom Models
	47055-G2	LARGE MIRROR SUPPORT ASSY	REF	Int Models
-1	243-1	. BUSHING, Strain Relief	1	Dom Models
-2	47056-G1	. CORD, Power	1	Dom Models
	245-10	. PLUG	1	Int Models
	45057-G1	. HARNESS ASSEMBLY, Line Cord (not shown)	REF	Dom Models
	460-02-WH	. . HOUSING, Cap (P33)	1	
	459-02-RD	. . HOUSING, Plug (J35)	1	
-3	45476-P1	. NUT, Spring	4	
-4	461-9	. TAPE (4416 3M Co.)	1	
-5	461-2	. TAPE (4416 3M Co.)	1	
-6	45473-P1	. SUPPORT	1	

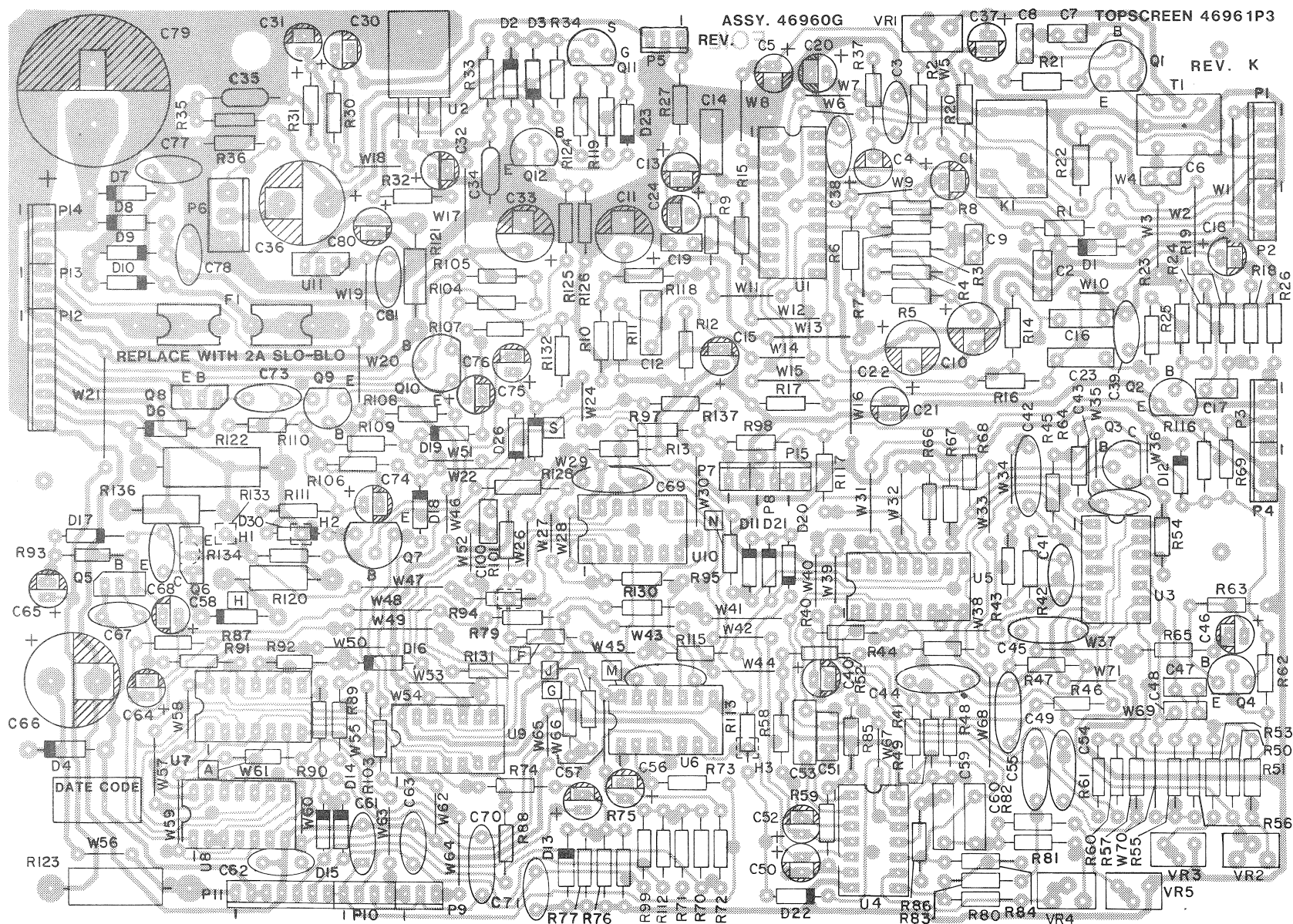


Figure 6.24 Record/Play Circuit Board Assembly

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	MODELS USED ON
6.24-	46960-G7 46960-G8	A1 MAIN BOARD ASSY, R/P A1 MAIN BOARD ASSY, R/P	4490, 4494 4340, 4344, 4480, 4484
C1,4,13,30,64	450-1R0-50M	CAPACITOR, Electrolytic, 1.0 μ F, 50V	
C2	455-223	CAPACITOR, Polyester, .022 μ F, 100V	
C3	415B-P472K-C	CAPACITOR, Ceramic, 4700 pF, 12V	
C5,37,46,75	44030-P9	CAPACITOR, Electrolytic, 10 μ F, 16V	
C6	455-222	CAPACITOR, Polyester, 2200 pF, 100V	
C7	455-103	CAPACITOR, Polyester, .01 μ F, 100V	
C8	455-102	CAPACITOR, Polyester, 1000 pF, 100V	
C9,47,48	455-682	CAPACITOR, Polyester Film, 6800 pF, 100V	
C10,11,22	42267-P4	CAPACITOR, Electrolytic, 100 μ F, 16V	
C12,16,23	455-104	CAPACITOR, Polyester Film, .1 μ F, 100V	
C14,19	455-472	CAPACITOR, Polyester Film, 4700 pF, 100V	
C15,20,24,40,56,58	42267-P10	CAPACITOR, Electrolytic, 1.0 μ F, 16V	
C17	455-332	CAPACITOR, Polyester Film, 3300 pF, 100V	
C18	42267-P18	CAPACITOR, Electrolytic, 2.2 μ F, 25V	
C21	450-10R-16	CAPACITOR, Electrolytic, 10.0 μ F, 16V	
C31	44030-P17	CAPACITOR, Electrolytic, 22 μ F, 16V	
C32	450-2R2-50M	CAPACITOR, Electrolytic, 2.2 μ F, 50V	
C33	44030-P18	CAPACITOR, Electrolytic, 100 μ F, 35V	
C34	454-104	CAPACITOR, Ceramic, .1 μ F, 50V	
C35	454-224	CAPACITOR, Ceramic, .22 μ F, 50V	
C36	44030-P19	CAPACITOR, Electrolytic, 470 μ F, 35V	
C38	415B-P332K-C	CAPACITOR, Ceramic, 3300 pF, 12V	
C39	415A-P103M-C	CAPACITOR, Ceramic, .01 μ F, 12V	
C41	415B-P222K-J	CAPACITOR, Ceramic, 2200 pF, 100V	4490, 4494 4340, 4344, 4480, 4484
	415A-P181K-H	CAPACITOR, Ceramic, 180 pF, 50V	
C42,45,49	415D-P224M-D	CAPACITOR, Ceramic .22 μ F, 16V	
C43	415A-P181K-H	CAPACITOR, Ceramic, 180 pF, 50V	
C44	415D-P224M-D	CAPACITOR, Ceramic, .22 μ F, 16V	4490, 4494
C50,52	450-R47-50M	CAPACITOR, Electrolytic, .47 μ F, 50V	4490, 4494
C51	455-682	CAPACITOR, Polyester Film, 6800 pF, 100V	4490, 4494
C53,59,60	455-473	CAPACITOR, Polyester Film, .047 μ F, 100V	
C54	415C-P104M-F	CAPACITOR, Ceramic, .1 μ F, 25V	
C55,69,70,72	415C-P104M-F	CAPACITOR, Ceramic, .1 μ F, 25V	4490, 4494
C57,80	450-4R7-25M	CAPACITOR, Electrolytic, 4.7 μ F, 25V	
C61,62,63	415A-P103M-F	CAPACITOR, Ceramic, .01 μ F, 25V	
C65	42267-P18	CAPACITOR, Electrolytic, 2.2 μ F, 25V	4490, 4494
C66	44030-P20	CAPACITOR, Electrolytic, 220 μ F, 50V	
C67,73	415B-P102K-H	CAPACITOR, Ceramic, 1000 pF, 50V	
C68	415B-P102K-H	CAPACITOR, Ceramic, 1000 pF, 50V	4490, 4494
C71	415A-P103M-F	CAPACITOR, Ceramic, .01 μ F, 25V	4490,4494
C74	450-22R-10M	CAPACITOR, Electrolytic, 22.0 μ F, 10V	
C76	44030-P9	CAPACITOR, Electrolytic, 10 μ F, 16V	4490, 4494
	450-1R0-50M	CAPACITOR, Electrolytic, 1.0 μ F, 50V	4340, 4344, 4480, 4484
C77,78,81	415J-P473K-H	CAPACITOR, Ceramic, .047 μ F, 50V	
C79	453-22-35	CAPACITOR, Electrolytic, 2200 μ F, 35V	
C100	455-103	CAPACITOR, Polyester Film, .01 μ F, 100V	4340, 4344, 4480, 4484
D1,2,3,4,6,7,8,9,10	40875-P1	DIODE (IN4003)	
D5	40875-P1	DIODE (IN4003)	4490, 4494

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	MODELS USED ON
6.24-		A1 MAIN BOARD ASSY, R/P (Continued)	
D11,17,18,20,22,30	44522-P2	DIODE, Silicon (IN4149)	4490, 4494
D12,13,14,15, 16,19,21,23	44522-P2	DIODE, Silicon (IN4149)	
D25,26	44522-P2	DIODE, Silicon (IN4159)	4340, 4344, 4480, 4484
F1	410-17	FUSE (2.0 Amp)	
J14	46973-G8	CONNECTOR, 4 Position	4480-4494
K1	46966-P1	RELAY, SPDT	
P1,2	443-FL-09	CONNECTOR, Friction Lock, 9 Position	
P3,4	443-FL-08	CONNECTOR, Friction Lock, 8 Position	
P5	443-FL-03	CONNECTOR, Friction Lock, 3 Position	
P6	447-FL-03	CONNECTOR, Friction Lock, 3 Position	
P7,8,15	443-FL-06	CONNECTOR, Friction Lock, 6 Position	
P9,10,11	443-FL-14	CONNECTOR, Friction Lock, 14 Position	
P12,13,14	443-FL-15	CONNECTOR, Friction Lock, 15 Position	
Q1	44519-P1	TRANSISTOR, NPN, Silicon (MPS-A13)	
Q2	42721-P1	TRANSISTOR, NPN, Silicon (MPS-6514)	
Q3	45788-P1	TRANSISTOR, PNP, Silicon (PN5143)	
Q4,9,10,12	44294-P1	TRANSISTOR, NPN, Silicon (2N4400)	
Q5,8	44518-P2	TRANSISTOR, NPN, Silicon (D40C4)	4490, 4494
Q6	44518-P2	TRANSISTOR, NPN, Silicon (D40C4)	4340, 4344, 4480, 4484
	44294-P1	TRANSISTOR, NPN, Silicon (2N4400)	4490, 4494
Q7	44294-P1	TRANSISTOR, NPN, Silicon (2N4400)	
Q11	46819-P1	TRANSISTOR, Field Effect (J113)	
R1,25,67,70,71, 104,107,108, 112,116,125	406-103-3	RESISTOR, 10K	
R2,19,60,118	406-163-3	RESISTOR, 15K	
R3	406-123-3	RESISTOR, 12K	
R4	406-181-3	RESISTOR, 180	
R5,20	406-121-3	RESISTOR, 120	
R6,63	406-271-3	RESISTOR, 270	
R7,68,73,74,87,88, 90,92,111,117	406-223-3	RESISTOR, 22K	
R8,54	406-224-3	RESISTOR, 220K Ohm, $\pm 5\%$, $\frac{1}{4}$ watt	
R9	406-471-3	RESISTOR, 470	
R10,18,37	406-102-3	RESISTOR, 1K	
R11,12,13,14,30, 31,33,55,105, 109,115	406-104-3	RESISTOR, 100K	
R15,16	406-105-3	RESISTOR, 1M	
R17	406-275-3	RESISTOR, 2.7M	
R21,43	406-183-3	RESISTOR, 18K	
R22,26,69	406-681-3	RESISTOR, 680	
R23	406-392-3	RESISTOR, 3.9K	
R24,50,64	406-334-3	RESISTOR, 330K	
R27	406-562-3	RESISTOR, 5.6K	
R32,53,110	406-472-3	RESISTOR, 4.7K	
R34,46,75	406-184-3	RESISTOR, 180K	
R35	406-109-3	RESISTOR, 1.0	
R36	406-101-3	RESISTOR, 100	
R40	406-332-3	RESISTOR, 3.3K	4490, 4494

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	MODELS USED ON
6.24-		A1 MAIN BOARD ASSY, R/P (Continued)	
R41,42,44,45	406-472-3	RESISTOR, 4.7K	4340, 4344, 4480, 4484
R47	406-394-3	RESISTOR, 390K	
	406-273-3	RESISTOR, 27K	4490, 4494
R48,83	406-153-3	RESISTOR, 15K	4340, 4344, 4480, 4484
R49	406-184-3	RESISTOR, 180K	4490, 4494
R51	406-153-3	RESISTOR, 15K	4490, 4494
R52	406-563-3	RESISTOR, 56K	
	406-683-3	RESISTOR, 68K	4490, 4494
	406-224-3	RESISTOR, 220K	4340, 4344, 4480, 4484
R56	406-334-3	RESISTOR, 330K	4490, 4494
	406-105-3	RESISTOR, 1M	4340, 4344, 4480, 4484
R57	406-184-3	RESISTOR, 180K	4490, 4494
	406-124-3	RESISTOR, 120K	4340, 4344, 4480, 4484
R58,59	406-105-3	RESISTOR, 1M	4490, 4494
R61,78,97,100,102	406-223-3	RESISTOR, 22K	4490, 4494
R62,79,89,91, 124,126	406-473-3	RESISTOR, 47K	
R65	406-183-3	RESISTOR, 18K	4490, 4494
	406-333-3	RESISTOR, 33K	4340, 4344, 4480, 4484
R66	406-683-3	RESISTOR, 68K	
R72	406-333-3	RESISTOR, 33K	
R76	406-474-3	RESISTOR, 470K	
R77	406-824-3	RESISTOR, 820K	
R80,84	406-334-3	RESISTOR, 330K	4490, 4494
R81	406-563-3	RESISTOR, 56K	4490, 4494
R82	406-472-3	RESISTOR, 4.7K	4490, 4494
R85,101	406-224-3	RESISTOR, 220K	4490, 4494
R86,114	406-104-3	RESISTOR, 100K	4490, 4494
R93,98,99	406-103-3	RESISTOR, 10K	4490, 4494
R94	406-102-3	RESISTOR, 1K	4490, 4494
R95,96,106,113	406-473-3	RESISTOR, 47K	4490, 4494
R103	406-122-3	RESISTOR, 1.2K	4490, 4494
R120	408-270	RESISTOR, 27, 1 Watt	4490, 4494
	402-22-0-3	RESISTOR, 22, ½ Watt	4340, 4344, 4480, 4484
R121	39476-P15	RESISTOR, 56, 1 watt	
R122	409-150	RESISTOR, 15, 2 watt	
R123	39476-P14	RESISTOR, 39, 2 watt	
R128	406-332-3	RESISTOR, 3.3K	4490, 4494
R130	406-104-3	RESISTOR, 100K	4340, 4344, 4480, 4484
R131,132	406-474-3	RESISTOR, 470K	4340, 4344, 4480, 4484
R133	406-122-3	RESISTOR, 1.2K	4340, 4344, 4480, 4484
R134	406-182-3	RESISTOR, 1.8K	4340, 4344, 4480, 4484
R136	408-121	RESISTOR, 120	4340, 4344, 4480, 4484
R137	406-124-3	RESISTOR, 120K	4340, 4344, 4480, 4484
T1	46965-P1	TRANSFORMER	
U1	46963-P1	IC, Audio Preamp, LM1818N	
U2	46964-P1	IC, Audio Power Amp, TDA2030H	
U3	44295-P1	IC, Quad Amp, LM3900	
U4	44295-P1	IC, Quad Amp, LM3900	4490, 4494
U5	46638-P1	IC, Triple Double Throw Switch, CD4053BCN	

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	MODELS USED ON
6.24-		A1 MAIN BOARD ASSY, R/P (Continued)	
U6	45591-P1	IC, Quad 2 Input NOR Gate, CD4001BCN	
U7	45593-P1	IC, Quad 2 Input NAND Gate, CD4011BCN	
U8	45594-P1	IC, Triple 3 Input NAND Gate, CD4023BCN	
U9	45956-P1	IC, Hex Inverter, CD4069BCN	
U10	45592-P1	IC, Dual 4 Input NOR Gate, CD4002BE	4490, 4494
U11	46630-P1	IC, +12V Regulator, LM342-P12	
VR1	46962-P2	POTENTIOMETER, 1K	
VR2	46962-P1	POTENTIOMETER, 50K	
VR3	46643-P3	POTENTIOMETER, 2K	
VR4	46962-P1	POTENTIOMETER, 50K	4490, 4494
VR5	46643-P3	POTENTIOMETER, 2K	4490, 4494
	46997-P1	CLIP, Fuse (2 required)	
	116-6R-4G	SCREW, Machine 6/32 x 3/8 Pan head	
	46967-P1	HEAT SINK	

NOTES:

1. ALL RESISTORS IN OHMS, 1/4 WATT, $\pm 5\%$ UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS IN MICROFARADS UNLESS OTHERWISE NOTED.

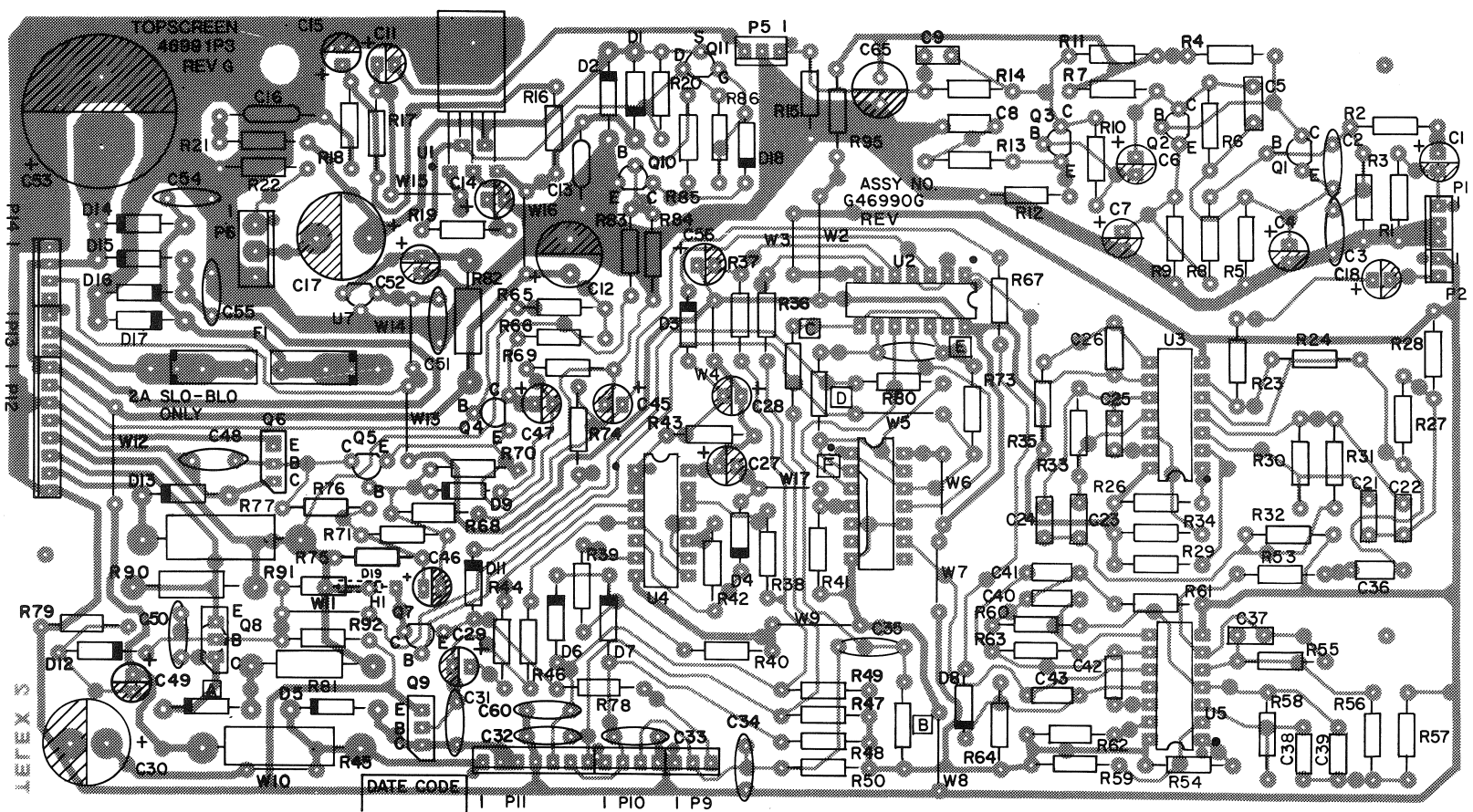


Figure 6.25 Silent/Play Only Circuit Board Assembly

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	MODELS USED ON
6.25-	47223-G1	A1 MAIN BOARD ASSEMBLY (Silent)	4120,4124
	46990-G8	A1 MAIN BOARD ASSEMBLY (PO)	4320,4324,4460,4464
	46990-G7	A1 MAIN BOARD ASSEMBLY (PO, SP)	4470,4474
C1,11	450-1R0-50M	CAPACITOR, Electrolytic, 1.0, 50V	Except 4120,4124
C2	415A-P181K-H	CAPACITOR, Ceramic, 180 pF, 50V	Except 4120,4124
C3	415B-P331K-H	CAPACITOR, Ceramic, 330 pF, 50V	Except 4120,4124
C4	450-R22-50M	CAPACITOR, Electrolytic, .22, 50V	Except 4120,4124
C5,22,24	455-152	CAPACITOR, Polyester, 1500 pF, 100V	Except 4120,4124
C6,18	42267-P10	CAPACITOR, Electrolytic, 1.0, 16V	Except 4120,4124
C7	42267-P3	CAPACITOR, Electrolytic, 4.7, 25V	Except 4120,4124
C8,26	455-104	CAPACITOR, Polyester, .1, 100V	Except 4120,4124
C9,23	455-103	CAPACITOR, Polyester, .01, 100V	Except 4120,4124
C12	44030-P18	CAPACITOR, Electrolytic, 100, 35V	Except 4120,4124
C13	454-104	CAPACITOR, Ceramic, .1, 50V	Except 4120,4124
C14	450-2R2-50M	CAPACITOR, Electrolytic, 2.2, 50V	Except 4120,4124
C15	44030-P17	CAPACITOR, Electrolytic, 22, 16V	Except 4120,4124
C16	454-224	CAPACITOR, Ceramic, .22, 50V	Except 4120,4124
C17	44030-P19	CAPACITOR, Electrolytic, 470, 35V	Except 4120,4124
C21	455-223	CAPACITOR, Polyester, .022, 100V	Except 4120,4124
C25	455-102	CAPACITOR, Polyester, 1000 pF, 100V	Except 4120,4124
C27,56	42267-P10	CAPACITOR, Electrolytic, 1.0, 16V	
C28	450-4R7-25M	CAPACITOR, Electrolytic, 4.7, 25V	
C29	450-1R0-50M	CAPACITOR, Electrolytic, 1.0, 50V	
C30	44030-P20	CAPACITOR, Electrolytic, 220, 50V	
C31	415B-P102K-H	CAPACITOR, Ceramic, 1000 pF, 50V	
C32,33,60	415A-P103M-F	CAPACITOR, Ceramic, .01, 25V	
C34		CAPACITOR, Ceramic, .01, 25V	4470,4474
C35,44	415C-P104M-F	CAPACITOR, Ceramic, .1, 25V	4470,4474
C36,38,40,43	455-104	CAPACITOR, Polyester, .1, 100V	4470,4474
C37	455-222	CAPACITOR, Ceramic, 2200 pF, 50V	4470,4474
C39,41	455-153	CAPACITOR, Ceramic, .015, 50V	4470,4474
C42	455-472	CAPACITOR, Ceramic, 4700 pF, 50V	4470,4474
C45	44030-P9	CAPACITOR, Electrolytic, 10, 16V	4470,4474
C46	450-22R-10M	CAPACITOR, Electrolytic, 22, 10V	Except 4120,4124
C47	44030-P9	CAPACITOR, Electrolytic, 10, 16V	Except 4120,4124
C48	415B-P102K-H	CAPACITOR, Ceramic, 1000 pF, 50V	Except 4120,4124
C49	42267-P18	CAPACITOR, Electrolytic, 2.2, 25V	4470,4474
C50	415B-P102K-H	CAPACITOR, Ceramic, 1000 pF, 50V	4470,4474
C51	415J-P473K-H	CAPACITOR, Ceramic, .047, 50V	Except 4120,4124
C52	450-4R7-25M	CAPACITOR, Electrolytic, 4.7, 25V	Except 4120,4124
C53	453-22-35	CAPACITOR, Electrolytic, 2200, 35V	
C54,55	415J-P473K-H	CAPACITOR, Ceramic, .047, 50V	
C65	42267-P14	CAPACITOR, Electrolytic, 47, 16V	Except 4120,4124
D1,2	40875-P1	DIODE, 1N4003	Except 4120,4124
D3,4,6,7	44522-P2	DIODE, 1N4149 or 1N3064	Except 4120,4124
D5,14,15,16,17	40875-P1	DIODE, 1N4003	
D8,11,12	44522-P2	DIODE, 1N4149	4470,4474
D9,18	44522-P2	DIODE, 1N4149	Except 4120,4124
D10,19	40875-P1	DIODE, 1N4003	4470,4474
D13	40875-P1	DIODE, 1N4003	Except 4120,4124
F1	410-17	FUSE, 2 Amp, 250V	

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	MODELS USED ON
6.25-		A1 MAIN BOARD ASSY, Silent, PO (Continued)	
J14	46973-68	CONNECTOR, 4 Position	4460-4474
P1,2	443-FL-05	CONNECTOR, Friction Lock, 5 Position	Except 4120,4124
P5	443-FL-03	CONNECTOR, Friction Lock, 3 Position	Except 4120,4124
P6	447-FL-03	CONNECTOR, Friction Lock, 3 Position	Except 4120,4124
P9,10,11	443-FL-14	CONNECTOR, Friction Lock, 14 Position	4470,4474
P10,11	443-FL-11	CONNECTOR, Friction Lock, 11 Position	
P12,13	443-FL-11	CONNECTOR, Friction Lock, 11 Position	Except 4120,4124
P13	443-FL-03	CONNECTOR, Friction Lock, 3 Position	4120,4124
P14	443-FL-04	CONNECTOR, Friction Lock, 4 Position	Except 4120,4124
P22	46998-G1	HARNESS ASSEMBLY (not available)	4460-4474
Q1	45947-P1	TRANSISTOR, MPS-A09	Except 4120,4124
Q2,3	42721-P1	TRANSISTOR, MPS-6514	Except 4120,4124
Q4,5,10	44294-P1	TRANSISTOR, 2N4400	Except 4120,4124
Q6	44518-P2	TRANSISTOR, D 40C4	Except 4120,4124
Q7	44294-P1	TRANSISTOR, 2N4400	4470,4474
Q8	44294-P1	TRANSISTOR, 2N4400	Except 4120,4124
	44518-P2	TRANSISTOR, D 40C4	4470,4474
Q9	44518-P2	TRANSISTOR, D 40C4	
Q11	46819-P1	TRANSISTOR, J113	Except 4120,4124
R1	406-154-3	RESISTOR, 150K	Except 4120,4124
R2	406-102-3	RESISTOR, 1.0K	Except 4120,4124
R3,4,33	406-224-3	RESISTOR, 220K	Except 4120,4124
R5,9	406-681-3	RESISTOR, 680	Except 4120,4124
R6,29	406-564-3	RESISTOR, 560K	Except 4120,4124
R7,15	406-822-3	RESISTOR, 8.2K	Except 4120,4124
R8,11,14,32,66, 69,70,83	406-103-3	RESISTOR, 10K	Except 4120,4124
R10	406-155-3	RESISTOR, 1.5M	Except 4120,4124
R12	406-331-3	RESISTOR, 330	Except 4120,4124
R13,22	406-101-3	RESISTOR, 100	Except 4120,4124
R16,17,18,65,71	406-104-3	RESISTOR, 100K	Except 4120,4124
R19,28,76	406-472-3	RESISTOR, 4.7K	Except 4120,4124
R20	406-184-3	RESISTOR, 180K	Except 4120,4124
R21	406-109-3	RESISTOR, 1.0	Except 4120,4124
R23	406-392-3	RESISTOR, 3.9K	Except 4120,4124
R24,34	406-474-3	RESISTOR, 470K	Except 4120,4124
R26	406-105-3	RESISTOR, 1.0M	Except 4120,4124
R27	406-183-3	RESISTOR, 18K	Except 4120,4124
R30	406-274-3	RESISTOR, 270K	Except 4120,4124
R31	406-153-3	RESISTOR, 15K	Except 4120,4124
R35	406-335-3	RESISTOR, 3.3M	Except 4120,4124
R36,38,39,42,44	406-223-3	RESISTOR, 22K	
R37	406-333-3	RESISTOR, 33K	
R40,41,46	406-473-3	RESISTOR, 47K	
R43	406-823-3	RESISTOR, 82K	
R45	39476-P14	RESISTOR, 39, 2 Watt	Except 4120,4124
R47,48,49	406-103-3	RESISTOR, 10K	
R50,79	406-103-3	RESISTOR, 10K	4470,4474
R51,52	406-223-3	RESISTOR, 22K	4470,4474
R53	406-333-3	RESISTOR, 33K	4470,4474
R54	406-125-3	RESISTOR, 1.2M	4470,4474

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	MODELS USED ON
6.25-		A1 MAIN BOARD ASSY, Silent, PO (Continued)	
R55	406-684-3	RESISTOR, 680K	4470,4474
R56	406-183-3	RESISTOR, 18K	4470,4474
R57	406-822-3	RESISTOR, 8.2K	4470,4474
R58	406-184-3	RESISTOR, 180K	4470,4474
R59	406-394-3	RESISTOR, 390K	4470,4474
R60	406-123-3	RESISTOR, 12K	4470,4474
R61	406-562-3	RESISTOR, 5.6K	4470,4474
R62	406-334-3	RESISTOR, 330K	4470,4474
R63	406-154-3	RESISTOR, 150K	4470,4474
R64	406-335-3	RESISTOR, 3.3M	4470,4474
R67,68,72,73	406-473-3	RESISTOR, 47K	4470,4474
R74	406-681-3	RESISTOR, 680	4470,4474
R75	406-223-3	RESISTOR, 22K	Except 4120,4124
R77	409-150	RESISTOR, 15, 2 Watt	Except 4120,4124
R78	406-122-3	RESISTOR, 1.2K	4470,4474
R80	406-102-3	RESISTOR, 1.0K	4470,4474
R81	406-22-0-3	RESISTOR, 22, ½ Watt	4320,4324,4460,4464
	408-270	RESISTOR, 27, 1 Watt	4470,4474
R82	39476-P15	RESISTOR, 56, 1 Watt	Except 4120,4124
R84,85	406-473-3	RESISTOR, 47K	Except 4120,4124
R90	408-121	RESISTOR, 120, 1 Watt	4320,4324,4460,4464
R91	406-122-3	RESISTOR, 1.2K	4320,4324,4460,4464
R92	406-182-3	RESISTOR, 1.8K	4320,4324,4460,4464
R95	406-271-3	RESISTOR, 270	Except 4120,4124
U1	46964-P1	IC, Audio Power Amp, TDA 2030H	Except 4120,4124
U2	45591-P1	IC, Quad 2 Input NOR Gate, CD4001 BCN	
U3	44295-P1	IC, Quad Amp, LM3900	Except 4120,4124
U4	45593-P1	IC, Quad 2 Input NAND Gate, CD4011 BCN	
U5	44295-P1	IC, Quad Amp, LM3900	4470,4474
U6	45592-P1	IC, Dual 4 Input NOR Gate, CD4002 BE	4470,4474
U7	45972-P2	IC, +12V Regulator, LM78L12ACZ	Except 4120,4124
	46967-P1	HEAT SINK, Power Amp	Except 4120,4124
	46997	CLIP, Fuse (2 required)	
	46293	SPACER (Used on leads of R43,45,77,81,82)	Except 4120,4124
	116-6R4G	SCREW, Machine, Heat Sink Mounting, 3/8 x ¼ Pan head	Except 4120,4124

NOTES:

1. ALL RESISTORS IN OHMS, ¼ WATT, ±5% UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS IN MICROFARADS UNLESS OTHERWISE NOTED.

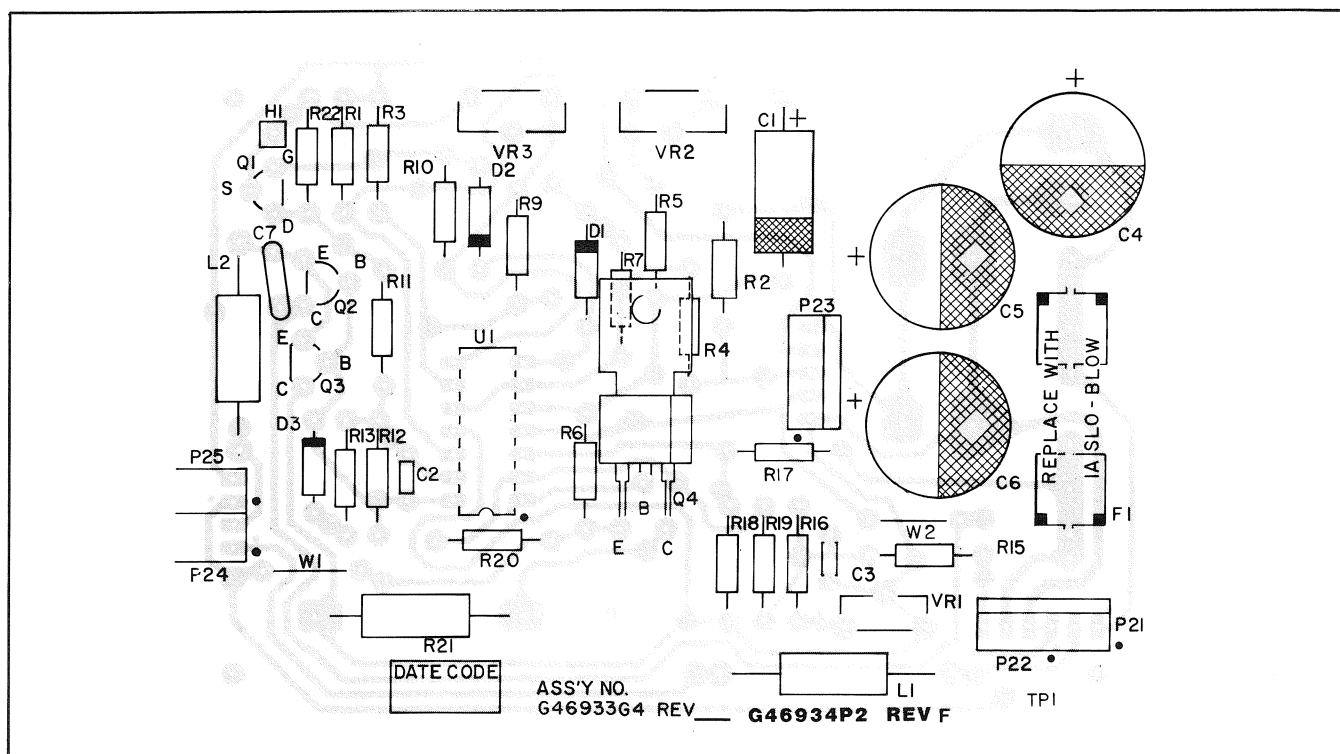


Figure 6.26 Auto-Focus Driver Circuit Board Assembly

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	MODELS USED ON
6.26-	46933-G4	A6 BOARD ASSY, Auto Focus Driver	4460-4494
C1	42267-P1	CAPACITOR, Electrolytic, 10, 25V	
C2,3	455-103	CAPACITOR, Polyester, .1, 100V	
C4,5,6	44030-P13	CAPACITOR, Electrolytic, 1000, 16V	
C7	415B-P102K-H	CAPACITOR, Ceramic, 1000 pF, 50V	
D1,2,3	44522-P2	DIODE, (1N4149)	
F1	410-21	FUSE, 1.0 Amp, 250V, Slo-Blo	
J22	46973-G8	CONNECTOR, 4 Position	
L1,2	46173-P1	CHOKES, 12 μ H	
P21,22	443-FL-06	CONNECTOR, Friction Lock, 6 Position	
P23	443-FL-05	CONNECTOR, Friction Lock, 5 Position	
P24,25	443-FL-04	CONNECTOR, Friction Lock, 4 Position	
Q1	46819-P1	TRANSISTOR, Field Effect, (J113)	
Q2	44294-P1	TRANSISTOR, NPN, (2N4400)	
Q3	44294-P2	TRANSISTOR, PNP, (2N4402)	
Q4	47052-P2	TRANSISTOR, PNP, Power (D41D1)	
R1	406-153-3	RESISTOR, 15K	
R2	406-223-3	RESISTOR, 22K	
R3,9	406-473-3	RESISTOR, 47K	
R4	406-393-3	RESISTOR, 49K	
R5	406-561-3	RESISTOR, 560	
R6	406-472-3	RESISTOR, 4.7K	
R7,18	406-183-3	RESISTOR, 18K	
R10	406-824-3	RESISTOR, 820K	
R11	406-272-3	RESISTOR, 2.7K	
R12,13	406-334-3	RESISTOR, 330K	

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	MODELS USED ON
6.26-		A6 BOARD ASSY, Auto Focus Driver (Continued)	
R15	406-102-3	RESISTOR, 1K	
R16	406-182-3	RESISTOR, 1.8K	
R17,19	406-123-3	RESISTOR, 12K	
R20	406-822-3	RESISTOR, 8.2K	
R21	406-150	RESISTOR, 15 Ohm, $\pm 5\%$, 2 Watt	
R22	406-682-3	RESISTOR, 6.8K	
U1	46583-P1	IC, Quad Amplifier, LM324N	
VR1,3	40761-P6	POTENTIOMETER, (10K)	
VR2	40761-P11	POTENTIOMETER, (1K)	
		CLIP, Fuse, (2 required)	
	46293	SPACER (assemble to leads of R30, 2 required)	

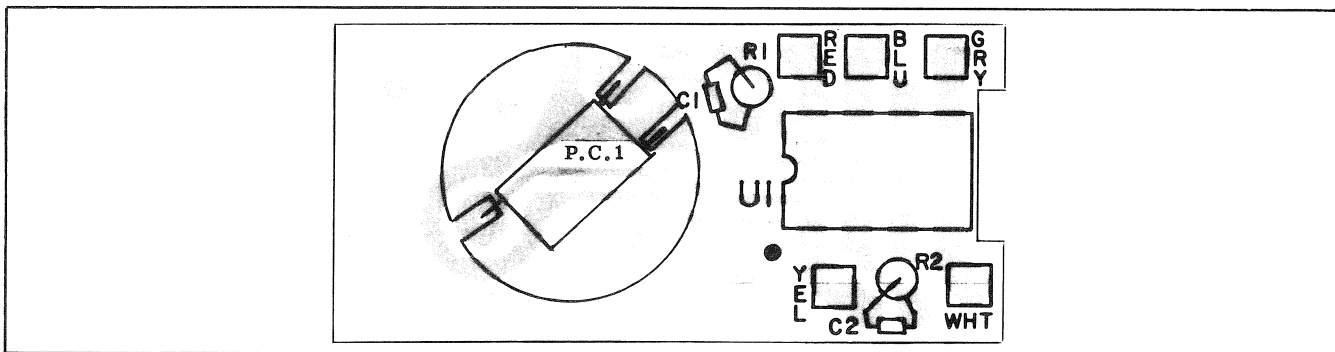


Figure 6.27 Sensor Board Assembly

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	MODELS USED ON
6.27-	46925-G1	SENSOR BOARD ASSEMBLY	4460-4494
C1,2	415A-P101K-H	CAPACITOR, Ceramic, 100 pF, 50V	
PC-1	46929-P1	PHOTO CELL	
	46930-P1	SUPPORT	
R1,2	406-155-3	RESISTOR, 1.5M	
U1	46999-P1	IC, Dual Op Amp, LF442CN	

The diagram shows the Record LEDs Board Assembly. It features two dual in-line packages (DI2 and DI) with various colored LEDs (WH, BK, BL, BN, GN, RD) connected to them. The board is labeled with 'TOPSCREEN' and '45561P1 REV F'.

Figure 6.28 Record LEDs Board Assembly

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	MODELS USED ON
6.28- D1 D12	46971-G2 45948-P1 45948-P3 46973-G4	RECORD LEDS BOARD ASSEMBLY LED (Red) LED (Green) CONNECTOR ASSY, 4 Position (not shown)	4340, 4344, 4480-4494

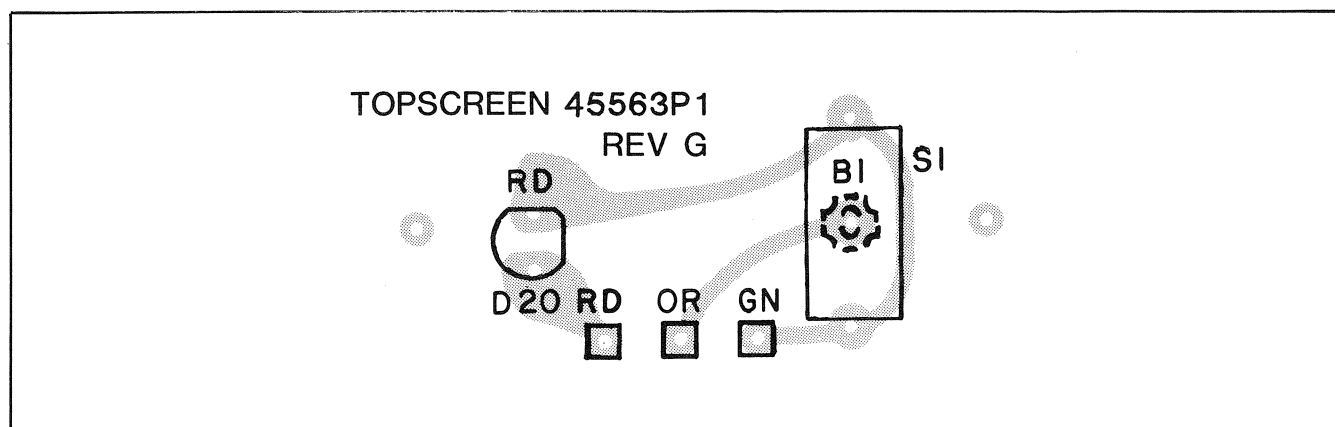


Figure 6.29 Stop Pulse Circuit Board Assembly

FIGURE & ITEM NO.	PART NUMBER	DESCRIPTION	MODELS USED ON
6.29- D20 S1 B1	47024-G1 45948-P1 45164-P1 45163-P1 46973-G2	STOP PULSE CIRCUIT BOARD ASSY LED, Red SWITCH CONTACT CONNECTOR ASSY (not shown)	4470, 4474, 4490, 4494