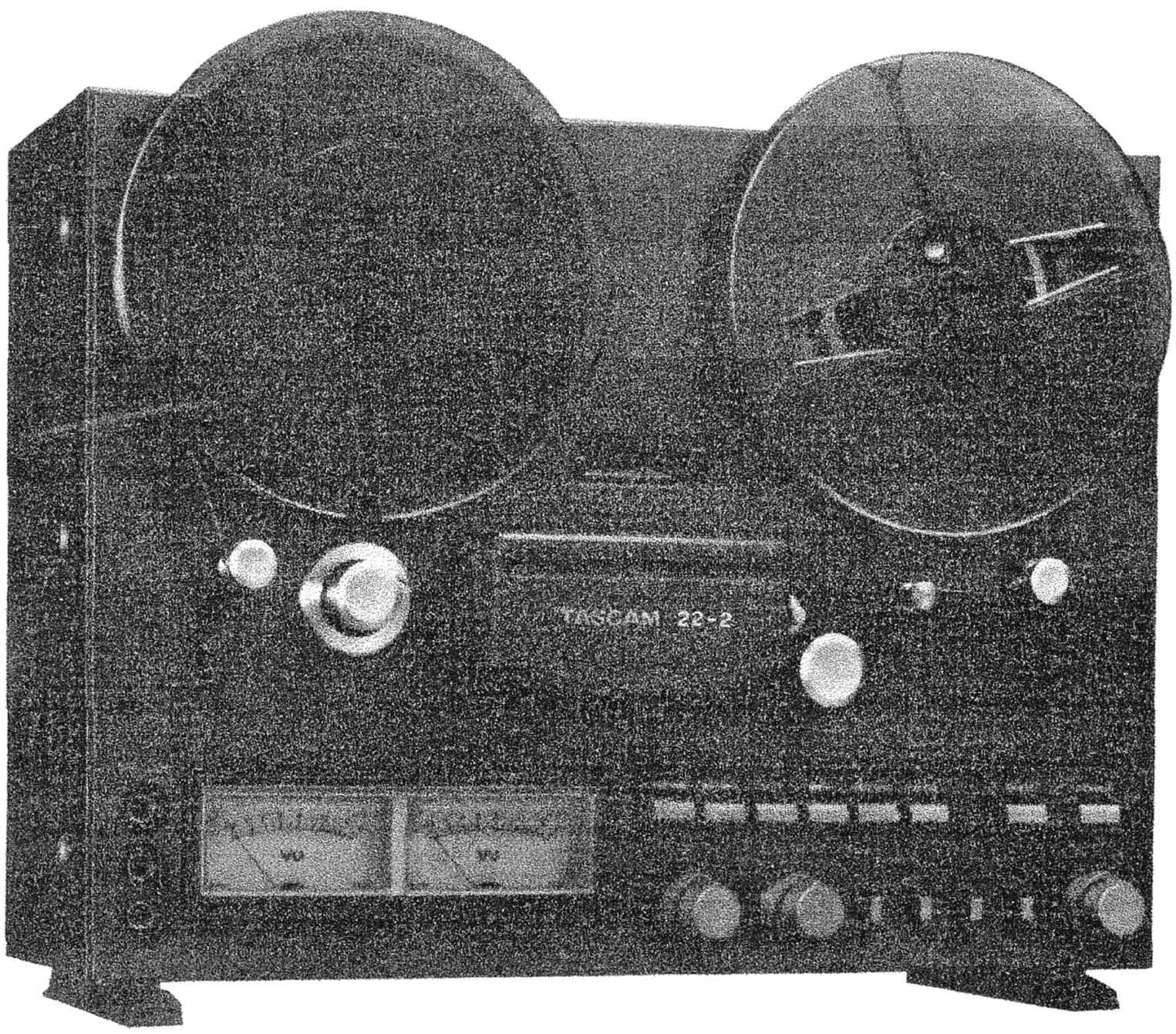
TASCAM

TEAC Production Products

22-2

2-Track Recorder/Reproducer



OPERATION/MAINTENANCE

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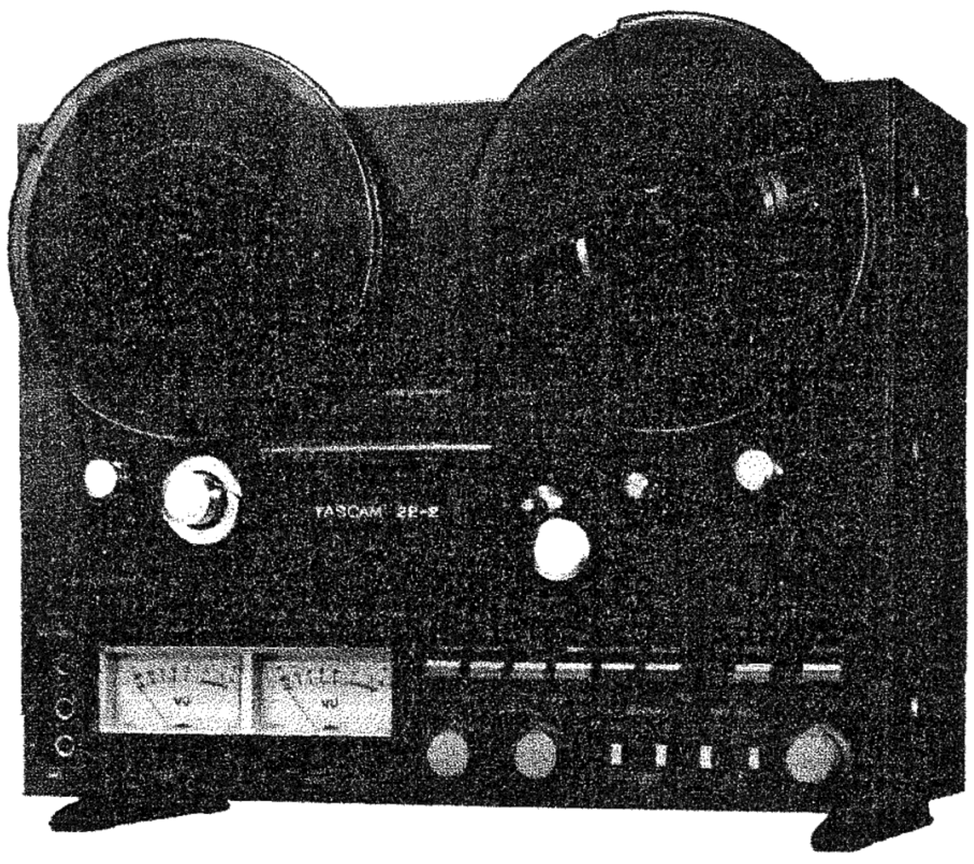
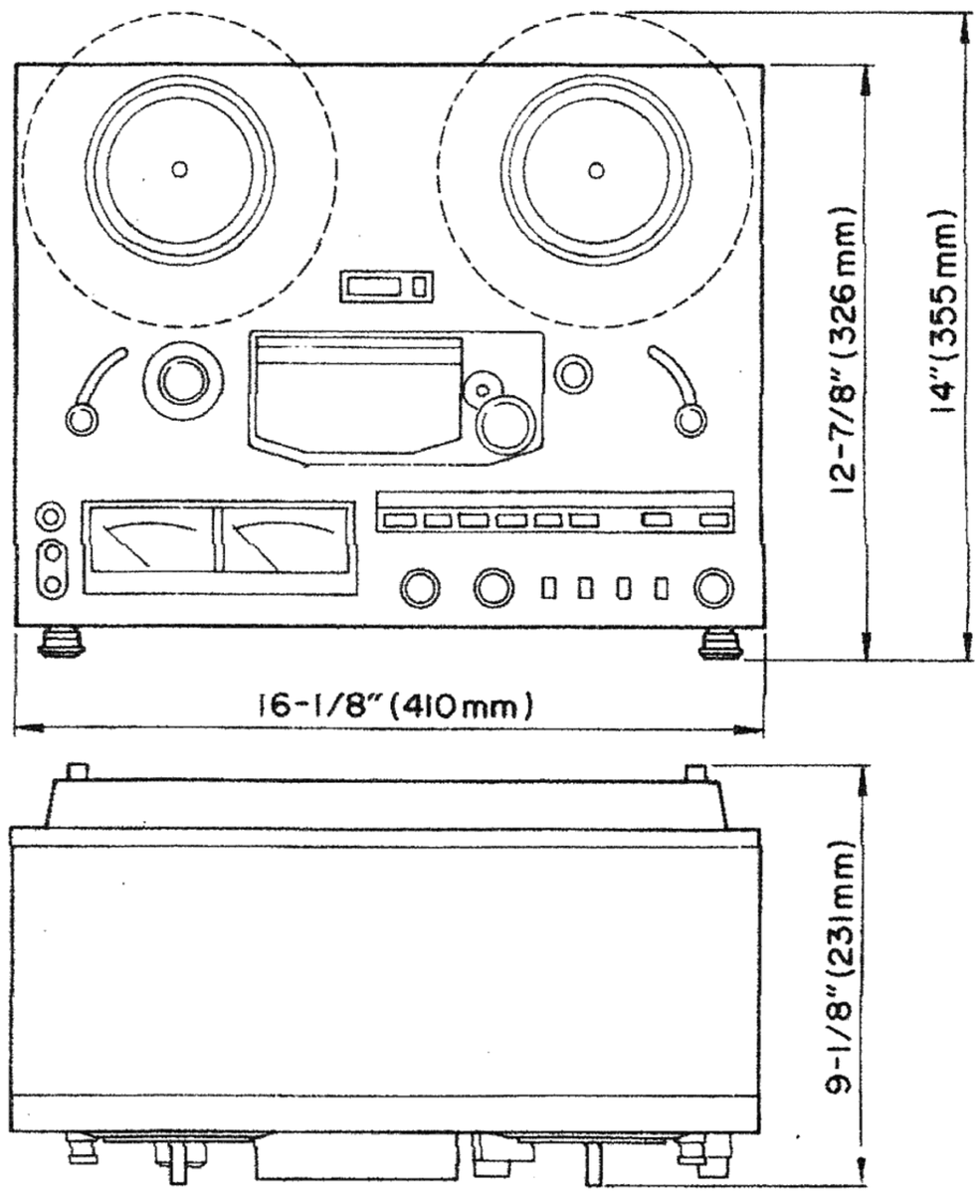




INTRODUCTION

1 What you have bought . . . . .
The TASCAM 22-2 is a 2-track, 2-channel recorder-reproducer especially designed to provide quality recording capability of fully professional standard in a cost-effective and convenient format. Two speeds (15 and 7-1/2 ips), a new light touch locking switch transport control system capable of remote pause in both the record and play modes, and the 3-motor, 3-head design make the 22-2 unique in terms of quality performance, flexibility, and operating convenience.

2 What you do not have . . . . .
The 22-2 was not designed as a purely domestic stereo tape deck complementing a home hi-fi system, and has therefore replaced some of the more conventional features of a domestic deck with those that are especially intended to both facilitate the recording process as well as to improve recording quality to equal that of professional standards. Such conventional features such as bias and EQ switches and full remote control have been omitted in favor of such special features as: remote pause control capability to facilitate final master tape editing as well as transport control during a recording session, factory calibrated bias and EQ for optimal recording quality, a 3-head, 3-motor design using a 1-mil half-track tape format for optimal precision, reliability and performance, and independent selection of record or reproduce mode for either track with tape or source monitoring.

This tape deck has a serial number located on the rear panel. Please record the model number and serial number and retain them for your records.
Model number_____
Serial number_____

WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

* dbx noise reduction system made under license from dbx, Incorporated. The name "dbx" and the dbx symbol are trademarks of dbx, Incorporated.

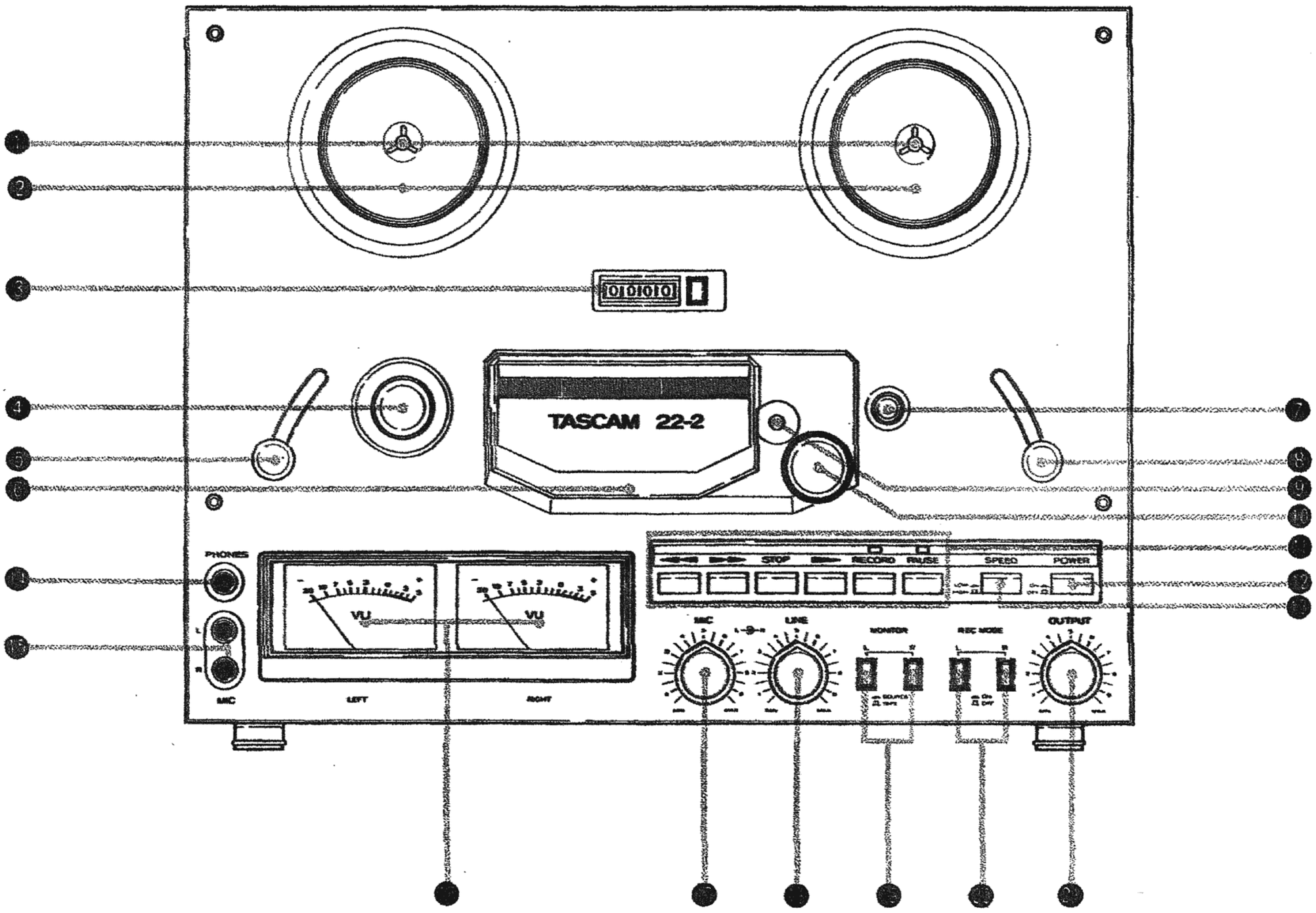
Bias and equalization
Tapes differ considerably in their bias and EQ requirements. Many tape decks therefore provide switchable or continuous adjustment for these two parameters. There are two reasons why we at TEAC felt that this was a facility we could dispense with without compromising on quality.
The fact is that most studios don't use a variety of tapes. They choose one type and stick with it. If different types of tape are in constant use, the deck has to be constantly realigned to suit the tape in use. This is an extremely time-consuming procedure.
22-2 has been factory adjusted for optimum results with TEAC YTT-8013, and the 22-2 may also be used with tapes listed below.

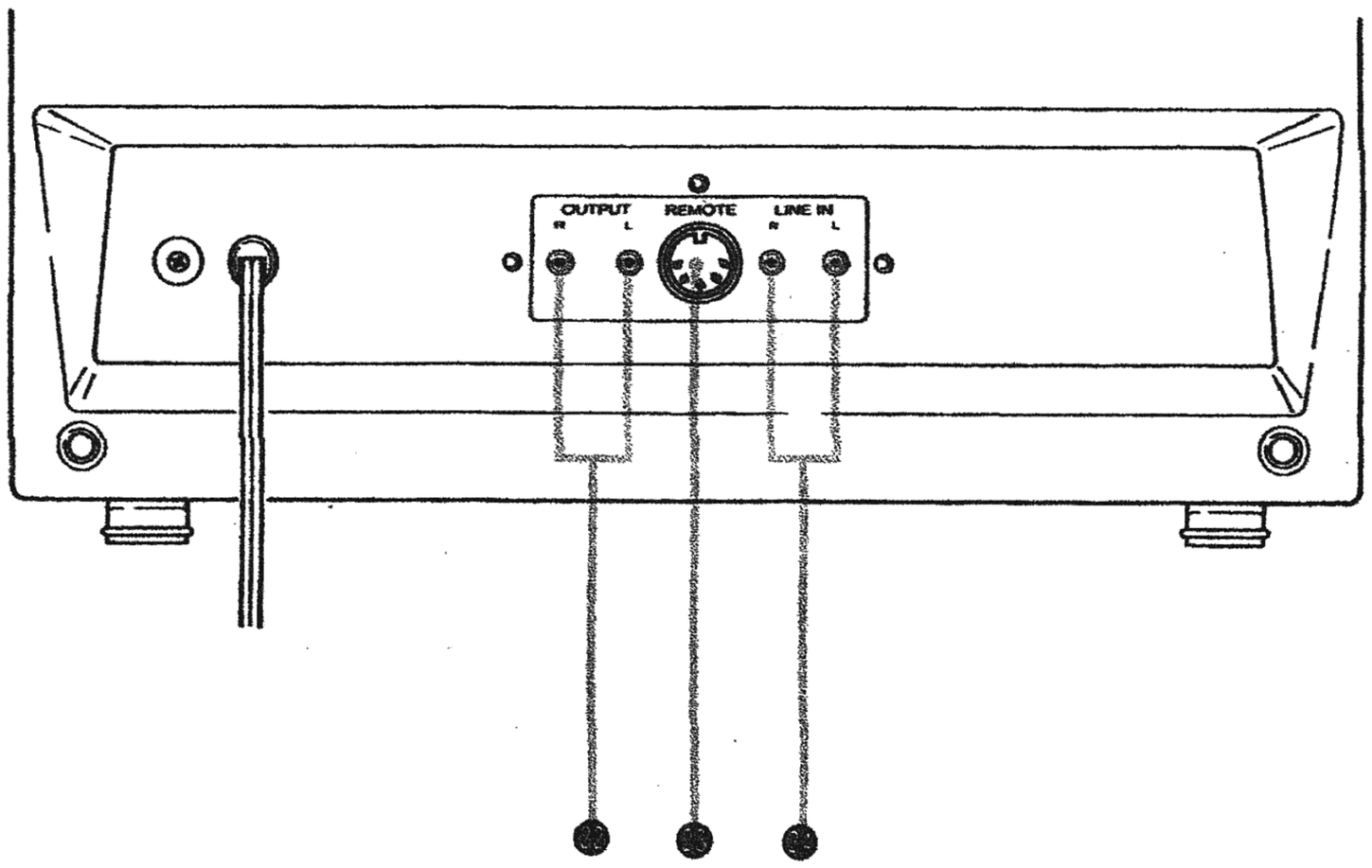
Which tapes to use
Use of the recommended tapes in the chart below will ensure optimum performance from your 22-2. The use of tapes other than those that we recommend for the 22-2 will produce results that may lie outside the limits of our published specifications. The use of 1-1/2 mil tape is not recommended. If you have a special reason or need to use a tape other than one of those recommended, we suggest you ask your dealer to readjust the bias and EQ.
It is good professional practice to standardize on one particular tape.

BRAND	TAPE DESIGNATION
AMPEX	357, 407
MAXELL	UD, UD-XL
SCOTCH	227, 207
SONY	DUAD
TDK	ADUA (L SERIES)

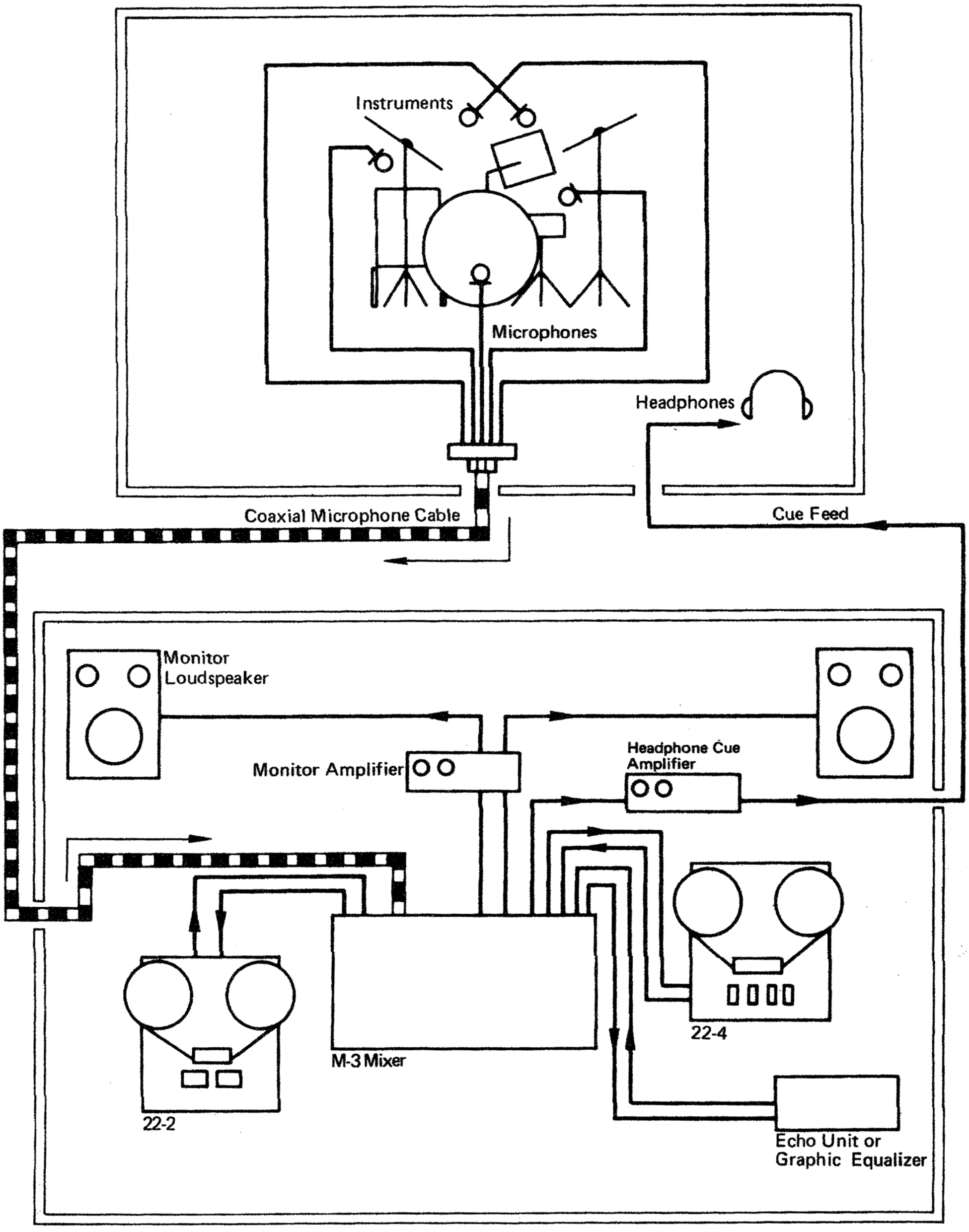
1 OPERATION

1-1 FEATURES AND CONTROLS





Typical recording set-up



❶. Reel retainer

❷. Reel table

3. Tape counter and Reset button
The four-digit counter provides an indication of relative tape position in reference to a starting position of 0000. The counter is incremented when the tape is advanced and decremented when the tape is rewound. Pressing the reset button clears the counter for a beginning reference position of 0000.

❹. Tape guide roller

❺. Tension arm (Left)

❻. Head housing

❼❽. Guide post, Right tension/Shut-off arm

❾. Capstan shaft

❿. Pinch roller

⓫. Control buttons
(▶▶) Fast-Forward button
Pressing this button advances the tape at a high speed and cancels the record mode if previously engaged.

(◀◀) Rewind button
Pressing this button rewinds the tape at a high speed and cancels the record mode if previously engaged.

STOP button
Pressing this button stops tape transport and cancels the record mode if previously engaged.

(▶) Play button
Pressing this button advances the tape at the selected speed for recording or for reproducing recordings. For recording, this button must be pressed simultaneously with the RECORD button after the appropriate REC MODE button(s) has/have been engaged.

RECORD button
After pressing the REC MODE button(s) corresponding to the track(s) to be recorded on, pressing this button simultaneously with the play button initiates recording on the selected track or tracks.

PAUSE button
Pressing this button temporarily halts the record or playback modes by stopping tape transport, but unlike the STOP button, neither mode is cancelled and may be resumed by simply pressing the PAUSE button again.

***RECORD/PAUSE function**
Simultaneously pressing the RECORD, play, and PAUSE buttons places the deck in the record-standby mode prior to recording. This is useful for making any last-minute adjustments or monitoring for precise levels before actually beginning to record. In this way, recording can be initiated by simply pressing the PAUSE button again after adjustments have been completed without having to engage, disengage, and re-engage the record mode.

⓬. POWER switch

⓭. SPEED selector
Depress for low speed (7-1/2 ips) and release for high speed (15 ips). Higher speed gives higher recording quality, whereas lower speed gives greater economy as it uses only half as much tape for a given recording time. It's an artistic/financial trade-off which you will have to make.

⓮. PHONES jack
This allows the connection of 8-ohm stereo headphones for monitoring or simply to enjoy private listening.

⓯. MIC input jacks (L . R)
These allow connection of two microphones for left and right channel stereo recording or one microphone for single-channel recording. Microphones with impedances from 200 ohms to 10k ohms are recommended; however, those with impedances between 150 to 200 ohms may also be used.

⓰. VU meters (L . R)

⓱. MIC control knob
This knob controls the level of the signals input from the MIC jacks. Left and right controls are geared together to allow simultaneous adjustment of both channels, or by holding the opposing channel control steady, either channel can be adjusted independently.

⓲. **LINE control knob**
This knob controls the level of the signals input from the LINE IN terminals. Left and right controls are geared together to allow simultaneous adjustment of both channels, or by holding the opposing channel control steady, either channel can be adjusted independently.

MIC and LINE mixing
Due to the provision of both LINE IN terminals and MIC input jacks, line input and mic input sources can be connected and recorded simultaneously, and mixed for optimum blending and balance by adjusting the MIC and LINE control knobs.

⓳. **Monitor buttons (L . R)**
For recording, these buttons allow either the original source or the taped signals to be monitored to check for proper recording set-up and balanced levels. These buttons control which signals are sent to the PHONES jack and OUTPUT terminals for monitoring over headphones or via speakers. In the SOURCE position (⏢), the original source is monitored, and in the TAPE position (⏢), the signals actually recorded on the tape are monitored. Buttons for left and right channels are provided to allow either channel to be monitored independently as well as both channels monitored together. For playback, these buttons should be in the TAPE position. Regardless of the position of the MONITOR buttons, the VU meters are only affected by the LINE and MIC controls. The setting of the OUTPUT control knob has no affect on the reading of the VU meters.

⓴. **REC MODE buttons (L . R)**
Pressing either one of these buttons, or both, will make the corresponding track or tracks ready for recording, and will be recorded on when the RECORD and play buttons are pressed simultaneously. Buttons for left and right channels are provided to allow independent recording on either channel.

㉑. **OUTPUT control knob**
This knob controls the level of the signals sent to both the PHONES jack and the OUTPUT (L & R) terminals. Left and right controls are geared together to allow simultaneous adjustment of both channels, or by holding the opposing channel control steady, either channel can be adjusted independently. Use this knob to set optimum monitoring or listening levels.

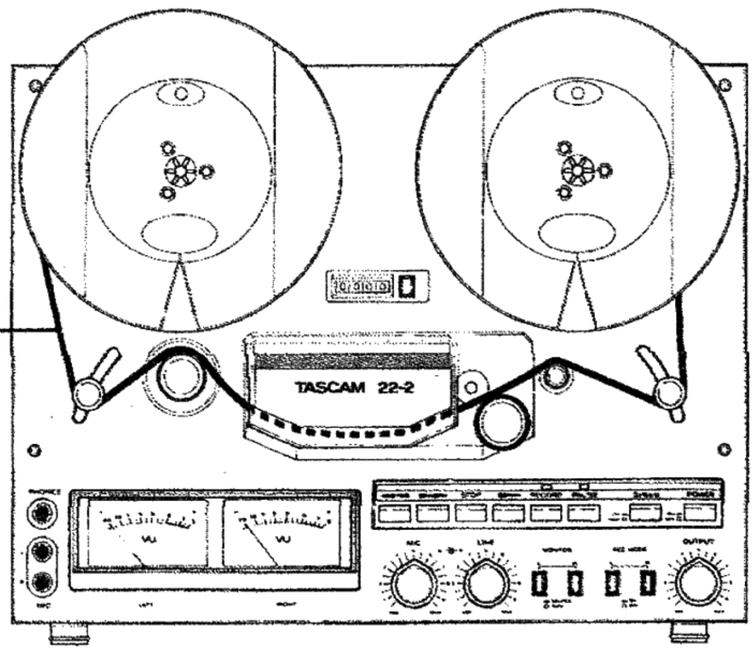
㉒. **OUTPUT terminals (L . R)**
These two RCA-type pin terminals output an amplifier, the input or off-the-tape signals for each channel, as selected by the MONITOR buttons, these terminals may be connected to the input of an amplifier, a mixer, etc., depending upon the application for which the 22-2 will be used. Do not connect to an input with an impedance of less than 10k ohms.

㉓. **REMOTE (DIN) terminal**
This terminal allows the connection of an optional pedal PAUSE remote control device. The use of this device facilitates the final editing of a master tape by being able to place the deck in the pause mode with a foot pedal.

㉔. **LINE IN terminals (L . R)**
This is the interface between the 22-2 and the rest of your recording set-up. These are RCA-type terminals with an input impedance of 50k ohms with a -10 dB line-in level corresponding to 316 mV. The output of a mixer, signal processor, multitrack recorder, another two-track deck, an amplifier, etc., may be connected to these terminals, depending upon the application for which the 22-2 will be used.

***INPUT and OUTPUT levels**
Stated at its simplest, these levels should be set so that the signal strength is strong enough to require minimum amplification to produce a clear sound at a comfortable listening level to obtain the highest signal-to-noise ratio, while at the same time, not so strong as to cause tape saturation or clipping at the highest levels of the signals, producing distortion. If you do not have access to any test equipment or test tapes, a good working position for the output controls would be position "7". From that position, careful monitoring and experimentation will help you determine the optional setting. For input the source signals at moderate to high levels should register around -3 to 0 VU on the VU meters. The loudest peaks may briefly register in the red zone, but if the needles seem to spend a lot of time in the red zone, the input levels should be reduced. For more information on setting the correct input and output levels, see the section on "Calibrating" on page 9.

1-2 BASIC OPERATING PROCEDURES



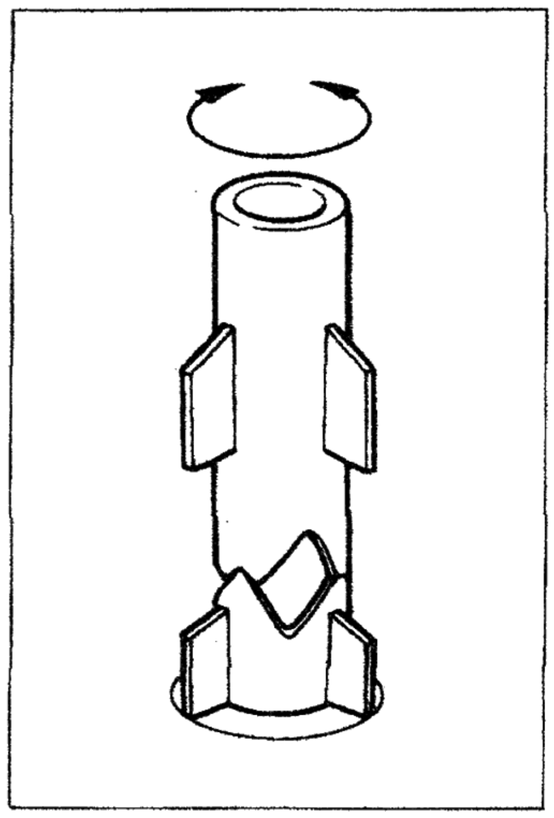
1-2-1 Threading the tape

Use the same size and type of reel on both reel tables, as mixing reels causes uneven tension. If you use metal reels, be sure that the flanges (sides) don't get bent as this will damage the tape.
Load a full reel on the supply (left) reel table and route the tape as shown in the illustration. Wind a reasonable length onto the take-up (right) reel table by hand. The right tension arm must be lifted by the tension of the tape, otherwise the deck will not operate. Always make sure that the tabs on the "QUIK LOK" reel retainers ❶ are turned to secure the reels.

NOTE: If you use a reel of tape that has been stored "tails out" (see page 11, "Editing and Tape Storage"), it must be placed on the right reel table and rewound to the left.

1-2-2 Erasing the tape

A previously-recorded tape is automatically erased when you make a new recording on it. If only one REC MODE button is pressed, only the channel corresponding to that button will be erased by the new material being recorded on that channel. For the best-quality recordings and for convenience, we recommend the TEAC E-2A bulk eraser. This will erase your tapes cleanly in one pass for the best signal-to-noise ratio. Another way to erase is to record with the input controls set to the minimum levels.



1-3 MAKE A TWO-TRACK RECORDING

If you do not have previous recording experience, or as a simple and easy way to get a feel for the basic handling procedures of the 22-2, we suggest that you first make a stereo recording from a convenient source such as a record or an FM broadcast from a tuner. First load a tape as previously described, then, as a precautionary measure, make sure that all rotary controls are turned fully counterclockwise and that all pushbuttons are out. Next, follow the procedures explained below.

1-3-1 Input connection

Locate the two LINE IN terminals on the rear panel. Connect the output from a cassette deck, amplifier, or receiver, etc., to LINE IN L and R (24) using a pin cord connecting cable. Turn on the cassette deck or amplifier. Turn on the 22-2 by pressing the POWER switch ⓬ in. The VU meters should now light. Next, plug a pair of headphones into the PHONES jack ⓮ . Press the REC MODE buttons ⓴ in to make both tracks ready for recording. Put the deck in the record-standby mode by simultaneously pressing the RECORD, play, and PAUSE buttons ⓫ . The red RECORD LED and the green PAUSE LED will light. Depress the MONITOR buttons ⓳ to the SOURCE position. Turn up the LINE control knob for a suitable level on the VU meters (see page 6). Turn up the OUTPUT control knobs ㉑ . You should now be able to hear the source over the headphones. You are now monitoring the source, but the deck will not record until first placed in the record mode.

1-3-2 Enabling the record mode

Press the counter reset button ❸ to clear the counter and begin the recording with a starting tape reference position of 0000. Press the PAUSE button again to release the record-standby mode. The deck will immediately go into the record mode. The RECORD LED will stay lit, but the PAUSE LED will go out. The reels will start to rotate, and the source signals will be recorded. The sound that you are hearing is the original source, and not what is being recorded on the tape.

1-3-3 Monitoring off-the-tape

To find out what the signals actually being recorded on the tape sound like, press the MONITOR buttons ⓳ to the TAPE position. You can now hear the actual signals coming off the tape.

By changing the MONITOR button from SOURCE to TAPE, you can compare the sound of the original source with that recorded on the tape. There will be some slight difference between the two positions regarding the place being monitored, owing to the distance between the record and playback heads, but other than that, the two sounds should be identical. If not, you know that some switch has not been properly set.

1-3-4 Now play it back

When you have recorded enough to satisfy your curiosity, rewind the tape by pressing the rewind (◀◀) button ⓫ . When the tape counter reaches 0000, stop the tape by pressing the STOP button ⓫ . Release the two REC MODE buttons and set the deck in the playback mode by pressing the play (▶) button.

1-4 SUPPLEMENTAL INFORMATION

1-4-1 Impedance matching

Impedance means opposition to an AC signal and can be thought of as the AC equivalent of resistance. All electronic devices, including cables, microphones, mixers, etc., have impedance, which is measured in ohms. It is important that the impedances of one device connected to another are compatible. If not, the signals passing between the two devices may be significantly attenuated, modified, or distorted. In some cases, if the mismatch is particularly severe, circuits on one or the other device may be destroyed.

The general thinking is that output impedance should be low and should be matched with a high input impedance. In order to guarantee a safe connection, the input impedance of a device should be a minimum of seven times the output impedance of a device from which it is receiving input. Never connect two devices in which the input impedance of one is less than seven times the output impedance of the other. When connecting one output to more than one input, divide the impedance of the input with the lowest input impedance value by the total number of inputs to be connected, and if the result is still at least seven times greater than the output impedance, then the impedances are correctly matched. For instance, if you're connecting an output with an output impedance of 100 ohms to four inputs with input impedances of 50k ohms, 50k ohms, 15k ohms, and 10k ohms, respectively, then divide 10k ohms by four, and if the result (2.5k ohms) is seven times greater than the output impedance (which in this case it is), then it's safe to make the connection.

Don't be confused by terminology. For instance, the specifications for a particular device may recommend a maximum load impedance of a certain value. This means that the total input impedance, or maximum load, should be no lower than the value specified. Note that summing the impedances of more than one input lowers the total input impedance, and lowering the input impedance increases the load on a line. Remember, total input impedance must be no less than seven times the output impedance, so the higher the total input impedance the better, and the lower the total input impedance, the greater the load on the line. When in doubt about matching the impedances of any devices, consult your dealer.

NOTE: The method given above does not provide the exact load impedance on a line, but is a simple, easy-to-remember method to obtain a safe approximation of the load impedance so that you can be sure that you do not overload the line. For those interested in the exact values, the formula for two or more parallel inputs is:

$$RX = \frac{R1 \times R2 \times R3 \cdots Rn}{\frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} \cdots \frac{1}{Rn}}$$

1-4-2 Calibrating

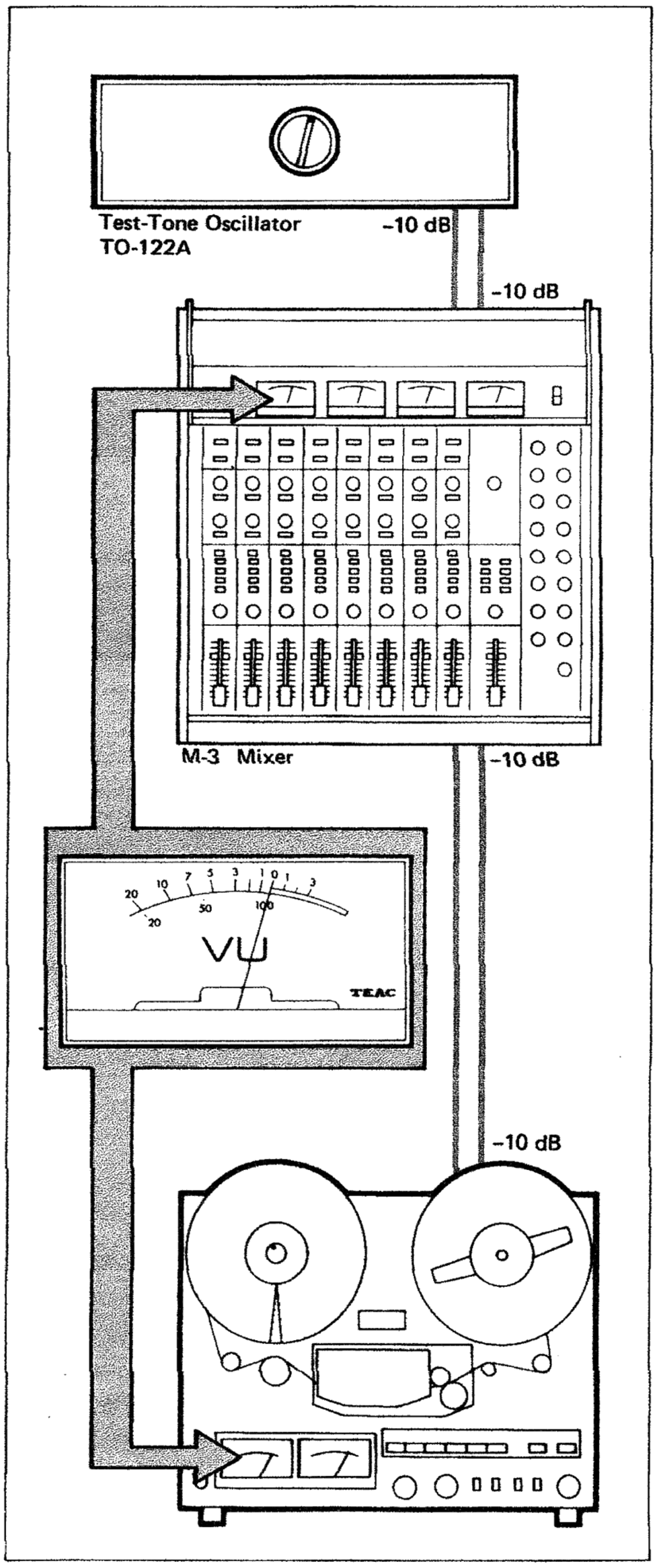
"Calibration" simply means matching all the reference levels in your recording system to ensure that signals from one element in the system are equally interpreted by all the other elements in the system.

If you're really serious about making true professional-quality recordings, then a reliable tone generator is a necessity in order to accurately calibrate your system. We recommend the TEAC TO-122A test-tone oscillator. When using a tone generator, select a signal that will be equivalent to 0 VU when passed through the device to which you are calibrating the 22-2. For example, if you are using a mixer with 0 dB referenced to 1 V (TASCAM mixers and recorders all use this reference level) and the mic input level is –60 dB and the line level (both input and output) is –10 dB, then, with the mixer's faders set to the shaded area, a 1 mV signal fed through the mic input or a 316 mV signal fed through the line input can be used to precisely establish the 0 VU level on the mixer. In this case (as with TASCAM line), –10 dB corresponds to 0 VU. If the equipment you are using references 0 dB to .775V rather than 1V, then a correction factor of –2.2 dB will have to be used to compensate for the difference.

The frequency of the tone used as the calibration signal has little affect on calibration, so any reasonable frequency may be used (400 Hz or 1 kHz is recommended). If you wish to calibrate your system without a tone generator, any source that produces a sustained tone, such as a musical instrument or even a vacuum cleaner, can be used to generate a reference signal; however, since there is no way to measure the reference level of such a signal, experimentation with microphone placement and/or different volumes will be required to establish a reasonable recording reference level.

To calibrate, use a sustained tone and set the controls on your mixer and/or multitrack recorder so that their VU meters read 0 VU, and, passing the signal through the multitrack recorder and/or mixer, set the controls on the 22-2 so that its VU meters also read 0 VU. After calibrating your system, make all subsequent level adjustments from the mixer or the first unit receiving input in the recording chain; do not change the controls on the rest of your equipment.

NOTE: Peak meters may vary considerably in the values which are equivalent to 0 VU. If any of the equipment in your system uses peak meters, make sure you match your peak meter levels to correspond to 0 VU; do not automatically assume a direct correlation between the readings on the two different types of meters.



1-4-3 Dynamic range and dbx noise reduction

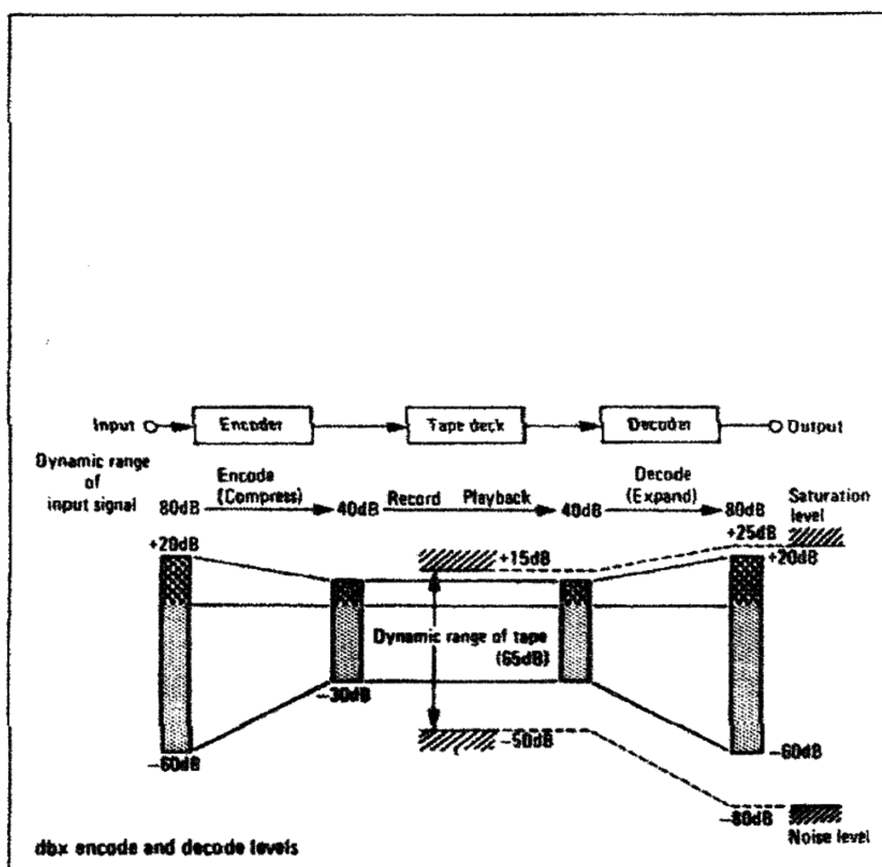
"Dynamic range" refers to the contrast between the softest musical passages and the loudest. Music quite often contains dynamic ranges of up to 80 dB, or even as high as 100 dB. Unfortunately, recording tape is limited in the amount of dynamic range it is able to record due to the level of inherent noise on the tape and the level of signals the tape can accept before it reaches a saturation point. The dynamic range of even the best recording tape is limited to about 70 dB; therefore, some of the drama and impact of the music is lost as a result of the limitations of the recording media itself.

dbx noise reduction systems serve two related purposes — *to reduce the relative level of inherent noise on the tape, and thereby restore the dynamic range of the taped signals.* Without getting into the pros and cons of which system is better, we can state that both systems are broadly comparable, but using a dbx noise-reduction unit gets you into the world of professional noise reduction at a fraction of the outlay for a Dolby A system (not to be confused with "domestic" Dolby NR as used in cassette decks).

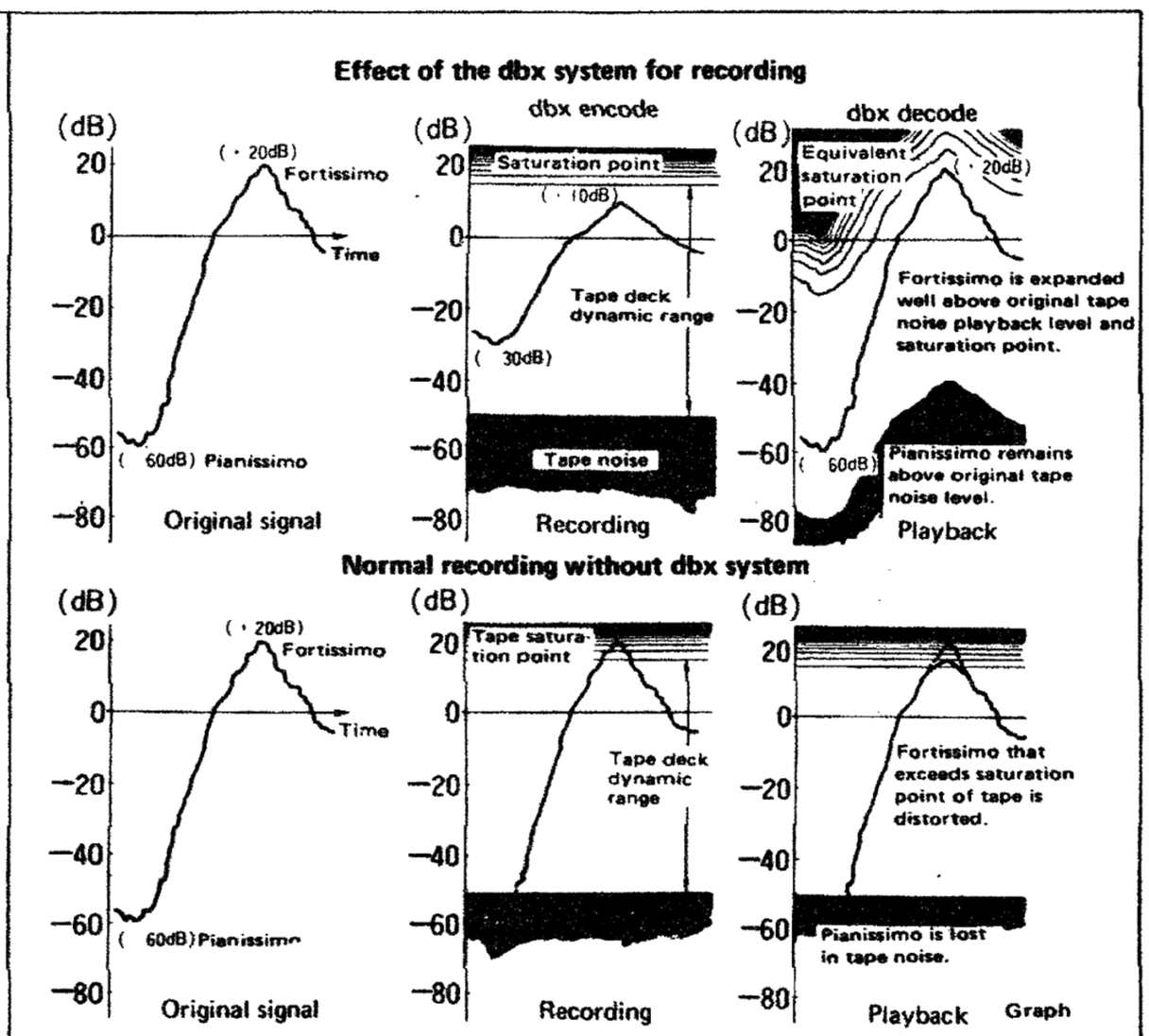
In simple, non-technical terms, dbx improves tape machine performance and it simplifies recording. It becomes possible to make recordings that are nearly indistinguishable from the live performance and copies with no more noise than the original.

Technically speaking, dbx is a "compander" system (compressor + expander), with 2 parts, encoding and decoding. The dbx encoder circuitry compresses ("squeezes") the level of the signal being recorded by a 2:1 ratio. Loud parts are made quieter, and the quiet parts louder. Upon playback, the decoder circuitry expands ("stretches") the dynamic range by a 1:2 ratio to restore the original dynamics; the loud parts get louder, and the quiet parts quieter, reducing the tape noise.

Because tape noise is additive when tracks are combined during mixdown, dbx noise reduction is especially valuable with multitrack tape formats. It permits the narrower tape tracks of TASCAM recorders to deliver signal-to-noise and crosstalk performance on a par with, or better than, that obtained from traditional full-width multitrack tapes.



dbx encode and decode levels



Graph

1-4-4 Editing and tape storage

Never use ordinary adhesive tape for this vital procedure. Use only the special tape made exclusively for tape editing. Monitor with the MONITOR button(s) in the TAPE position. When you have located the precise point to make the cut, stop the tape and mark the back of the tape with a Chinacraft type pencil (yellow is the most popular color) at the center of the playback head (the right-most head as you face the deck). The use of non-magnetic tools is highly recommended. A good quality machine-milled tape-editing block will help ensure good edits. Placing the deck in a horizontal position will make editing much easier.

Tapes should be stored in a cool, dry place well away from the influence of magnetic fields. Print-through (the unwanted transfer of magnetic signals from one part of the tape to an adjacent part of the tape, causing "echos") may be reduced by winding (NOT fast winding) the tape onto the take-up reel at normal playing speed for storage. When the tape is played again, it is first rewound at a high speed onto the supply reel. This is called storing the tape "tails out" and is a common practice in many studios. A helpful idea is to use white leader tape at the beginning and red leader tape at the tail end. The analogy with vehicle head and tail lights is then an easy way to remember which end is which.

1-5 CARE AND MAINTENANCE

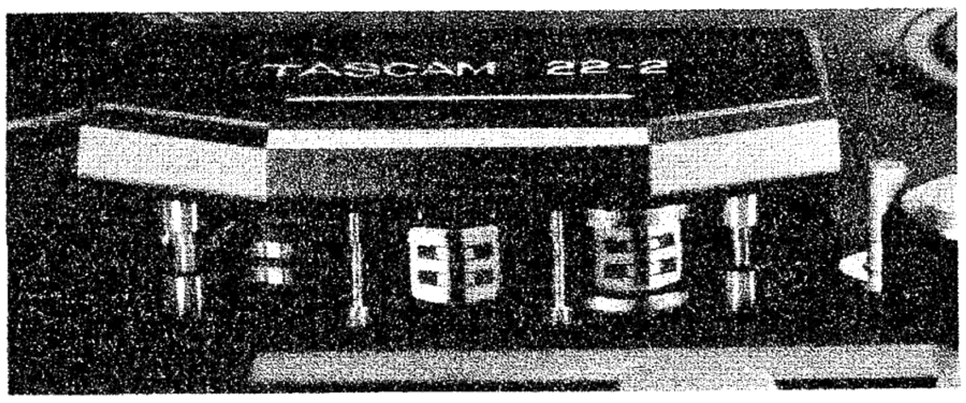
1-5-1 Cleaning

Uneven head wear, a serious problem on all tape decks, can be prevented by closely following a regularly scheduled cleaning routine. Cleaning is simple and easy, requiring only two special fluids and cotton swabs (we recommend the TEAC TZ-261 cleaning kit, but any equivalent kit or proper fluids and swabs are acceptable).

To clean, simply remove the head housing cover and apply head cleaning fluid with the swab applicators to each of the heads, wiping the heads until the surface is thoroughly cleaned. Also, using head cleaning fluid, clean the capstan shaft, the tape guides, and all ferrous parts in the tape path. The pinch roller must be cleaned using rubber cleaning fluid. (The pinch roller material is very sensitive. Protect it from contact with any foreign substances except the proper rubber cleaning fluid. Even touching the pinch roller with your fingers can contaminate the material.)

Periodic cleaning is essential to maintain optimum performance levels and to maximize product life. With experience you may determine your own cleaning schedule that best suits your recording requirements and conditions; however, to ensure that your deck is kept in the best possible condition, we recommend cleaning before and after every recording session, everytime you take a break in the middle of a recording session, and after every six hours of use.

DON'T OVERLOOK THE IMPORTANCE OF CLEANING. INSUFFICIENT CLEANING IS THE NUMBER ONE CAUSE OF THE DEGRADATION OF PERFORMANCE LEVELS.



1-5-2 Degaussing (Demagnetizing)

IMPORTANT:

1. Do not overlook the importance of degaussing. Magnetism in the tape path can significantly degrade performance. In extreme cases, the heads may not respond to signals at all.
2. Turn off the deck before degaussing.
3. Do not turn the degausser off or on while it is in close proximity to the tape path.
4. Keep all recorded tape a safe distance from the degausser.

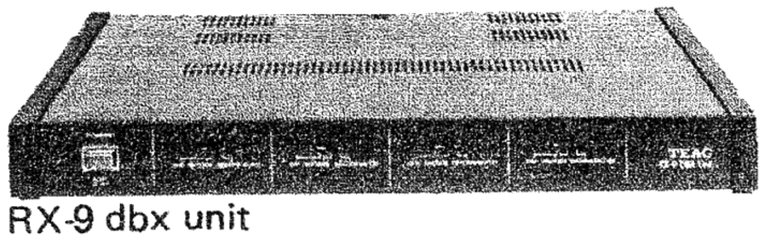
Even a small amount of magnetic build-up can have a noticeable affect on performance. As the level of magnetism increases, the more the ability to respond to high-frequency signals is impaired. To keep your deck performing to the best of its ability, the heads and all ferrous parts in the tape path must be degaussed (demagnetized) periodically. Degaussing requires the use of a special device called a degausser (we recommend the TEAC E-3 degausser, but any equivalent product is acceptable). Degaussing is easy and requires a minimal amount of time.

1. To begin, remove the head housing cover. Before turning on the degausser, make sure that the power to the deck has been turned off.
   NOTE: This is very important because with the deck on, the signals produced by the degausser will register at extremely high VU levels, possibly causing serious damage to the deck's circuitry and/or VU meters.
2. Turn the degausser on at least three feet away from the deck.
   NOTE: Keep all prerecorded tapes a safe distance from the degausser, otherwise the signals from the degausser could erase your tapes.
3. Slowly bring it toward the heads. Move the degausser slowly up and down in close proximity to all ferrous parts in the tape path, including the heads, capstan shaft, tape guides, etc.
4. Slowly move the degausser at least three feet away from the deck before turning it off.

1-5-3 Lubrication

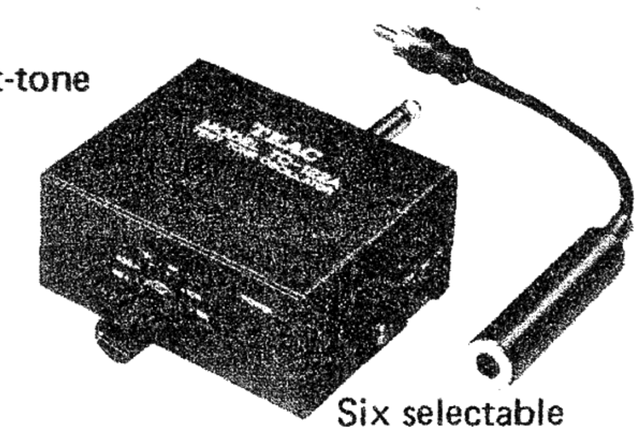
Lubrication is only required very infrequently, and must be done by a qualified TEAC service technician. Consult your dealer on this matter. DO NOT ATTEMPT TO LUBRICATE THE 22-2 YOURSELF.

1-6 ACCESSORIES

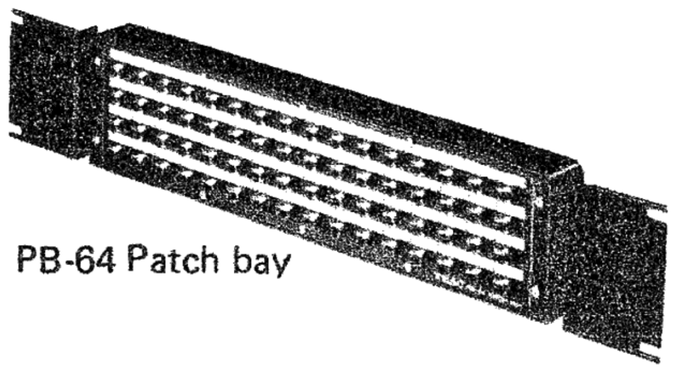


RX-9 dbx unit

TO-122A Test-tone oscillator

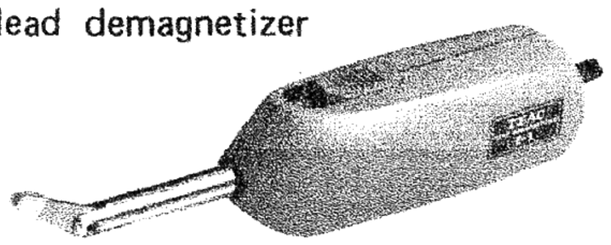


Six selectable frequencies



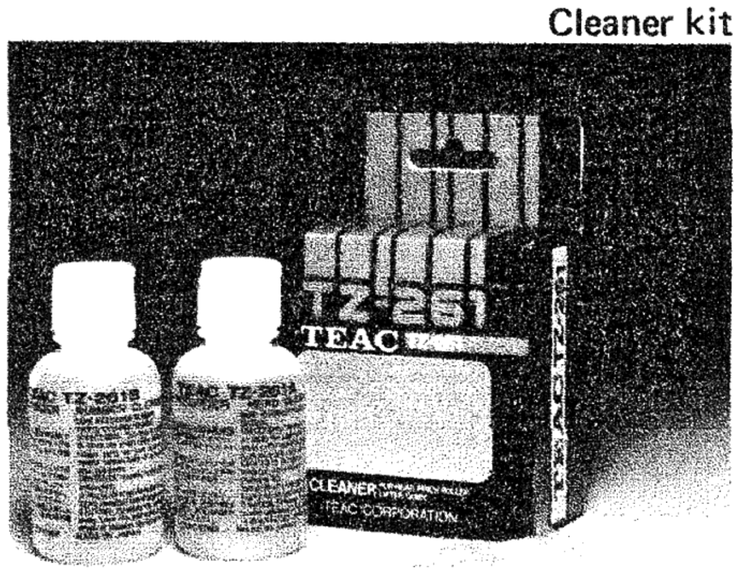
PB-64 Patch bay

E-3 Head demagnetizer



E-2A Bulk eraser

TZ-261
Cleaner kit



1-7 SPECIFICATIONS

MECHANICAL

1.	**Tape:**	1/4 inch, 1.0 mil, low noise, high output tape
2.	**Track Format:**	2-track, 2-channel, track width 0.068 inch (1.75 mm)
3.	**Reel Size:**	7" maximum per EIA/ANSI standard
4.	**Tape Speeds:**	15 and 7-1/2 inches per second, switchable
5.	**Speed Accuracy:**	15 ips ±1.0 % deviation 7-1/2 ips ±1.0 % deviation
6.	**Wow and Flutter:**	• 15 ips (1) 0.07 % peak (DIN/IEC/ANSI weighted)
		0.12 % peak (DIN/IEC/ANSI unweighted)
		0.04 % RMS (JIS/NAB weighted)
		0.07 % RMS (JIS/NAB unweighted)
		• 7-1/2 ips (2) 0.09 % peak (DIN/IEC/ANSI weighted)
		0.14 % peak (DIN/IEC/ANSI unweighted)
		0.05 % RMS (JIS/NAB weighted)
		0.08 % RMS (JIS/NAB unweighted)
7.	**Fast Wind Time:**	120 seconds for 1,800 feet
8.	**Start Time:**	15 ips: less than 0.5 sec. to reach standard wow and flutter
9.	**Capstan Motor:**	FG (frequency generator) DC servo motor
10.	**Reel Motors:**	2-AC eddy current induction motors
11.	**Head Configuration:**	3 heads; erase, record and reproduce
12.	**Dimensions:**	(W) 16-1/8" x (H) 12-7/8" x (D) 9-1/8" (410 x 326 x 231 mm)
13.	**Weight:**	30.8 pounds (14 kg), net

ELECTRICAL

1.	**Microphone Input:**	Input source impedance 200 ohms normal
	Nominal input level:	-60 dB (1.0 mV)
	Minimum input level:	-70 dB (316 μV)
	Maximum input level:	-30 dB (25 mV)
2.	**Line Input:**	
	Input impedance:	50k ohms, unbalanced
	Maximum source impedance:	10k ohms or less
	Nominal input level:	-10 dBv (0.3 V)
	Minimum input level:	-20 dBv (100 mV)
3.	**Line Output:**	
	Output impedance:	1k ohms, unbalanced
	Minimum load impedance:	10k ohms or higher
	Nominal output level:	-10 dBv (0.3 V)
	Maximum output level:	0 dBv (1.0 V)
4.	**Headphone Output:**	300 mW maximum at 8 ohms, stereo headphones
5.	**Bias Frequency:**	100 kHz
6.	**Equalization:**	NAB (National Association of Broadcasters)
		3180 μsec + 50 μsec at 15 and 7-1/2 ips
7.	**Frequency Response: (3) (Record/Reproduce)**	• 15 ips 40 Hz – 22 kHz, ±3 dB at 0 VU
		35 Hz – 25 kHz, ±3 dB at -10 VU
		• 7-1/2 ips 40 Hz – 18 kHz, ±3 dB at 0 VU
		40 Hz – 20 kHz, ±3 dB at -10 VU
8.	**Total Harmonic Distortion: (THD)**	1.0 % at 0 VU, 1,000 Hz, 185 nWb/m
		3 % at 10 dB above 0 VU, 1,000 Hz, 585 nWb/m
9.	**Signal-to-Noise Ratio: (3)**	At a reference of 1 kHz, at 10 dB above 0 VU, 585 nWb/m
		• 15 ips 66 dB A weighted (NAB), 58 dB unweighted
		• 7-1/2 ips 64 dB A weighted (NAB), 56 dB unweighted
10.	**Adjacent Channel Separation:**	Better than 50 dB down at 1,000 Hz
11.	**Erasure:**	Better than 70 dB at 1,000 Hz, + 10 VU reference
12.	**Headroom:**	Recording Amplifier – Better than 26 dB above 0 VU at 1 kHz
		Reproduce Amplifier – Better than 38 dB above 0 VU at 1 kHz
13.	**Power Requirement:**	117 VAC, 60 Hz, 70 watts

In these specifications, 0 dBv is referenced to 1.0 Volt.
Specifications were determined using TEAC Test Tapes YTT-2004(1), YTT-2003(2) and YTT-8013(3).
Changes in specifications and features may be made without notice or obligation.

2. THEORY OF OPERATION

2-1. CONTROL SECTION

2-1-1 Capstan motor

The M801 capstan motor which is servocontrolled by an FG (frequency generator).
When the right tension arm is lifted with a tape loaded on the 22-2, shut-off switch S803 is switched to the N.O. (Normally Open) side. As a result, the capstan motor and the servo amplification circuit are connected to GND through D511 and S803, thus starting the capstan motor.
When the right tension arm drops after the end of the tape, S803 is switched to the N.C. (Normally Closed) side. The capstan motor circuit is opened and thus the capstan motor stops.
Refer to the inserted control circuit diagram.

2-1-2 Reset of operating switches

While pressing any of the play (▶), rewind (◀◀) and fast forward (▶▶) buttons (operating switches), bias current is supplied to the base of Q602 through that operating switch and R604 from the +24 V power supply. However, while the tape is in run, Q602 does not go on, because its emitter is open when shut-off switch S803 is set to the N.O. side.
When the right tension arm drops after the end of the tape, S803 is switched to the N.C. side, thus turning on Q602. Thereby, the reset solenoid operates to release the operating switch from mechanical lock. When the operating switch is reset, the bias current to the base of Q602 is interrupted, thus turning off Q602 and at the same time restoring the reset solenoid to its off position.
Refer to the inserted control circuit diagram.

2-1-3 Reel motors (See Fig. 2-1.)

For the reel motors, outer rotor type induction motors are used. C501 and C503 are phase advance capacitors to drive the reel motors and stabilize their rotation. The capacities of C501 and C503 are 3 μF/250 WV at 60 Hz. At 50 Hz, however, C502 and C504 (0.5 μF/250 WV both) are connected in parallel to C501 and C503, respectively.
When the right tension arm is lifted with a tape loaded on the 22-2, shut-off switch S802 is switched from the N.C. to N.O. side. As a result, one side of the AC power supply (the secondary winding of the power transformer) is connected to the reel motor circuit. Voltage is supplied to the reel motors in each operating mode as follows:

Play mode

- When pressing the " ▶ " button, S604 goes on.
- To the right reel motor, 70 V AC is supplied through relay K901-a and K902-a and switch S606-a and S604-a. This voltage is used to produce take-up torque.
- 70 V AC passed across S606-a is supplied to the left reel motor through S604-b after being adjusted by R802. This voltage is used to produce back-tension torque.
- Relay K901 is a "flashing" relay which takes up slack in the tape. Its operation is described under Operation of the "flashing circuit", on page 17.
- Relay K902 is used for the remote control PAUSE operation. Its operation is described in the next paragraph.

PAUSE mode

- When pressing the PAUSE button during the play (or REC/play) mode, S606 goes on.
- When S606-a goes on, the 70 V AC line is opened. The voltage to the right and left reel motors is interrupted, thereby stopping rotation.
- When S606-b goes on, current passes point Ⓐ, S604-d, S606-b, D701 and GND in this order, causing the PAUSE LED to light.
- When pressing the PAUSE button on the remote control unit PR-22 (option), current is fed to the base of Q902 through the PAUSE switch and R904 from the +24 V power supply, thus turning on Q902, thereby operating relay K902.
- When K902 goes on and K902-a is switched to the N.O. side, the 70 V AC line is opened. As a result, the voltage to the right and left reel motors is interrupted, thus they stop rotation.
- When K902-b is switched to the N.O. side, current flows through point Ⓐ, S604-d, S606-b, K902-b, R903, D701 and GND in this order, thus the PAUSE LED lights.

Rewind mode

- When pressing the " ◀◀ " button, S601 goes on.
- 100 V AC is supplied through S601-a and S604-b to the left reel motor, which rewinds the tape at high speed.
- At this time, the voltage, reduced by R801, is supplied to the right reel motor. This applies a light back tension to the tape to prevent it from slackening and shutting off during rewind.

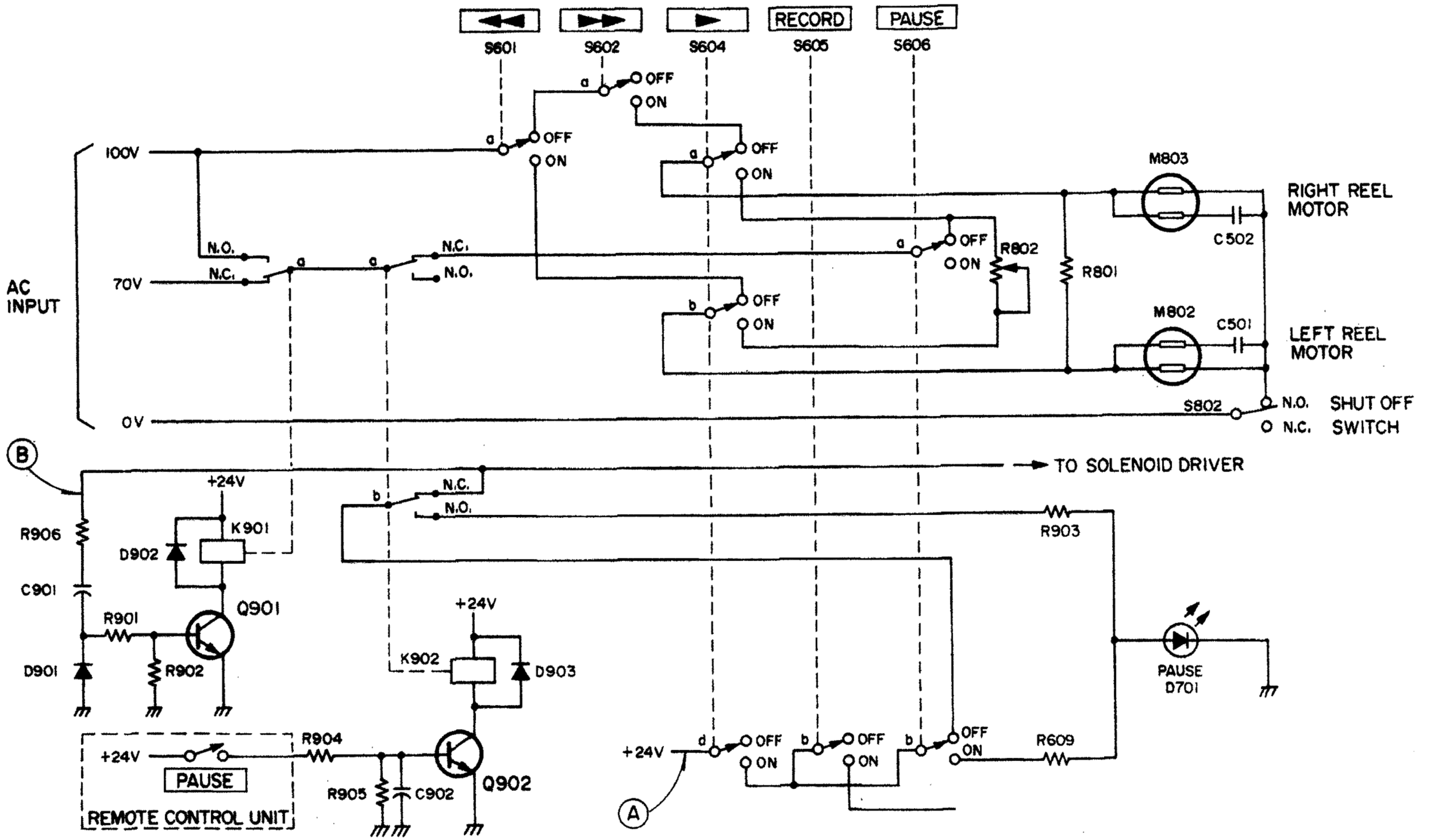


Fig. 2-1 Reel motor drive circuit

Fast forward mode

- When pressing the " ▶▶ " button, S602 goes on.
- 100 V AC is supplied through S601-a, S602-a and S604-a to the right reel motor, to wind the tape at high speed.
- Voltage reduced by R801 is supplied to the left reel motor to apply a light back tension to the tape.

Operation of the "flashing circuit"

(1) Start of play mode

- When pressing the " ▶ " button, the charging current (base current of Q901) is fed to C901 through S604-d, S606-b, K902-b, point Ⓑ , R906, C901 and Q901 in this order from point Ⓐ (+24 V). Q901 is on for about 300 msec until C901 is fully charged. While Q901 is on, flashing relay K901 is also on.
- While K901 is on, relay K901-a is at the N.O. side and 100 V AC is supplied to the right reel motor.
  When C901 has been fully charged, Q901 goes off and then K901 turns off. At this time, relay contact K901-a returns to the N.C. side and the voltage to the right reel motor is switched over to 70 V AC.
- This voltage switch-over operation takes up slack in the tape by temporarily generating a large take-up torque in the right reel motor at the very start of play.

(2) Operation when the PAUSE mode is canceled

- After the play mode starts, when the PAUSE button is pressed, the +24 V supply from points Ⓐ to Ⓑ is interrupted by S606-b.
  When the PAUSE on the remote control unit PR-22 (option, connected to the remote connector on the rear panel) is switched on, Q902 and K902 go on and the +24 V supply to point Ⓑ is interrupted by K902-b.
- C901 completely discharges through D901, C901, R906, and the solenoid drive circuit.
- When canceling the PAUSE mode by pressing the PAUSE button again, S606-b goes off and +24 V is resupplied to point Ⓑ . As a result, charging current flows in C901 and Q901 goes on momentarily. This results in the so-called flashing operation of relay K901.
  When the PAUSE mode is canceled from the remote control unit PR-22, Q902 and K902 go off. At this time, when relay contact K902-b returns to the N.C. side, K901 "flashes" as described above.

2-1-4 Operation of delay circuit (See Fig. 2-2.)

The delay circuit has three main functions:

At power-on

1: When turning on the power supply of the 22-2, this circuit prevents the deck from entering into the operating mode until full stabilization of the amplifier and control circuit voltages, the capstan motor rotation, etc. has been achieved.

- It is now assumed that the POWER (S801), " ▶ " (S604), RECORD (S605) and REC MODE (S101 L and/or R) switches are on and AC power is not supplied to the 22-2. (This state is equivalent to the waiting state when "timer recording".)
- When AC power is supplied to the 22-2 using an external timer, etc. the regulated power supply (Q501 – Q503) supplies a DC voltage to the amplifier and the capstan motor begins to rotate.
- When AC power is supplied to the 22-2, C516 is charged rapidly via route ① and C517 is also charged via route ② . However, due to R527, C517 is charged more slowly than C516. Therefore, the emitter voltage of Q511 will be higher than the base voltage until C517 is fully charged. Thus, Q511 is forward biased and goes on. Q510 is turned on by the collector current of Q511.
- While Q510 is on, Q509 is off, because no base current flows.
  While Q509 is off, Q508 is also off, because no current flows into its base.
- When Q508 is off, even when S604 and S605 are on, no operating signals are fed to the capstan solenoid or brake solenoid drive circuit and the deck is in the STOP mode.
- When Q510 goes off, current is fed to the base of Q509 through R522 and R521 from the regulated voltage supply, thus turning Q509 on. This turns on Q508 as current flows through the emitter and base and thence through R520 and Q509 to GND.
- When Q508 goes on, operating signals are fed to the capstan solenoid drive circuit via route ③ and to the brake solenoid drive circuit via route ④ . The tape begins to run due to the operation of these two solenoids. (Refer to section 2-1-5 "Solenoid drive".)
- At the same time, power is applied to the bias oscillator via route ⑤ .
  The RECORD LED lights due to the current flowing via route ⑥.

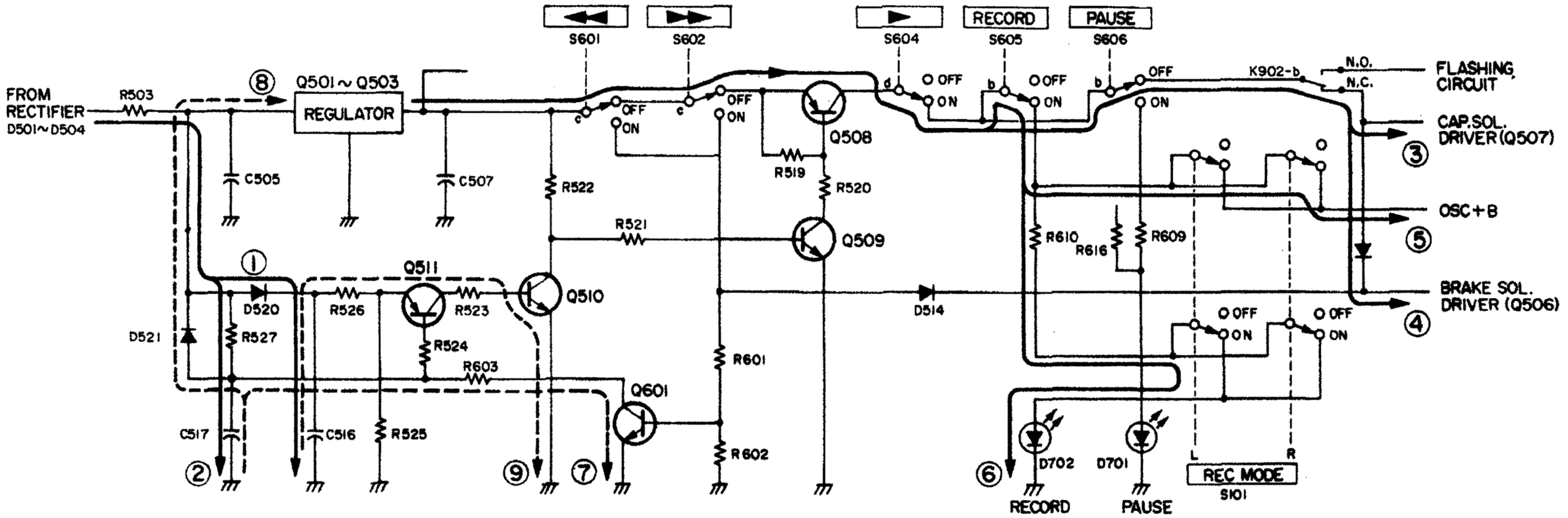


Fig. 2-2 Delay circuit

From the fast to play modes

2: If the " ▶ " (or " ▶ " + RECORD) button is pressed when the deck is in either the rewind or fast forward mode, this circuit changes the mode to play (or REC/play) after the tape has come to a complete stop.

- The brake solenoids operate during the rewind (or fast forward) mode, because of the operating signal from the constant voltage circuit flowing through S601-c (or S602-c) and D514.
  In addition, the base current of Q601 flows through S601-c (or S602-c) and R601 from the constant voltage circuit and thus Q601 is on.
- When Q601 goes on, C517 discharges via route ⑦ , thus reducing the base voltage of Q511 and turning it on. As a result, Q510 goes on and Q509 goes off.
- If the " ▶ " button is pressed with the deck in this state, S604 goes on, resetting S601 (or S602). When S601 and S602 both go off, +24 V is supplied to the emitter of Q508. However, since Q509 is off, no current flows into the base of Q508 so Q508 does not go on.
- When S601-c and S602-c both go off, the base current of Q601 is interrupted, switching it off. Since the brake solenoid signal is also interrupted, the brake solenoid goes off again, braking the right and left reel tables to stop the tape.
- When Q601 goes off, C517 is charged via route ② and the base voltage of Q511 increases gradually.
- When C517 has been charged, about 3 sec after Q601 goes off, Q511 and Q510 go off, Q509 and Q508 go on.
- When Q508 goes on, operating signals are sent to the capstan and brake solenoids via routes ③ and ④ , respectively. As a result, the 22-2 enters into the play mode.

On power-off

3: If the AC power supply goes off while the tape is running, tape slackening and click noises recorded on the tape are prevented by putting the 22-2 directly into the STOP mode.

- Assume the 22-2 is in the REC/play mode (S604 and S605 are both on).
  When AC power supply is turned off by the POWER switch, an external timer switch, or the like, C517 discharges rapidly via route ⑧ , reducing the base voltage of Q511. Q511 goes on immediately and C516 discharges via route 9 , turning Q510 on.
  When Q510 goes on, Q509 and G508 go off. Since the signals via routes ③ — ⑥ are interrupted, the 22-2 enters immediately into the the STOP mode.

2-1-5 Solenoid drive (See Fig. 2-3.)

Two solenoids are used in the 22-2. One is the capstan solenoid which goes on in the play or REC/play mode to operate the pinch roller to run the tape at a constant speed. The other solenoid is the brake solenoid which goes on in the play, REC/play, rewind or fast forward mode to release the brakes on the right and left reel tables.

Play mode

- It is now assumed that the " ▶ " button is pressed. This makes S604-d go on and voltage $+B_1$ is applied to the base of Q507 through R516 and to the base of Q506 through D515 and R515, thus turning on Q507 and Q506.
- When Q506 goes on, the C514 charging current (the base current of Q505) flows via route ① , turning Q505 on. In addition, the collector current of Q505 flows into the base of Q504 and turns it on.
  As a result, a high voltage ($+B_{HIGH}$) is supplied to the capstan and brake solenoids through Q504 and D512, activating the two solenoids strongly.
- The base current of Q505 decreases gradually as C514 charges. When C514 has been fully charged, Q505 goes off. At this time, the base current of Q504 is interrupted and Q504 also goes off. When Q504 goes off, the $+B_{HIGH}$ supply to the solenoids is interrupted. However, a low voltage ($+B_{LOW}$) is supplied to the solenoids through D506, so they remain operating.
  This supply voltage switching activates the solenoids positively at first, but, prevents solenoid overheating by reducing the solenoid currents during operation.

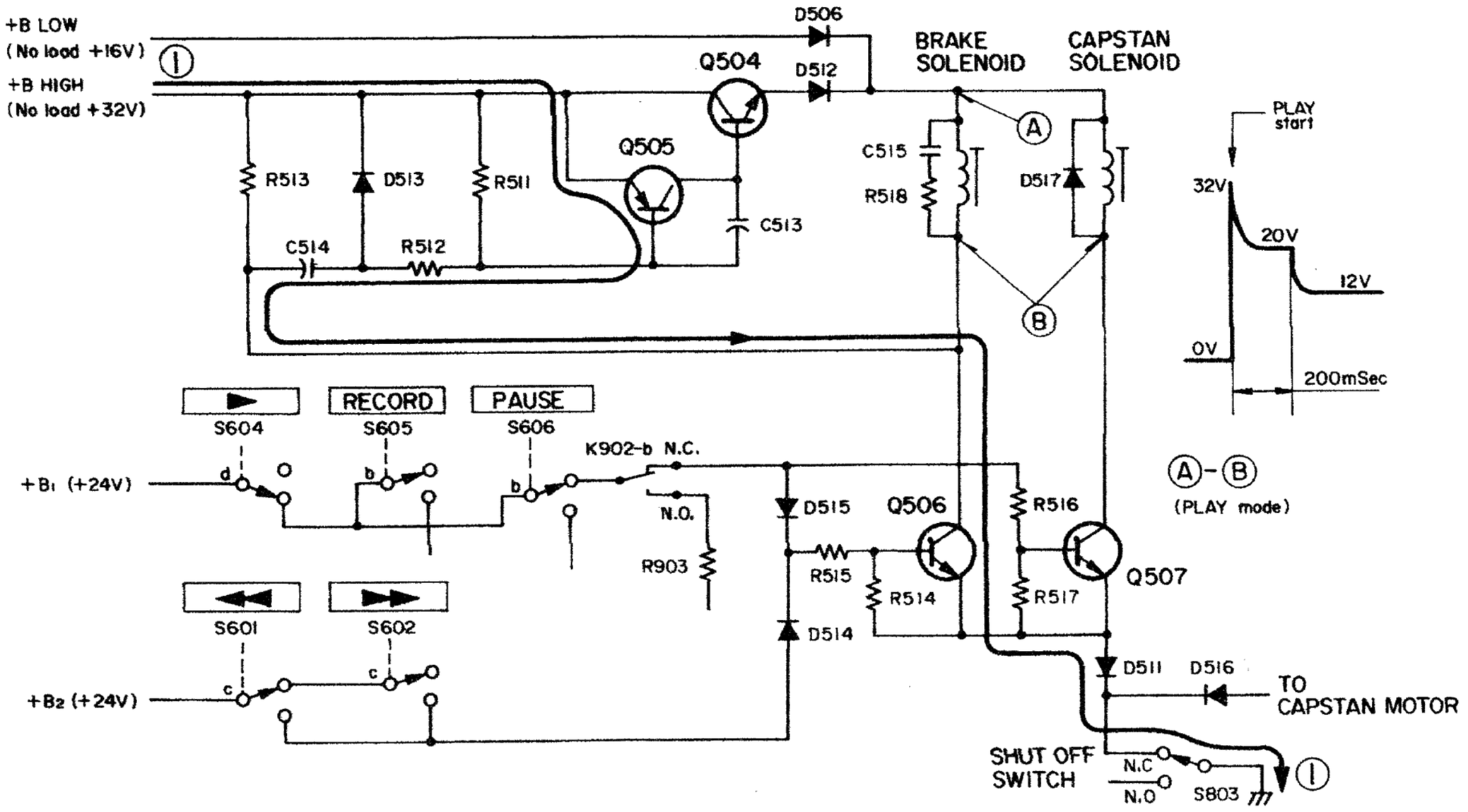


Fig. 2-3 Solenoid drive circuit

PAUSE mode

- If the PAUSE button (or when pressing the PAUSE button on the remote control unit PR-22) is pressed during the play mode, the base currents of Q506 and Q507 are interrupted by S606-b (or K902-b), so Q506 and Q507 both go off.
- The brake and capstan solenoids both go off, and stop the tape.
- When canceling the PAUSE mode, the brake and capstan solenoids operate exactly as in the play mode.

Fast mode

- When pressing the " ◀◀ " (or " ▶▶ ") button, voltage $+B_2$ is supplied to the base of Q506 through S601-c (or S602-c), D514 and R514, thus turning Q506 on. The brake solenoid operates in the same way as in the play mode.
  Since Q507 remains off, the capstan solenoid does not operate.

2-2. RECORD/REPRODUCE AMPLIFIER SECTION

This section describes mainly the Lch. With certain exceptions, numbers in the 100's refer to the Lch, those in the 200's to the Rch, and those in the 300's to circuits common to the Lch and Rch.

For the bias oscillator of section 2-2-5 see schematic, Fig. 2-4, and for others, the inserted circuit diagrams.

2-2-1 Reproduce equalizer amplifier

- The reproduce compensation characteristic is determined by the time constant of the operational amplifier (U101) negative feedback circuit.
- When the SPEED switch S607 is not depressed, the high speed (38 cm/sec, 15 ips) is selected and +24 V is supplied to terminal 10 of the REC/REPRODUCE AMP PCB. Q102 goes on (the impedance between drain and source is 0 ohm).

In this case, the reproduce compensation characteristic is obtained from the following formulas:

Low-frequency time constant:

$$T_L = R107 \times C104$$
$$(= 3240\ \mu sec)$$

NOTE: To compensate for losses at low frequency, this time constant is greater than 3180 μsec.

High-frequency time constant:

$$T_H \fallingdotseq R108//(R109 + R111) \times C104$$

NOTE: T_H is set by trimmer resistor R111. R108//(R109 + R111) is the parallel composite value of R108 and the sum of R109 and R111.

- When high speed is selected, –2 V is supplied to the gate of Q101 through D101 and R113, turning it off.
- When the SPEED switch is pressed, low speed (19 cm/sec, 7-1/2 ips) is selected. In this case, Q101 goes on and Q102 off.
  The reproduce compensation characteristic is obtained from the following formulas:
  Low-frequency time constant:
  $T_L = R107 \times C104$
  NOTE: Same as for high speed.
  High-frequency time constant:
  $T_H \fallingdotseq R108//(R109 + R110) \times C104$
  NOTE: T_H is set by trimmer resistor R110.
- Trimmer resistor R115 adjusts reproduce level.

2-2-2 Monitor amplifier

- This amplifier (the reproduce output amplifier, the phone amplifier and the meter amplifier) is a linear IC pack (U102); it handles both the Lch and Rch.
  Power is supplied to this IC from the independent +12 V regulated voltage circuit (Q301, Q302, D301, etc.). This regulated voltage circuit reduces mutual interference between any two amplifiers within ICs and between channels by lowering the power supply source impedance.
- The tape or source signal selected by the MONITOR switch is divided into two.
  One is fed to the reproduce output amplifier through the OUTPUT control (R198). The signal from the reproduce output amplifier goes to the OUTPUT terminal and also to the phone amplifier. The output of the phone amplifier is fed to the PHONES jack.
  The other is fed to the meter amplifier through the meter level control (R119, trimmer resistor) to swing the pointer of the VU meter.
  Therefore, the OUTPUT and PHONES levels are connected to the OUTPUT control. However, the indication on the VU meter is not connected to the OUTPUT control.
- The VU meter indicates the tape reproduce level irrespective of the setting of the OUTPUT control.
  On recording, this meter indicates the SOURCE level irrespective of the MONITOR level (the OUTPUT and PHONES levels). The meter controls the recording input level.

2-2-3 Mixing amplifier

The output of the MIC amplifier (Q103) and the LINE input are mixed resistively. As the virtual impedance at the mixing point is 0 ohm, no mutual interference between MIC and LINE occurs.
The mixing amplifier (U103-1/2) is an operational amplifier configured to make it unlikely to suffer from any effects due to load fluctuations, especially those due to switching the MONITOR switch.

2-2-4 Record amplifier

- Q104 is the muting transistor for the record amplifier. When not in the RECORD mode, a bias current is supplied to the base of Q104 through S605 and R155 from the +24 V power supply. Q104 is therefore on and the input to the record amplifier is muted. In the RECORD mode, the bias current is interrupted by S605 and Q104 goes off. Thus the muting of the record amplifier is canceled.
- The record amplifier also is an operational amplifier (U103-1/2). The record compensation characteristic is created by an LC series resonant circuit.
- At high speed, +24 V is supplied to terminal 60 of the REC/REPRODUCE AMP PCB, thus turning on Q106.
  At low speed, +24 V is supplied to terminal 59 of REC/REPRODUCE AMP PCB, thus turning on Q105.
- When Q106 is on, the impedance of the series resonance circuit, consisting of L103, R168 and C136, is minimum (value at R168) at the resonant frequency of L103 and C136 ($f = 1/2\pi\sqrt{L103 \times C136}$).
  Therefore, the negative feedback of the record amplifier is minimum, but the gain is maximum. R168 is inserted to prevent distortion or oscillation by limiting the minimum impedance of the resonant circuit.
- R165, R166 and C132 in the negative feedback serve for low-frequency compensation as well. At middle and high frequencies, since the impedance of C132 decreases, negative feedback is through C132 and R165. At low frequency, since the impedance of C132 rises, negative feedback is through R166 and R165. Therefore, when the characteristics of the LC resonant circuit are ignored, the amount of negative feedback decreases for low frequencies compared with middle and high frequencies and amplification gain increases.
- R175 is inserted to drive the record head with a constant current, so the impedance of the signal source is higher when seen from the record head.

- The parallel circuit consisting of C138 and L102 is the bias trap. The resonant frequency is adjusted by L102 to coincide with the frequency of the bias oscillator. The bias trap impedance is almost infinite at the resonance frequency and this prevents the record amplifier from saturation due to bias current.

2-2-5 Bias oscillator

Fig. 2-4 shows the bias oscillator and allied circuits.

Oscillation control

- If the REC MODE switch (L and/or R) is on, and the " ▶ " and RECORD buttons are pressed simultaneously, +24 V is supplied to point Ⓐ, immediately charging C308.
- C304 is charged through R309. Q304 goes on slowly with the rise in voltage in C304, and this starts bias oscillation.
- When L and R of S604, S605 or S101 both go off, the C308 discharges to the oscillator side through R307 and the C304 through D305 and R307 respectively. Since the base voltage of Q304 decreases with this discharge, Q304 goes off slowly, thus stopping bias oscillation. Start and stop timing of bias oscillation are set so that no click noise is recorded on the tape.

Oscillator output

- The output from the bias oscillator powers the erase head and at the same time is superimposed on the output of the record amplifier through bias adjustment trimmer capacitor C151.
- When recording from one channel only, since the other erase and record heads are not connected, the load on the bias oscillator becomes lighter. Since load fluctuations cause oscillation frequency or output level variation, load fluctuation in the bias oscillator is suppressed by connecting dummy load L301. Compared with the record head, the erase head consumes more current and represents a heavier load. The impedance of the dummy coil is thus made almost equal to that of the erase head.

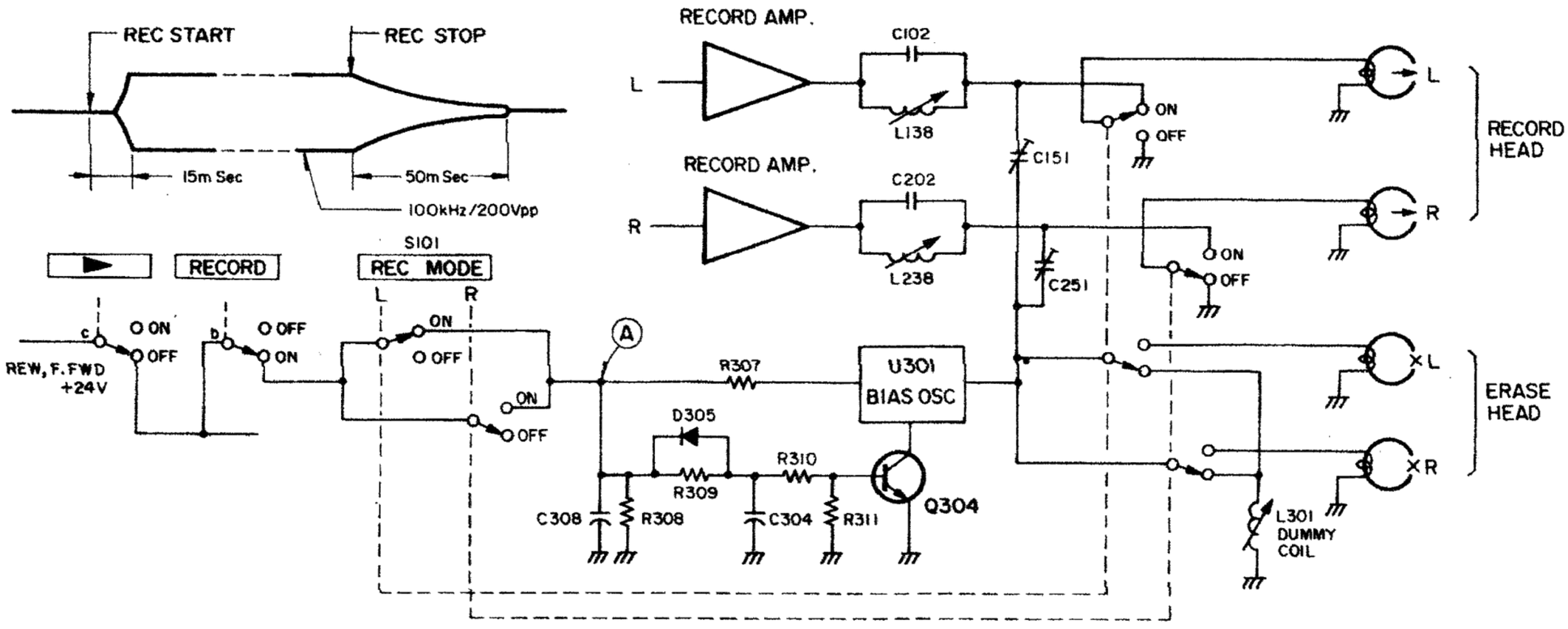


Fig. 2-4 Bias oscillator and its allied circuits

2-2-6 Power muting

Relay K301 makes and breakes the output circuit so that noise occuring when 22-2's power is turned on or off is not sent to the OUTPUT terminals.

At power-on

- When power is turned on, C303 is charged through R305 and D304 from the lamp power source (+6 V).
- When the anode voltage of D304 reaches about 5.4 V, D303 is turned on, thus turning on Q303.
- When Q303 goes on, K301 operates. Contact K301-a is closed to cancel muting. The muting time at power-on is about 5 sec.

On power-OFF

- When power is turned off, C303 discharges rapidly to the lamp circuit through D302.
- As soon as C303 starts to discharge, D305 goes off, turning off Q303 and K301.
- When K301 goes off, contact K301-a is opened, preventing amplifier noise from being sent to the OUTPUT terminal.

3. MAINTENANCE EQUIPMENT

Spring scale:	0 to 500 g, 0 to 4 kg
Wow & flutter meter:	Meguro Dempa Sokki Model MK-668B or equivalent
Audio oscillator:	Hewlett Packard Model 204C or equivalent
Frequency counter:	Range: 0 to 1 MHz, Sensitivity: 0.1 V RMS, Impedance: More than 1 MΩ, less than 25 pF
Band pass filter:	TEAC M-206A or frequency analyzer
Level meter:	Range: –80 to +40 dB Impedance: More than 1 MΩ, less than 25 pF
Distortion meter:	400 Hz, 1 kHz
Oscilloscope:	Ordinary type
Attenuator:	Ordinary type
Head demagnetizer:	TEAC E-3
Cleaning liquid:	TEAC TZ-261
Oil:	TEAC Spindle Oil TZ-255
Test tapes:	TEAC YTT-8013 blank test tape or equivalent TEAC YTT-2003 (19 cm/sec, 7-1/2 ips), YTT-2004 (38 cm/sec, 15 ips), wow & flutter test tapes TEAC YTT-1003 (19 cm/sec, 7-1/2 ips), YTT-1044 (38 cm/sec, 15 ips), head azimuth/frequency characteristic test tapes

4. TESTING AND ADJUSTMENT OF MECHANICAL SECTION

4-1. CAPSTAN THRUST CLEARANCE

1. There must be a clearance of 0.1 to 0.3 mm between the capstan shaft and the thrust plate. Check to see that the clearance is within this range. If not, loosen the two screws on the flywheel, adjust the clearance, and retighten the screws.

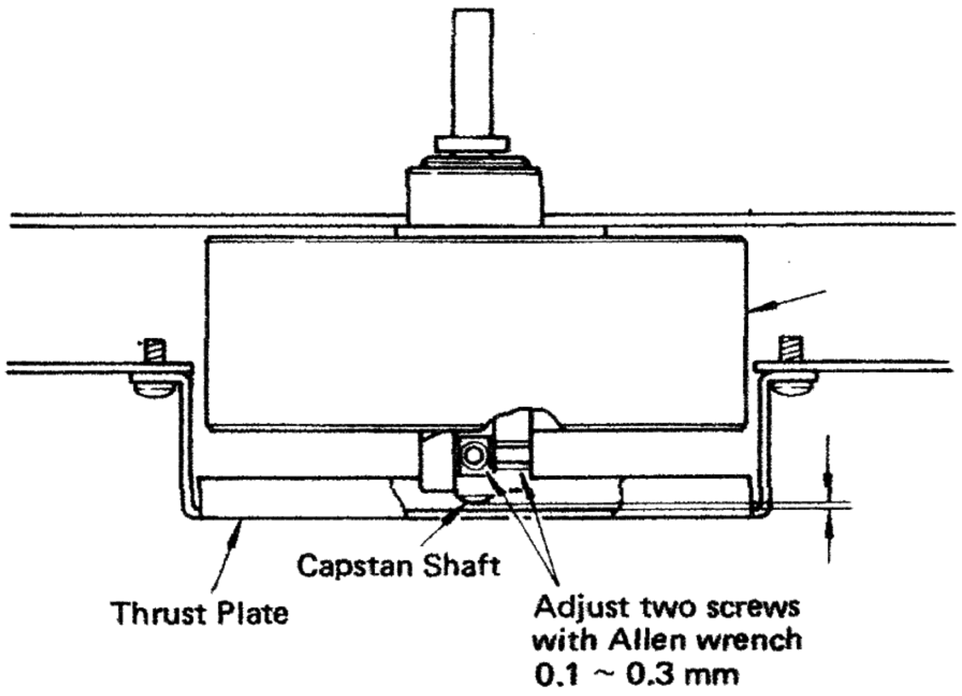


Fig. 4-1

4-2. SHUT-OFF SWITCH POSITION

1. There must be a clearance of 1 to 1.5 mm between the cam and actuator (A) when the microswitch is off; and 1.0 mm between the microswitch and actuator (B) when the microswitch is on. Check to see that the clearance is within these values. If not, adjust as necessary.
2. Adjust with the two screws which mount the micro switch.

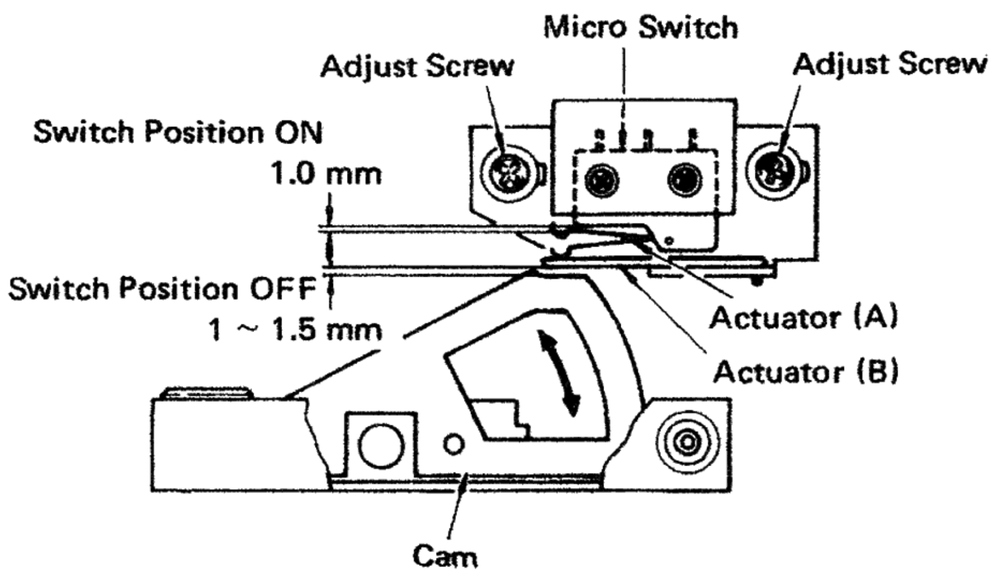


Fig. 4-2

4-3. BRAKE MECHANISM

NOTE: Be sure that the power is turned off prior to making any adjustments to the brakes.

1. Screw (A) for the left brake (as viewed from the front) must be adjusted so that there is a clearance of 1 mm between lever (C) and lever (E). Screw (A) for the right brake must then be adjusted so that lever (B) is parallel to lever (C).
2. Push the plunger softly until there is contact at (a); i.e., until the clearance has been eliminated, but make sure that the plunger is not pushed so strongly that the levers (E), (C), and (B) are deflected — they must remain in a horizontal plane.
3. Position the solenoid housing, while the plunger is pushed as described in step #2 above, so that the gap at (f) (the distance between the leftmost edge of the plunger and the leftmost edge of the solenoid housing) is between 11 to 12 mm. When the solenoid housing is so positioned, the plunger should be able to be deflected between 1 to 2 mm when pushed strongly.

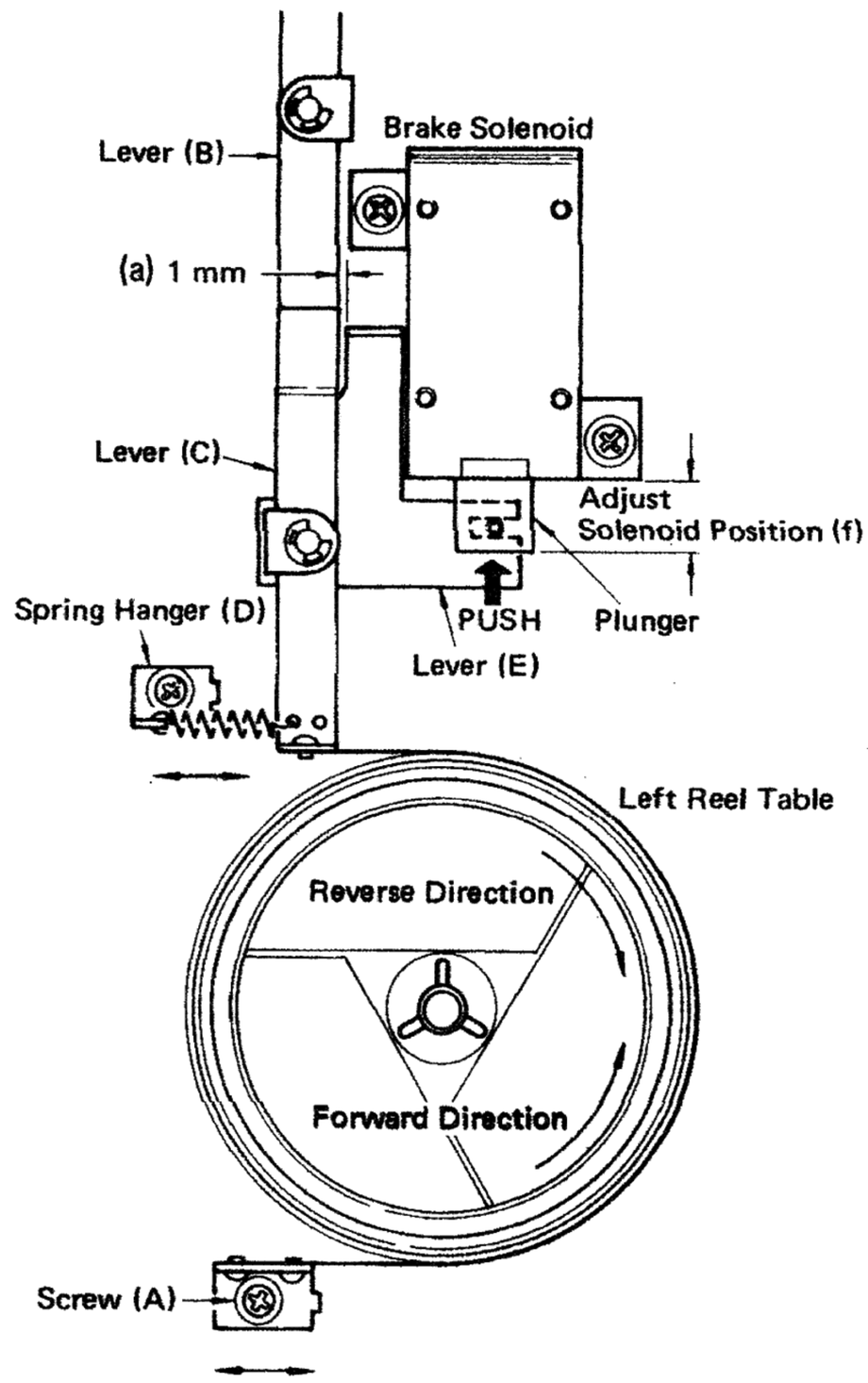


Fig. 4-3

4-4. BRAKE TORQUE

NOTE: Before making any brake adjustments or measurements, make sure the power is off.

1. Mount an empty 7" reel onto either reel table and attach a spring scale to the reel with a string. See Fig. 4-4.
2. Smoothly pull the scale away from the reel under test and note the torque value when the reading on the scale is steady. The proper torque values are given in the chart below.
3. Follow steps 1 and 2 for each measuring condition; i.e., (A) through (D) in Fig. 4-4.
4. If the forward-direction torque is not correct, change the hooking position of the spring hanger (reference (D) in Fig. 4-3) for the corresponding brake requiring adjustment. If, after the forward-direction torque has been properly adjusted, the reverse-direction torque is not correct, or the forward-direction torque is still not correct, check to see if the brake felt pad is worn, and also check that the brake mechanism is properly aligned as explained in Section 4-3, "Brake mechanism". If necessary, replace the entire reel table.

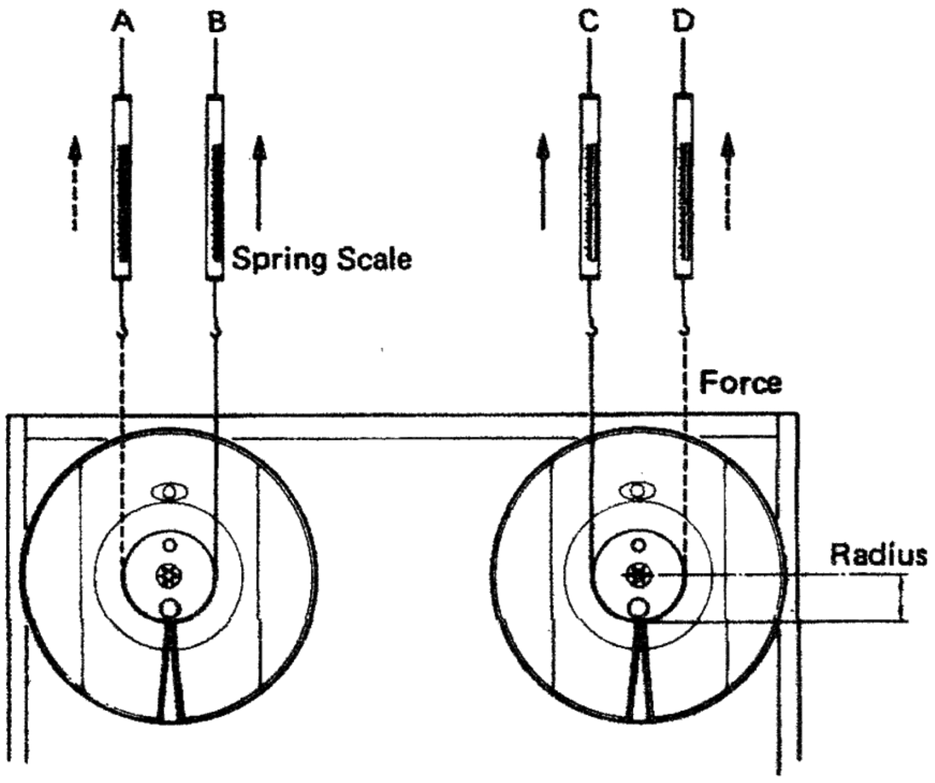


Fig. 4-4

Forward direction (B) (C)	1000 – 1300 g-cm (13.9 – 18.1 oz-inch)
Reverse direction (A) (D)	500 – 700 g-cm (6.94 – 9.72 oz-inch)
Left/Right deviation	200 g-cm (2.78 oz-inch)

Torque calculating formulas:

1. Torque (in g-cm or oz-inch)
   = Force or Weight (in g or oz) x Radius (in cm or inch)
2. Conversion of g-cm to oz-inch:
   g-cm x 0.0139 = oz-inch

4-5. REEL MOTOR TORQUE

NOTE: For torque calculation, refer to the said formulas.

4-5-1 Take-up torque

1. Hold the right tension arm up using a rubber band.
2. Mount an empty 7" reel onto the take-up (right) reel table, and attach a spring scale to the reel with a string.
3. Place the deck in the play mode.
4. Allow the rotation of the reel to slowly pull the scale toward the reel.
5. Hold the spring scale with enough force to allow steady reading. See Fig. 4-5.
6. The proper value is between 300 g-cm (4.58 oz-inch) and 470 g-cm (6.53 oz-inch).
7. There is no specially-provided adjustment for take-up torque, so if correction is needed, repair or replace the defective part and/or circuit.

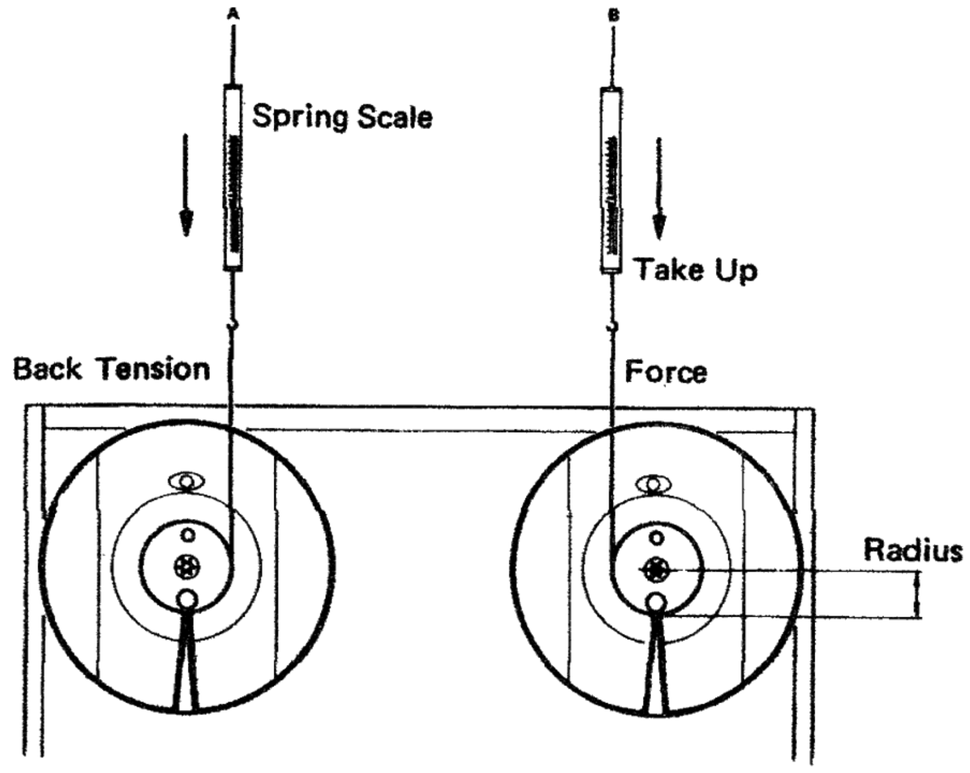


Fig. 4-5

4-5-2 Back tension

1. Hold the right tension arm up using a rubber band.
2. Mount an empty 7" reel onto the supply (left) reel table, and attach a spring scale to the reel with a string.
3. Place the deck in the play mode.
4. Using a steady, smooth motion, pull against the motor torque to draw the scale away from the reel.
5. After making sure that the reel motion is smooth (the string should not be rubbing against the reel flanges), note the value indicated on the scale.

6. The proper value is between 220 g-cm (3.06 oz-inch) and 280 g-cm (3.89 oz-inch).
7. If necessary, adjust the slider of the resistor (R802) until the proper torque value is obtained. See Fig. 4-6.

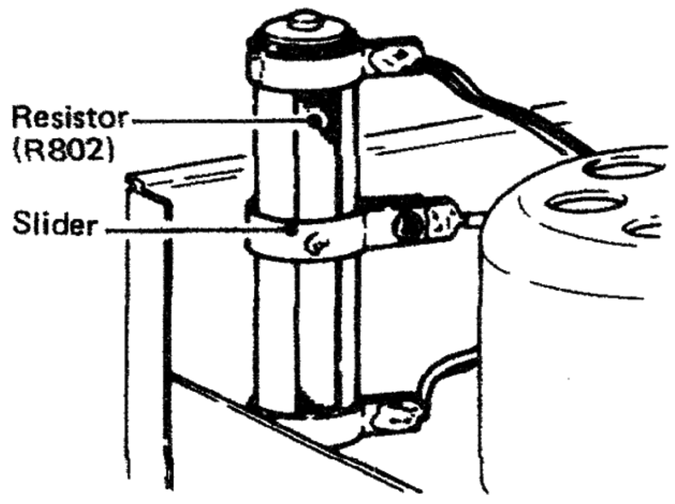


Fig. 4-6

4-6. PINCH ROLLER PRESSURE

1. Hold the right tension arm using a rubber band, string, etc.
2. Place the deck in the play mode without threading any tape.
3. Attach a spring scale to the pinch roller as shown in Fig. 4-7.
4. Pull the pinch roller away from the capstan shaft (on a plane intersecting the center of the capstan shaft and the pinch roller) until the capstan shaft and the pinch roller are separated.
5. Ease pressure on the scale until the pinch roller just begins to turn. The scale should then be read 1.8 kg to 2.2 kg (3-15/16 lbs to 4-7/8 lbs).

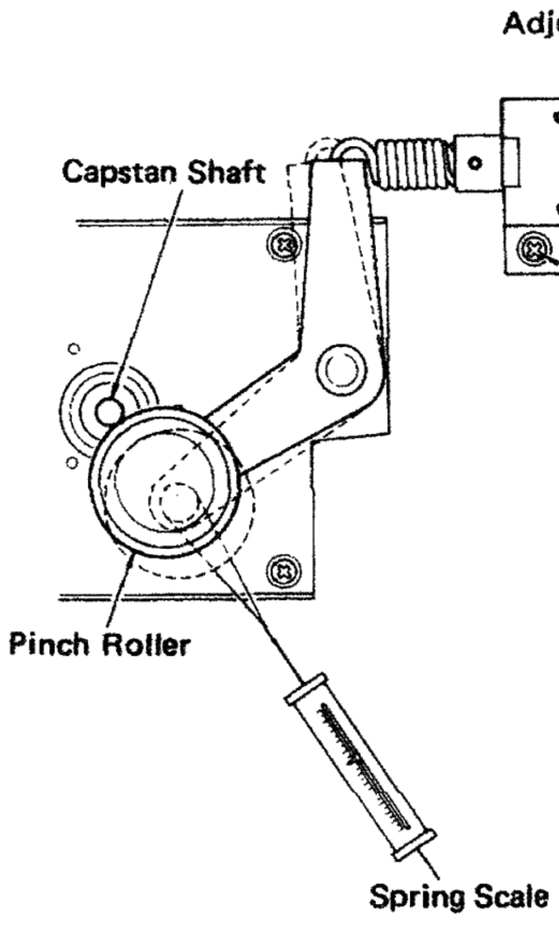


Fig. 4-7

4-7. REEL TABLE HEIGHT

1. As a general reference, the height of the reel table should roughly correspond to a distance of 38 mm (1-7/16") between the chassis of the deck and the rubber mat on the reel table. If checking reveals any large deviation from this value, loosen the two adjustment screws on the reel table, adjust the height, and retighten the screws.
2. For fine-adjustment, check that, while in fast-forward (forward direction) or rewind (reverse direction) modes starting at the beginning of the tape, the tape does not touch the upper or lower reel flanges. If it does, fine-adjust accordingly.

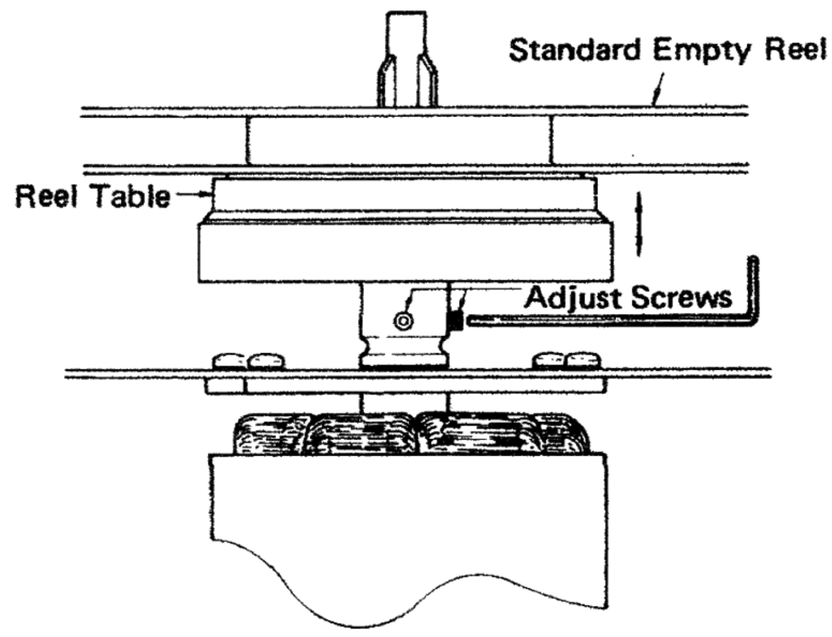


Fig. 4-8

4-8. TAPE SPEED

1. Connect a frequency counter to either OUTPUT jack. (See Fig. 4-10).
2. Load a TEAC YTT-2004 test tape containing a 3000-Hz test tone, and set the SPEED switch to HIGH (38 cm/sec or 15 ips).
3. Play the middle of the test tape and adjust the HIGH speed trimmer resistor until the frequency counter indicates a reading of 3000 Hz. See Fig. 4-9. (CAUTION: Use an insulated screwdriver to prevent shorting.)
4. Playing the tape at both the beginning and the end, check that the tape speed does not vary any more than the limits prescribed in the specifications, so that there is never a total deviation of more than ±30 Hz from the 3000-Hz test tone, nor a drift of more than 20 Hz at any given time.

5. Using a TEAC YTT-2003 test tape, repeat steps #3 and #4 above with the SPEED switch set to LOW (19 cm/sec or 7-1/2 ips). In step #3, the speed may be adjusted for the proper initial setting by using the LOW speed trimmer resistor.

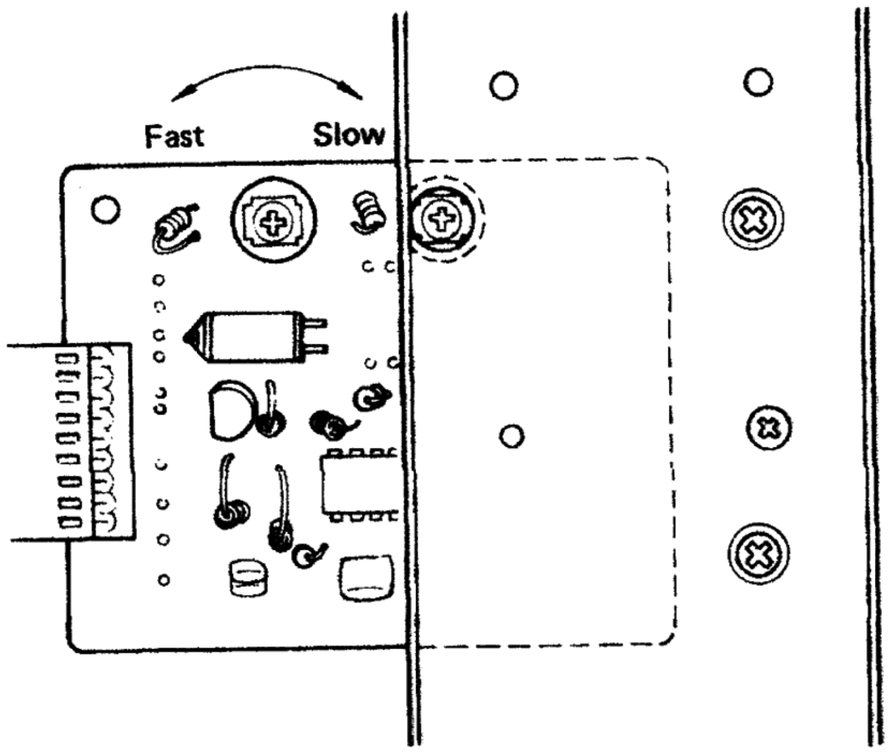


Fig. 4-9

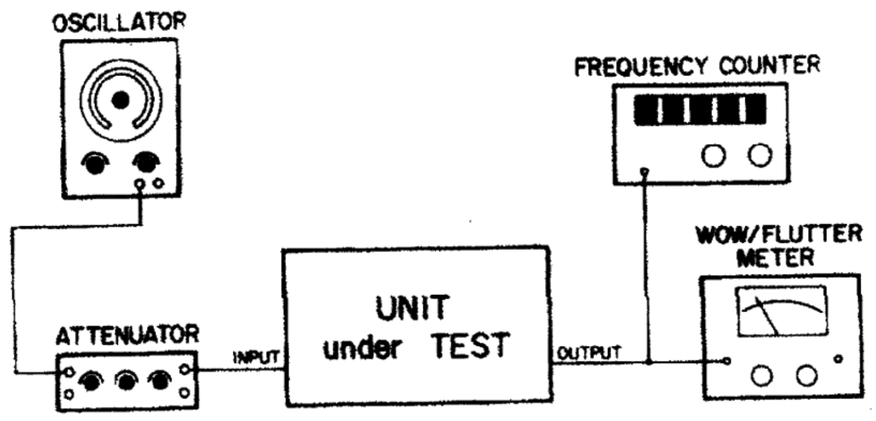


Fig. 4-10

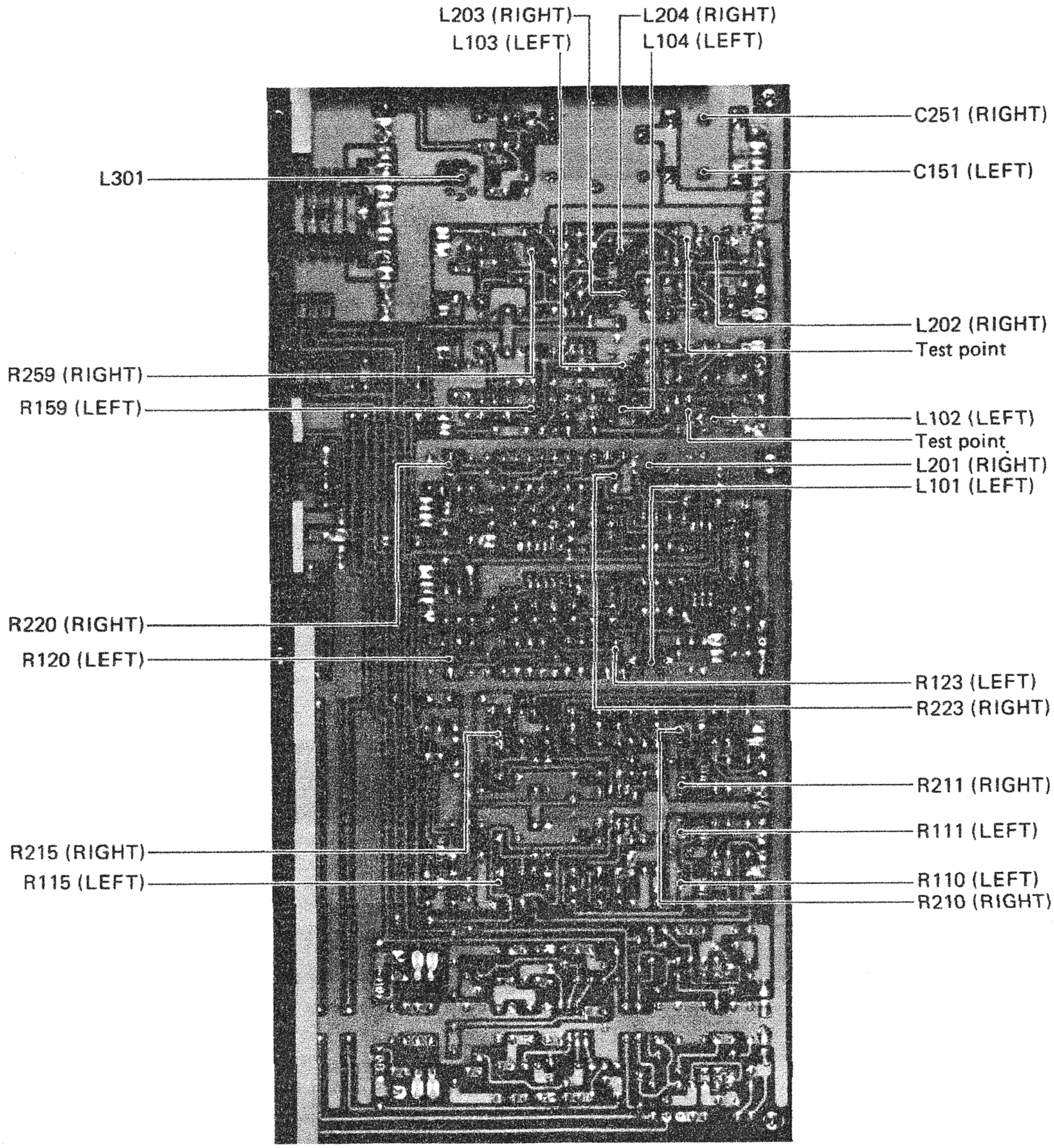
4-9. WOW AND FLUTTER

4-9-1 Playback

1. Connect a wow-and-flutter meter to the deck as shown in Fig. 4-10.
2. Load a TEAC YTT-2004 test tape to check the wow and flutter when the deck is set to HIGH speed, or a YTT-2003 test tape to check when set to LOW speed.
3. Play the beginning and end of the respective test tape for each speed setting, and read the wow-and-flutter meter.

4-9-2 Overall

4. Load a TEAC YTT-8013 test tape and record a 3000-Hz signal on it in both HIGH and LOW speed settings and at the beginning and end of the tape, and while recording the signal, simultaneously monitor the signal from the play head by setting the MONITOR switch to the TAPE position (raised position). Then read the wow-and-flutter meter.



5. RECORD/REPRODUCE AMPLIFIER CHECKS AND ADJUSTMENTS

5-1. LINE AMPLIFICATION LEVEL

1. Connect an AC voltmeter and a 10 K ohm-load the OUTPUT jacks on the rear panel.
2. Set the LINE and OUTPUT control knobs to position 7, then set the MIC control knob to MIN.
3. Set the MONITOR switches to SOURCE.
4. Apply a signal of 400 Hz, -10 dB (0.3 V) through the LINE IN jacks on the rear panel. The output level should be -10 dB (0.3 V).
5. If the output level is not within the specified value, adjust R123 (L) and R223 (R) accordingly.

5-2. METER CALIBRATION

1. When the output level is -10 dB (0.3 V) at the above line amplification level, the VU meters should read 0 VU.
2. If the meters do not indicate 0 VU, adjust R119 (L) and R219 (R) accordingly.

5-3. REPRODUCE AMPLIFIER

NOTE: Follow the following procedures prior to adjustment.

a. Thoroughly demagnetize and clean the heads, tape guides, etc.

b. Advance the tape, then check that the heads and tape guides are precisely aligned to establish the correct tape path. If not, adjust appropriately.

c. Set the MONITOR switches to TAPE. Run the test tape and check phase and azimuth while noting both the output level and the waveforms. If the phase and/or azimuth are out of position, adjust the heads. See Fig. 5-1 showing connections.
   Test tapes: YTT-1044 (38 cm/sec, 15 ips)
   YTT-1003 (19 cm/sec, 7-1/2 ips)

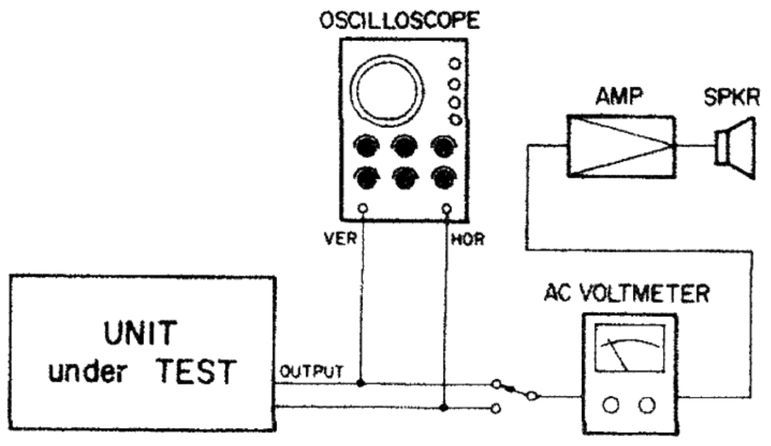


Fig. 5-1

Level setting

1. Connect an AC voltmeter and a 10 K ohm-load to the OUTPUT jacks.
2. Set the MONITOR switches to TAPE and the OUTPUT control knob to 7.
3. Run the tape, then check that the output level is -10 dB (0.3 V).
   Test tapes: YTT-1044 (38 cm/sec 15 ips)
   YTT-1003 (19 cm/sec 7-1/2 ips)
4. If the level is not within the specified value, adjust R115 (L) and R215 (R) accordingly.

Reproduce frequency response

1. Connect an AC voltmeter and a 10 K ohm-load to the OUTPUT jacks.
2. Set the MONITOR switches to TAPE and set the OUTPUT control knob to 7.
3. Run the tape, then check the frequency response while noting the output level.
   Test tapes: YTT-1044 (38 cm/sec 15 ips)
   YTT-1003 (19 cm/sec 7-1/2 ips)
4. If the AC voltmeters are not within the specified range, adjust R111 (L) and R211(R) for 38 cm/sec (15 ips), and R110 (L) and R210 (R) for 19 cm/sec (7-1/2 ips).

5-4. RECORDING BIAS

1. Connect an AC voltmeter and a 10 K ohm-load to the OUTPUT jacks, then load a blank test tape.
2. Set the LINE and OUTPUT control knobs to position 7, then set the MONITOR (L, R) switches to TAPE.
3. Note the output level while recording an input signal of 7 kHz, -20 dB (0.1 V) at 19 cm/sec (7-1/2 ips). Adjust trimmer capacitors C151 (L) and C251 (R) so that the over-bias is within the range of 1 to 3 dB.
   Blank test tape: YTT-8013

5-5. RECORDING LEVEL

NOTE: Set the reproduce level and recording bias, then adjust the recording level.

1. Connect an AC voltmeter and a 10 K ohm-load to the OUTPUT jacks.
2. Set the LINE and OUTPUT control knobs to position 7, then set the MONITOR (L, R) switches to TAPE.
3. Note the output level while recording an input signal of 400 Hz, -10 dB (0.3 V) at 38 cm/sec (15 ips). Adjust R159 (L) and R259 (R) so that the output level is -10 dB (0.3 V).

5-6. FREQUENCY RESPONSE (OVERALL)

NOTE: Adjust the overall frequency response after checking that the reproduce frequency response is within the prescribed values.

1. Connect an AC voltmeter and a 10 K ohm-load to the OUTPUT jacks.
2. Set the LINE and OUTPUT control knobs to position 7, then set the MONITOR switches to TAPE.
3. Record and reproduce an input signal of 400 Hz, -10 dB (0.3 V) at 38 cm/sec (15 ips), then change the frequency and check that the output is still within specification.
   If not, adjust REC EQ coils L103 (L) and L203 (R) using a frequency higher than 15 kHz.
4. For a tape speed of 19 cm/sec (7-1/2 ips), record and reproduce an input signal of 400 Hz, -20 dB (0.1 V), then change the frequency and check that the output is still within specification.
   If not, adjust REC EQ coils L104 (L) and L204 (R) using a frequency higher than 15 kHz.
   Blank test tape: YTT-8013

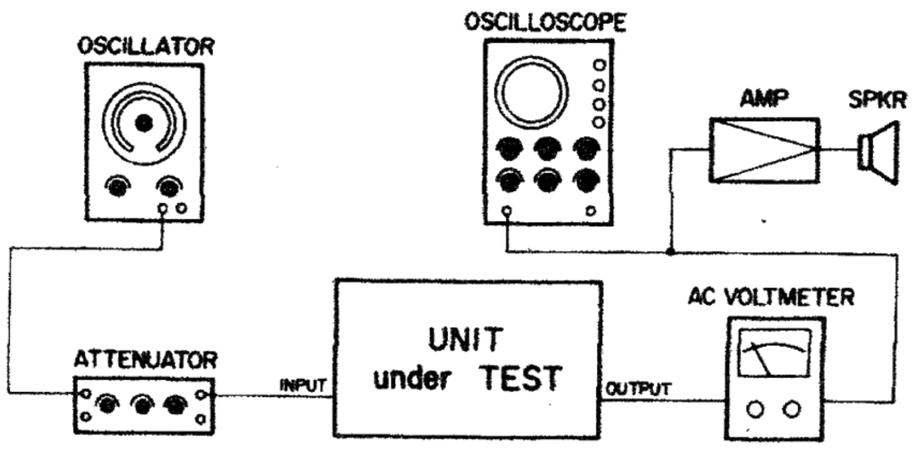


Fig. 5-2

5-7. MONAURAL FREQUENCY RESPONSE (OVERALL)

NOTE: After the overall stereo frequency response has been checked, check the frequency responses on the left and right channels individually.

1. Check the frequency responses in the same manner as described in section "Frequency response (overall)".
2. If there is a difference between the frequency responses of the left and right channels, adjust L301 so that they are within the values prescribed in the section on overall frequency response.

5-8. S/N RATIO (OVERALL)

NOTE: Before measuring this ratio, demagnetize and clean the heads, tape guides, etc. Then, check that the overall frequency response is within the prescribed values. If not, adjust accordingly.

1. Connect an AC voltmeter and a 10 K ohm-load to the OUTPUT jacks on the rear panel.
2. Set the LINE and OUTPUT control knobs to position 7. Record a small amount of a 1 kHz signal at 0 VU. Remove the oscillator connected to the INPUT jacks, then record a "no-signal" section (i.e. MIC controls set to MIN).
3. Set the MONITOR switches to TAPE.
4. Rewind the tape to the start of the 1 kHz section, then play it back.
5. Check that the output level is -10 dB (0.3 V). Increase the sensitivity of the AC voltmeter, then measure the noise level on the tape at the portion containing the no-signal recording.
6. The signal-to-noise ratio should be as follows:
   38 cm/sec (15 ips): Better than 48 dB (UNWTD)
   19 cm/sec (7-1/2 ips): Better than 45 dB (UNWTD)
7. When the S/N ratio is not within the above values, follow the procedures below:
   - Demagnetize and clean the record and playback heads.
   - Check for correct erasing ratio.
   - Check and adjust the overall frequency response.
   - Check and adjust the bias trap.
   - If all else fails, replace the tape.

5-9. BIAS TRAP

NOTE: It is not necessary to adjust the bias traps except:
- When replacing the record head.
- When replacing parts associated with the record amplifier (especially the bias circuit and the trap coil).
- When bias leakage is excessive.
- When replacing the erase head.
- When replacing the oscillator unit.

L101, L201 (Line amplifier)

1. Connect an AC voltmeter and a 10 K ohm-load to the OUTPUT jacks on the rear panel.
2. Place the deck in the record/pause mode with the OUTPUT control knob set to position 7.
3. Increase the sensitivity of the AC voltmeter and check the output level is less than -40 dB.
4. Check the bias leakage and if excessive adjust bias traps L101 (L) and L201 (R) to minimize the leakage.

L102, L202 (Record amplifier)

1. Connect the positive terminal of the AC voltmeter or oscilloscope to the test points between R175 and L102 (L) and R275/L202 (R). Then, connect the negative terminal to the chassis ground.
2. Adjust L102 or L202 for minimal bias leakage in the record/pause mode.

5-10. ERASING RATIO

1. Connect an AC voltmeter, 10 K ohm-load and a 1 kHz band-pass filter to the OUTPUT jacks on the rear panel.
2. With the MONITOR switches set to TAPE, record a test tone signal of 1 kHz, 0 dB (1 V). Rewind the tape to the beginning of the recorded section and record a no-signal portion over the recording of the 1 kHz signal.
3. Measure the difference between the 1 kHz signal level and the no-signal portion. The difference should be at least 70 dB.

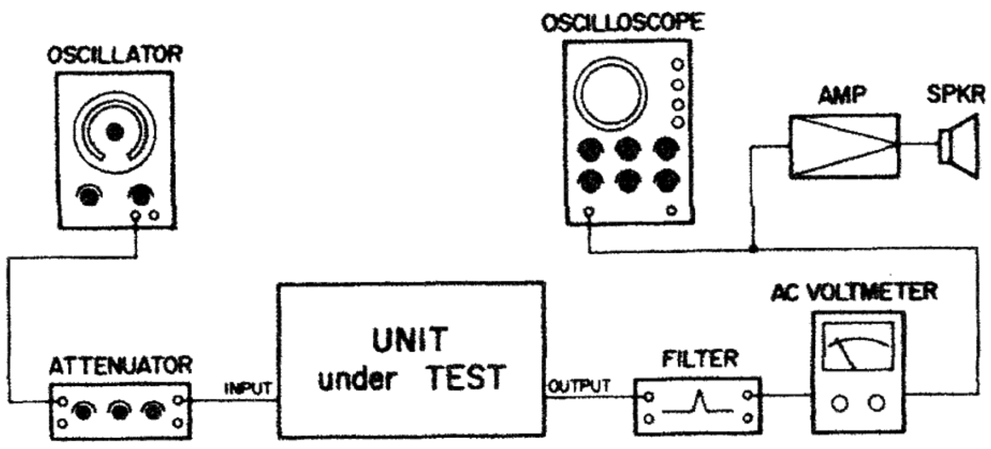


Fig. 5-3

5-11. SOURCE MONITOR CHECK

1. Connect an AC voltmeter and a 10 K ohm-load to the OUTPUT jacks on the rear panel.
2. Set the MONITOR switches to SOURCE.
3. Supply an input signal of -10 dB (0.3 V) through the LINE IN jacks with the LINE and OUTPUT control knobs at position 7, then check that the output level is -10 dB (0.3 V). The MIC control knob should be set to MIN.
   Frequency response: 40 Hz to 20 kHz, ±2 dB
   S/N ratio: Better than 60 dB

Headphones

1. Connect an 8 Ω dummy resistor to the headphones terminal.
2. Set the MONITOR switches to SOURCE.
3. Supply a 400 Hz input signal through the LINE IN jacks with the LINE control knob at position 7 and the OUTPUT control knobs at MAX, then measure the headphones output level. The MIC control knob should be set to MIN.
   Max. output level: More than 3 mV

5-12. CHANNEL SEPARATION

1. Connect and AC voltmeter, a 10 K ohm-load and a 1 kHz band-pass filter to the OUTPUT jacks on the rear panel.
2. With the LINE and OUTPUT control knobs at position 7, record and reproduce a test tone signal of 1 kHz, -10 dB (0.3 V) on the left or right channel in MONO mode. The MIC control knob should be set to MIN. Measure the ratio of the output level in each channel in relation to the signal leakage from the other channel. The ratio should be no less than 50 dB.

5-13. DISTORTION (OVERALL)

1. Connect a distortion meter, an AC voltmeter and a 10 K ohm-load to the OUTPUT jacks on the rear panel.
2. Set the LINE and OUTPUT control knobs to position 7, then set the MIC control knob to MIN.
3. Set the MONITOR switches to TAPE.
4. Apply an input signal of 1 kHz, -10 dB (0.3 V) through the LINE IN jacks on the rear panel and record it.
5. Rewind the tape to the beginning of the recorded portion, and play it back, measuring the distortion. The distortion should be no higher than 1 %.

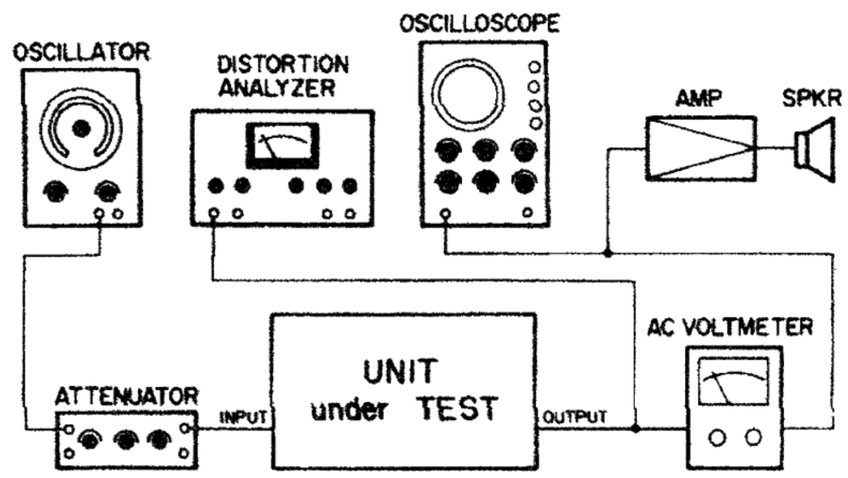


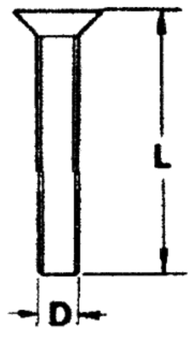
Fig. 5-3

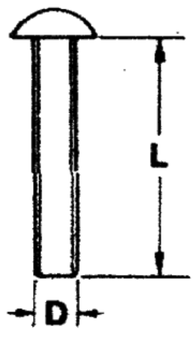
6. ASSEMBLING HARDWARE CODING LIST

All screws conform to ISO standards, and have crossrecessed heads, unless otherwise noted.
ISO screws have the head inscribed with a point as in the figure to the right.

FOR EXAMPLE:

B M 3 x 6
- 6 — Length in mm (L)
- 3 — Diameter in mm (D)*
- M — Metric System
- B — Nomenclature





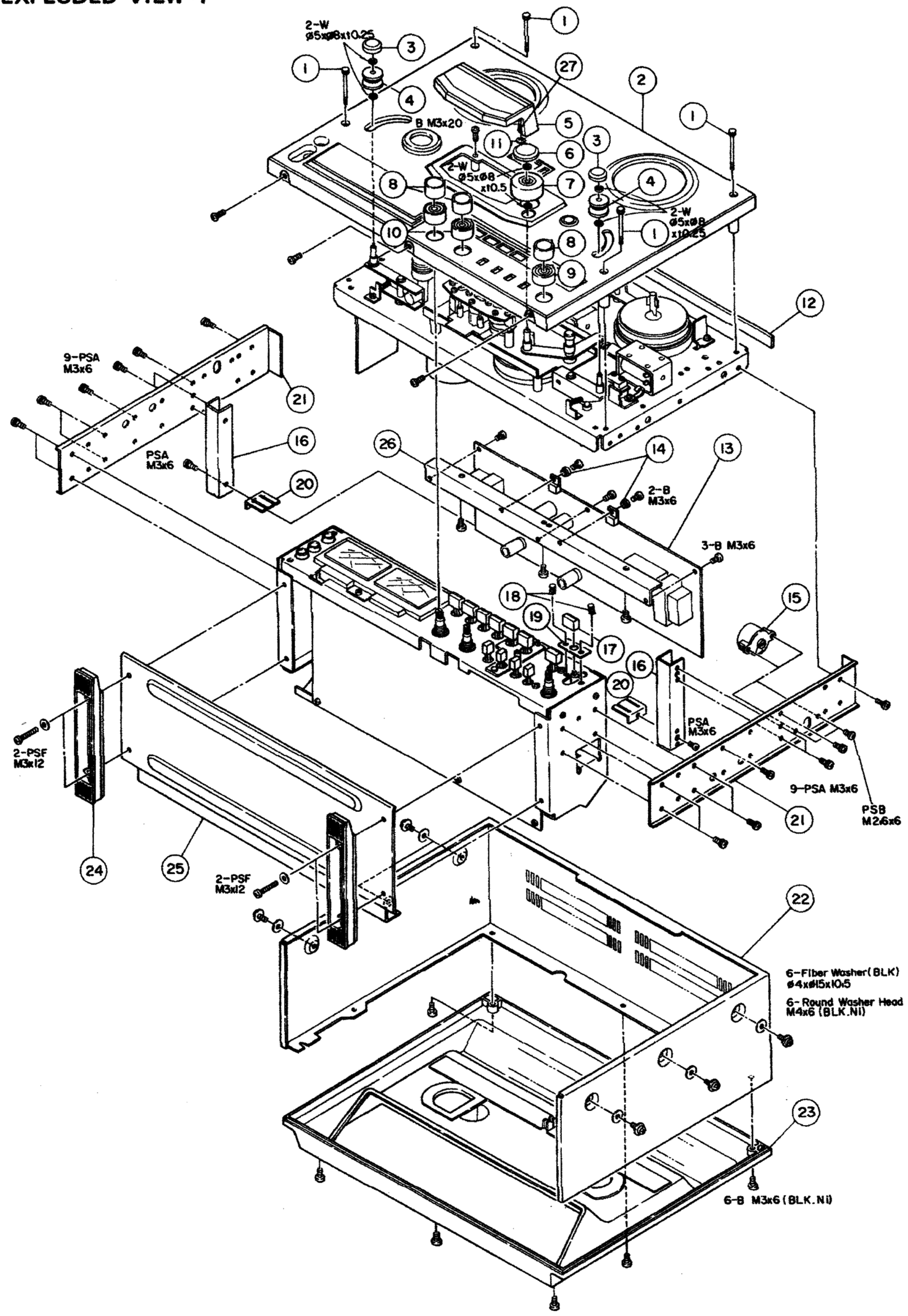
*Inner dia. for washers and nuts

	Code	Name	Type
MACHINE SCREW	**R**	Round Head Screw	
	P	Pan Head Screw	
	T	Stove Head Screw (Truss)	
	B	Binding Head Screw	
	F	Flat Countersunk Head Screw	
	O	Oval Countersunk Head Screw	
WOOD SCREW	**RW**	Round Head Wood Screw	
TAPTITE SCREW	**PTT**	Pan Head Taptite Screw	
	WTT	Washer Head Taptite Screw	
SEMS SCREW	**BSA**	Binding Head SEMS Screw(A Type)	
	BSB	Binding Head SEMS Screw(B Type)	
	BSF	Binding Head SEMS Screw(F Type)	
	PSA	Pan Head SEMS Screw(A Type)	
	PSB	Pan Head SEMS Screw(B Type)	

	Code	Name	Type
TAPPING SCREW	**BTA**	Binding Head Tapping Screw(A Type)	
	BTB	Binding Head Tapping Screw(B Type)	
	RTA	Round Head Tapping Screw(A Type)	
	RTB	Round Head Tapping Screw(B Type)	
SETSCREW	**SF**	Hex Socket Setscrew(Flat Point)	
	SC	Hex Socket Setscrew(Cup Point)	
	SS	Slotted Socket Setscrew(Flat Point)	
WASHER	**E**	E-Ring (Retaining Washer)	
	W	Flat Washer (Plain)	
	SW	Lock Washer (Spring)	
	LWI	Lock Washer (Internal Teeth)	
	LWE	Lock Washer (External Teeth)	
	TW	Trim Washer (Countersunk)	
NUT	**N**	Hex Nut	

7. EXPLODED VIEWS AND PARTS LIST

EXPLODED VIEW -1



22-2 VIEW-1

Parts marked with * require longer delivery time than regular parts.

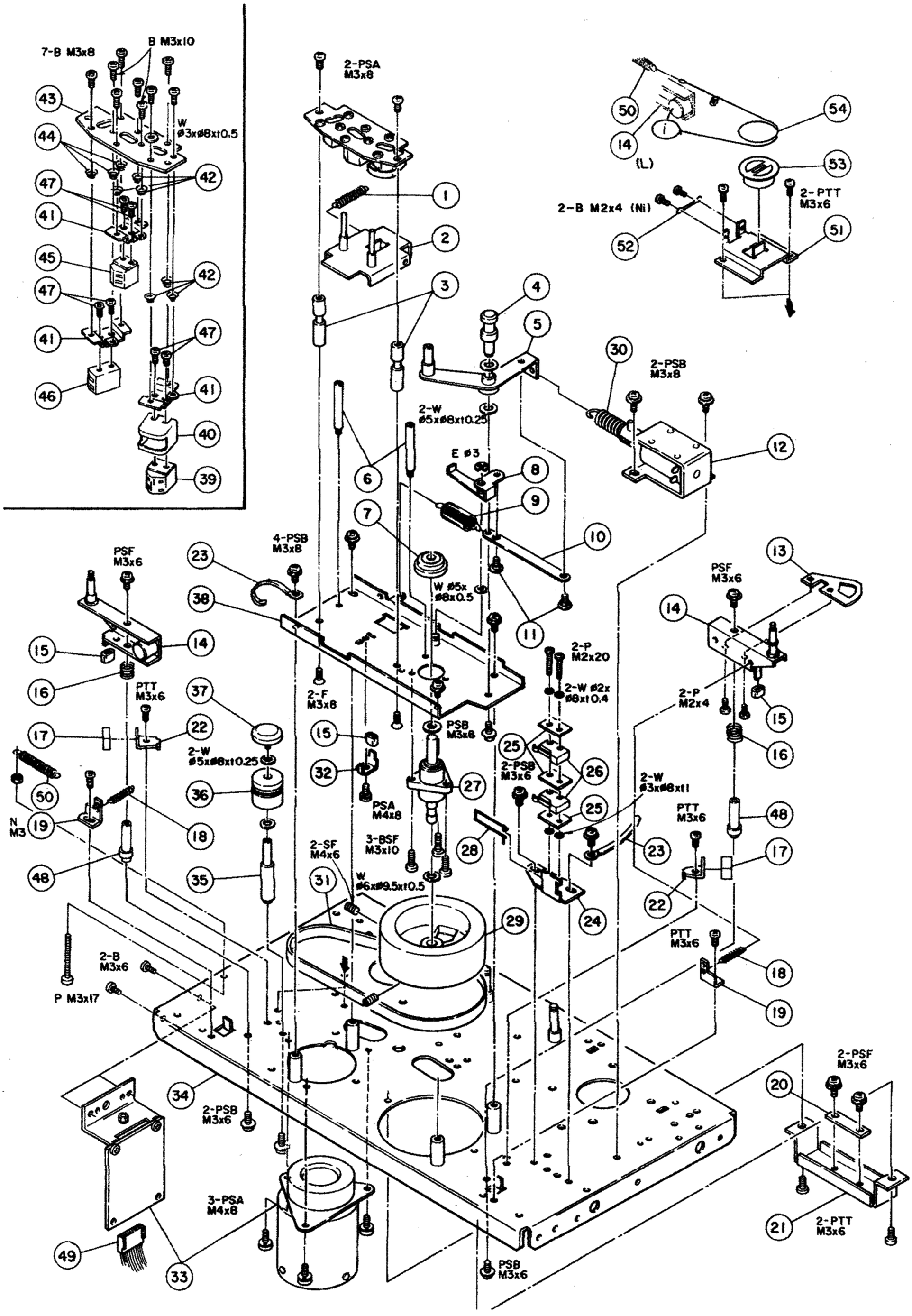
EXPLODED VIEW -1

PEF. NO.	PARTS NO.	DESCRIPTION
1 - 1	* 5781713035	Screw, Trim; M3 x 35 (Ni)
1 - 2	* 5800127100	Panel Assy, Front
1 - 3	* 5800066000	Cap, Tension Roller
1 - 4	5504843000	Roller Assy, Tension
1 - 5	* 5800126800	Housing, Head
1 - 6	* 5800066200	Cap, Pinch Roller
1 - 7	5014175100	Pinch Roller
1 - 8	5800080600	Knob, F
1 - 9	5800080800	Knob, H
1 - 10	5800080700	Knob, G
1 - 11	* 5786106000	Ring, CS
1 - 12	* 5555948000	Cushion, Bonnet
1 - 13	* 5200030410	PCB Assy, POWER SUPPLY [U, C]
	* 5200030420	PCB Assy, POWER SUPPLY [E, UK, A]
	* 5200030400	PCB Assy, POWER SUPPLY [GE]
1 - 14	* 5033295000	Tube, Insulating
1 - 15	* 5131007000	Selector, Voltage [GE]
1 - 16	* 5555943000	Support, Push
1 - 17	5800080200	Button, A
1 - 18	* 5534118000	Rivet, Push
1 - 19	* 5800019100	Guide, Joint Bar
1 - 20	* 5800079900	Bracket, PCB; C
1 - 21	* 5553366001	Frame, Side
1 - 22	* 5551047001	Bonnet
1 - 23	* 5502267000	Cover Assy, Rear
1 - 24	* 5533260000	Leg, Case
1 - 25	* 5553367000	Botton, Plate
1 - 26	* 5553362000	Bracket, POWER SUPPLY PCB

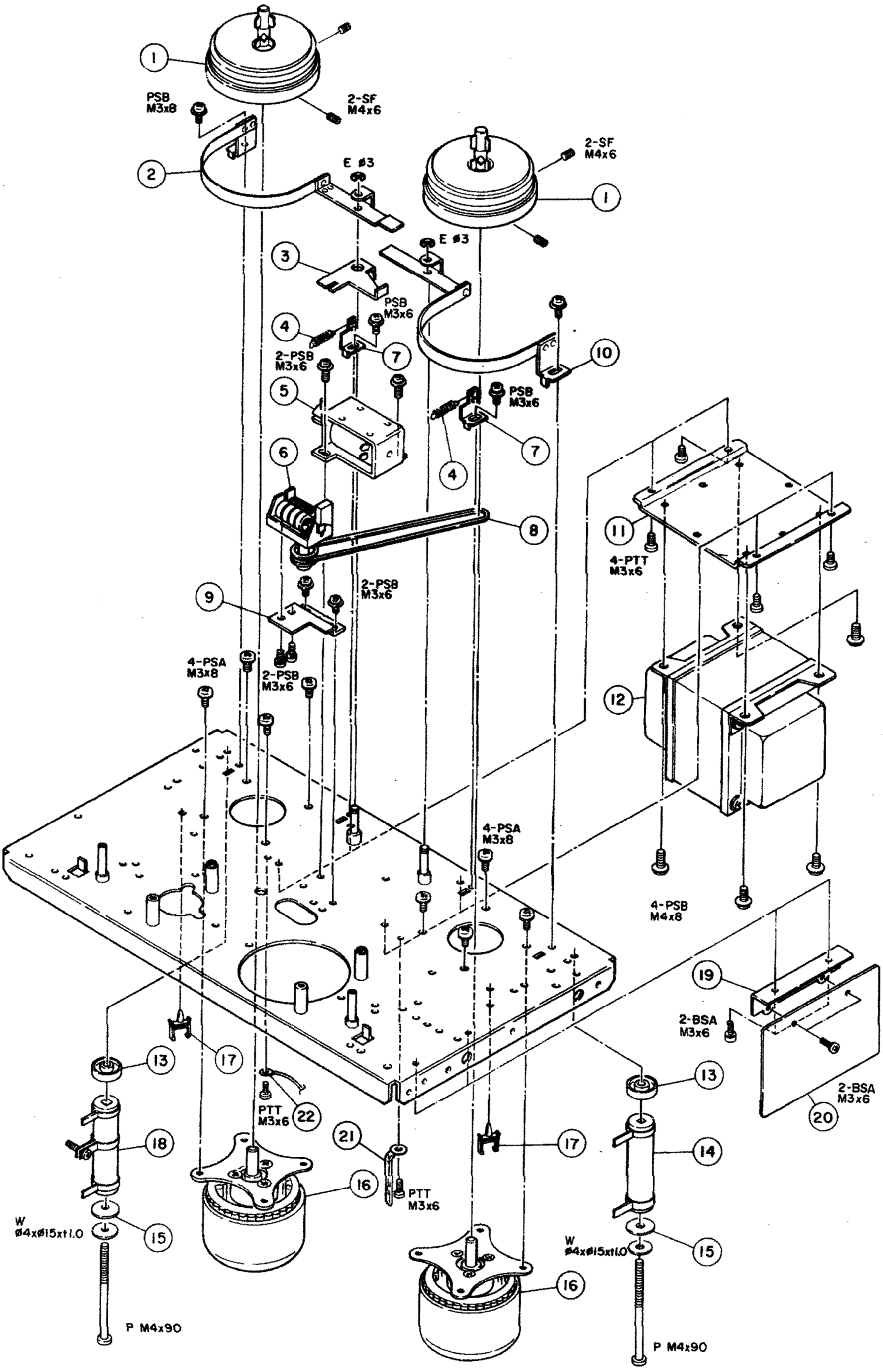
EXPLODED VIEW - 2

REF. NO.	PARTS NO.	DESCRIPTION
2 - 1	* 5524287000	Spring, Lifter Return
2 - 2	* 5504836001	Plate Assy, Lifter Base
2 - 3	* 5545181000	Guide, Tape
2 - 4	* 5545178000	Pole, Guide
2 - 5	* 5504835000	Arm Assy, Pinch Roller
2 - 6	* 5545190000	Stud, Housing
2 - 7	* 5545175000	Cap, Dust
2 - 8	* 5555925000	Arm, Joint; A
2 - 9	* 5524288000	Spring, Return
2 - 10	* 5555926000	Arm, Joint; B
2 - 11	* 5581056000	Screw, Shoulder
2 - 12	5163048000	Solenoid
2 - 13	* 5555928000	Cam, Micro Switch Actuating
2 - 14	* 5504842000	Arm Sub Assy, Tension
2 - 15	* 5534850000	Cushion Stopper
2 - 16	* 5524289000	Spring, Bias
2 - 17	* 5534851000	Damper, Arm
2 - 18	* 5524106000	Spring, Return
2 - 19	* 5555929000	Hook Spring
2 - 20	* 5555921000	Plate, Thrust
2 - 21	5504834000	Angle, Thrust Plate
2 - 22	5555930000	Stopper, Arm
2 - 23	* 5581038000	Clamper, Cord; A
2 - 24	5555932000	Bracket, Micro Switch
2 - 25	* 5550025100	Plate, Insulating
2 - 26	5301455500	Switch, Micro
2 - 27	* 5504832000	Capstan Assy
2 - 28	5524290000	Bar, Actuating
2 - 29	* 5534849000	Flywheel
2 - 30	* 5524286000	Spring, Pressure
2 - 31	* 5534468000	Belt, Capstan Drive
2 - 32	* 5555924000	Stopper, Lifter
2 - 33	* 5370000701	Motor Assy, Capstan
2 - 34	* 5800079700	Chassis Assy, Main
2 - 35	* 5545182000	Shaft, Guide Roller
2 - 36	* 5504839000	Roller Arm, Guide
2 - 37	* 5800066100	Cap, Guide Roller
2 - 38	* 5504831000	Plate Assy, Capstan Base
2 - 39	5569205000	Head, Playback
2 - 40	* 5554949000	Case, Shield; B
2 - 41	* 5013437100	Bracket, Head
2 - 42	* 5520182000	Spring, D
2 - 43	* 5555927000	Plate, Head Base
2 - 44	* 5022050000	Spring, B
2 - 45	5569204000	Head, Record
2 - 46	5569210000	Head, Erase
2 - 47	* 5581058000	Screw, Binding Head; M2 x 4
2 - 48	* 5800048300	Shaft, Tension Arm
2 - 49	* 5122172000	Connector, Socket; 10P
2 - 50	* 5800068100	Spring, Dumper
2 - 51	* 5800068400	Bracket, Dumper Spring
2 - 52	* 5524215000	Stopper, Wire
2 - 53	* 5534684000	Drum, Dumper
2 - 54	* 5788200200	String, Dial

EXPLODED VIEW -2



EXPLODED VIEW -3



Parts marked with * require longer delivery time than regular parts.

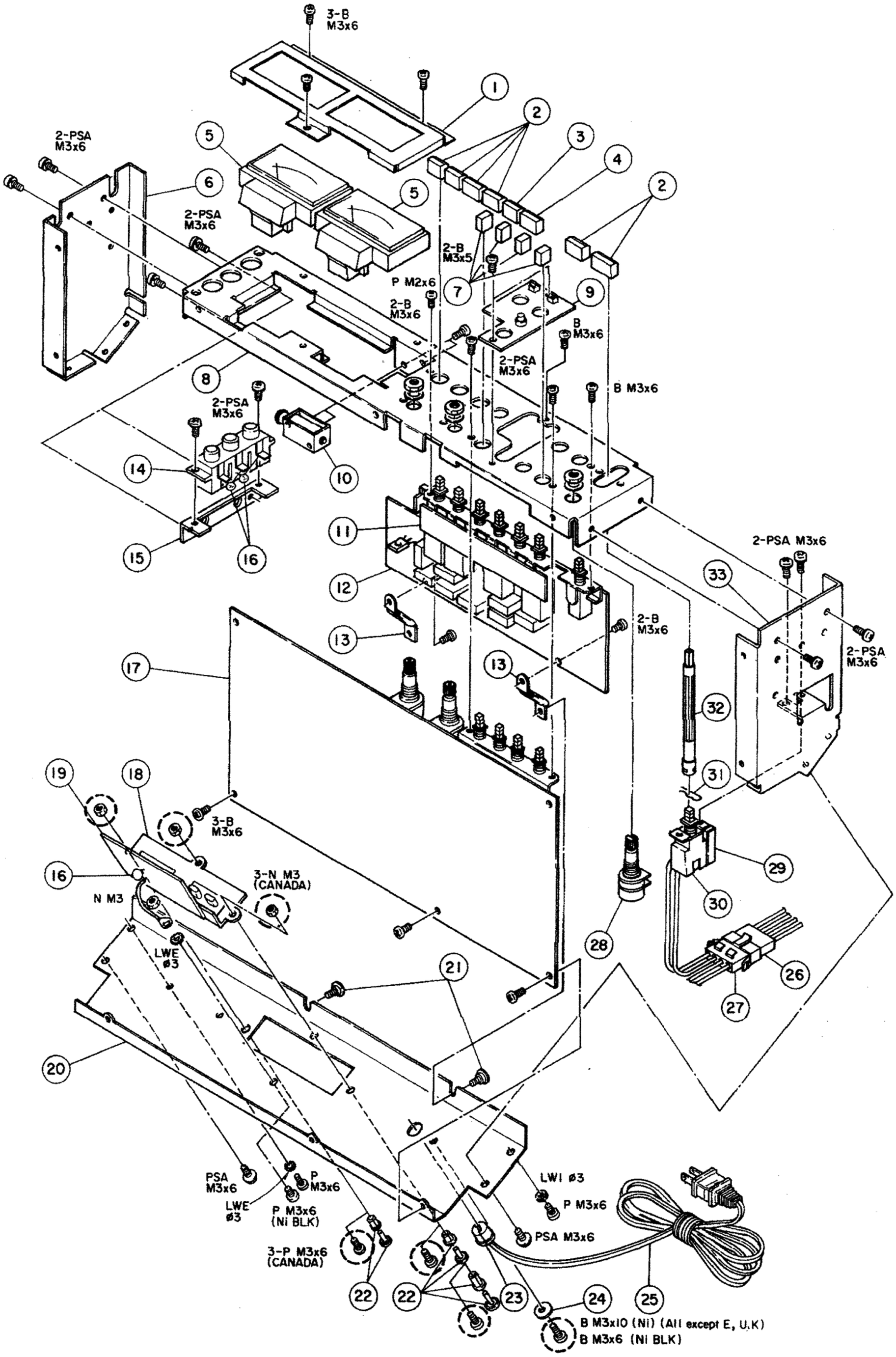
EXPLODED VIEW - 3

REF. NO.		PARTS NO.	DESCRIPTION
3 - 1		5600018100	Table Assy, Reel; A
3 - 2		* 5504847000	Band Assy, Brake; L
3 - 3		* 5555939000	Lever Brake Actuating
3 - 4		* 5524291000	Spring, Brake
3 - 5		5163048000	Solenoid
3 - 6		5058509000	Counter
3 - 7		* 5555929000	Hook, Spring
3 - 8		5534853000	Belt, Counter
3 - 9		* 5555940000	Bracket, Counter
3 - 10		* 5504848000	Band Assy, Brake; B
3 - 11		* 5555919000	Bracket, Transformer
3 - 12	⚠	5320006300	Transformer, Power [U, C]
	⚠	5320002400	Transformer, Power [E, UK, A]
	⚠	5320002500	Transformer, Power [GE]
3 - 13		5534585000	Holder, Resistor
3 - 14	⚠	* 5181581000	Resistor, Non Flammable 1 kΩ/30W
3 - 15		* 5785254000	Washer, Bakelite; φ4 x φ17 x t1
3 - 16		7104601001	Motor, Reel
3 - 17		* 5033258000	Clamper, Cord; E
3 - 18	⚠	* 5181597000	Resistor, Non Flammable 250Ω/30W
3 - 19		* 5800126900	Bracket D, PLASHING PCB
3 - 20		* 5200029200	PCB Assy, FLASHING
3 - 21		* 5581038000	Clamper, Cord; A
3 - 22			Earth Rag φ3

EXPLODED VIEW - 4

REF. NO.		PARTS NO.	DESCRIPTION
4 - 1		* 5800080500	Plate, Motor
4 - 2		5800080200	Button, A
4 - 3		5800080300	Button, B
4 - 4		5800080400	Button, C
4 - 5		5165068000	Meter, VU
4 - 6		* 5553364000	Chassis, Side; L
4 - 7		5800080000	Button
4 - 8		* 5552489001	Chassis, Amplifier
4 - 9		* 5260030700	PCB Assy, LED
4 - 10		5163049000	Solenoid
4 - 11		* 5158110000	PCB Assy, CONTROL B
4 - 12		* 5200030500	PCB Assy, CONTROL A [All except C]
		5200030510	PCB Assy, CONTROL A [C]
4 - 13		* 5555945000	Bracket, PCB; B
4 - 14		5124063000	Jack Assy, 3-gang
4 - 15		* 5555946000	Bracket, Jack
4 - 16		* 5054204000	Capacitor, Ceramic; 0,01μF 50 V
4 - 17		* 5200031300	PCB Assy, REC/PLAY AMP,
4 - 18		* 5327005500	Terminal Assy, IN/OUTPUT
4 - 19		* 5200031400	PCB Assy, IN/OUTPUT
4 - 20		* 5552488001	Chassis, Rear
4 - 21		* 5581056000	Screw, Shoulder; A
4 - 22		5534118000	Rivet, Push
4 - 23		* 5534660000	Strain Relief, AC Power Cord [All except UK]
		* 5534661000	Strain Relief, AC Power Cord [UK]
4 - 24		* 5555063000	Washer GND
4 - 25	⚠	* 5128083000	Cord, AC Power [U, C]
	⚠	* 5127246000	Cord, AC Power [GE]
	⚠	* 5128077000	Cord, AC Power [E]
	⚠	* 5550008300	Cord, AC Power [A]
	⚠	* 5128095000	Cord, AC POWER [UK]
4 - 26		* 5122261000	Connector, Plug; 4P
4 - 27		* 5122262000	Connector, Socket; 4P
4 - 28		5282705800	Var. Res., 100 kΩ (A) x 2
4 - 29	⚠	* 5052910000	Spark Killer 0.033μF + 120Ω/125V [U]
	⚠	* 5292002600	Spark Killer 0.033μF + 120Ω/125V [C]
	⚠	* 5052907000	Spark Killer 0.01μF + 300Ω/300V [GE, L]
	⚠	* 5267702500	Spark Killer, 0.0047μF/250V [E, UK, A]
4 - 30	⚠	* 5300019400	Switch, Power [All except U, C]
	⚠	* 5134122000	Switch, Power [U, C]
4 - 31		* 5786360500	R-Pin, φ5
4 - 32		* 5534855000	Bar, Joint
4 - 33		* 5553365000	Chassis, Side; R

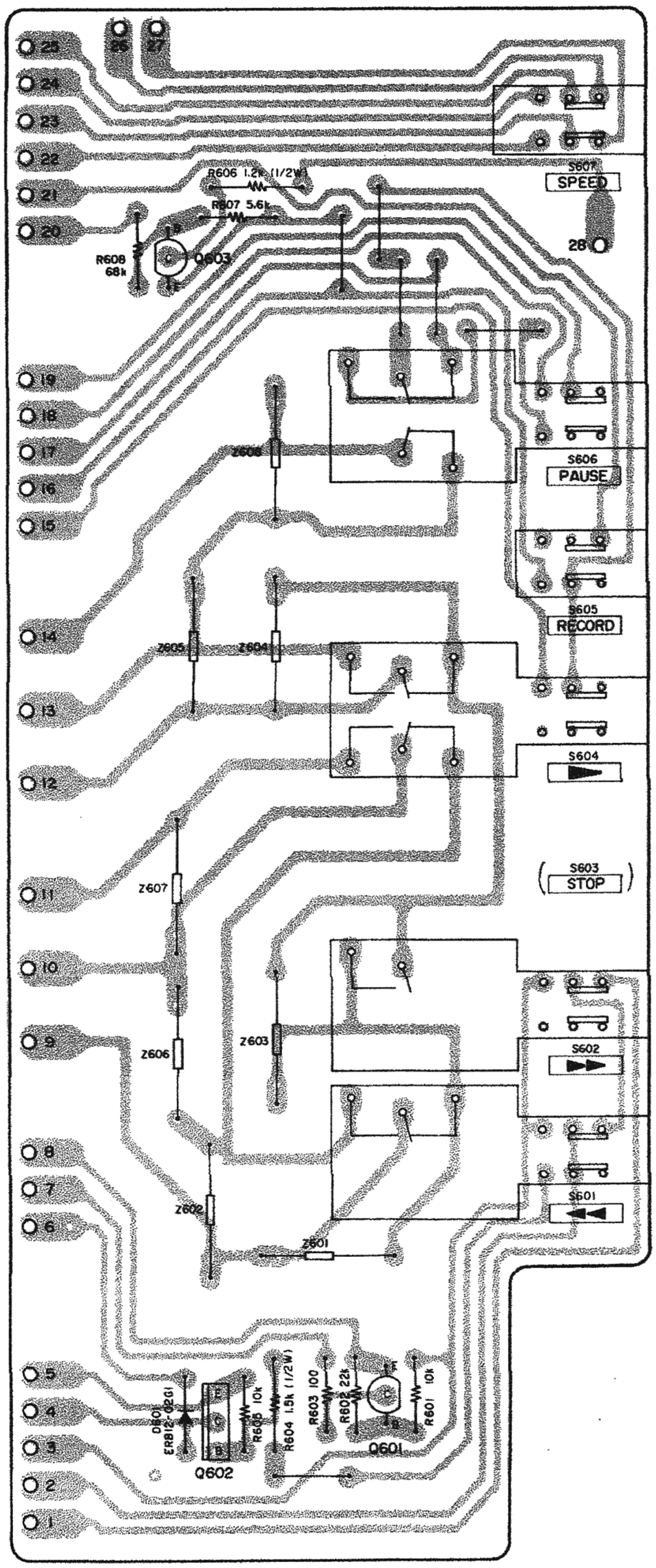
EXPLODED VIEW -4



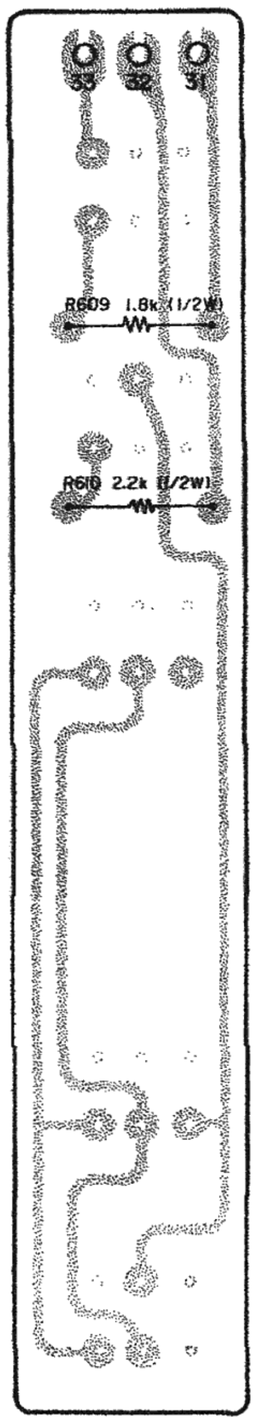
8. PC BOARDS AND PARTS LIST

PC Boards shown viewed from foil side except CONTROL B PCB ASSY

CONTROL A PCB ASSY

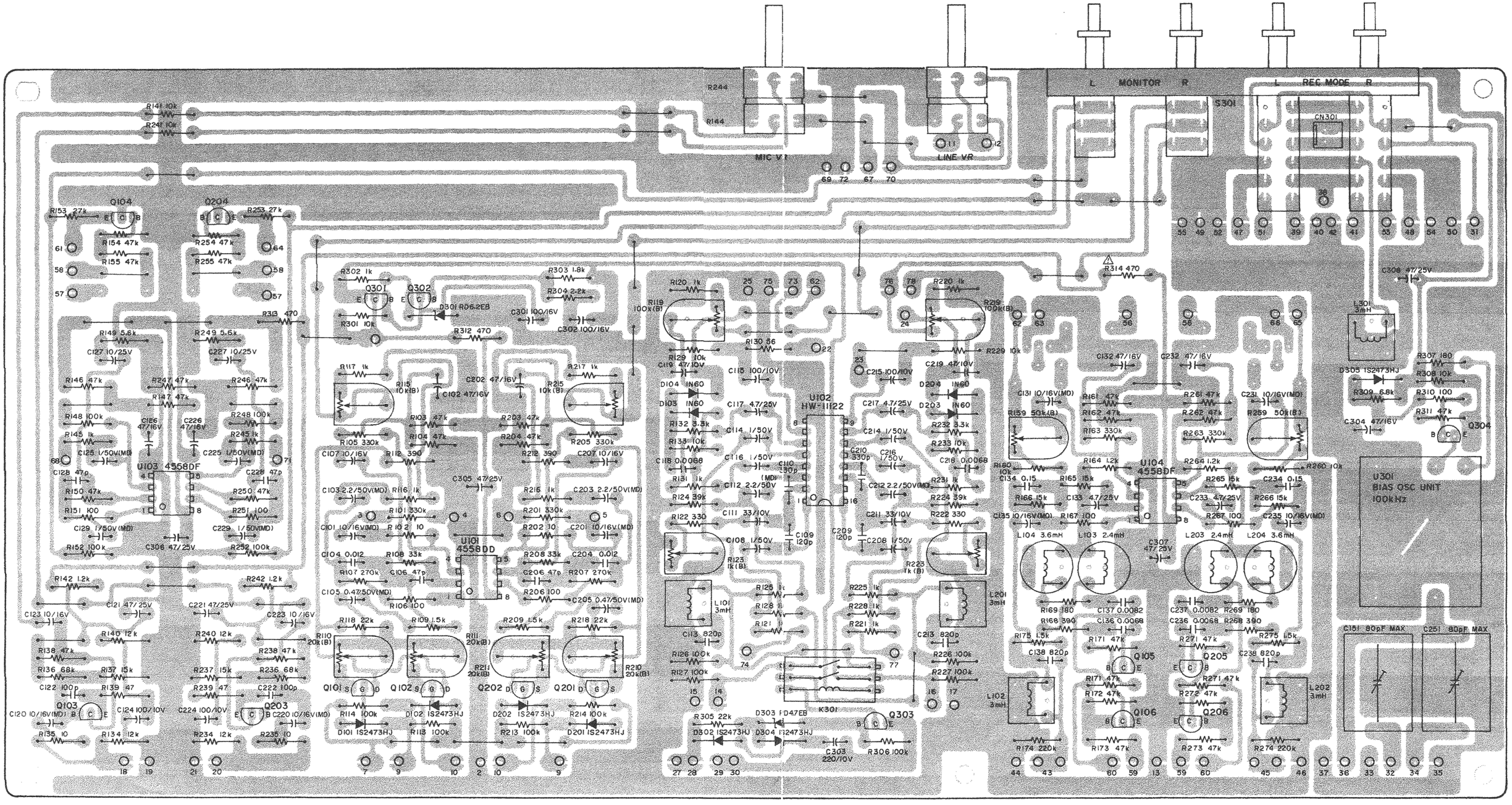


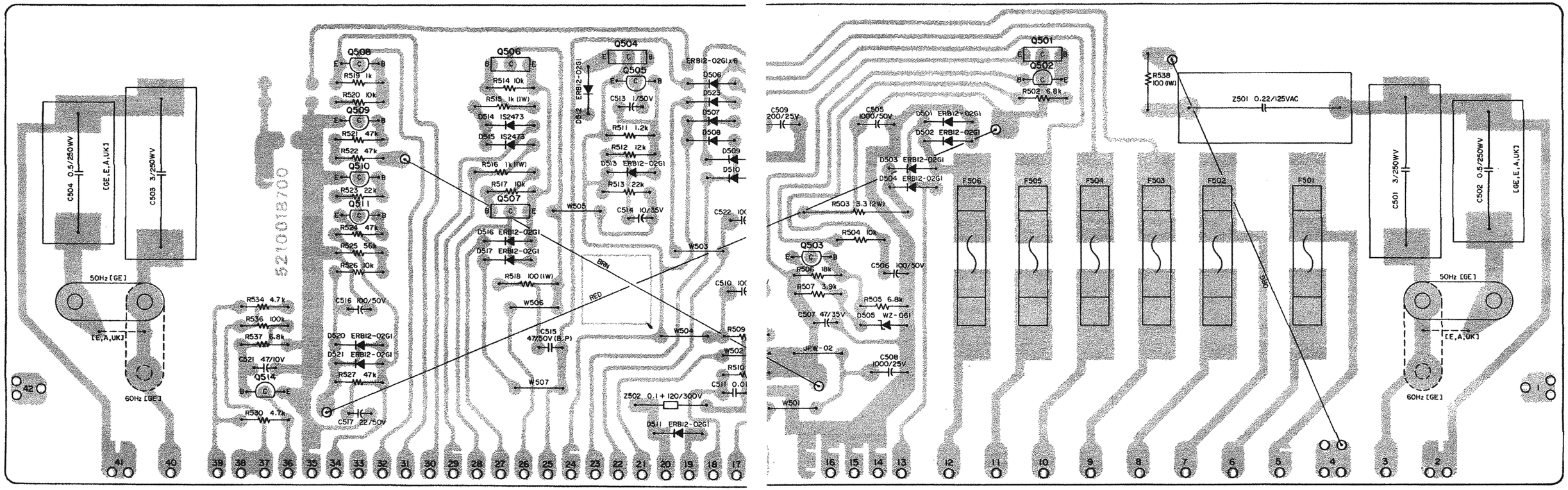
CONTROL B PCB ASSY



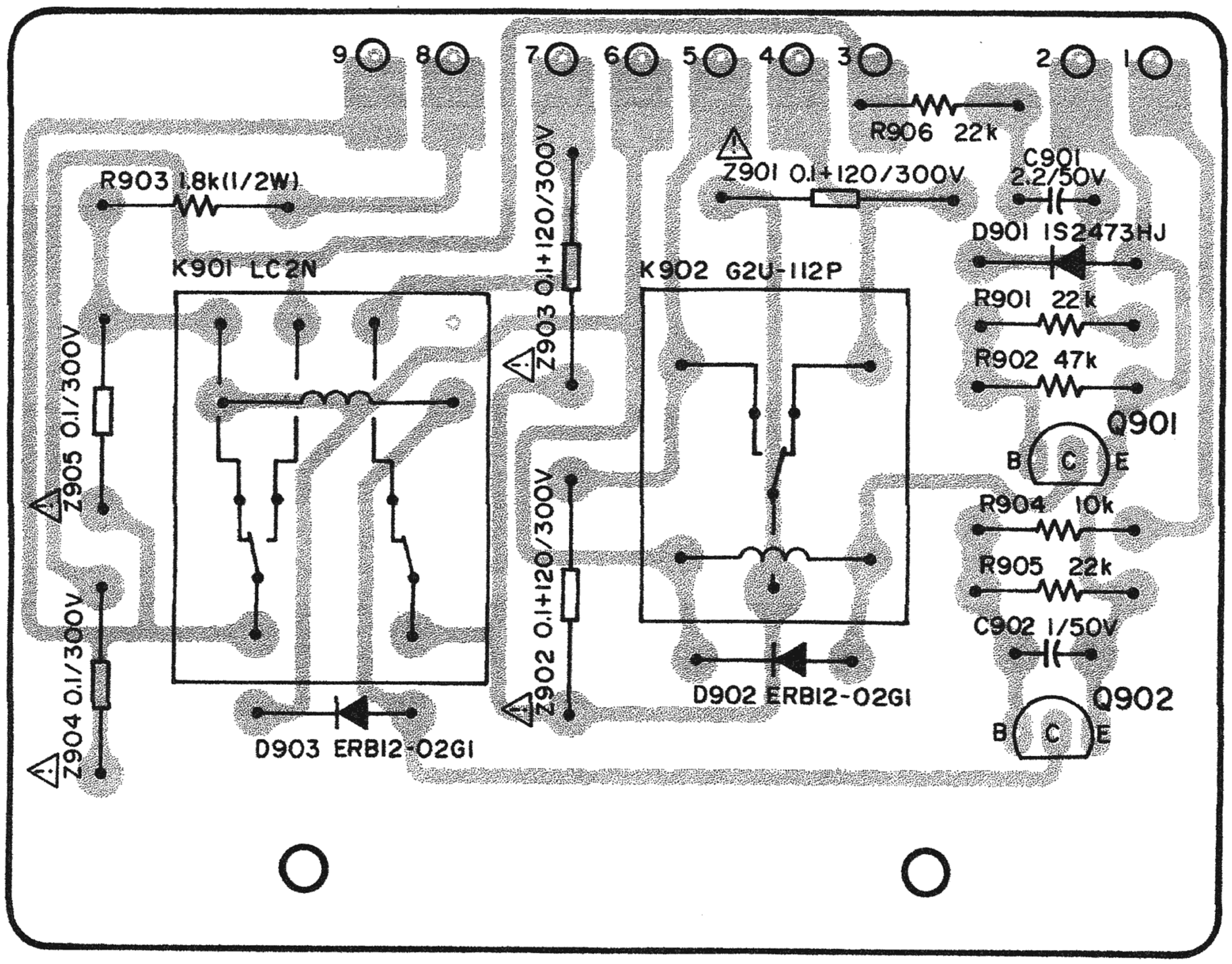
PC Board shown viewed from component side.

RECORD/REPRODUCE AMP PCB ASSY




C504 0.5/250WV
[GE,E,A,UK]
C503 3/250WV
50Hz [GE]
[E,A,UK]
60Hz [GE]
42
41
40
Q508
R519 1k
R520 10k
Q509
R521 47k
R522 47k
Q510
R523 22k
Q511
R524 47k
R525 56k
R526 30k
Q506
R514 10k
R515 1k (1W)
D514 1S2473
D515 1S2473
R516 1k (1W)
R517 10k
Q507
D516 ERB12-02GI
D517 ERB12-02GI
R518 100 (1W)
C516 100/50V
D520 ERB12-02GI
D521 ERB12-02GI
R527 47k
C517 22/50V
R534 4.7k
R536 100k
R537 5.6k
C521 47/10V
Q514
R530 4.7k
39
38
37
36
35
Q504
D512 ERB12-02GI
Q505
C513 1/50V
R511 1.2k
R512 12k
D513 ERB12-02GI
R513 22k
C514 10/35V
W505
W506
C515 47/50V (B-P)
W507
ERB12-02GI x6
D506
D523
D507
D508
D509
D510
C522 10(
W503
BRN
RED
C510 10(
R509
W502
R510
C511 0.0
Z502 0.1 + 120/300V
D511 ERB12-02GI
34
33
32
31
30
29
28
27
26
25
24
23
22
21
20
19
18
17
Q501
Q502
R502 6.8k
C509 200/25V
C505 1000/50V
D501 ERB12-02GI
D502 ERB12-02GI
D503 ERB12-02GI
D504 ERB12-02GI
R503 3.3 (2W)
R504 10k
Q503
R506 18k
R507 3.9k
C507 47/35V
JPW-02
W501
C506 100/50V
R505 6.8k
D505 WZ-061
C508 1000/25V
F506
F505
F504
F503
F502
F501
R538 100 (W)
Z501 0.22/125VAC
C501 3/250WV
C502 0.5/250WV
[GE,E,A,UK]
50Hz [GE]
[E,A,UK]
60Hz [GE]
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1

FLASHING PCB ASSY



Parts marked with * require longer delivery time than regular parts.

CONTROL A PCB ASSY

REF.	PARTS NO.	DESCRIPTION
	* 5200030500	Control PCB Assy [All except C]
	* 5200030510	Control PCB Assy [C]
	* 5157109000	Control PCB A
	TRANSISTORS	
Q601	* 5042625000	2SC-1318S
Q602	* 5145078000	2SD-600F
	DIODES	
D601	* 5143243000	ERB12-02G1
	RESISTORS	
	All resistors are rated ±5% tolerance, 1/4 watt and of carbon type unless otherwise noted.	
R601	* 5183106000	10kΩ
R602	* 5183114000	22kΩ
R603	* 5183050000	100Ω
R604	* 5180086000	1.5kΩ
R605	* 5183106000	10kΩ
	MISCELLANEOUS	
Z601, Z608	* 5052910000	Spark Killer 0.033μF +120/125V [All except C]
Z601, Z608	* 5292002600	Spark Killer 0.033μF +120/125V [C]

CONTROL B PCB ASSY

REF.	PARTS NO.	DESCRIPTION
	* 5158110000	Control B Assy
	* 515711000	Control B
	RESISTORS	
R609	* 5180088000	Carbon 1.8kΩ ±5%, 1/4 watt
R610	* 5180090000	Carbon 2.2kΩ ±5%, 1/4 watt

REC/REPRODUCE AMP PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	* 5200031300	REC/Reproduce Amp. PCB Assy
	* 5210031300	REC/Reproduce Amp. PCB
	IC's	
U101	* 5147028000	JRC-4558D-D
U102	* 5147053000	HA-1122W
U103, U104	* 5147024000	JRC-4558D-F
	TRANSISTORS	
Q101, Q201	* 5145103000	FET 2SK-68AM
Q102, Q202	* 5145103000	FET 2SK-68AM
Q103, Q203	* 5230770100	2SC-2240BL
Q104, Q204	* 5145185000	2SD-655E
Q106, Q206	* 5145092000	2SC-1740LNS
Q107, Q207	* 5145092000	2SC-1740LNS
	DIODES	
D101, D201	* 5143118000	1S2473HJ
D102, D202	* 5143118000	1S2473HJ
D103, D203	* 5042213000	1N60
D104, D204	* 5042213000	1N60
	RESISTORS	
	All resistors are rated ±5% tolerance, 1/4 watt and of carbon type unless otherwise noted.	
R101, R201	* 5183142000	330kΩ
R102, R202	* 5183082000	1.0kΩ
R103, R203	* 5183122000	47kΩ
R104, R204	* 5183122000	47kΩ
R105, R205	* 5183142000	330kΩ
R106, R206	* 5183058000	100Ω
R107, R207	* 5183140000	270kΩ
R108, R208	* 5183118000	33kΩ
R109, R209	* 5183086000	1.5kΩ
R112, R212	* 5183072000	390Ω
R113, R213	* 5183130000	100kΩ
R114, R214	* 5183130000	100kΩ
R116, R216	* 5183082000	1.0kΩ
R117, R217	* 5183082000	1.0kΩ
R118, R218	* 5183114000	22kΩ
R120, R220	* 5183082000	1.0kΩ
R121, R221	* 5183082000	1.0kΩ
R122, R222	* 5183082000	1.0kΩ
R124, R224	* 5183120000	39kΩ
R125, R225	* 5183082000	1.0kΩ
R126, R226	* 5183130000	100kΩ
R127, R227	* 5183130000	100kΩ
R128, R228	* 5183082000	1.0kΩ
R129, R229	* 5183106000	10kΩ
R130, R230	* 5183052000	56Ω
R131, R231	* 5183082000	1.0kΩ
R132, R232	* 5183094000	3.3kΩ
R133, R233	* 5183106000	10kΩ
R134, R234	* 5183108000	12kΩ
R135, R235	* 5183034000	10Ω
R136, R236	* 5183126000	68kΩ
R137, R237	* 5183110000	15k
R138, R238	* 5183122000	47k
R139, R239	* 5183042000	22Ω
R140, R240	* 5183108000	12kΩ

[U]: U.S.A. [C]: CANADA [GE]: GENERAL EXPORT
[A]: AUSTRALIA [E]: EUROPE [UK]: U.K.
[L]: LIMITED AREA

Parts marked with * require longer delivery time than regular parts.

REF. NO.	PARTS NO.	DESCRIPTION
R141, R241	* 5183106000	10kΩ
R142, R242	* 5183084000	1.2kΩ
R145, R245	* 5183082000	1.0kΩ
R146, R246	* 5183122000	47kΩ
R147, R247	* 5183122000	47kΩ
R148, R248	* 5183130000	100kΩ
R149, R249	* 5183100000	5.6kΩ
R150, R250	* 5183122000	47kΩ
R151, R251	* 5183058000	100Ω
R152, R252	* 5183130000	100kΩ
R153, R253	* 5183116000	27kΩ
R154, R254	* 5183122000	47kΩ
R155, R255	* 5183122000	47kΩ
R160, R260	* 5183106000	10kΩ
R161, R261	* 5183122000	47kΩ
R162, R262	* 5183122000	47kΩ
R163, R263	* 5183142000	330kΩ
R164, R264	* 5183084000	1.2kΩ
R165, R265	* 5183110000	15kΩ
R166, R266	* 5183110000	15kΩ
R167, R267	* 5183058000	100Ω
R168, R268	* 5183064000	180Ω
R169, R269	* 5183050000	47Ω
R170, R270	* 5183122000	47kΩ
R171, R271	* 5183122000	47kΩ
R172, R272	* 5183122000	47kΩ
R173, R273	* 5183122000	47kΩ
R174, R274	* 5183138000	220kΩ
R175, R275	* 5183086000	1.5kΩ

REF.	PARTS NO.	DESCRIPTION			
		CAPACITORS			
C101, C201	* 5173571800	Elec.	10μF	16V	VF
C102, C202	* 5173036800	Elec.	47μF	16V	(SM)
C103, C203	* 5173560800	Elec.	2.2μF	50V	MD
C104, C204	* 5170427000	Mylar	0.012μF	100V	±5%
C105, C205	* 5173554800	Elec.	0.47μF	50V	MD
C106, C206	* 5172308000	Ceramic	47pF	50V	±10%
C107, C207	* 5173010800	Elec.	10μF	16V	(SM)
C108, C208	* 5172992800	Elec.	1μF	50V	(SM)
C109, C209	* 5172313000	Ceramic	120pF	50V	±10%
C110, C210	* 5172318000	Ceramic	330pF	50V	±10%
C111, C211	* 5173027800	Elec.	33μF	16V	(SM)
C112, C212	* 5173560800	Elec.	2.2μF		MD
C113, C213	* 5054344000	Styl.	820pF	50V	±10%
C114, C214	* 5172992800	Elec.	1μF	50V	(SM)
C115, C215	* 5173044800	Elec.	100μF	10V	(SM)
C116, C216	* 5172992800	Elec.	1μF	50V	(SM)
C117, C217	* 5173564800	Elec.	47μF	25V	MD
C118, C218	* 5170421000	Mylar	0.0068μF	100V	±5%
C119, C219	* 5173035800	Elec.	47μF	10V	
C120, C270	* 5173571800	Elec.	10μF	16V	MD
C121, C221	* 5173037800	Elec.	47μF	25V	(SM)
C122, C222	* 5172312000	Ceramic	1000pF	50V	±10%
C123, C223	* 5173571800	Elec.	10μF	16V	MD
C124, C224	* 5173044800	Elec.	100μF	10V	(SM)
C125, C225	* 5173556800	Elec.	1μF	50V	MD
C126, C226	* 5173036800	Elec.	47μF	16V	(SM)
C127, C227	* 5173011800	Elec.	10μF	25V	(SM)
C128, C228	* 5172308000	Ceramic	47pF	50V	±10%
C129, C229	* 5173556800	Elec.	1μF	50V	MD
C131, C231	* 5173571800	Elec.	10μF	16V	MD
C132, C232	* 5173036800	Elec.	47μF	16V	(SM)
C133, C233	* 5173564800	Elec.	4.7μF	25V	MD
C134, C234	* 5170453000	Mylar	0.15μF	100V	±5%
C135, C235	* 5173571800	Elec.	10μF	16V	MD
C136, C236	* 5170421000	Mylar	0.0068μF	100V	±5%
C137, C237	* 5170423000	Mylar	0.0082μF	100V	±5%
C138, C238	* 5054344000	Styl	820pF	50V	±5%

REF.	PARTS NO.	DESCRIPTION	
		VARIABLE RESISTORS	
R110, R210	* 5150233000	Semi-fixed	20k (B)
R111, R211	* 5150233000	Semi-fixed	20k (B)
R115, R215	* 5150092000	Semi-fixed	10k (B)
R119, R219	* 5150096000	Semi-fixed	100k (B)
R123, R223	* 5053446000	Semi-fixed	1k (B)
R143, R243	* 5282705900	10k (A) x 2	
R144, R244	* 5282705900	10k (A) x 2	
R159, R259	* 5150094000	Semi-fixed	50k (B)
		TRIMMER CAPACITORS	
C151, C251	* 5054707000	5-80pF	
		COILS	
	* 5160041000	Rec. EQ, 2.4mH	20%
	* 5160042000	Rec. EQ, 3.6mH	20%
L101, L201	* 5056659000	Trap, 3mH	20%
L102, L202	* 5056659000	Trap, 3mH	20%

Parts marked with * require longer delivery time than regular parts.

POWER SUPPLY PCB ASSY

REF.	PARTS NO.	DESCRIPTION
	MISCELLANEOUS	
U301	* 5040090000	OSC Unit
S101	* 5300020900	Switch, Push ; 4-gang
	* 5122126000	Connector Plag, 2P
	TRANSISTORS	
Q301	* 5042475000	2SC-1384Q
Q302~Q304	* 5145092000	2SC-1740LNS
	DIODES	
D301	* 5042554000	RD6.2EB 3% Zener
D302	* 5143118000	1S2473HJ
D303	* 5143121000	RD4.7EB Zener
D304, D305	* 5143118000	1S2473HJ
	RESISTORS	
	All resistors are rated ±5% tolerance, 1/4 watt and of carbon type unless otherwise noted.	
R301	* 5183106000	10kΩ
R302	* 5183082000	1.0kΩ
R303	* 5183088000	1.8kΩ
R304	* 5183090000	2.2kΩ
R305	* 5183114000	22kΩ
R306	* 5182130000	100kΩ
R307	* 5183064000	180Ω
R308	* 5183106000	10kΩ
R309	* 5183102000	6.8kΩ
R310	* 5183058000	100Ω
R311	* 5183122000	47kΩ
R312~R314	* 5184265000	470Ω Non Flammable
	CAPACITORS	
C301, C302	* 5173045800	Elec. 100μF 16V (SM)
C303	* 5173053800	Elec. 220μF 16V (SM)
C304~308	* 5173037800	Elec. 47μF 25V (SM)
	COIL	
L301	* 5056659000	Trap, 3mH 20%
	MISCELLANEOUS	
K301	* 5061137000	Relay Reed 12V LAB2L

REF. NO.	PARTS NO.	DESCRIPTION
	* 5200030410	Power Supply PCB Assy [U, C]
	* 5200030400	Power Supply PCB Assy [J, GE]
	* 5200030420	Power Supply PCB Assy [E, UK, A]
	* 5210018700	Power Supply [All except E, UK, A]
	* 5210031200	Power Supply [E, UK, A]
	TRANSISTORS	
Q501	* 5145087000	2SD-313E
Q502	* 5042625000	2SC-1318S
Q503	* 5145092000	2SC-1740LNS
Q504	* 5145087000	2SD-313E
Q505	* 5145043000	2SA-720Q
Q506, Q507	* 5145078000	2SD-600F
Q508	* 5145043000	2SA-720Q
Q509, Q510	* 5145093000	2SC-1740LNS
Q511	* 5042553000	2SA-733P
	DIODES	
D501~D504	* 5143243000	ERB12-02G1
D505	* 5042514000	Zener, WZ-061
D506~D513	* 5143243000	ERB12-02G1
D514, D515	* 5143118000	1S2473HJ
D516, D517	* 5143243000	ERB12-02G1
D520~D524	* 5143243000	ERB12-02G1
	RESISTORS	
	All resistors are rated ±5% tolerance, 1/4 watt and of carbon type unless otherwise noted.	
R502	* 5183102000	6.8kΩ
R503	⚠ * 5184306000	3.3Ω 2W ±10% Cement
R504	* 5183106000	10kΩ
R505	* 5183102000	6.8kΩ
R506	* 5183112000	18kΩ
R507	* 5183096000	3.9kΩ
R509	* 5183106000	10kΩ
R510	⚠ * 5184233000	22Ω Non Flammable
R511	* 5183084000	1.2kΩ
R512	* 5183108000	12kΩ
R513	* 5183114000	22kΩ
R514	* 5183106000	10kΩ
R515,R516	⚠ * 5185790000	1.0kΩ 1W Non Flammable
R517	* 5183106000	10kΩ
R518	⚠ * 5184755000	100Ω 1W Non Flammable
R519	* 5183082000	1.0kΩ
R520	* 5183106000	10kΩ
R521, R522	* 5183122000	47kΩ
R523	* 5183114000	22kΩ
R524	* 5183122000	47kΩ
R525	* 5183124000	56kΩ
R526	* 5183106000	10kΩ
R527	* 5183122000	47kΩ
R538	⚠ * 5184755000	100Ω 1W Non Flammable
R539	* 5183072000	390Ω
R540	* 5183078000	680Ω

Parts marked with * require longer delivery time than regular parts.

REF. NO.		PARTS NO.	DESCRIPTION
		CAPACITORS	
C501, C503		* 5171613000	AC Film 3μF 250V
C502, C504		* 5267702700	AC Film 0.5μF 250V [All except J, GE]
C505		* 5172973800	Elec. 1000μF 50V (SM)
C506		* 5172936800	Elec. 100μF 35V (SM)
C507		* 5172927800	Elec. 47μF 35V (SM)
C508		* 5172971800	Elec. 1000μF 25V (SM)
C509		* 5172978800	Elec. 2200μF 25V (SM)
C510		* 5172973800	Elec. 1000μF 50V (SM)
C511		* 5054802000	Mylar. 0.01μF 100V ±10%
C513		* 5172882800	Elec. 1μF 50V (SM)
C514		* 5172902800	Elec. 10μF 35V (SM)
C515		* 5055949000	Elec. 47μF 50V B.P.
C516		* 5172937800	Elec. 100μF 50V (SM)
C517		* 5172911800	Elec. 22μF 50V (SM)
C522		* 5172970800	Elec. 1000μF 16V (SM)
C523		* 5172961800	Elec. 470μF 16V (SM)
		MISCELLANEOUS	
Z501		* 5171615000	Meta-polypro. 0.22μF 125V ±20%
Z502	⚠	* 5052905000	Spark Killer 0.1μF +120/300V
		* 5033291000	Plate, Insulating (2 used)
		* 5033295000	Table, Insulating (2 used)
F501,F502	⚠	* 5307003600	Fuse, 1A 250V [U, C]
F503	⚠	* 5307004300	Fuse, 3A 250V [U, C]
F504	⚠	* 5307003600	Fuse, 1A 250V [U, C]
F505	⚠	* 5307004100	Fuse, 2A 250V [U, C]
F506	⚠	* 5307004000	Fuse, 1.6A 250V [U, C]
F501,F502	⚠	* 5041101000	Fuse, T1A 250V [J, GE]
F503	⚠	* 5042211000	Fuse, T3A 250V [J, GE]
F504	⚠	* 5041101000	Fuse, T1A 250V [J, GE]
F505	⚠	* 5041114000	Fuse, T2A 250V [J, GE]
F506	⚠	* 5041151000	Fuse, T15A 250V [J, GE]
F501,F502	⚠	* 5041140000	Fuse, 1A 250V [E, UK, A]
F503	⚠	* 5142191000	Fuse, 3.15A 250V [E, UK, A]
F504	⚠	* 5141140000	Fuse, 1A 250V [E, UK, A]
F505	⚠	* 5142189000	Fuse, 2A 250V [E, UK, A]
F506	⚠	* 5142188000	Fuse, 1.6A 250V [E, UK, A]
	⚠	* 5041237000	Holder, Fuse (12 used) [J, U, C, GE]
	⚠	* 5142087000	Holder, Fuse (12 used) [E, UK, A]

LED PCB ASSY

REF.	PARTS NO.	DESCRIPTION
	*5200030700	LED PCB Assy
	*5210008500	PCB LED
	DIODES	
D701	*5143139000	SLB-26GG (GREEN)
D702	*5143140000	SLB-26UR (RED)

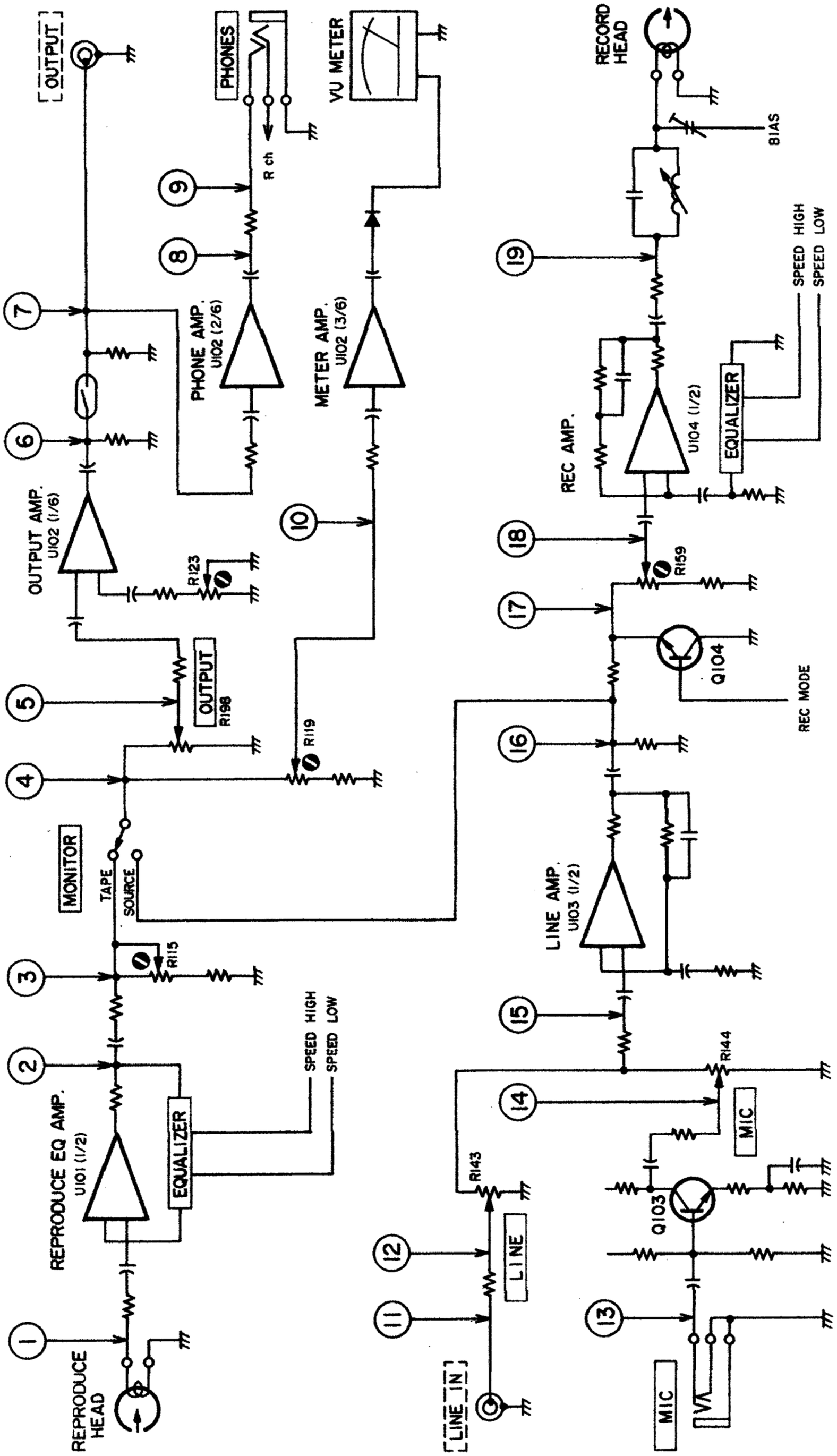
IN/OUTPUT PCB ASSY

REF.	PARTS NO.	DESCRIPTION
	*5200031400	IN/OUTPUT PCB Assy
	*5157104001	PCB IN/OUTPUT
	RESISTOR	
	All resistors are rated ±5% tolerance, 1/4 watt and of carbon type unless otherwise noted.	
R199, R299	*5183124000	56kΩ

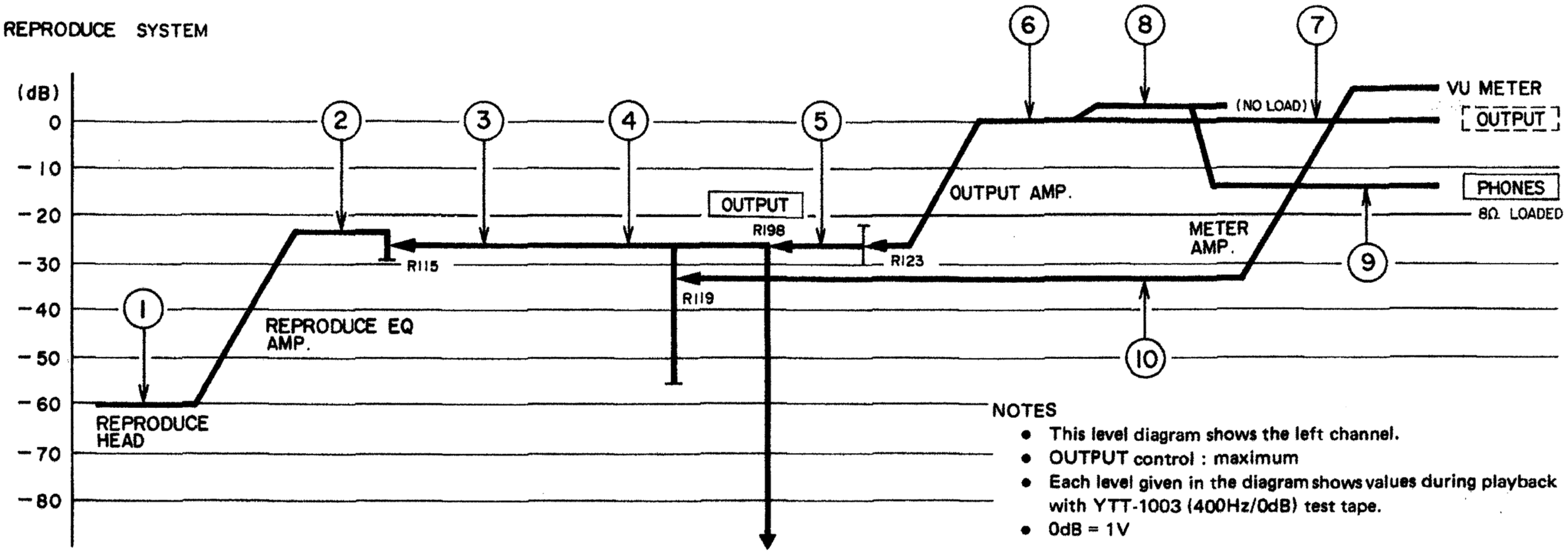
FLASHING PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	*5200029200	FLASHING PCB Assy
	*5210029200	PCB FLASHING
	TRANSISTORS	
Q901, Q902	*5145092000	2SC1740LNS
	DIODES	
D901	*5143118000	1S2473HJ
D902, D903	*5143243000	ERB12-02G1
	RESISTORS	
R901	*5183114000	22kΩ
R902	*5183122000	47kΩ
R903	*5180088000	1.8kΩ (1/2W)
R904	*5183106000	10kΩ
R905, R906	*5183114000	22kΩ
	CAPACITORS	
C901	*5172886800	Elec. 2.2μF 50V
C902	*5172882800	Elec. 1μF 50V
	MISCELLANEOUS	
Z901~Z903	*5052905000	Spark Killer 0.1μF +120/300V Non Flammable
Z904, Z905	*5054992000	Spark Killer 0.1μF/300V Non Flammable
K901	*5290008500	Relay LC2N
K902	*5061131000	Relay G2V-112P

9. LEVEL DIAGRAM



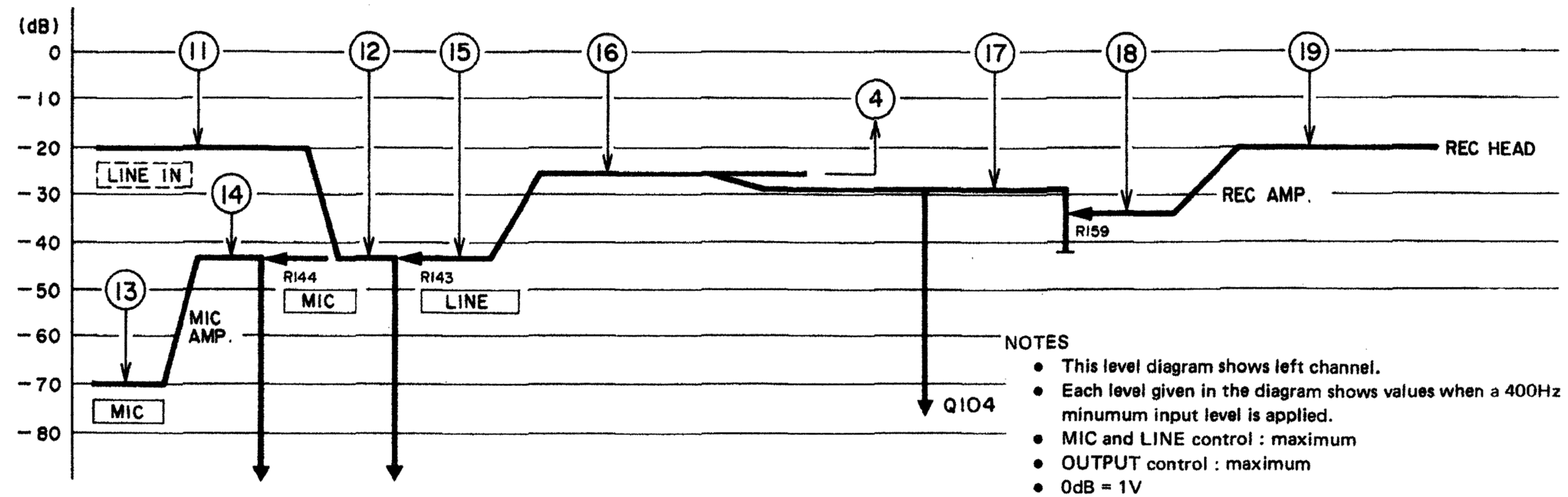
REPRODUCE SYSTEM



NOTES

- This level diagram shows the left channel.
- OUTPUT control : maximum
- Each level given in the diagram shows values during playback with YTT-1003 (400Hz/0dB) test tape.
- 0dB = 1V

RECORDING SYSTEM



NOTES

- This level diagram shows left channel.
- Each level given in the diagram shows values when a 400Hz minumum input level is applied.
- MIC and LINE control : maximum
- OUTPUT control : maximum
- 0dB = 1V