

TEAC®

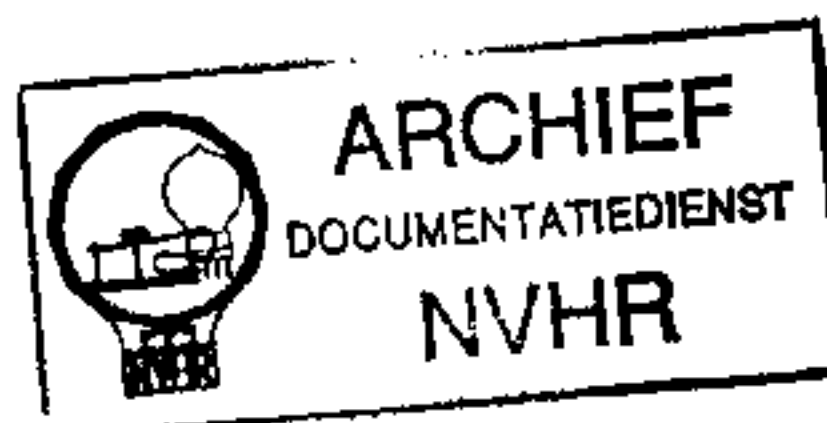
Met dank aan A.R.A. van Rossum

Information Supplement

Open Reel Tape Deck

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Ned. Ver. v. Historie v/d Radio



The purpose of this booklet is to supply a fund of information that will increase your knowledge of and interest in open reel tape decks. We realize that no manual this size could possibly answer every question you may have nor cover every feature and technique used today. But, if this booklet helps you to enjoy your deck a little more, its basic purpose has been achieved.

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ENVIRONMENTAL CONSIDERATIONS

Your TEAC deck is well constructed and is adaptable to a wide range of conditions, but a few cautions should be observed to insure proper operation and prolong unit's useful life.

TEMPERATURE EXTREMES

Do not operate the deck at temperatures above 100°F (38°C) or lower than 40°F (5°C). Direct sunlight, stoves, or heating devices nearby will also raise the internal temperature of the deck which may cause damage to some components. Low Temperatures may cause sluggish operation and place an overload on the drive mechanism.

DUSTY ENVIRONMENTS

As with any precision machine having moving parts, your deck should be covered when not in use. Excessive dust may result in bearing or tape head wear. Also protect your tapes from dust.

HIGH HUMIDITY AND OCEAN SALT AIR

High humidity conditions will shorten equipment life from corrosion and possible fungus growth on the printed circuit boards. If near the ocean, extra care should be taken to cover your deck after use. Covering will prevent salt air from corroding metal surfaces, especially the bearings and internal connections.

EXTREME LINE VOLTAGE FLUCTUATION

If you are in an area where line voltage fluctuation is severe, the use of a voltage controller (VARIAC) may be advisable.

Tape Tracks and Channels of The Open Reel Tape Decks

1. **Full track recording:** The magnetic flux pattern produced by the head covers almost the whole surface of the tape. The entire tape is recorded in one direction only.

2. **Half track monophonic:** The flux pattern generated by the head covers less than half of the tape surface and the recording head is off-set to one edge of the tape. A monophonic signal is recorded on one half of the tape and then the reels are inter-changed and the other half of the tape is recorded. The same half track head is used for both passes. The tracks are, of course, recorded in opposite directions on the tape.

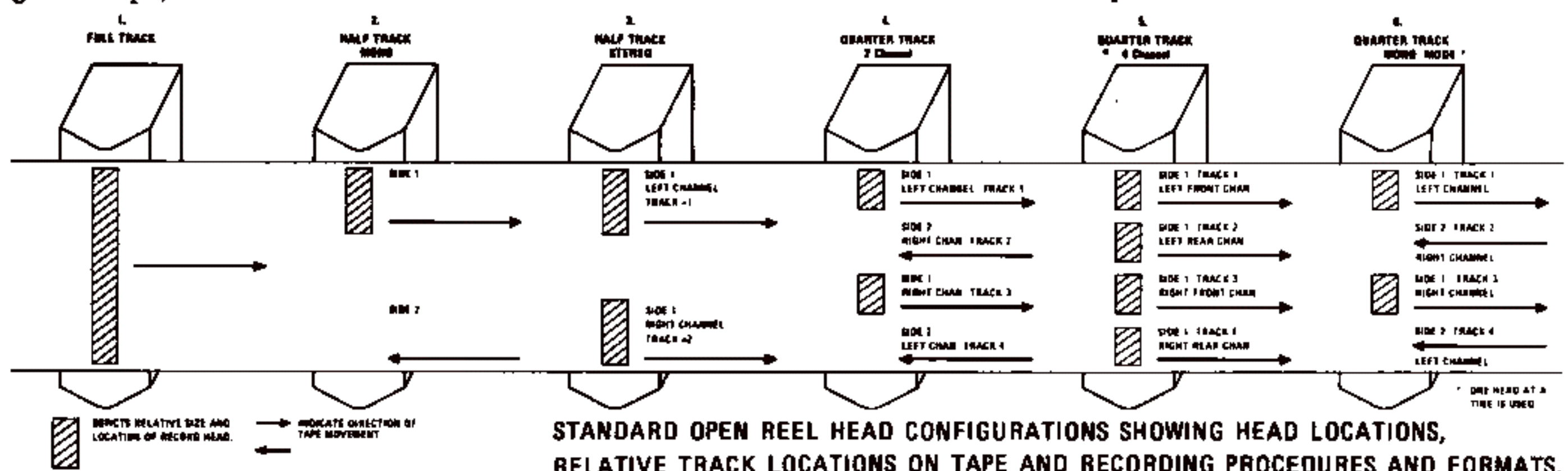
3. **Half track stereo:** Two recording sections (heads) are used to record two tracks simultaneously on the tape. Both channels are recorded in the same direction on one pass through the tape.

4. **Quarter track, 2-channel stereo:** 2 record heads are used to record all 4 tracks on the tape. On the first pass through the tape, track 1 and 3 are recorded simultaneous-

ly. At the end of the first pass, the reels are inter-changed and tracks 2 and 4 are recorded using the same two heads that recorded tracks 1 and 3. The actual program on the tape for tracks 1 and 3, and 2 and 4 is recorded in opposite directions but since the reels are inter-changed between passes, the tape is recorded and played in the forward direction for both passes of the tape.

5. **Quarter track, 4-track/4-channel (Quadriphonic):** The head assembly consists of 4 separate heads and all 4 tracks can be recorded at the same time on a single pass through the tape.

6. **Quarter track, single channel (Monophonic):** The 4 tracks on the tape are recorded one track at a time. At the end of each pass through the tape the reels are inter-changed and the next track is recorded. The order in which the tracks are recorded is 1, 4, 3 and 2. Four track recording gives maximum playback time however, the benefits of stereo reproduction are lost.



STANDARD OPEN REEL HEAD CONFIGURATIONS SHOWING HEAD LOCATIONS, RELATIVE TRACK LOCATIONS ON TAPE AND RECORDING PROCEDURES AND FORMATS.
DIAGRAM A.

Playback compatibility

Diagram A shows the relative track locations and dimensions on a standard prerecorded $\frac{1}{4}$ " open reel tape. The playback heads closely correspond to the record heads depicted in the diagram. Some decks in fact use the same record head for playback also. A brief study of the track locations and recording sequence for the various common tape formats will lead to many valid conclusions concerning compatibility between various tapes and tape decks. Some of these conclusions are stated briefly below.

1) A half track mono deck can playback a pre-recorded full track tape.

2) A half track stereo deck can play either a full track or a half track tape but the signal from a half track mono tape on side 2 will be played back in the opposite direction. However, the right channel output can be turned down and the left channel only used for playback of both sides of the tape. When playing a full track tape the left and right channel will reproduce the same sounds.

3) A four track stereo tape deck can playback both 4 track and 2 track tapes and from the point of compatibility has the widest possible range of utilization. When playing a 2 track stereo tape on a 4 track recorder, track #1 will be

completely covered by the head. Track #2 will be slightly off alignment but stereo can still be enjoyed by compensating for the slight loss of track #2 volume with the volume or balance controls of the amplifier. On the other hand a four track tape cannot be played back on a two track recorder as both tracks #1 and #2, and #3 and #4 will be reproduced together resulting in mixed unintelligible sound.

There are of course other possibilities for playback compatibility that the inventive audiophile or home recordist can discover by consulting this diagram and other sources. The procedures for recording in each of the various formats will be covered in the Owner's Manual supplied with each TEAC deck. This section is intended to give the interested recordist a complete overview of standard recording tape formats.

Almost all tape decks are designed and constructed to record and playback only one of the standard formats. A few 4-channel decks have a selectable 2-track playback head for compatibility with pre-recorded 2-track tapes. Full track and half track monophonic decks for home use are rarely, if ever, available today. Full track professional decks may be purchased however.

Introduction to Open Reel Tape Decks

Open Reel

Many articles have been written concerning the relative merits of open reel decks vs cassettes decks. Some of these articles have even selected one or the other as being better. Our position, at TEAC, is that both types are excellent, can give good service and provide many months and even years of recording and listening pleasure. A large number of audiophiles own both an open reel deck and a cassette deck. Cassette decks have many advantages and features that continue to attract customers (especially convenience and price). Open reel decks also have capabilities and features that appeal to many serious audiophiles. Here are some of them. Features such as separate Record/Playback heads, Editing and cueing controls, mic-line mixing, monitoring functions, provide versatility for many creative recording situations. The modern audiophile doesn't seem to be content to just record performances as they are. He or she wants to create, to experiment, to modify. They want to put something of themselves into their recordings. The pro or semi-pro recordist will find the high end

performance and versatility a distinct advantage. Few, if any, records are made today directly from a single live performance. A singer's voice is recorded at one time, instruments are added or changed, a chorus may be added and often other special effects are mixed in. The final recording may be completely unrecognizable by the artist who sang the original song.

The higher speeds of the open reel decks make possible higher quality recordings which challenge the limits of one's entire stereo system.

The quality, styling and price of open reel decks make them prestige items. A well designed open reel deck seems to blend in with the most expensive furniture decor and even enhances the overall atmosphere of successful living.

There are various head types and configurations. This section is intended to give you a basic idea of how some of the systems operate. Please consult your owner's manual for complete details of the features and capabilities of your deck.

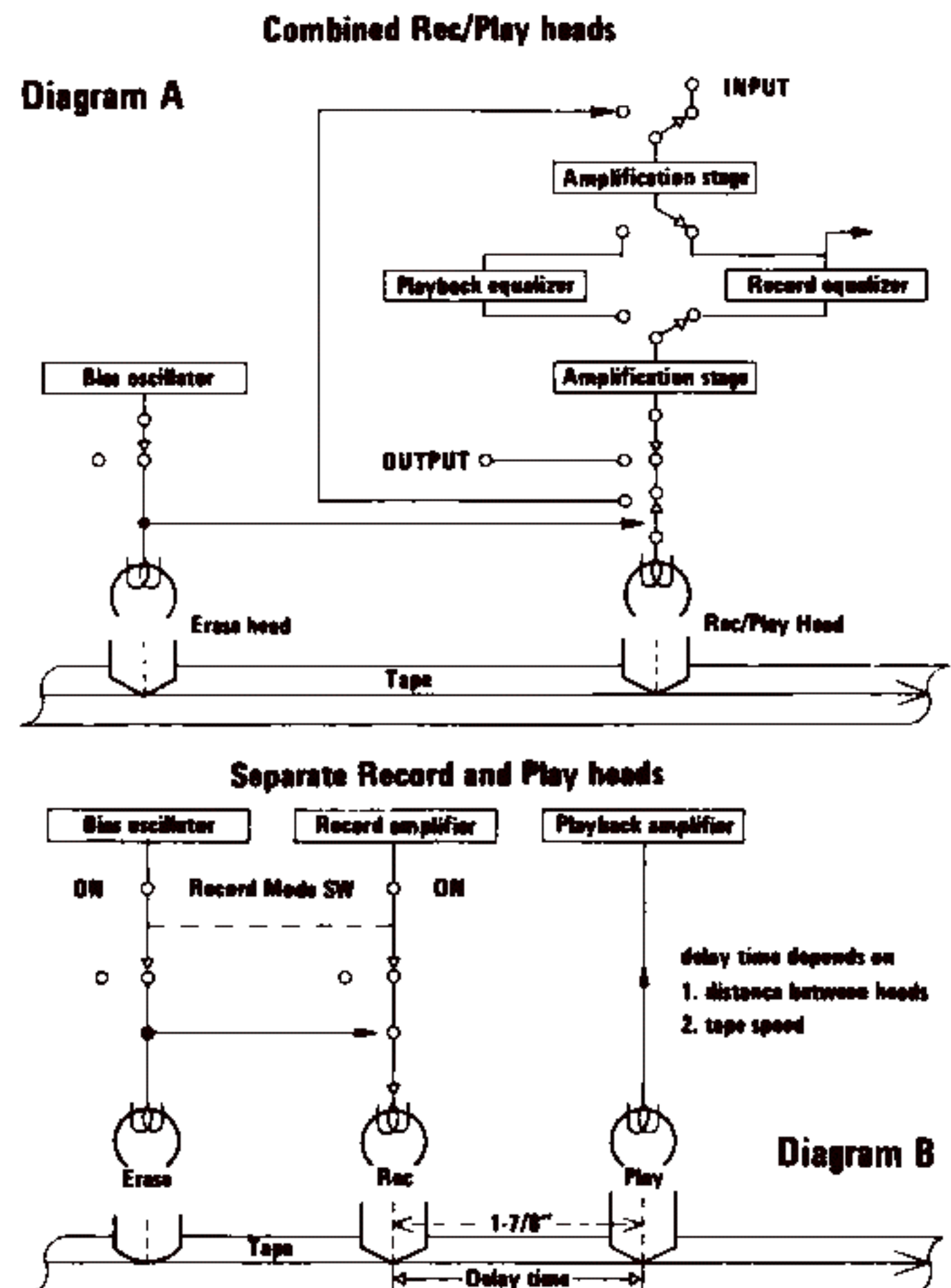
Earlier models of tape recorders used a combined Record/Play head. (Diagram A). With such a head, you cannot record and reproduce at the same time. Another disadvantage of the combined head was in the design of the width of the head gap. Modern head technology generally dictates that the gap width should be different between the record and playback functions for optimum output and frequency response.

When there are severe space and cost limitations, combined record/play heads are still used today, and even though these heads are well designed and highly efficient they still represent a compromise of optimum head design. Open reel decks which normally have no head space limitations and usually command a higher price due to their special capabilities, normally have separate Record and Play heads. (Diagram B). The separate heads allow monitoring of the tape during recording. This system has distinct advantages. You can insure that your tape is actually being recorded properly as you record. The playback signal can also be connected to the record head for special effects, such as sound-on-sound, echo and sound-with-sound. (These techniques are explained on pp. 9, 10.)

With separate record and playback heads there will be a time delay between the recorded signal and the reproduced signal. The delay depends on two factors; the physical distance between the two heads and the tape speed. For instance, if the record head and playback heads are $1\frac{7}{8}$ " apart and the tape speed is $3\frac{3}{4}$ ips, the delay is about $\frac{1}{2}$ second. With the tape speed increased to $7\frac{1}{2}$ ips; the delay is $\frac{1}{4}$ second. At 15 ips the delay is about $\frac{1}{8}$ second. See diagram B.

For some recording situations, even this fraction of a second is not acceptable. If a musician or audiophile

wanted to add a new instrument or voice to a song already recorded and wanted to listen to the recorded song for timing and synchronization, this delay would present a problem.



Introduction to Open Reel Tape Decks (cont)

Editing and Cueing

Editing means to change a tape by physically cutting out unwanted sections of a recording or adding sounds by adding pieces of pre-recorded tape. The cutting and rejoining of sections of tape is called splicing. Cueing means to locate a section of tape by listening for the beginning or end of a recorded section. High speed cueing is done by causing the tape to contact the playback head during fast forward or rewind operation by retracting the tape "lifters." Manual cueing is done by moving the tape across the playback head by turning the tape reels by hand. High speed and manual cueing are special features that are available on most TEAC open reel tape decks.

MIC/Line Mixing

MIC/LINE mixing is a feature that allows the recordist to mix a line input and a microphone input together on the same track. An internal mixer in the tape deck is required to accomplish this. You can add a live sound by MIC (your own voice or other sounds) to a pre-recorded song connected to the LINE Inputs for real creative recording.

Monitoring function

Monitoring basically means to listen to the playback of a recording while recording. You can insure that the sound is actually going on the tape properly without waiting until the tape is rewound and then played back. The deck must have separate REC and Play heads for this monitoring function.

Splicing Tape

Editing tape is a fascinating way to make creative recordings by eliminating and joining different segments of a recording into one pleasing tape. Long, silent or boring segments can be removed by proper editing. In fact, as editing is a creative exercise, there is only your imagination and the length of tape to limit the possibilities. Broken tape can also be easily mended by splicing, one of the steps required in editing.

The first step is to precisely locate the section of tape to be removed.

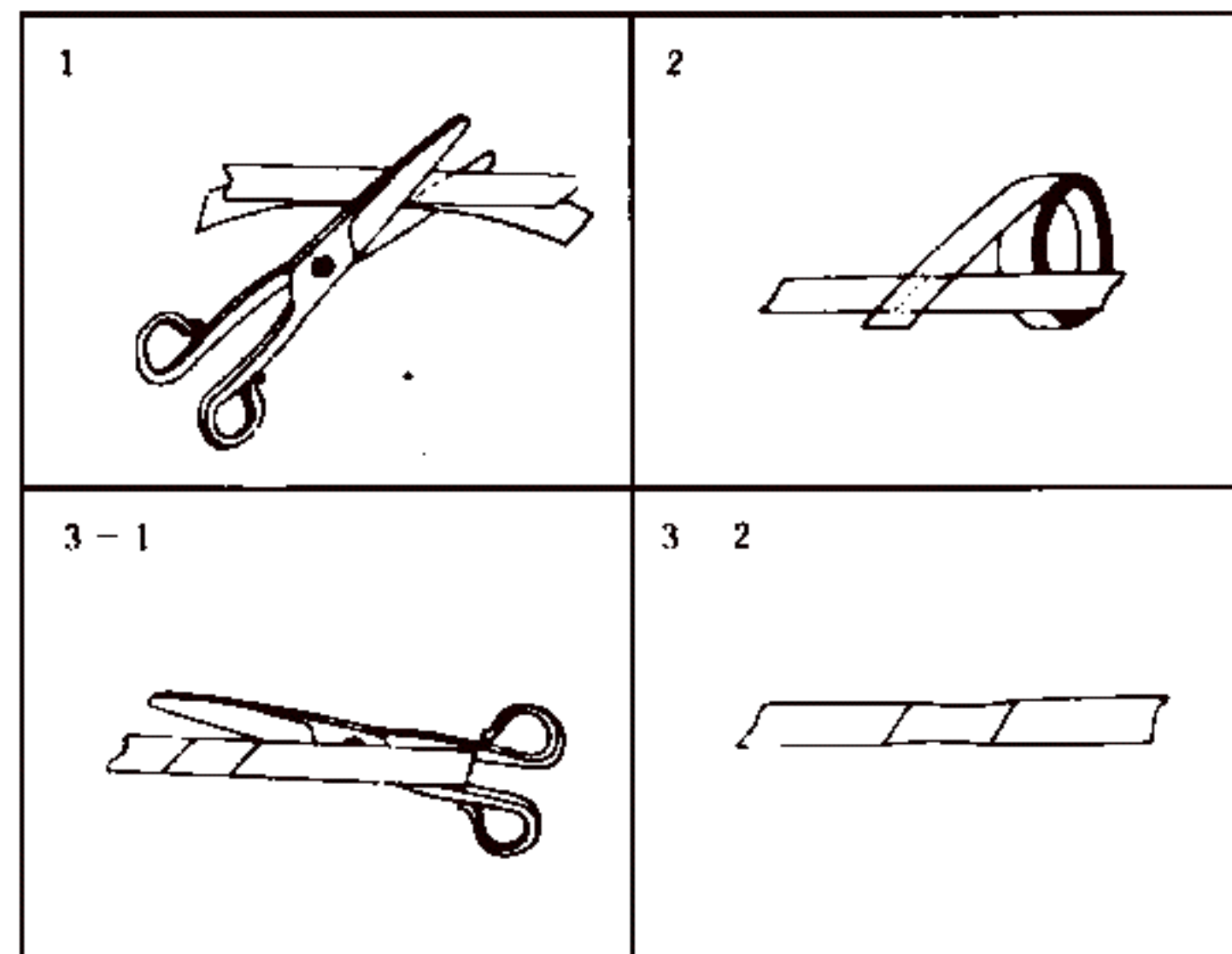
On some TEAC decks this can be done by manually cueing the tape. Consult the Owner's Manual for operation of this feature in your deck.

Next, use an Editing Block or a pair of scissors (demagnetized) to cut the tape at the places marked.

Finally, the splicing is to be done.

A Tape Splicer is preferred, but a pair of scissors that have been demagnetized will be satisfactory. Before you proceed, have some commercially available Splicing Tape available. Never use Cellophane (Scotch Brand) tape, for that adhesive will spread and contaminate your heads.

1. Overlap the ends to be spliced by approximately 1/2 inch and align them carefully.
2. Cut through the center of the overlapped area at a 45 to 60 degree angle.
3. Butt the slanted ends of the cut tape together. Use a straightedge or ruler to assure a perfectly straight alignment.



4. Apply splicing tape to the shiny base side of the tape (opposite to the tape side that touches the head) as shown in diagram 2. Note that splicing tape goes perpendicular to the recording tape.
5. Place the spliced connection on a hard surface and rub the splicing tape briskly with your fingernail or other hard smooth object. This is to assure a firm adherence to the splicing tape.
6. Trim off the excess splicing tape as shown in Fig. 3-1 and 3-2. Note how to cut slightly into the recording tape to insure complete removal of the excess.

IMPORTANT: Editing will destroy or seriously "cut" any material recorded on the other side of the tape (tracks 2 & 4). If editing is anticipated, record only on one side of the tape.

After editing, material can then be copied onto both sides of another tape.

When attaching blank "leader" tape onto your tapes, follow the same procedures given here for splicing.

Bias and Equalization-General Theory

Bias

In order to get the magnetic particles on a tape to respond properly to the changing signal supplied to the record head, a pre-conditioning bias is needed. Most home recorders today use an alternating current (AC) bias at a frequency of 50 to 150 kHz. This bias raises the magnetic level of the oxide particles so that even small changes in the signal from the record head will cause relatively similar changes in the magnetic level of the particles on the tape. Without this bias pre-conditioning, the oxide particles do not respond properly to the signal from the record head. This high frequency bias signal is applied to the tape together with the desired audio signal by the record head. Since the bias signal frequency is much higher than the audio frequency range, there is little chance that the bias signal will interfere with the sound reproduction.

The amount of bias (bias level) affects the signal-to-noise ratio, distortion and the frequency response of the tape and hence of the deck itself. Too little bias will allow more distortion than is necessary. Bias also affects the output level of the tape. Normally, as bias is increased the signal level off the tape increases, up to a maximum output level which depends on the type and quality of the tape. Increasing the bias level beyond this point causes the output level (and consequently, the S/N ratio) to decrease. The "optimum" level of bias is usually a compromise between the best results in S/N ratio, distortion and high frequency response, and usually differs with different types and brands of tape. For this reason, all TEAC tape decks offer the user a switch selection for different bias levels or a bias adjustment. One or the other of these is absolutely necessary if the recordist expects to use more than one type of tape. If everyone used the same type and brand of tape, the tape deck manufacturers could all set their bias circuits for a specific type of tape and everything would be fine. But, there are many good brands and types of tapes available and many recordists use more than one type of tape. Experience and experimentation will help you decide which tape to use and what bias level is most appropriate

for specific situations.

TEAC offers charts and/or instructions on how to set the bias level for various brands of tape. These instructions should be followed until the recordist develops sufficient knowledge (and has the proper measuring equipment) to make reliable tape evaluations.

Equalization

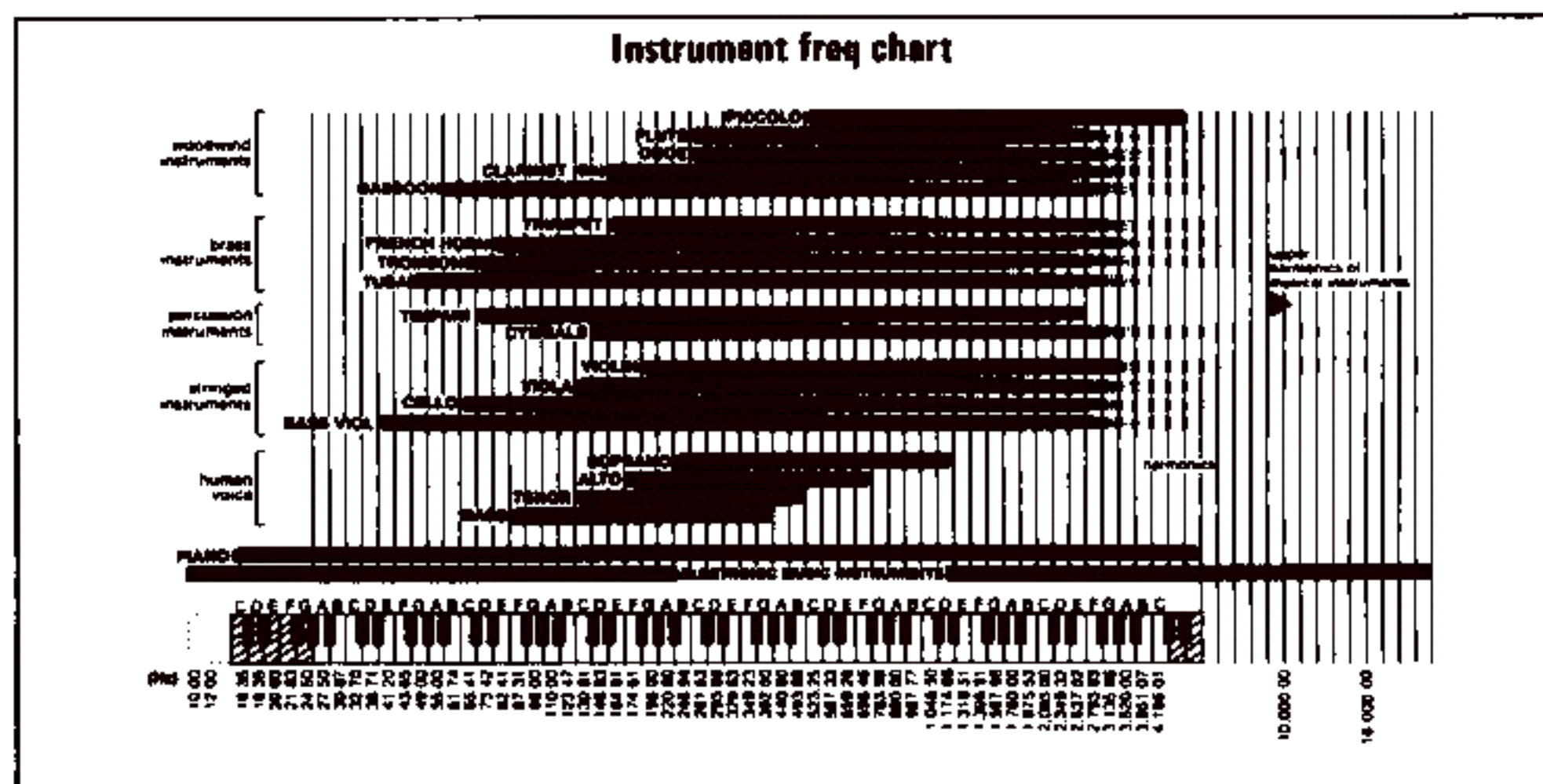
The EQ (equalization) selection must also match the type of tape formulation being used. If for instance, a deck was factory adjusted for standard tapes and the recordist decided to use low noise/high output tapes with their accompanying high frequency emphasis, the high frequencies would sound too bright.

The equalization switch can be used to reduce this high frequency over-emphasis and restore the output signal to its original fidelity. Conversely, if the deck is factory adjusted for low noise/high output tapes and the recordist decided to use standard tapes, the high frequencies will be much lower and an equalization setting that emphasizes high frequencies should be selected to compensate for these low levels. TEAC tells in our instruction manual what equalization level should be selected for various types of tape. Together with the bias setting, the suggestions should be closely adhered to until the audiophile develops the experience and knowledge to decide for himself.

Frequency Response

Frequency response is one of many parameters or specifications that manufacturers consider in the design of their open reel tape decks. But it is possible to over-emphasize this one parameter at the expense of others, such as signal to-noise ratio. In general, it's best to consider a well designed tape deck as a series of compromises that are made to give the best overall operation and performance.

The following musical sound frequency chart will help you understand the basic requirements of frequency response versus actual recordable frequencies.



4-Channel Tape Decks

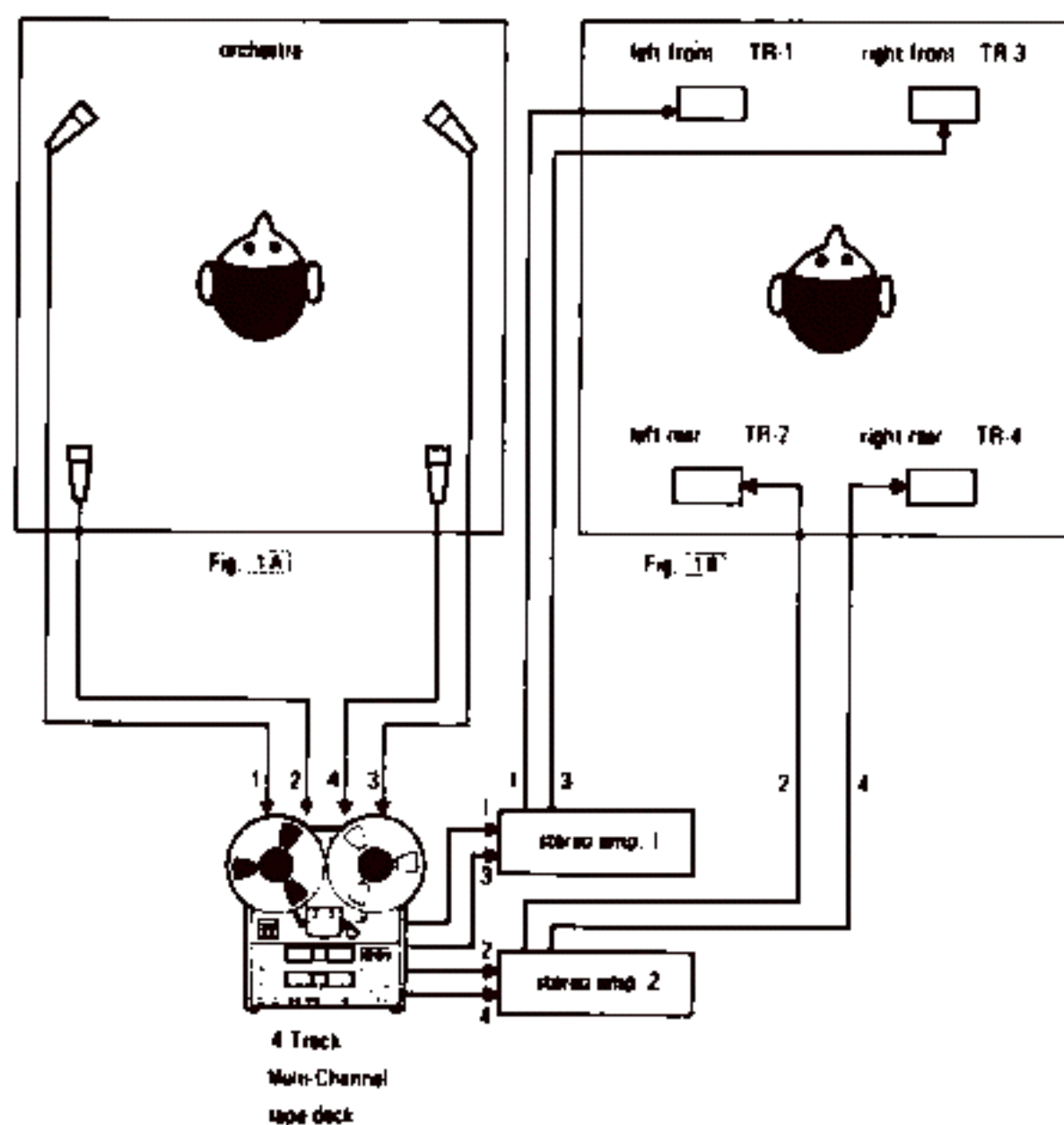
Introduction to Quadraphonic Sound

Proponents of quadraphonic sound may overwhelm the newcomer with high sounding words like "spatial effect, ambience, music hall realism" or "surround sound". In simple terms, the philosophy behind the emergence of quadraphonic sound goes like this.

When a person attends a concert or other musical production in an auditorium or concert hall he hears sounds from many directions. The primary or most significant sound originate from the direction of the orchestra, but there are also reflected sounds which one hears from many other directions, including the sides, top and rear of the hall. The sound from the top and sides of the hall are often insignificant because the primary sounds from the front tend to over-ride them. However, the sounds from the rear seem to add a special dimension to the performance and give a sense of space and position to the listener. Without these rear sounds the "ambience" of the auditorium would be lost and the listener would not enjoy the realism of

being in the audience. To accurately record all of the dimensions one "feels" at a live concert requires many channels but as a practical limit due to both space at home and financial restrictions, 4 channels was determined to be the minimum number of channels required. These are the two front primary stereo channels and two more rear channels that give the sense of position, ambience or "music hall realism".

Another use of 4-channel sound has also been investigated by some people. This is "surround sound". Although the "music hall ambience" concept and "surround sound" are often considered the same thing, there is a difference. The music hall ambience concept attempts to put the listener in the audience at a concert or musical performance. The idea is to faithfully record and reproduce the true sounds and realism of the hall. The sounds heard from each channel are basically the same, with only a slight (though important) difference in reverberation, volume level and acoustic phases.

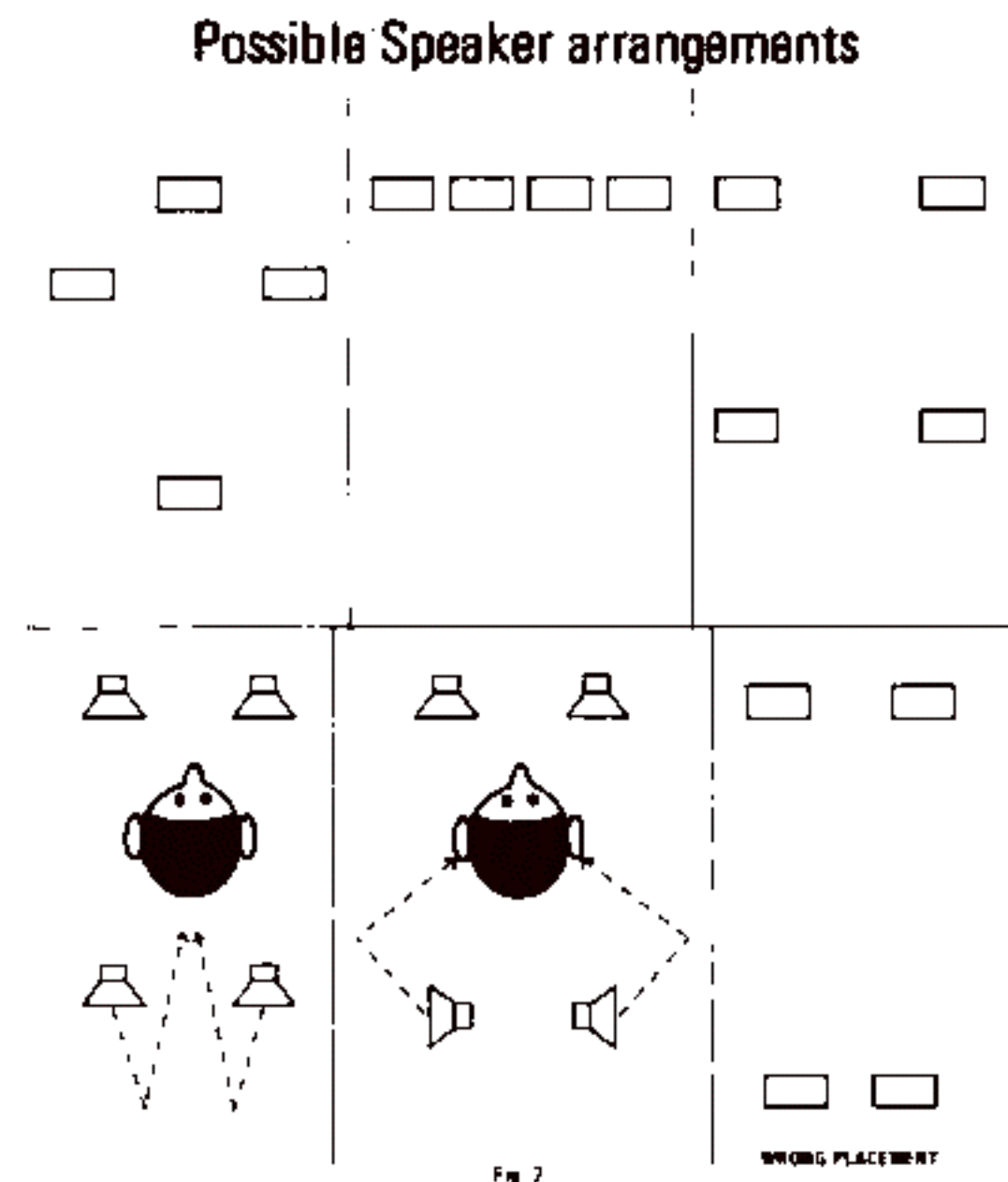


Surround sound by contrast tries to put you in the band and even allows you to "walk through the band". The sounds on the 4 channels are often quite different. A piano may emanate from channel 1, a bass may dominate channel 2 and channels 3 and 4 may contain other sounds. The instruments and the volume levels may vary on each channel and the listener may get the impression that he is moving around in the orchestra, some music experts call this type recording "gimmickry". Some others will say this type of 4-channel sound provides vastly expanded creative possibilities.

4-channel speaker placement

In order to get the same sound ambience and emotional atmosphere of the original recorded 4-channel music logically requires that the speaker layout be the same as the original mike placement. For instance, if you record using a mike arrangement as shown in Figure 1A, your speaker arrangement should be similar to 1B.

Acoustic properties of the room or studio during recording versus these of the listening room may cause some differences in the sound experience. Since music is an emotional as well as a physical experience you may want to experiment for the arrange-



ment that suits you best and gives you the greatest personal satisfaction. Some of the many possible speaker placements are shown in Figure 2. The geometry and size of the listening room will also affect the sound quality. A very small room will severely limit the spacing and placement of your speakers. A large listening room would offer more freedom of choice and perhaps more problems with acoustics. One suggestion concerning speaker placement in order to get faithful reproduction of pre-recorded tapes is to try to picture your own listening room in the original auditorium or recording area.

The Tape - Record Time vs Length

The Tape

The length of a full reel of recording tape as well as the recording time, is determined by the reel diameter and the thickness of the base material.

The use of 1 or 1/2 mil base tape is recommended for 4 track high fidelity recording. Polyester base tape is preferred for use in humid or extremely dry areas. Three recording speeds are commonly used, 3-3/4, 7-1/2 and 15 inches per second (ips). 15 ips is generally used for production of master tapes and for professional and semiprofessional use. 7-1/2 ips is commonly used for home high fidelity recording. Generally speaking, the higher the recording speed, the better fidelity (especially at the very high audio frequencies). However, due to the extremely high quality of the TEAC tape decks, recordings of excellent quality can be made at the lower speeds. This provides maximum tape economy and extended playing time.

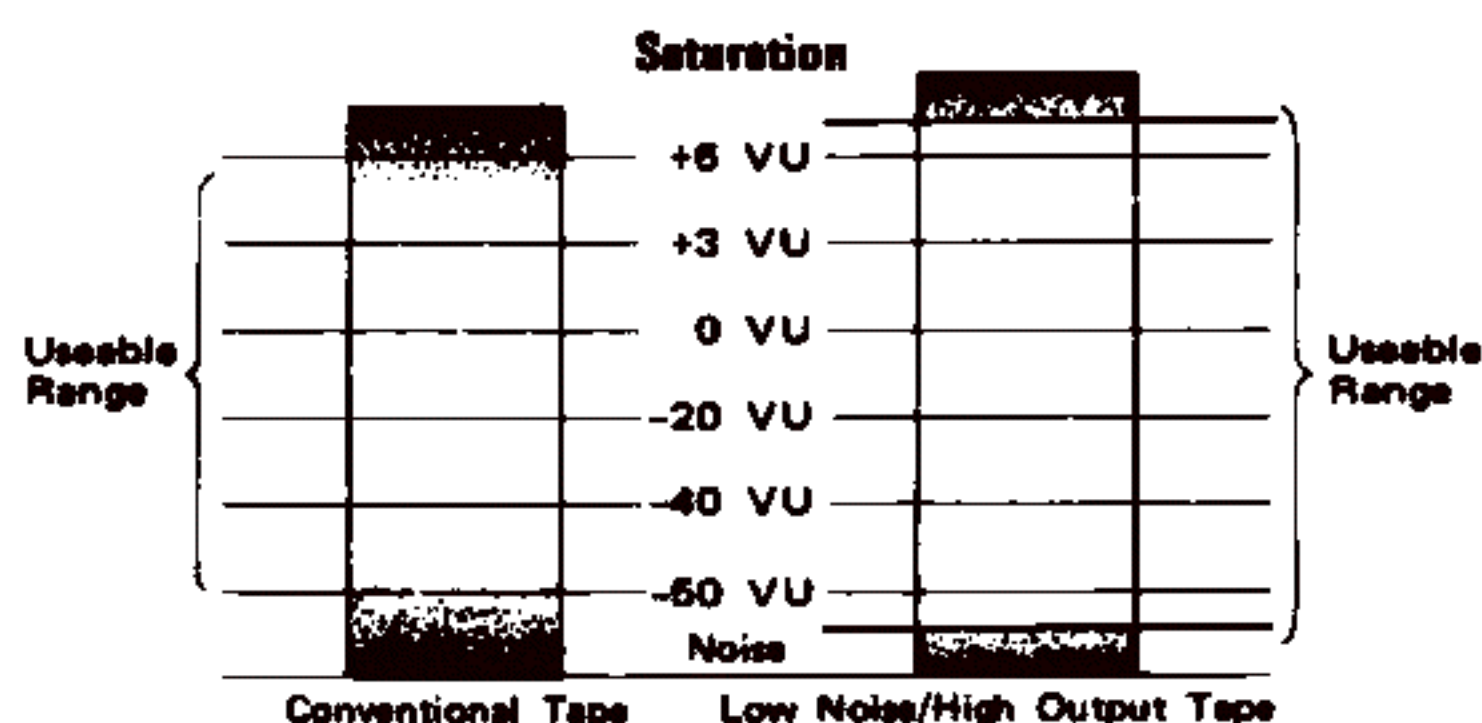
The recording time indicated in the charts below is for one single pass of the tape, therefore the total recording time will be either two or four times that indicated, depending upon the method of recording (2 track stereo or monophonic).

7" reel			
Base	Tape length	Recording time	
		7-1/2 ips	3-3/4 ips
1-1/2 mil	1200 ft.	30 min.	60 min.
1 mil	1800 ft.	45 min.	90 min.
1/2 mil	2400 ft.	60 min.	120 min.

10-1/2" reel				
Base	Tape length	Recording time		
		15 ips	7-1/2 ips	3-3/4 ips
1-1/2 mil	2400 ft.	30 min.	60 min.	120 min.
1 mil	3600 ft.	45 min.	90 min.	180 min.
1/2 mil	4800 ft.	60 min.	120 min.	240 min.

Level Setting

Correct level setting of the MIC and LINE Input Controls will assure full frequency response, maximum dynamic range, minimum amount of tape noise and the least possible distortion in your recorded tape. This is based upon the nature of magnetic recording tape which has a useable recording range as shown in the chart below.



When the input level (an audio signal of a specified voltage) is very low or weak, it must compete with the hiss and noise always present at the same low level on the tape. Stronger input levels, are recorded above this tape noise and tend to cover or "mask" it so you hear only the desired sound during playback. If the input level is too high, it enters the region shown at the top of the chart, which represents the limits of the tape. This limit says that no matter how much stronger you record, the tape cannot accept and return the same strength of signal. The result is known as "saturation distortion", and is heard as a garbled or harsh sound. The dynamic range available is found between this distortion at the high end and the noise at the low end. As the chart also shows, there is a difference between recording tape. The tape on the left is representative of conventional or normal recording tape. To the right is the improved kind of low noise/high output tape.

Input Level Controls (MIC and LINE) are used to match the strength of the input signal to the requirements of the tape. If the input signal is a little too strong these controls must be adjusted to reduce it to prevent distortion. If the signal is a little too weak, the controls must be set to increase the preamplification for raising the signal above the tape's noise level. Of these two limits, the distortion caused by high level inputs is used as a reference for setting the controls. Generally speaking, the shaded area at the upper (right side) of the VU meters' scale indicates that distortion levels are being approached. This area begins at 0 VU.

As the ideal is to record the program without distortion of the loud parts or losing the purity on the quieter parts, the recording level must consider both limits.

Choice of Tape

Most magnetic tape available commercially today is clearly marked with its specifications, such as thickness, type of base material, tape length (or reel diameter) and other characteristics.

Since TEAC open reel decks are factory adjusted for use with low-noise types of tapes as standard reference, we recommend that you use the tape selection table printed in the Owner's Manual for selecting the tape to be used.

Tape-Judging Condition and Handling

Tape condition can be judged by appearance when wound on the reel and viewed from the side.

1) Is it neatly wound? 2) Are there steps or irregularities in the winding? 3) Is the color of the base uniform as seen from the side? 4) Is the tape edge smooth?

Selecting the tape and reel

For recording, new tape is not necessarily needed. If the tape is of good quality the erase head will erase the previous recording as the new recording is made. However, avoid using tape whose coating is worn, peeled off or stretched.



If the color of the winding is different throughout the reel it is an indication that two different types of tape have been spliced in. In some cases, the color may differ according to production lot even for the same type tape, or between opposite sides of the wound tape.

Normal condition reel

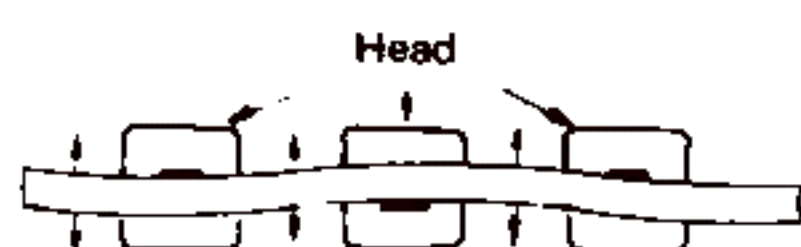
The use of a good quality reel is an important point in preventing damage to the tape edge or uneven stretching. Always use reels of the same diameter.

Judging tape condition by how it travels

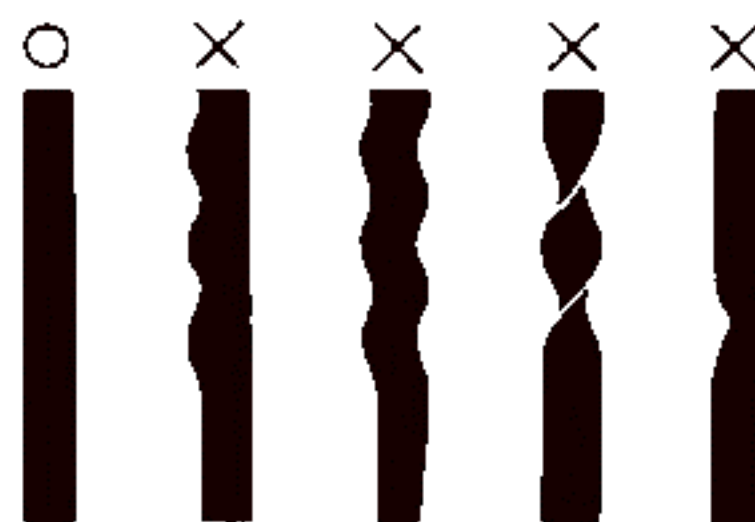
Tapes which snake up and down between the guides or over the heads will inevitably lead to level fluctuation and azimuth misalignment.

Unevenly stretched tape which travels either higher or lower than the true path of the tape will in extreme cases drift off the pinch roller.

Snaky motion of an unevenly stretched tape is indicated by the arrows.



Hang down a length of tape to check straightness



Tape Storage and Handling

Magnetic tape recordings are superior to phonograph discs because, with proper care, they can be kept and replayed for many, many years without degradation. During playback, the biggest danger to the recording is a magnetized or dirty point on the deck, such as a head or capstan. Care for the recording and the tape must be continued even after playing it by following these guides:

1. Protect the tape from dust

Keep it in the plastic bag and the original carton.

2. Protect the tape from heat

Do not place it on top of audio components. Store it in a cool room but also avoid freezing temperatures. Keep it out of direct sunlight.

3. Protect the tape from stress

Tremendous pressure is built-up on the inner windings of tape. This pressure is acceptable unless you apply additional stress by bending or squeezing the sides of the reels. This problem is increased if the windings are irregular. Frequent starts and stops will cause uneven winding pressure and the tape will be unevenly wound from side to side within the reel. Slight pressure on the sides will then break or crack the edge of the tape. Therefore, always prepare your tapes for longterm storage by re-winding them using the [F] (forward) and [R] (Reverse) Playback operating speeds or the Uniform Wind speed (if you deck has this feature). The Fast Forward and Rewind speeds normally apply a greater tape tension that is not recommended for tapes that will be unused for a long time.

4. Protect the tape from strong magnetic fields

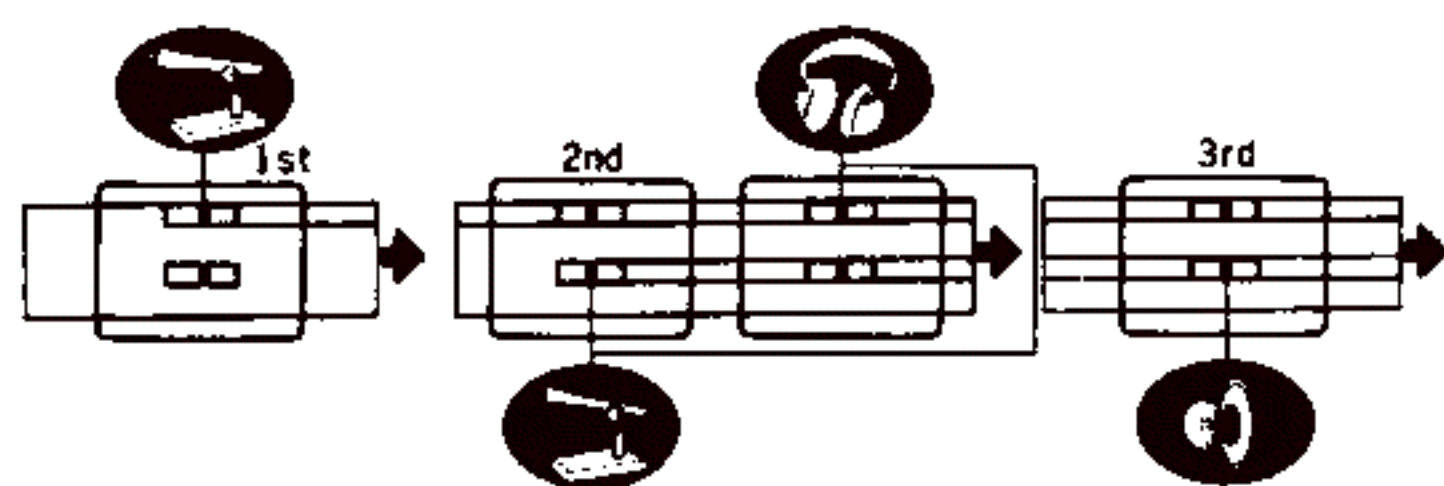
Just as a Bulk Eraser will remove the recorded material, so will a permanent magnet or the voice coil of a speaker destroy your favorite recording.

5. Protect the tape from humidity

Fungus growths will cause irreparable damage to the tape if stored in damp places. Keep the the tape in the original plastic bag, but insure that it is dry before storing.

Sound-On-Sound Recording

The technique of recording sound on sound is basically a method for mixing the monophonic recording from one track with a subsequent recording (generally live) on the second track (also monophonic). This procedure can be repeated from one track into the other until the noise level (tape hiss) from successive recordings has added together to an undesirable level, probably after five or six recordings.



1. Make a monophonic recording on the Left channel (track 1).
2. Rewind the tape to the beginning of the recording.
3. Connect an audio cable from the Left channel OUTPUT jack to the Right channel LINE IN jack.
4. Insert a headphone plug into the PHONES jack and microphone into the MIC R (right) jack.
5. Place the RECORD – MODE L (left) switch OFF and the R (right) switch ON.
6. Engage the Record/Pause mode by depressing the REC and PAUSE control buttons.
7. Reduce the Left LINE Level Controls and the Left MIC Level Control. Make a preliminary level setting with the Right MIC Level control, using SOURCE Monitor.
8. Switch to TAPE-MONITOR. Release the Record Pause Mode by pushing the **REC** button.
9. Listen only to the Left earpiece on the headphones.
10. While monitoring the Left channel with headphones, make a mixed recording by adjusting the MIC-R and LINE-R Level controls. Observe the VU Meter (Right) but note that the reading will be slightly delayed because of the distance from the Record head to the Playback head.

TEAC decks that have dual inputs and outputs facilitate Sound on Sound recording and make it possible to record Sound on Sound with a Line Source as well as a Microphone Source as described above. Procedures for Sound on Sound with line are basically the same as above; substitute "Right LINE" for "Right MIC" while maintaining the Right channel output stationary. For succeeding recordings, simply reverse the channels each time, and use the alternate controls and switches.

If the LINE control does not provide sufficient adjustment you might re-adjust the OUTPUT control to prevent saturation or to raise it to a satisfactory level for recording. If the mixed recording on track 3 (right channel) is unsatisfactory, you may record it again, for the original material still remains on track 1.

Sound-with-Sound

"Sound with Sound", like sound on sound, involves recording monophonic material one track at a time on each of the two channels. Unlike sound on sound, however, there is no mixing of the first track signal together with the second track recording. During playback after the second recording, you will hear two distinct channels simultaneously but they will not be synchronized nor have the affects obtainable from stereophonic methods.

Procedures are similar to monophonic recording, except the tape is rewound after the first track is recorded so that the next recording is made parallel and in the same direction on the other channel. The first track is monitored during the second recording to retain a relationship between the two channels.

For example, in language training, the student's response will be on the second track, re-recorded as often as desired, without destroying the teacher's recording on track 1. Perhaps more common is to record music on one track and then add dialogue or commentary on the other or vice versa. Music is generally not recorded "with" music, however, for the two recordings will not be synchronized.

Another interesting use for the Sound with Sound recording technique is to produce your own personalized "sing-a-long." Play your favorite record and record in monophonic on one channel. As you are recording you can add your voice to the other track via a MIC input. During playback you can adjust the OUTPUT level of each channel to get the "best" blend of your voice and the original song on the other track.

Sound-on-sound recording step chart

	1st	2nd	3rd
MIC IN or LINE IN jack	L	R	L
MIC or LINE Level Control	L	R	L
MONITOR SELECT Switch	SOURCE and TAPE	TAPE	TAPE
VU Meter	L	R	L
REC. MODE SELECT Switch	Left	Right	Left
OUTPUT Headphone	L Left	L Left	R Right

Echo Recording

The echo repetition cycle is strictly limited by the spacing between the Record head and the Playback (monitor) head, and by the tape speed. The higher tape speed (7-1/2 ips) gives the quicker echo. Echo persistence (the number of repetitions) depends upon the strength of recording. Persistence can be increased by increasing the OUTPUT Level setting. Avoid oversetting the Level for saturation will begin when the echo becomes too strong. Set the MONITOR switch to TAPE.

Sound on Sound and Stereo Echo Unit

Creative recording is especially enhanced with the versatile AX-10 Sound-on-sound and Echo Unit. On standard 2-channel decks with separate record and playback heads, you can produce sound-on-sound and a wide range of echo effects including normal or "mono" echo and stereo or "cross" echo.

The Model AX-10 Sound-on-Sound and Stereo Echo Unit is designed to adapt a stereo tape recorder so that it can make sound-on-sound recordings (mixing and recording from one track to the other) or apply echo effects during recording in stereo. Either process is simply carried out by depressing the red buttons singly or in proper combinations. This unit is adaptable only to stereo tape decks which feature the ability to record on one track while playing back the opposite track. In addition, decks with separate record and playback heads and electronics are essential for the echo function.

With 4-channel decks, two AX-10's create dazzling quad-rasonic effects — like rotating echo and psuedo-quad from stereo recordings. Also recommended for 4-channel decks is the AX-20 Mix-down Panel. A hand-held studio console, the AX-20 converts 4-channel recordings into 2-channel stereo masters and, with the level controls on the deck, can be used for mixing and blending selected channels during recording.



AX-10

Recording Directly from a Source

Although most connection diagrams show the tape deck connected directly to a stereo amplifier, it is not necessary to limit yourself to that one source for quality recording. In fact, almost any standard audio component may be connected from its output to the LINE IN jacks of the deck with the following exceptions.

1. Never connect the Speaker output of any amplifier to the deck.
2. Turntable and phonograph outputs need special amplification and equalization from an amplifier before they can be recorded.
3. DIN cords are designed only for connection between the deck and a stereo amplifier.
4. Electrical pickups for musical instruments, electric guitars and electronic organs are probably unacceptable. Check with your dealer or the unit's instruction manual before attempting to record directly from these sources.

Dubbing (duplicating) tapes for yourself or others to enjoy is one of the many pleasures of tape recording. All that is needed is another tape deck or player. Copying may be done from open-reel to open-reel, to cassette or to cartridge by connecting the output of one to the input of another.

If possible, all copies should be made from one "Master" tape: either the original recording you have made or a first copy from a spliced and edited tape. If copy # 1 is used to make copy # 2, then # 2 to make # 3, etc., the successive generations of copies tend to accumulate a small amount of tape noise from each sequential copy.

The primary key to maintaining high quality copies is having a Master tape recorded at as high an input level (without distortion) as possible for maximum dynamic range. Other means to reduce the small losses in dynamic range from tape hiss build-up include: (a) the use of Dolby Noise Reduction processing during the original (Master) recording; (b) the use of good quality "low noise/high output" tapes at every stage of recording and copying; and (c) the establishment of identical playback and recording levels while copying.



AX-20

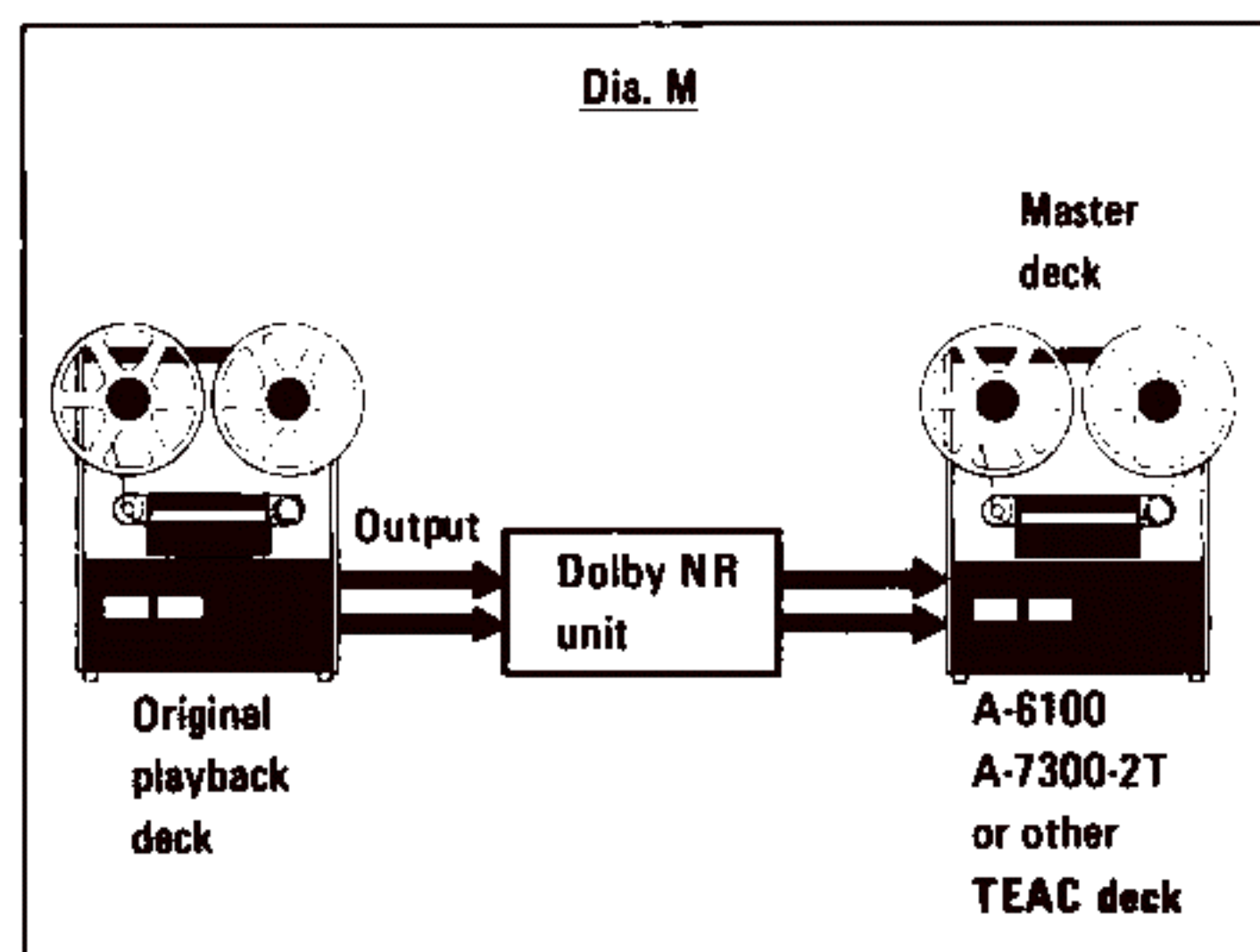
Dolby Noise Reduction Units

The Dolby Noise Reduction Units are designed to reduce the hiss noise that is an inherent problem in the tape recording process. When dubbing or copying tapes without some type of hiss reduction, the hiss from the two decks becomes cumulative and can become a serious problem. Dolby noise reduction units reduce this noise by special circuits which overemphasize the mid and high range sounds during re-recording and then reduce these same sounds (and the inherent hiss of the tape and the recording circuitry) during playback.

Since Dolby circuits are licensed by Dolby Laboratories Inc., there are no significant differences in the basic function of the various TEAC Dolby Noise Reduction Units. The primary choice of which unit to buy depends on the features, convenience of operation and controls and the quantity and types of inputs and outputs desired.

Dubbing with the Dolby Noise Reduction Unit

When dubbing a master tape it may be advisable to record the master tape through a Dolby Noise Reduction Unit as shown in the diagram below.

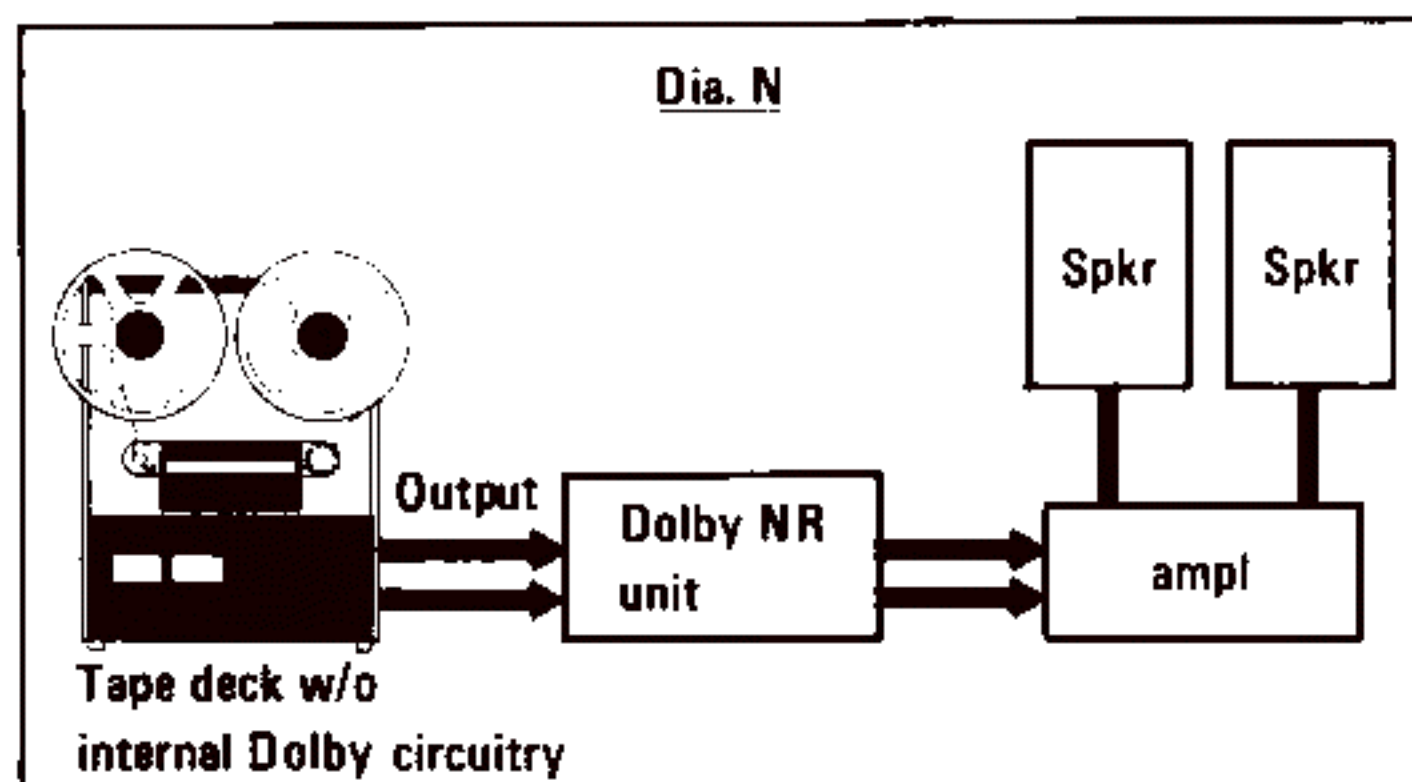


Dolby Laboratories Inc. have developed an effective noise reduction system which reduces tape noise and hiss by as much as 10 dB. This system is available from TEAC Corp. in the AN-60, AN-80, AN-180, AN-300 and other models. When using a Dolby Noise Reduction Unit with a TEAC deck, note these following points:

1. Connect the Dolby NR unit directly to the deck. All audio cables from the amplifier or other sources are then connected to the Dolby NR unit.
2. Unless specifically stated otherwise in the Dolby unit's Instruction Manual, all instructions in this manual are still applicable. The type of tape used in recording will determine the BIAS and EQ switch positions.
3. Before recording, be sure to perform the Dolby calibration procedure per the instructions in the Dolby Noise Reduction Unit's Owner's Manual.

Playback of Dolby encoded tapes

When playing back a tape which was Dolby encoded on a deck which does not have internal Dolby circuitry, a separate Dolby Noise Reduction Unit is necessary. (Diagram N)



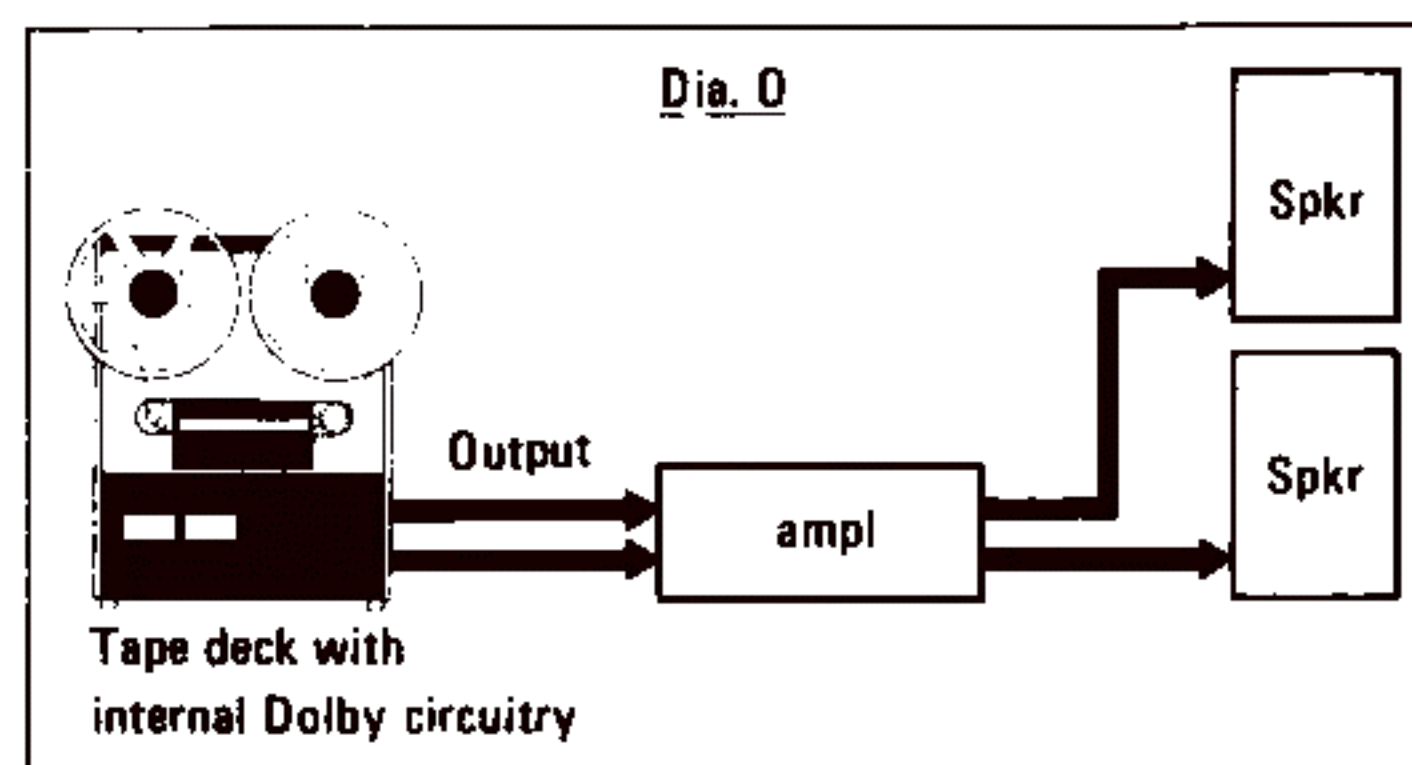
To enjoy the benefits of the Dolby Noise Reduction System both recording and playback levels must be matched. Therefore, "Dolby-encoded", "Dolby processed", or Dolbyized" tapes must be played back through a properly calibrated Dolby Noise Reduction Unit, available from TEAC and other companies.

Playback calibration for the Dolby NR System is simplified with the TEAC Memory Marker Guides. The M-M guide on the OUTPUT Control can be used to accurately mark the calibrated setting for quick re-establishment of the calibration.

Please note these points:

1. The Dolby NR System is not a filter and will not eliminate noises that are present in the original recording.
2. Improvements in the recording tape itself (such as low noise/high output tape) have significantly reduced the inherent tape noise level. Although the Dolby NR System is still contributing to an improved signal to noise ratio when using these tapes, the advantages of the system may not be so readily apparent.

When playing back a Dolby-encoded tape on a deck which has internal Dolby circuitry, no external Dolby unit is needed. (Diagram O)

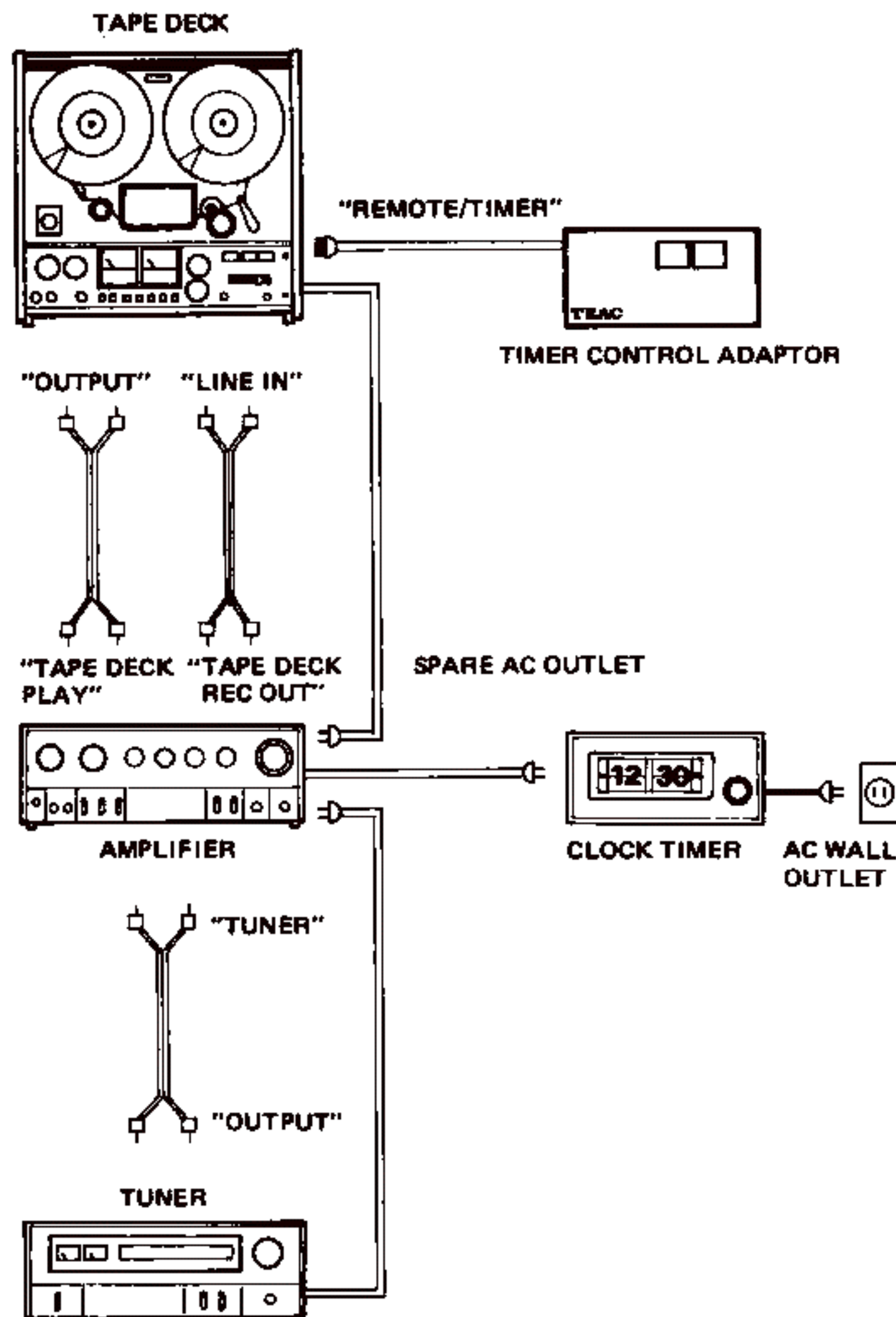


Timer and Remote Control

Timer Controlled Record and Playback

TEAC makes a variety of timer control adaptors sold separately from the deck as accessories. These timer control adaptors can be connected to the deck for automatic timed control of the Record and Playback functions of the deck. During your absence or while sleeping, your favorite FM program can be recorded; or awaken yourself to a recording of a favorite song or music.

Carefully read the operating instructions enclosed with the timer control adaptor, which explain how to connect it to the deck, how to prepare the deck and set the recording levels for automatic, timed recording. After setting the timer control, push the **REC** or Play **▶** button as desired. When the timer reaches the designated time, record or playback will be started automatically when electricity is provided by the AC clock timer control.



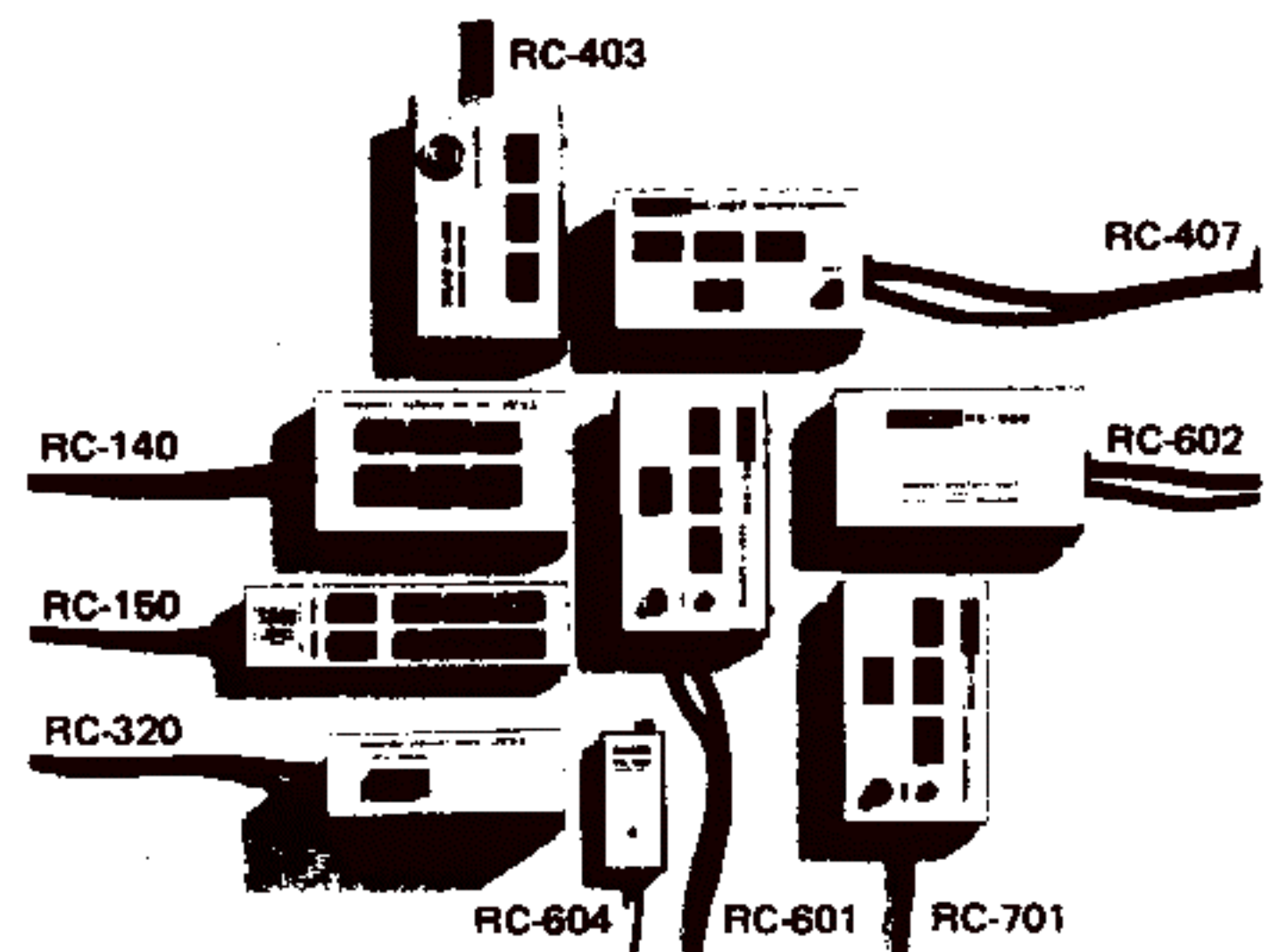
Remote Controlled Operation

To further enhance the flexibility and convenience of TEAC tape decks, TEAC produces many models of Remote Control Units. These units allow you to control all or most of the transport functions from up to 15 feet away from the deck. You can control the deck from the comfort of your easy chair or have freedom to move around during live recording sessions.

For more specific instructions and capabilities of each of the timer control adaptors and the remote control units, consult the operating instruction manual. The following three illustrations will give you basic hook-up information, pictorial views of the various units and a compatibility chart for many of the tape decks that TEAC sells throughout the world. Be sure to get the correct unit that matches your deck.

Timer Control Adapter/Remote Control compatibility chart

TEAC Model	Timer Control Adaptor	Remote Control
A-7300	RC-350	RC-170
A-6100/6300	RC-320	RC-120
A-7030GSL	RC-318	RC-701
A-7010/6010GSL	RC-316	RC-601
A-4078G	RC-314	RC-407
A-5300/5500	RC-350	RC-150
A-4300	RC-320	RC-140
A-3300S/2300S/ 3340S SERIES	RC-320	RC-120



Cleaning and Degaussing

The single most important point in tape deck maintenance is frequent and proper cleaning of the heads. The heads should always be cleaned before making important recordings and at least once for every 8 hours of use (record or playback). Dirty heads will cause a reduction in high frequency response, irregular head wear, drop-outs and in extreme cases may cause the deck not to record at all. The small amount of time and effort required will be more than compensated for by the higher quality of recording and reproduction available if these procedures are followed.

Commonly used cleaning fluids are chlorothane, isopropyl alcohol and TEAC Head Cleaner (Fluid "A" in the TZ-261 kit). Chlorothane is non-flammable and has excellent cleaning properties. Alcohol is harmless but is combustible and its cleaning properties are lower. TEAC Head Cleaning Fluid is non-toxic, non-combustible and has excellent cleaning properties and its use is recommended.

Using a stiff cotton swab or a piece of gauze dipped in cleaning fluid, rub the entire head surface, being cautious not to scratch it. Repeat the process on each head until all discoloration and tape oxides are removed. Clean all metal parts over which the tape passes, such as capstan shaft, tape guides, tape lifters, etc.

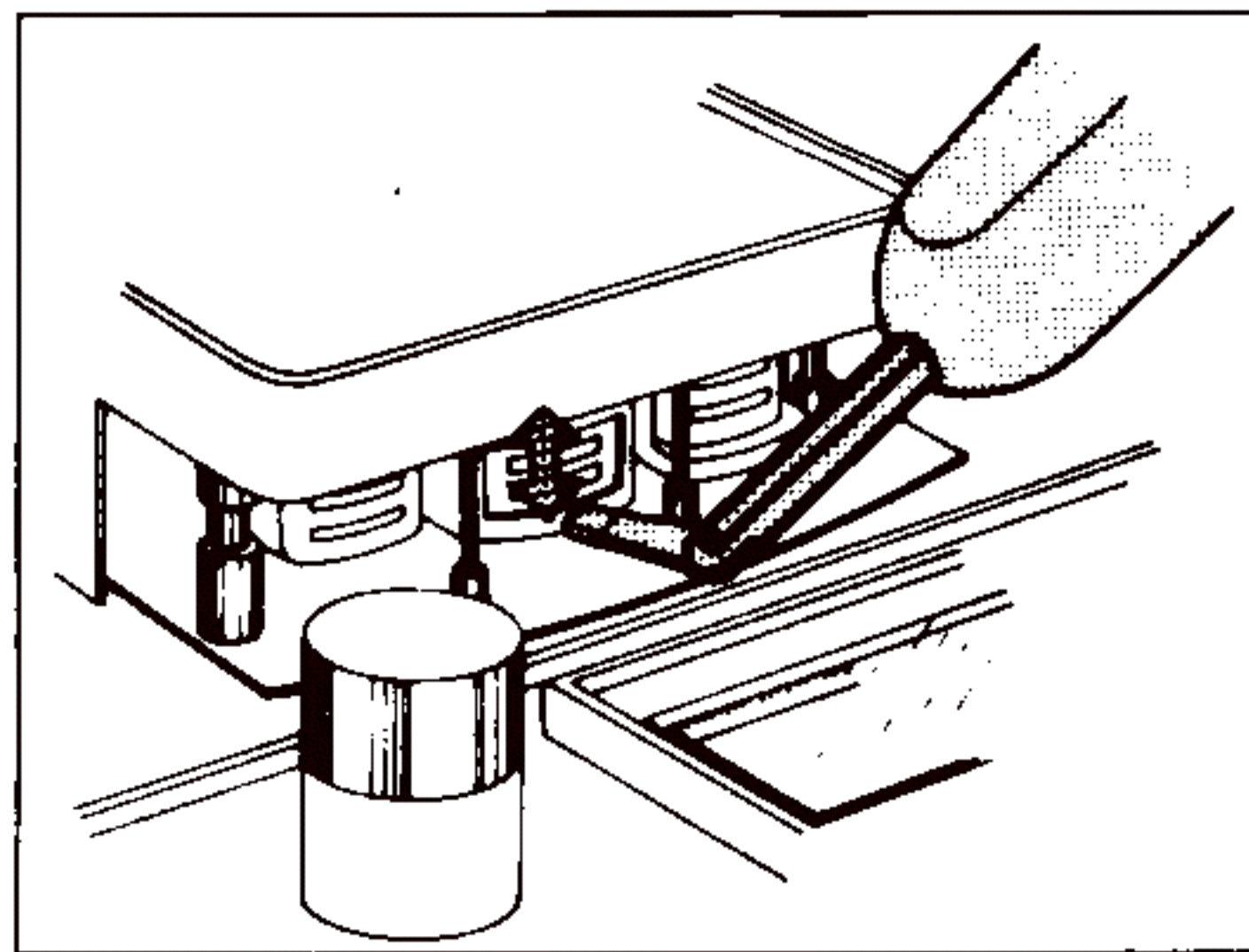
The cotton swabs should have a rigid shaft, a satisfactory job cannot be accomplished with the slender flexible types often seen.



During long periods of use, the heads may become slightly magnetized. As a result, high frequency response will decrease, noise will develop, or in extreme cases, the high frequencies will drop-out or noise will be introduced into your valued pre-recorded tapes. To keep your deck operat-

ing with its original fidelity the heads should thus be degaussed at least once for every 50 hours of use, with i.e., TEAC model E-1 Head Demagnetizer. Places specified for degaussing include each head, capstan shaft and guide post. Before proceeding with the following steps move all the pre-recorded tapes sufficiently away from the degaussing area.

1. Turn OFF power to the deck.
2. Slide the switch of E-1 ON, bring the tip close to the head and slowly move it up and down four or five times.
3. Slowly draw it away from the head.
4. After finishing all points, turn OFF power to the demagnetizer only after it has been drawn at least 12 inches (30 cm) away from the heads.



After prolonged use the pinch roller will accumulate a film of oxide. Use only Fluid "B" from the TEAC TZ-261 kit as it is especially formulated for cleaning rubber surfaces. Do not use chlorothane as it will cause deterioration of the rubber roller.

Note: The newer tape formulations leave a gray or white residue which is difficult to detect. Regular cleaning schedules should be established rather than relying on observation.

Care of the wooden cabinet

Ordinary furniture cleaner and polish can be used to maintain the attractive finish.

Cleaning the Faceplate.

A soft cloth and mild cleaning fluids (non-abrasive) can be used to restore the luster of the faceplate. An oil-damped cloth will also give good results, but take care not to get oil on the tape path components such as the pinch roller, capstan, etc.

Basic Trouble-shooting Chart

Basic trouble-shooting of an open reel tape deck is similar to trouble-shooting any other electrical or electronic equipment. Always check the most obvious possible causes first including such things as: power cord, fuse, switch and control setting or position, proper connections to the desired input and output signal, etc. Consult your Owner's

Manual for the correct operating procedure and instructions.

Many of the most common problems are listed in the chart below.

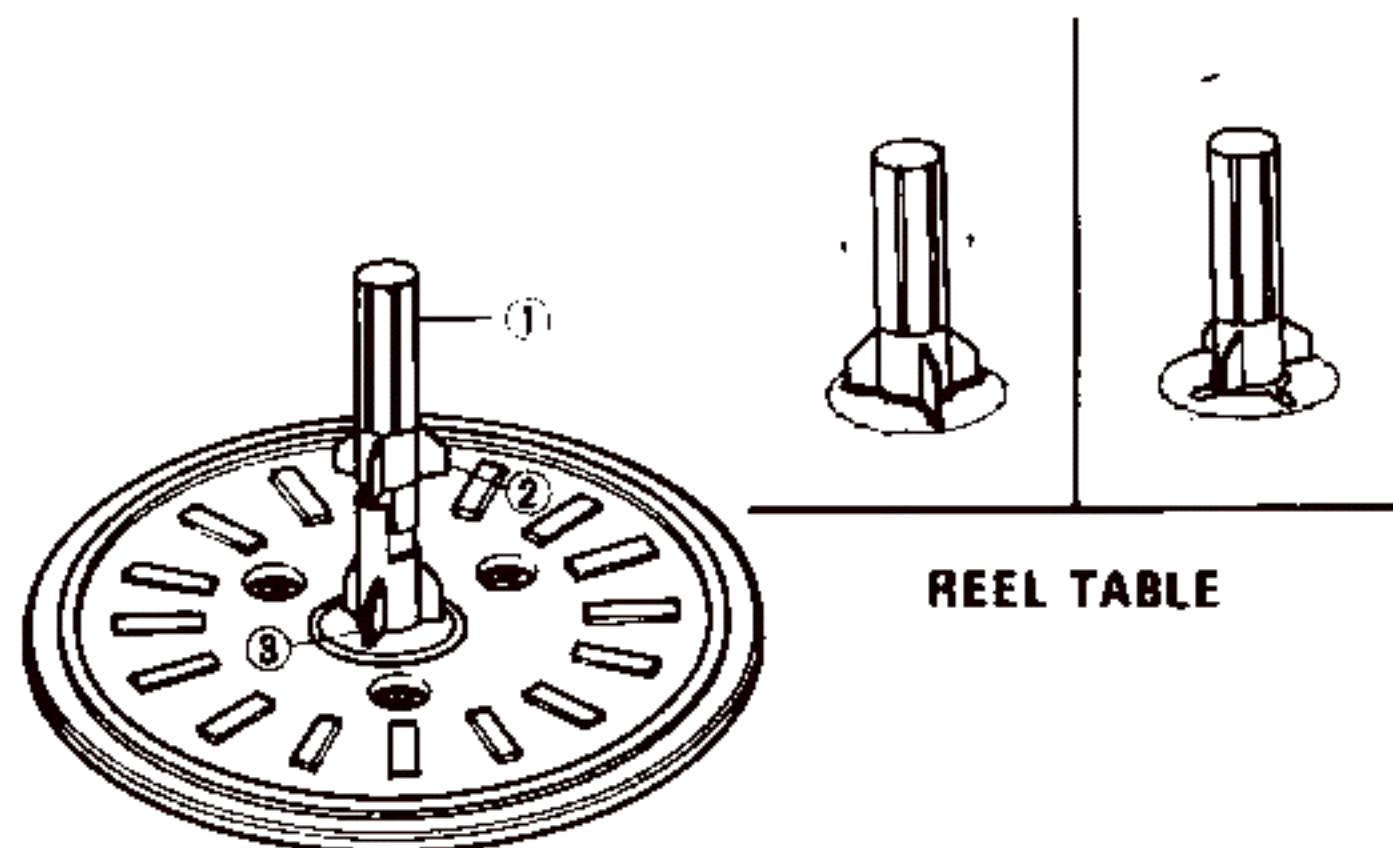
SYMPTOM		CORRECTIVE ACTION
Tape Transport		
VU meter lamps do not illuminate when power SW is turned on	Power cord connected, fuse ok?	
No tape motion	Is tape properly threaded and shut-off arm held in proper position?	
Tape rubbing reel flanges	Is reel properly seated, reel adaptor spacer installed or removed per instructions, tape in good condition?	
Playback Operation		
No sound. VU Meter shows normal indication.	Are connections between tape deck and amplifier properly made?	
No sound, no meter indication	Check connections and switch settings per procedure in Owner's Manual. Was tape actually recorded? Try another tape.	
Poor sound quality	Are heads clean? Is the tape in good condition and properly recorded?	
Unstable sound.	Same as above. Also, is pinch roller clean?	
Recording		
Does not Record	Check switch settings and connection per Recording procedure in the Owner's Manual.	
Does not Record, no audio at tape monitor but OK at SOURCE	Record mode switches ON, tape in motion, heads clean?	
Monitored sound is poor, distorted, noisy, etc.	Are Input levels properly set, BIAS/EQ Switches in correct position for the type of tape you are using? Heads clean and demagnetized, tape in good condition? Did you follow correct Recording procedure given in Owner's Manual?	

Tape Loading and Erasing

TEAC's "QUIK-LOK" reel holders

Always secure these reel holders before operating the deck to assure adequate, solid support for the tape reels. Install the clamp adaptors for 10½" reels (when required) to the reel table before mounting the large reels. Follow the procedures below for mounting 7" reels or the adaptors onto the deck. Numbers given refer to the illustration.

- 1) Rotate sections 2 and 1 of the reel shaft fully counterclockwise.
- 2) Place the reel onto the reel shaft while slowly rotating the reel CCW to keep both tab sets in line.
- 3) When the reel is firmly seated on the reel table, turn sections 1 and 2 fully clockwise to secure the reel firmly in place. The tabs on section 2 of the shaft should be centered between the slots on the reel.



REEL TABLE

10½" reel clamp adaptor

When using large diameter tape reels use the reel clamp adaptor (TZ-612).

- 1) Secure the reel clamp adaptor to the reel tables using the same procedures as above.
- 2) Turn the locking knob of the adaptor fully CCW.
- 3) Align the 3 notches in the 10" reel hub with the 3 pair of detents on the adaptor and push the reel all the way onto the adaptor.
- 4) Turn the locking knob of the adaptor tightly clockwise about 90 degrees until the reel is firmly secured to the adaptor. When removing the reel from the adaptor, turn the locking knob CCW and use both hands to carefully pull the reel off the adaptor. This adaptor includes a special spacer (shown in diagram A) which must be used when adaptor is used with NAB Standard 10½" metal reels. To use the adaptor with Standard plastic reels, this spacer must be removed. Removal of the spacer is quite easy:

DIAGRAM (A)

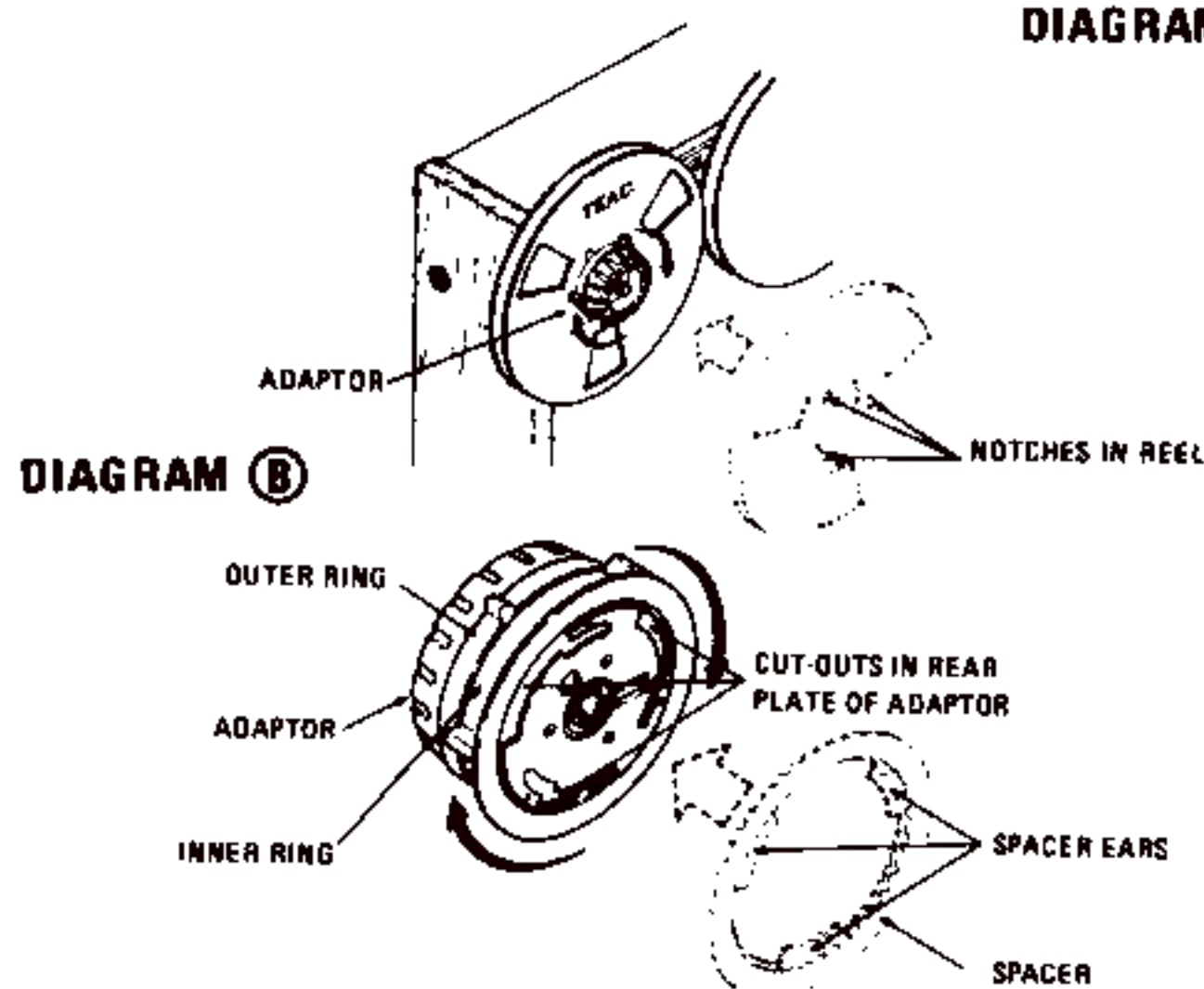


DIAGRAM (B)

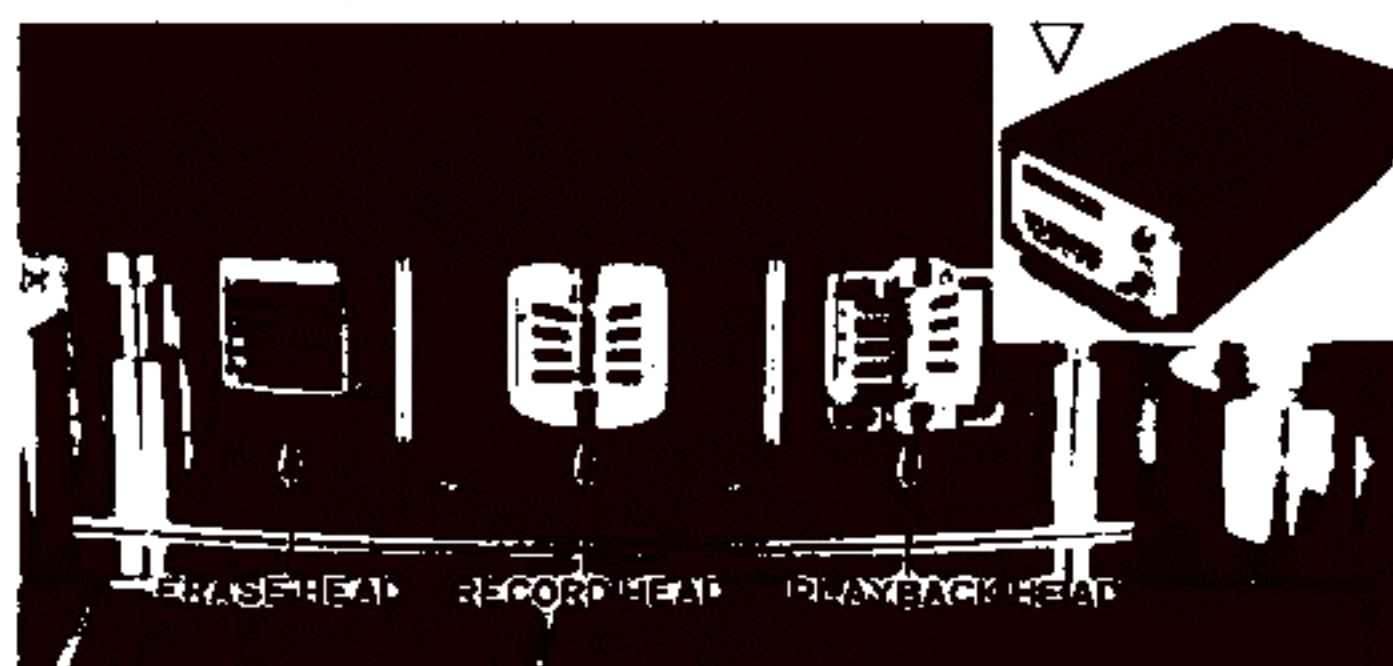
- 1) turn the adaptor while holding the spacer until the ears of the spacer match the cut-outs at the back surface of the adaptor 2) lift spacer off of the adaptor 3) keep the spacer for future use with metal reels.

Erasing recorded tape

One of the advantages of recording tape over records is that it can be recorded over and over again. This raises the question of how is the previous recording removed. Here are three different ways to erase earlier recorded material. **Automatic erasing and recording:** As the photo shows, there is an Erase head located to the left of the Record head in your deck. Its function is to purge the tracks of all previous recording by means of a strong alternating magnetic field immediately before the tape reaches the Record head. This is done automatically whenever you select record mode in the deck.

Erasing with the deck: You may erase the entire tape track (s) at a time with no recording by rotating the MIC and LINE level controls fully to MIN. and/or disconnecting the input connections. Start the deck in the Record Mode and tracks selected (by MODE switched ON) will be erased. ▷

Bulk erasure: TEAC's Model E-2 Bulk Tape Eraser (or its equivalent) will quickly erase the entire tape in a few seconds. This is the only satisfactory way to erase a previously recorded ½ or full track tape to prevent undesirable "cross-talk" or chatter from the former material. For complete directions on how to use, consult the instruction supplied with the Bulk Eraser.



Lubrication and Optional Accessories

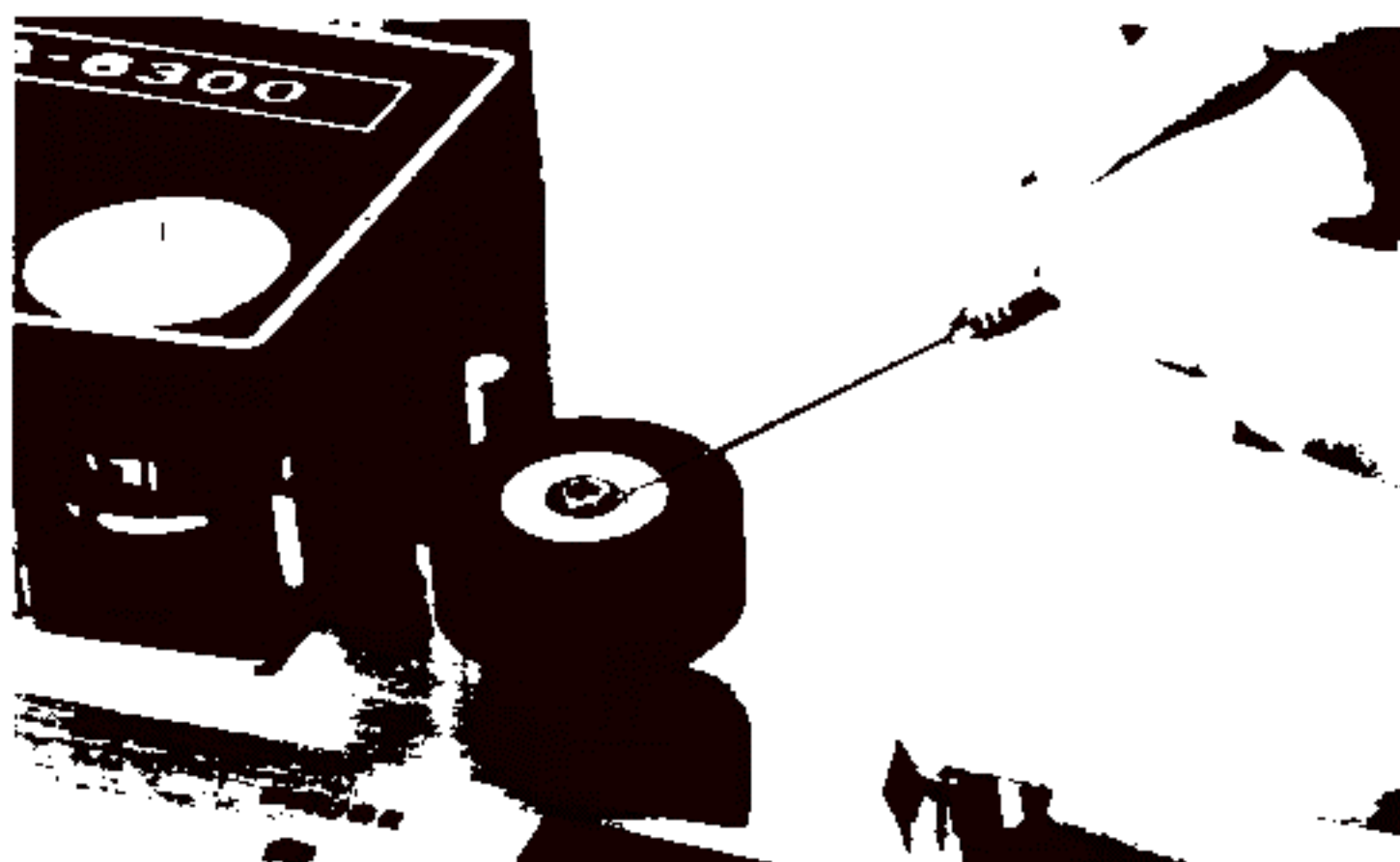
Use TEAC TZ-255 oil or equivalent.

Lubricate points listed below at every 1,000 hours of operation or once a year if equipment is infrequently used.

CAPSTAN SHAFT: Remove the dust cover by turning it counterclockwise with fingers, apply approximately 2 drops of oil to the oil-chamber felt.



PINCH ROLLER SHAFT: Unscrew the cap with fingers, apply one drop of oil to the shaft bearing.



CAUTION: Do not apply excessive quantities of oil, over lubrication can be a source of difficulty. Do not apply oil to any rubber parts. Should oil be spilled onto rubber parts, remove immediately with TEAC rubber cleaning fluid.

Lubrication should be accomplished immediately after use while equipment is still warm.

After applying lubricant, leave tape deck in horizontal position for 1-2 hours until oil is thoroughly absorbed.

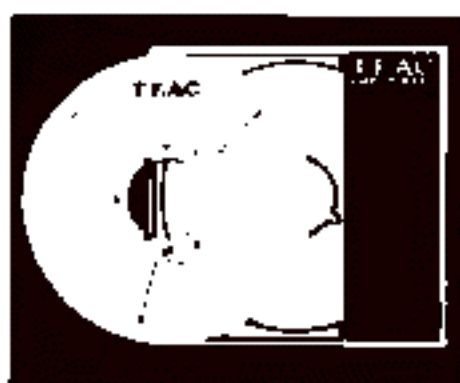
Optional Accessories

MC-201
Electret Condenser
Microphone



HP-103
Dynamic Headphones

RE-1002
10-1/2" Metal Reel



RE-701
7 inch Plastic Reel
(large hub)

RE-711
7 inch Metal Reel
(small hub)



RE-702
7 inch Plastic Reel
(small hub)

TEAC

The leader. Always has been.

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