

# TANDBERG

## TD 20 A

### Operating Instructions



ENGLISH



**For your safety!**

To avoid electric shock or fire electronic equipment must not be exposed to rain or damp. The cover (or back) on the set must not be removed. Entrust all service work to a qualified service engineer.

Remove the mains plug during thunderstorms and long term absence (e.g. during holidays, etc.).

The reel locks must always be in the locked position when the machine is in use, see pages 6 and 7.

Do not touch the reels during fast winding because injury can result, especially with use of 10½" reels.

**Specially for the United Kingdom:**

**IMPORTANT!** The wires in this mains lead are coloured in accordance with the following code:

BLUE: NEUTRAL (N)  
BROWN: LIVE (L)

If the wire colours in this mains lead do not correspond with the terminal identification of your plug, connect as follows:

Blue wire to terminal coded N or coloured **Black**.  
Brown wire to terminal coded L or coloured **Red**.

Do not make any connection to the larger terminal coded E or coloured **Green** or **Green and Yellow**.

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Tandbergs Radiofabrikk A/S has many years experience in the design, development, and manufacture of tape recorders and has achieved international acclaim for products of this type.

Model TD 20A is the outcome of traditions and experience built up over these years.

Technological advances will continue to bring tape recorders nearer and nearer to perfection, but we are confident that the TD 20A has reached a level of performance today that puts it straight into the top class.

For many reasons cassette tape recorders have become very popular. They are easy to operate and many users are satisfied with the quality of the sound reproduction. But for people who demand the very best in sound reproduction without compromise, there never can be any alternative to a well-designed open reel tape recorder. The reasons for this can be found in the principles and international standards behind the basic designs of these two types of machine.

Accordingly our aim with the TD 20A has been to provide the keen amateur tape recordist and those who really value faithful sound reproduction, a tape recorder with an outstanding performance specification and versatile operating facilities.

The advent of new types of recording tape has made it desirable to change the order of the recording chain in the tape recorder circuits. In the new recording system, called "Actilinear Recording", used in the TD 20A, the design has exploited the new generation of high-coersivity tapes that has recently come onto the market. Measurements and listening tests carried out in our laboratories have shown that the new system gives better results than any other system we have tested up till now.

That professional sound recordists have also shown great interest in the TD 20A we take as a sign that we have succeeded with all our original design objectives.

The TD 20A is — as a result of our high requirements for design, manufacture, and quality control — an expensive machine. At the same time our international marketing organization has received confirmation that our customers place a high value on the effort and skill that has gone into the TD 20A.



## Preparation for use

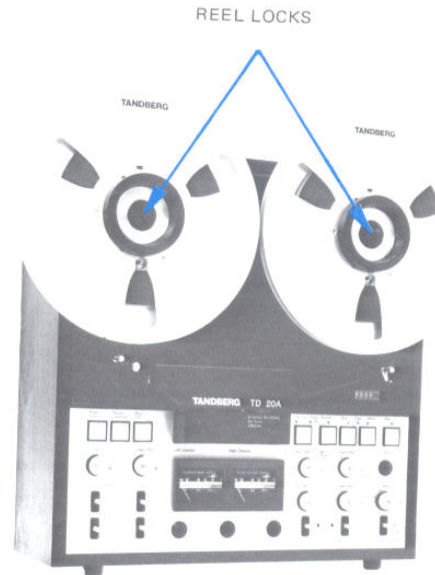
### Operating position

The tape recorder can be used in a horizontal or a vertical position or in any intermediate position.

**NOTE!** If the tape recorder is placed vertically (standing) you must be sure the surface is level. Otherwise the machine could fall forwards.

If the tape recorder is placed horizontally, the feet on the case can be unscrewed. Insert the four plastic buttons (in the bag) into the holes.

When the tape recorder is in use the reel locks must always be in the locked position so that the reels are held in place (see "Loading the reels onto the machine", page 6). The remark applies regardless of how the machine is placed.



*Vertical position*

### Power requirements

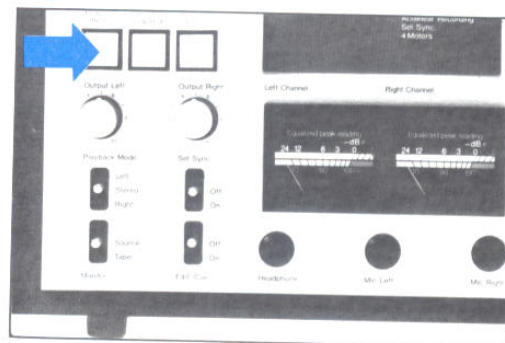
Plug the machine into a power socket with 240 V/50 Hz mains voltage. This voltage (within  $\pm 10\%$ ) will be found in most parts of Europe.

The tape recorder can be converted to take 115 V/60 Hz which is found in the USA and other countries. This conversion must be carried out by a qualified service engineer.

The power consumption is 110 watts.

### Off/On switch

Press in the button marked Power Off/On to switch the machine on (on the left of the machine).



*Switching on*



### Connecting to a tuner/amplifier

The TD 20A has no built-in output amplifiers so it must be connected to a stereo amplifier or a stereo tuner/amplifier.

### Connecting to a tuner/amplifier with phono leads

For *playback* connect two phono leads from the sockets marked LINE OUT L and R on the TD 20A to the same type of sockets marked TAPE IN L and R on the tuner/amplifier. The left channel (L) on the TD 20A must be connected to the left channel (L) on the tuner/amplifier, and the right channel (R) on the TD 20A must be connected to the right channel (R) on the tuner/amplifier.

For *recording* connect two phono leads from the sockets marked LINE 1 on the TD 20A to the corresponding sockets marked TAPE OUT on the tuner/amplifier.

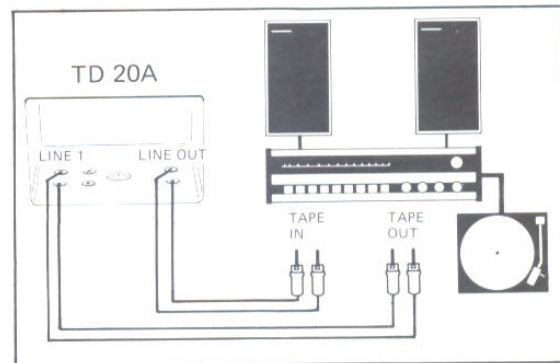
### Connecting to a tuner/amplifier with DIN lead

Alternatively you can use a DIN cable with 5-pin plugs between the RADIO socket on the TD 20A and the TAPE socket on the tuner/amplifier.

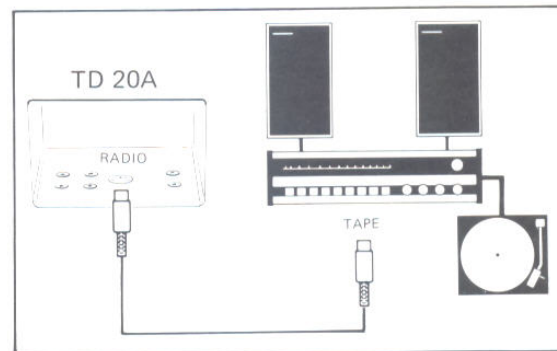
For recording from another program source two phono leads should be connected to the LINE 2 socket on the TD 20A. These phono sockets are connected in parallel with the input on the RADIO socket on the TD 20A.

### Connecting headphones

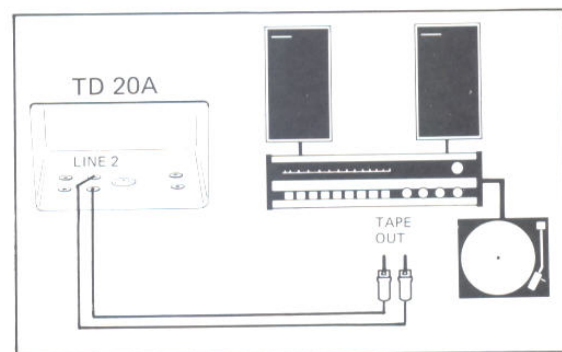
You can listen to a stereo or mono program on headphones connected to the jack socket marked Headphones at the front of the TD 20A. The headphones must have an impedance between 8 and 2000 ohms and be fitted with a ¼" jack plug.



Connecting a tuner/amplifier with the aid of four phono leads



Connecting a tuner/amplifier with the aid of a DIN lead

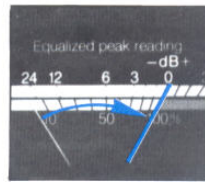


Connecting an extra program source with the aid of two phono leads

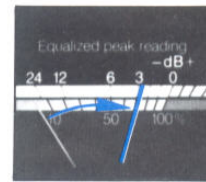
## Choosing tape

This tape recorder is adjusted for Maxell UD XL tape, or tape of a corresponding quality. For a given distortion this tape gives about 2 dB higher output signal than High Output Low Noise tape. This means in practice — amongst other things — that the tape noise is less noticeable. Tape with a matt reverse side can also be used.

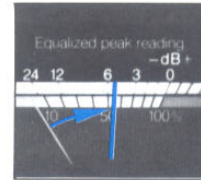
If a High Output Low Noise tape and ordinary low noise tape is used, the input controls (Input Left and Input Right) should be adjusted so that the deflection on the program meters is slightly lower, as shown in the figure. See also pages 8 and 9.



Recording on  
Maxell UD XL tape



Recording on  
HL tape



Recording on  
Low Noise tape

## Choosing the tape speed

Set the button marked Speed Low/High to the required tape speed. The best sound quality is obtained with the highest speed (Speed button in), while the lowest speed (Speed button out) gives the longest playing time.

## Threading the tape

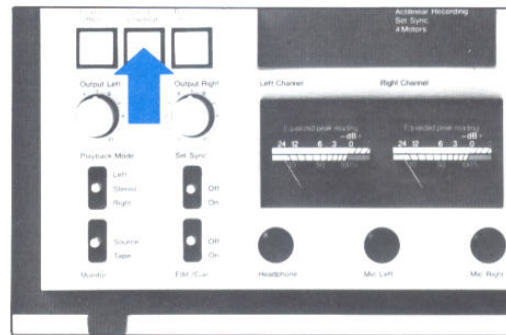
- Press in the button marked Power Off/On to switch on the tape recorder.
- Press in the button marked Reel o/O if you are using 10½" reels. For smaller reels the button should be out.

**NOTE!** Do not touch the reels during fast winding, because injury can result especially from 10½" reels.

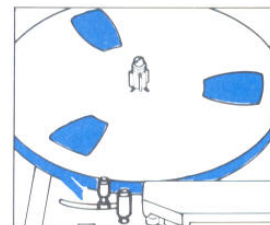
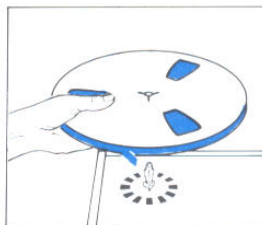
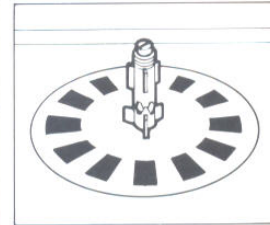
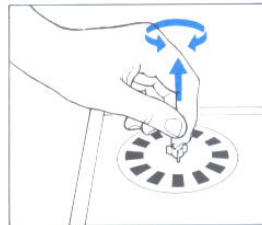
- If you require the brakes to be off the reel turntables so that they rotate freely, hold the Stop button in while you press the Wind button. Release the Stop button and the tape recorder will be in the Free mode.

**NOTE!** To cancel the Free mode, press the Stop button again.

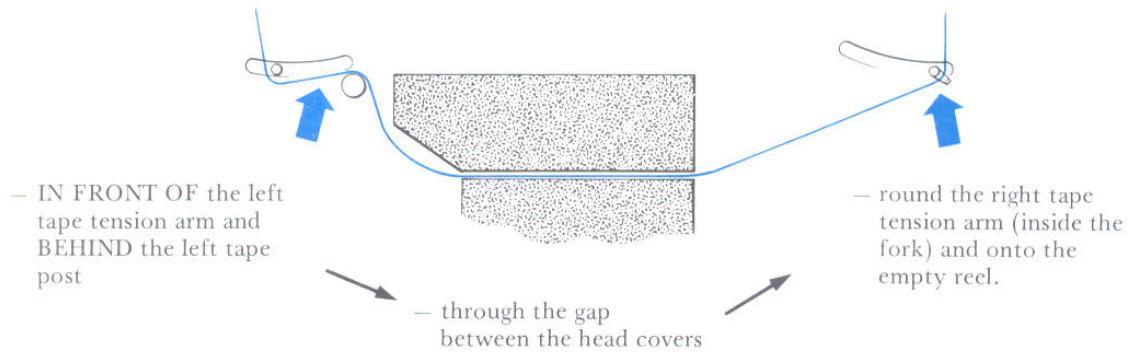
- Always use two reels of the same size.
- Place a full reel of tape on the left turntable and turn the reel lock 60° to the locked position.
- Place an empty reel on the right reel turntable and lock it.



Speed selector



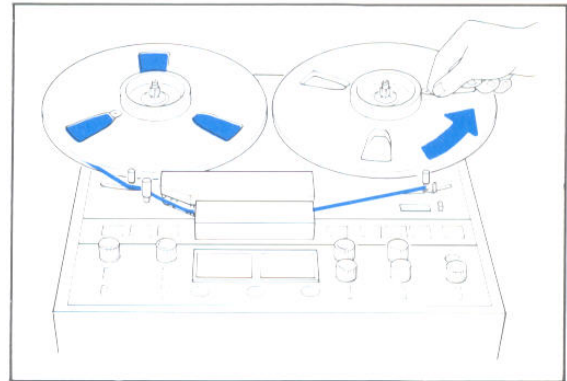
- Pull out a length of tape and lay it:



- Turn the empty reel anti-clockwise until the tape is trapped.

**NOTE!** If the tape recorder is in the Free mode, it must be released before the tape recorder's other functions will operate. Release the machine from the Free mode by pressing the Stop button.

- If the tape has a transparent end, hold the Play button in until the lamp over the Play button comes on. When the lamp comes on it indicates that the transparent end-tape has passed the heads.




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#### 10 1/2" reels with large centre holes

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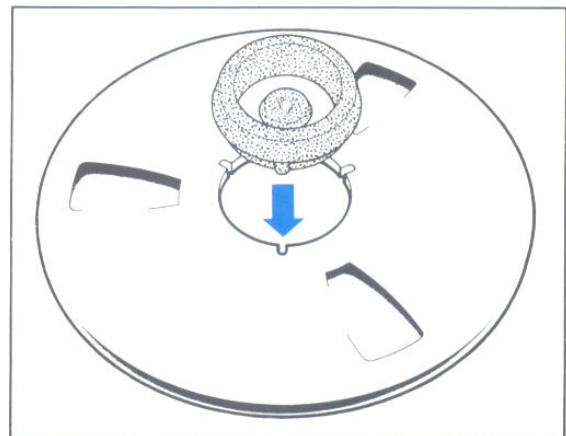
- Use the enclosed hub. Lay the reel on a level surface and insert the hub so that the splines on the hub engage in the grooves in the reel.
- Press in the button marked Reel o/O.
- Lay in the tape as described above.

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#### Rubber mats

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Differences in reels can cause the tape to rub on the outer edge of a reel. In this event, insert a rubber mat between the reel and the turntable.



*10 1/2" reel with large centre hole*



## Making a high quality recording

### Monitoring the program during recording

While the recording is being made you can monitor the recording quality with the aid of the Monitor switch. Our example shows a vocalist singing into a microphone while an operator monitors the recording on headphones plugged into the TD 20A. The diagram shows a mono recording.

When the Monitor switch is in the Source position, the operator hears the vocalists voice *before* it goes onto the tape. This is called the program (source) test.

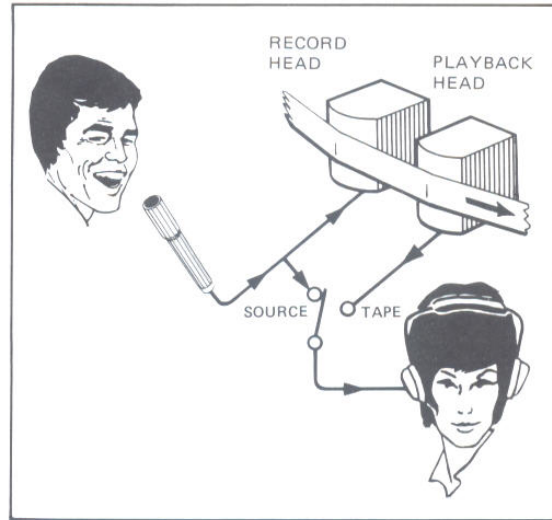
When the Monitor switch is in the Tape position, the operator hears the vocalists voice a split-second *after* it has gone onto the tape. This is called the tape test.

If the recording has been properly carried out there will be no audible difference in the sound quality before and after recording.

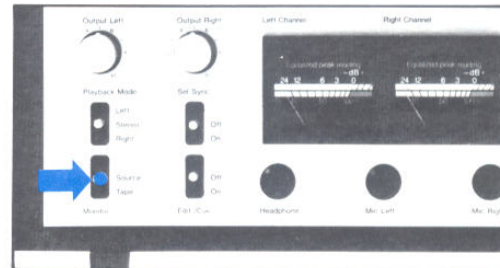
The operator's headphones can also be plugged into a tuner/amplifier connected to the TD 20A. Many tuners and amplifiers also have facilities for program monitoring over loudspeakers. But this type of monitoring is not possible when recording from a microphone since the microphone will pick up the sound from the speakers which causes an echo (acoustic feedback).

If there are audible differences between the source and tape tests it means that the recording was not properly carried out. A common fault is that the input controls – Input Left and Input Right – are set too high (distortion) or too low (tape noise).

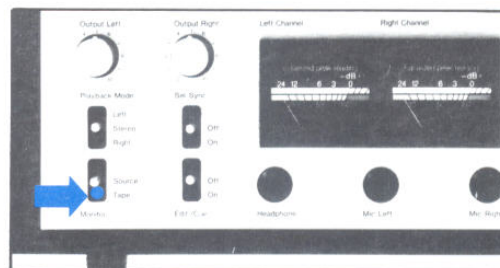
If monitoring of the signal before and after recording is carried out with the aid of the TAPE MONITOR button on a tuner/amplifier, the output controls (Output Left and Output Right) on the TD 20A should be adjusted so that the sound level is exactly the same for the source test and the tape test.



Program monitoring during recording



Program test (Source test)



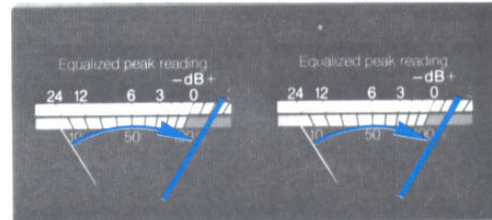
Tape test

### Watch the meters

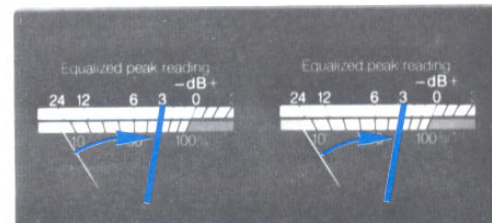
Correct adjustment of the input controls is very important! If the Input Left and Right controls are set so high that the meters deflect far into the red zone for long periods, the tape will be over-magnetized and the recording will be distorted.

On the other hand if the meter pointers do not deflect up to the red zone ( 0 dB), even in the loudest passages, the recorded signal will be too weak. This means the tape noise will be more noticeable.

To avoid re-adjusting, always adjust the input controls to match the strongest passages in the program you want to record. The tape recorder gives maximum 2% distortion at a meter deflection of 2 dB. This means that if you allow just a short deflection into the red area, the distortion will not be noticeable.



*Risk of distortion*



*Poor signal/noise ratio*

### Choose the right tape

Use only good quality tape. If in doubt, ask a good HiFi/radio dealer who stocks several types. He will usually recommend two or three brand names.

You will achieve the best results when recording on a new, unused tape.

Cut away the sticky parts at the ends of a new reel of tape to prevent the glue being deposited on the heads.

### Choose the right tape speed

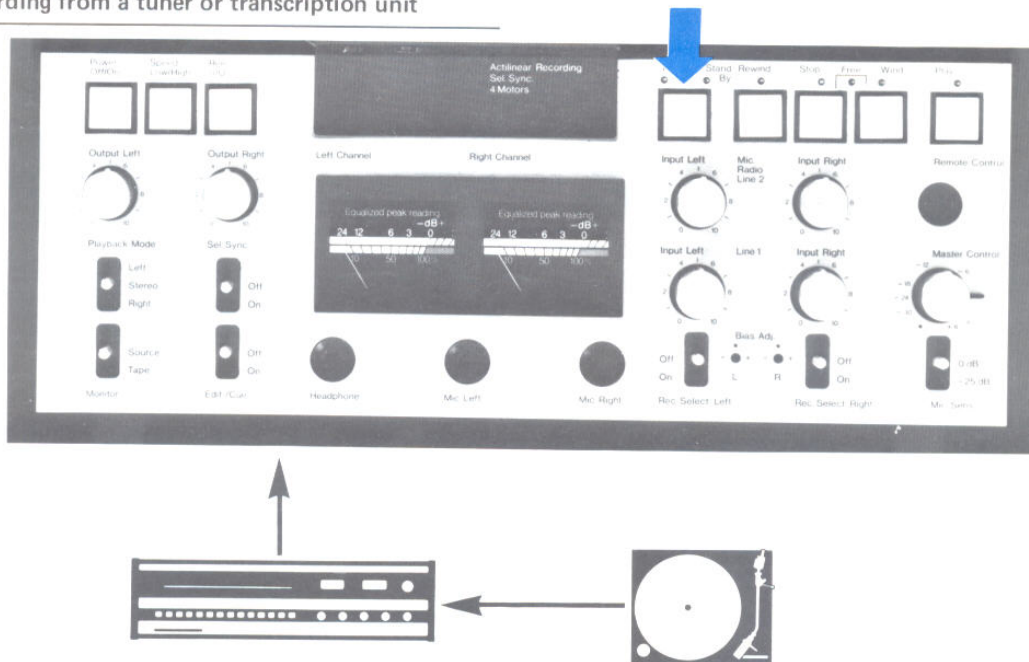
The highest tape speed gives the best quality and lends itself best to editing. The lowest speed also gives good results on recording and uses the least tape.

### Clean the tape path regularly

Dust and particles of tape will eventually be deposited on those parts of the machine that come into contact with the tape. This will lead to a reduced performance if the parts are not cleaned. See "Maintenance" on page 21.



## Recording from a tuner or transcription unit



### Recording from a tuner/amplifier

Thread the tape as described on pages 6 and 7.

Choose the tape speed and reel size (see page 9).

Set the Sel. Sync., Edit/Cue, and Mic. Att. controls to the Off position.

### Mono recording

Set one of the Rec. Select switches to On. The Stand By lamp will come on and both channels from the tuner/amplifier will be connected to the same track. So a stereo program will be recorded on mono. The input controls (Input Left and Input Right) for both channels will now operate on the same level meter.

Set the Playback Mode switch to Left or Right dependent on the Rec. Select switch. If the Rec. Select Left switch is On, set the Playback Mode switch to Left and vice-versa.

### Stereo recording

Set both Rec. Select switches to On. The Stand By lamp will come on as soon as one of the Rec. Select switches is set to On.

### Recording a radio program

The Master Control is electrically connected after the input controls, so the Master Control affects all four input controls.

Set the marker on the Master Control to 0 dB on the scale, which is a useful starting point. Set the Master Control to agree with the marker. When the balance between the two channels has been adjusted by means of the other input controls, the Master Control can be used to set the level.





Adjust the input controls\* so that the pointer on the meters deflects into the red zone. Deflection into the red zone can be tolerated for short, loud sound passages.

\* If DIN leads are used for connecting the tuner/amplifier, the meter deflection should be adjusted with the Mic. Radio Line 2 controls. If the connection is made with four phono leads, the meter deflection should be adjusted with the Line 1 control. Controls not in use should be set to 0.

Set the counter to zero and press the Record button to start the recording.

It is possible that you will need to adjust the input controls to different positions to obtain equal deflections on the two meters. The deflection shows the level of the program as it is going on to the tape.

With a mono program, only one of the meters will deflect.

For program monitoring during recording, see page 8.

#### Recording from a transcription unit

Press in the PHONO button on the tuner/amplifier. Put a record on and start playing it.

Watch the meters on the tape recorder when the pick-up on the transcription unit gets to a loud passage of music (see figure).

Adjust the input controls until the meter pointer reaches the red zone. Allow the pointer to go into the red zone on these short, loud passages.

Go back to the beginning of the record and press the Record button to start recording.

Keep an eye on the meters and adjust the input controls if necessary – or use the Master Control (slowly and gently).

Press the Stop button to stop the recording. Switch the Rec. Select switch to Off.

#### Flying start (direct switchover from Play to Record)

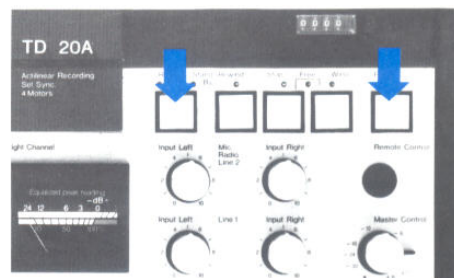
By pressing the Play button and holding it in while you press the Record button, you can go direct from playback to record without stopping the tape. (This assumes that one or both Rec. Select switches are in the On position.) Press the Play button to switch over the tape recorder from record to playback without stopping the tape.



LOUD PASSAGE      SOFT PASSAGE



*On records you can tell the loudest passages by looking at the record under light. The loud passages break up the light more than the soft passages.*



*Flying start*

## Placing microphones for a stereo recording

Two methods are in use. **Method A** (see figure) lends itself to small groups of musicians: a duet, a trio, or a chamber orchestra. The angle between the microphones should be  $110^{\circ}$  to  $120^{\circ}$  and the distance between them should correspond to the distance between a pair of human ears. The microphones should be mounted on the same stand.

Brass players and drummers should be further away from the microphones than string and woodwind players. The microphones should *not* be placed directly in line with brass or woodwind, and there must be free space between the instrument(s) and the microphones. It pays to make a few trial recordings with different sitings of microphones and musicians.

Remember to announce on every trial recording where the instruments and the microphones are placed, so that later you can recall the arrangement that gave the best results.

**Note!** Method A works best with cardioid microphones (see below).

**Method B** lends itself best to larger groups of performers, e.g. orchestras and choirs. The microphones should be mounted on separate stands 2 to 5 metres apart. A soloist should stand about 1 metre from his microphone, while the distance from a choir/orchestra should be about 3 metres.

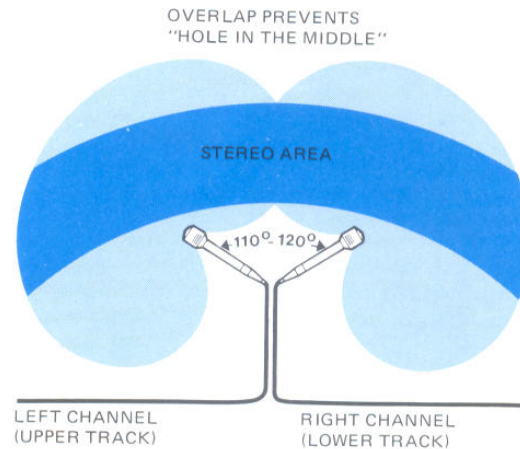
Microphones with a circular (omni-directional) characteristic are good for this type of recording. Cardioid microphones (see next section) can also be used.

### Microphone characteristics

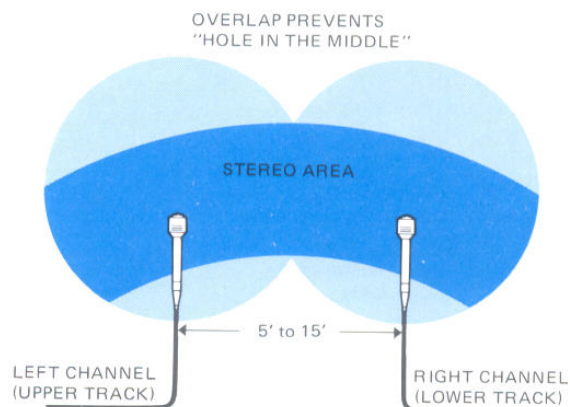
The microphone characteristic (polar diagram) tells you how sensitive the microphone is to sound from different directions. There are three main types:

1. Cardioid (uni-directional)
2. Figure-of-eight (bi-directional)
3. Circular (omni-directional)

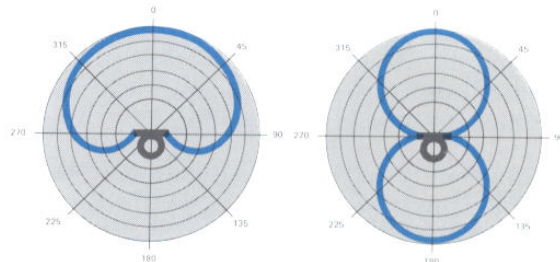
A figure-of-eight microphone can be advantageous for recording two speakers, singers, or instrumentalists. A circular microphone is useful for larger orchestras and choirs, especially where it is important to include the acoustic coloration of the hall into the recording. A cardioid microphone can be used for practically any recording. It reduces unwanted reflected sounds from the back and sides of a hall, and this is often an advantage. However, this reduction of reflected sounds can sometimes be frequency dependent giving unwanted coloration from the microphone itself (some frequencies are emphasized more than others). This is particularly true of the cheaper cardioid microphones on the market.



*Method A – Cardioid microphone*

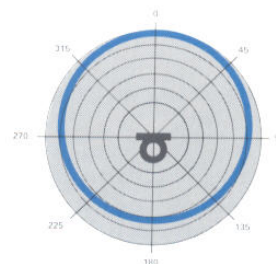


*Method B – Circular microphone*



*Cardioid*

*Figure-of-eight*

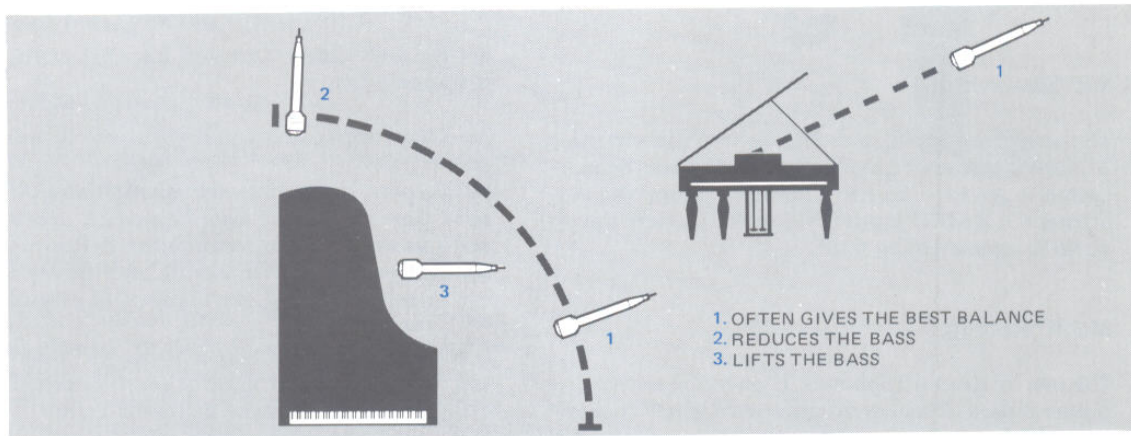


*Circular*



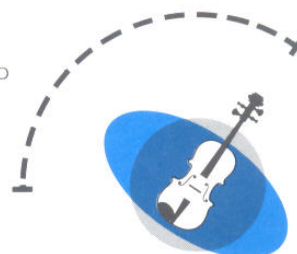
Suggested microphone positions for recording musical instruments

INSTRUMENT	MIC. POSITION
Upright piano	Best in a room with a long reverberation time. Place mic. 1' to 2' away from treble end of piano preferably behind it. Height should be 1' to 2' above top of piano. Difficult instrument. Pays to experiment.
Grand piano	See drawing below.
Violin family (including cello and double bass)	About 3' to 5' above instrument pointing at sound holes. If too close will pick up bow noises. See drawing below.
Woodwinds	Above player's head about 3' away pointing at finger holes or bell. Listen for "plopping" noises from stops and valves and experiment with microphone position to reduce them.
Brass	Pointing down at the bell from above the player at a distance of 5' to 7'. Halve the distance when using a mute.
Guitar	About 1' from sound holes. If too close will pick up finger scraping noises.
Percussion	Point at small drum from 2' to 3'. Wire brushes need a very good microphone. Set up recording conditions for percussion before dealing with other instruments.
Organ	Difficult instrument. Place in middle front, level with longest pipe and the length of the pipe away. Pays to experiment.
Electric organ and electric guitar	Place microphone near speakers.



*Recording a grand piano*

MOVE THE MICROPHONE ROUND THIS ARC FOR MORE OR LESS HIGH FREQUENCIES

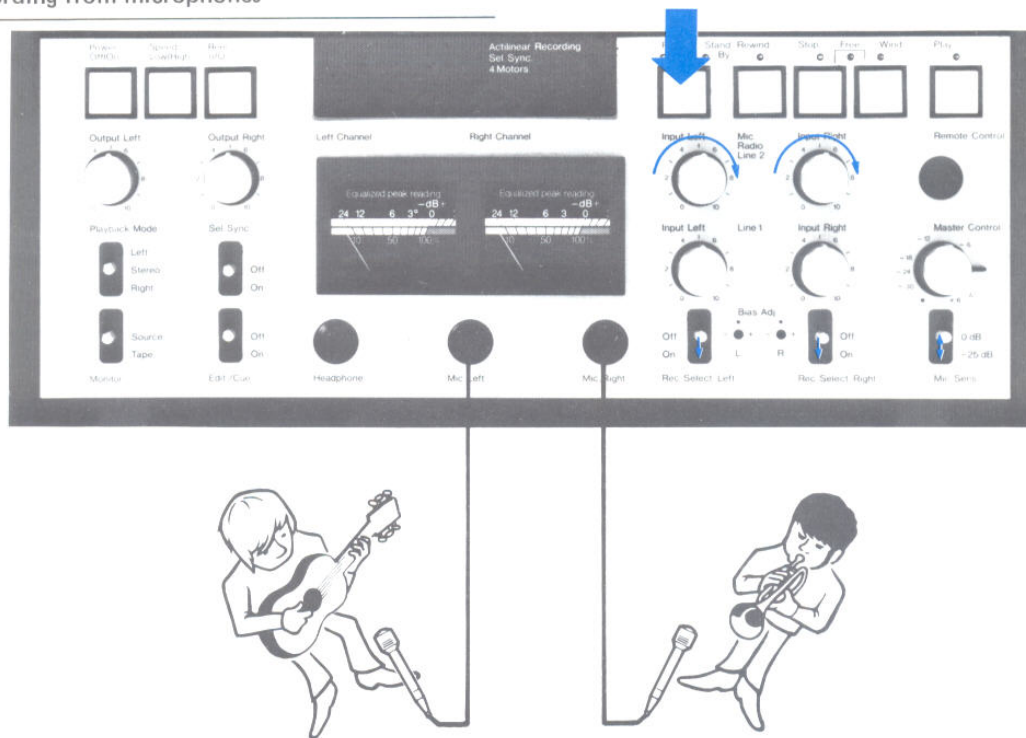


■ = LOW FREQUENCIES  
■ = HIGH FREQUENCIES

*Recording a violin*



## Recording from microphones



Use microphones with an impedance between 200 and 700 ohms. The sensitivity of the microphone input automatically adjusts itself to the particular microphone.

### Mic. Sens. switch

The sensitivity of the microphone amplifiers in the TD 20A is attenuated by 25 dB when the Mic. Sens. switch is set to -25 dB. This attenuation also affects the RADIO input (DIN sockets). Here the signal is attenuated by 6 dB.

### Mono recording

Use one or two microphones. If only one microphone is used, it makes no difference which socket is used (Mic. Left or Mic. Right).

Set one of the Rec. Select switches to On. When only one Rec. Select switch is set to On, the program from both microphone inputs will be connected to the same channel.

If only one microphone is used the Mic. Input for the input not in use should be set to 0.

For adjustment of the program meters and recording, see next paragraph.

### Stereo recording

Plug two microphones into the sockets Mic. Left and Mic. Right.

Set the Rec. Select Left and Rec. Select Right switches to On.

Set Line 1 Input Left and Right controls to 0.

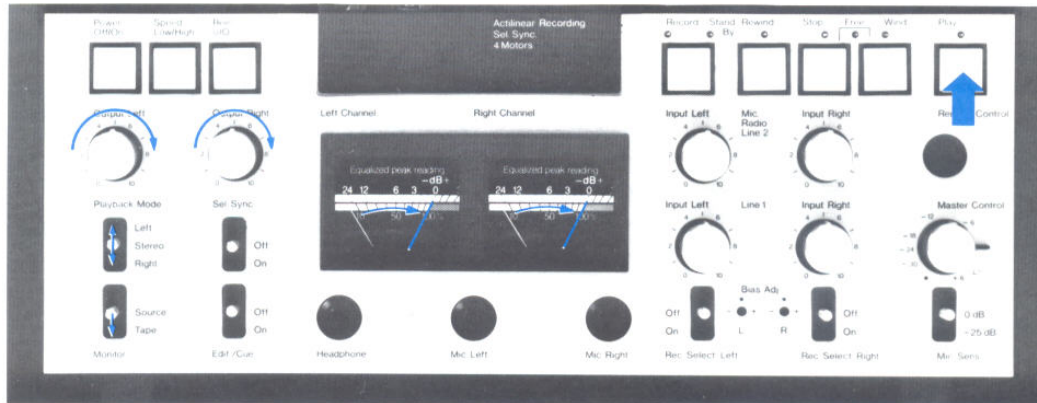
Speak, play, or sing into the microphones. At the same time, adjust the Mic. Input Left and Right controls so that the meter pointers deflect up to the red zone (0 dB). Deflection into the red zone can be tolerated on short, loud sound passages.

It is possible that the two controls Mic. Input Left and Mic. Input Right must be set to different positions to achieve the same meter deflection.

Press the Record button to start the recording.

Press the Stop button at the end of the recording. Set the Rec. Select switch to Off.

## Playback



### Playback over loudspeakers

The tape recorder does not have built-in output amplifiers, so it must be connected to a stereo amplifier or a stereo tuner/amplifier.

Switch on the tuner/amplifier and press in the TAPE button on this equipment.

### Playback a stereo program

Set the Playback Mode switch to Stereo and press the Play button.

### Playback of a mono program

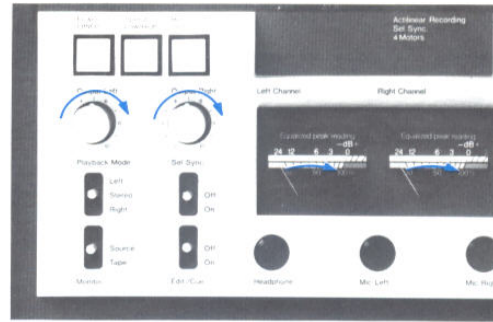
Set the Playback Mode switch to Left (playback of left channel) or Right (playback of right channel), and press the Play button. When the Playback Mode switch is set to Left or Right, the program from one of the tracks on the tape is connected to both outputs on the TD 20A (mono reproduction).

Both output controls (Left and Right) must be adjusted. See further information on tracks and channels on page 17.



The output (Left and Right) controls should be adjusted so that the program from the tape recorder is at the same level as programs from other sources connected to the tuner/amplifier (e.g. a transcription unit). The deflection on the meters shows the output level of the program in the two channels.

The program meters will often show a lower deflection on playback than on record (for the same tape). This is quite normal and is because the higher tones are pre-emphasized (given extra amplification) during recording. The pre-emphasis is greatest at the lowest speed. So the difference between the meter deflections on record and playback is most noticeable at this speed. See record and playback curves on page 24.



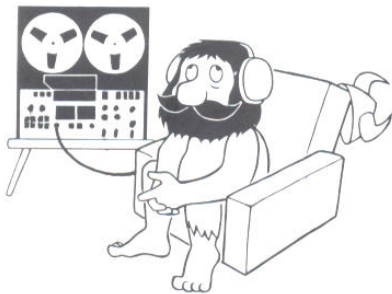
### Headphones

Stereo and mono programs from tape can be listened to on headphones connected to the socket marked Headphones on the TD 20A. The impedance of the headphones should be any value between 8 and 2000 ohms and they should be fitted with a 1/4" jack plug.

Several pairs of headphones can be connected with the aid of a junction box provided that the resultant impedance is not less than 8 ohms.



Connecting headphones





## What is a channel? What is a track?

A *channel* is the path the program follows through the tape recorder and the amplifier during recording and playback. A mono recording requires only one channel, whereas a stereo recording requires two channels – left and right.

A *track* is the strip of tape along the tape length that is magnetized during recording, and on which the sound is “stored”. There are two types of stereo tape recorders: the 4-track type and the 2-track type. The 4-track and 2-track versions of the TD 20A are marked with a label on the back of the deck. The label gives the speeds and tracks.

### 4-track tape recorders

The arrangement of the four tracks across the tape is such that when you record from one end of the tape, the program will record on track 1 when the Rec. Select Left switch is set to On. When the Rec. Select Right switch is set to On, the program will record on track 3.

When you record from the other end of the tape, the program will record on track 4 when the Rec. Select Left switch is set to On. When the Rec. Select Right switch is set to On, the program will record on track 2.

This means that you can make one stereo recording or two mono recordings from each end of the tape.

### 2-track tape recorders

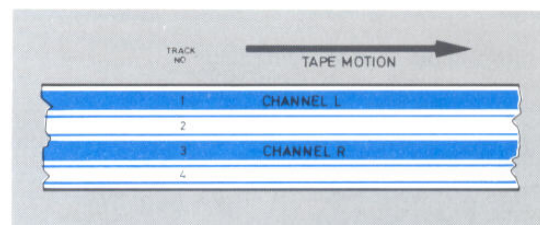
A stereo recording from one end of the tape occupies the complete width of the tape, so that it is not possible to record from the other end without erasing the first recording.

This means that if you have a 2-track tape recorder you can only make one stereo recording or two mono recordings on each tape.

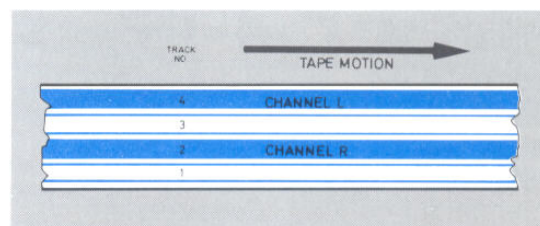
If you have made a mono recording from one end of the tape and wish to continue the recording from the other end, the same Rec. Select switch must be set to On.

It is the characteristics of the tape recorder, and not the tape, which determines whether the system is 4-track or 2-track. The same type of tape can be used on 4-track and 2-track machines.

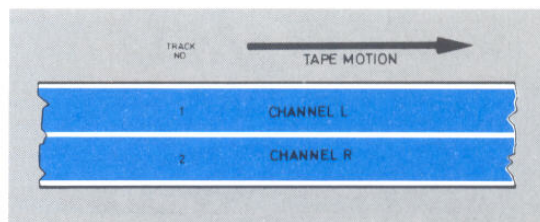
A tape recorded on a 2-track machine can be played back on a 4-track machine, but not vice versa if all 4 tracks have been used. If only track 1 and track 3 (or 2 and 4) have been used, you can play it back on a 2-track machine.



*4-track tape recorder – recording from one end of the tape*



*4-track tape recorder – recording from the other end of the tape*



*2-track tape recorder*

---

## Copying tape

---

Connect two phono leads from the LINE OUT sockets on the machine used for playback to the LINE IN sockets on the machine used for recording.

When phono leads are used, copying can take place in either direction, see diagram.

Alternatively copying can be carried out with a DIN lead and a special copying lead which can be bought at a radio dealer. Connect the DIN lead from the RADIO socket on the TD 20A to the RADIO socket on the other tape recorder, see diagram. Copying can take place in either direction.

Copying can also take place via a tuner/amplifier, but in this event you should follow the tuner/amplifier instruction book.

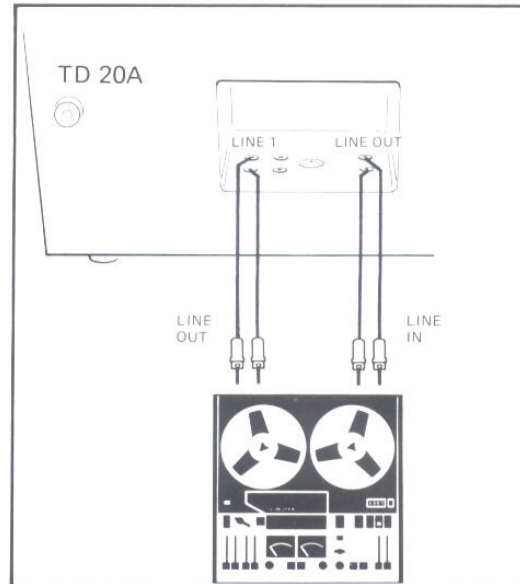
### Adjusting the level for recording

Set the input controls on the machine used for recording to between 6 and 7. Then adjust the output controls on the machine used for playback to about the correct level (0 dB on the recording machine meters). Then go back to the input controls on the machine used for recording and make final fine adjustments.

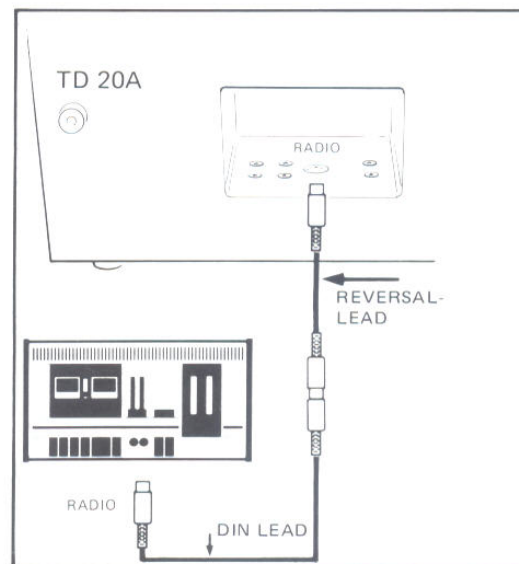
**NOTE!** If the machine used for playback does not have output controls, the signal will probably be too high for the RADIO input on the TD 20A. Set the Mic. Sens. switch to -25 dB and the sensitivity will be reduced by 6 dB on the RADIO input. If this does not help, use the LINE 1 or LINE 2 inputs which are less sensitive.

### Tips on copying

- Start the machine used for recording before you start the machine used for playback.
- You can edit the program that is played back by stopping the recording machine without stopping the playback machine. This method of editing is only suitable for removing longer pieces of a program.



*Copying with the aid of phono leads*



*Copying with the aid of a DIN lead and a reversal lead*

## Cutting and splicing

You may need to cut and splice a tape to get the recorded items into a particular order. You may also need to remove small imperfections from a recording such as a cough or a wrong note.

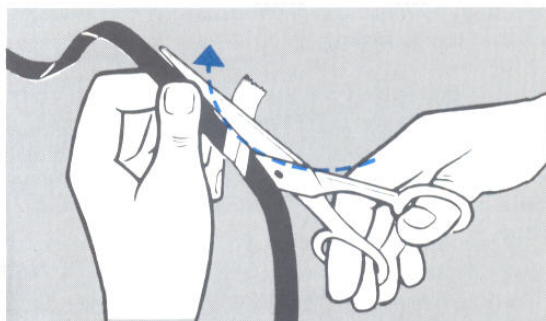
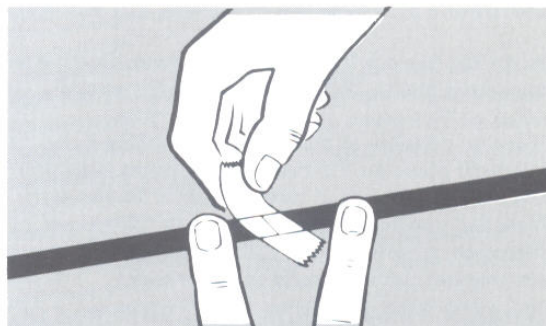
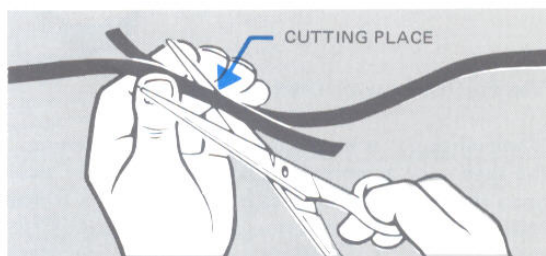
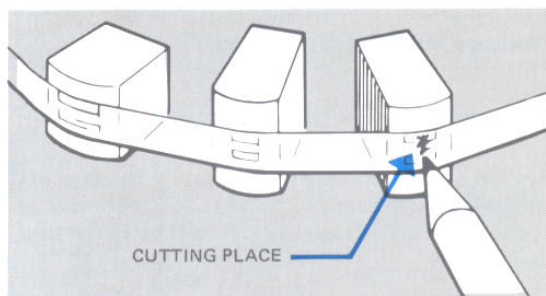
1. Locate the cutting place as described under "The Edit/Cue switch used for editing".
2. Pull off the front head cover (lift it straight up).
3. Use a soft pen (felt or fibre) or a chinagraph pencil to mark the tape at the playback head, (see figure). This mark indicates where the tape should be cut and spliced.
4. Lay one tape end over the other with the same sides of the tape uppermost. Cut the tape at the mark with scissors or knife (*non-magnetic!*) at an angle of  $45^\circ$  as shown in the figure. Do not handle the tape unnecessarily.

**WARNING!** Use a special splicing tape supplied by audio shops. Ordinary sticky tapes may damage the tape deck.

5. Lay the tape ends against each other and in a straight line to form a butt joint (no gap, no overlap) with the shiny side uppermost. Matt backed tapes do not have a shiny side but the splicing tape should always be placed on the side away from the tape heads. Lay the splicing tape across the joint, parallel to the cut, and press firmly to remove the air bubbles (see figure).
6. Cut the splicing tape along both sides of the joint with a slight curving action into the magnetic tape to prevent the adhesive being deposited on the heads (see figure).

Splicing will also be necessary for leader tape and if the tape breaks.

Cutting and splicing should not be performed if there are programs of value on other tracks.





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## Finding a recording on the tape

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### The counter

Set the counter to zero at the start of the tape and note the reading on the counter for each new recording. This will enable you to find a recording easily later.

Always use the same empty reel to get an accurate reading on the counter.

### The Edit/Cue switch used for editing

When editing it is necessary to localise a place on the tape very accurately. Play back the tape and press the Stop button so that the tape stops as near to the required place as possible. Set the Edit/Cue switch to On. If necessary put the tape recorder into the Free mode so that the reels rotate freely, see page 6. Turn the reels by hand and listen on speakers or headphones to localise the place exactly.

When the place is localised you can cut the tape as explained in the “Editing and cutting” section.

It is also possible to start a new recording from the localised place on the tape. In this event turn the reels so that the tape moves slightly *to the left*. How far you turn it depends on the degree of precision you need, but 2 to 3 cm is a useful starting out point. It pays to experiment.

The highest tape speed (Speed button in) is most suitable for editing work.

If you are searching for a recording during fast winding, the tape speed can be reduced as you get near to the recording.

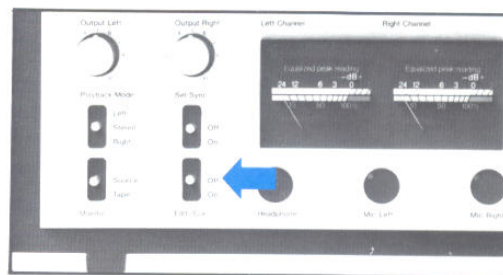
Hold in the button for the winding direction you require and at the same time press in the button for the opposite direction (several times, for longer or shorter periods) to reduce the tape speed. When both buttons are released the TD 20A will go to Stop.

### Edit/Cue switch used during fast winding

When the Edit/Cue switch is in the On position, you can listen to the program during fast winding (provided the Monitor button is on Tape).

Despite the high tape speed you will recognize characteristic transitions in the music.

The sound level is high and the Output Left and Right controls should not be set too high.

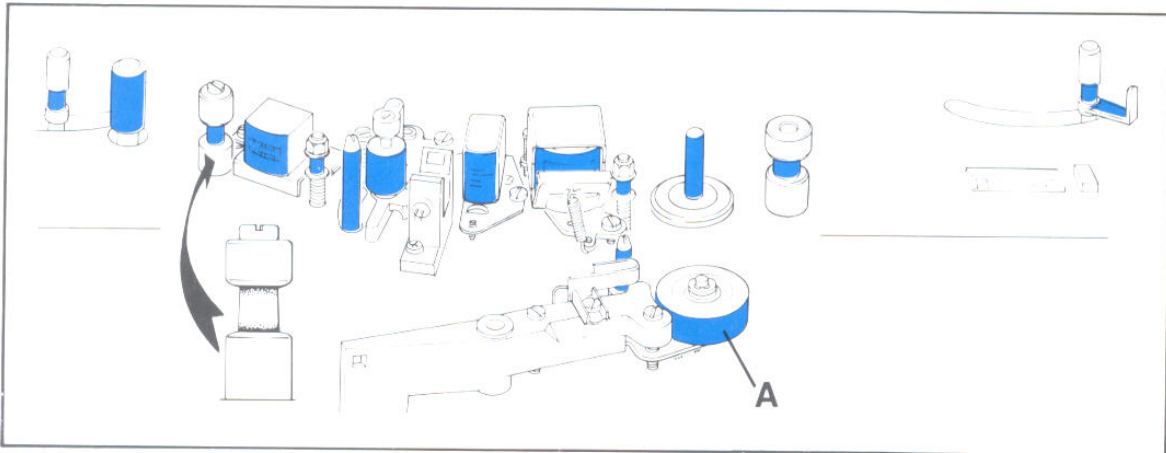


*Edit/Cue switch*



*Turn the reels by hand*

## Maintenance



*Clean the spots indicated in colour*

### Cleaning

The parts of the tape recorder in contact with the tape surface should be cleaned regularly, otherwise the sound quality will be greatly reduced.

**When to clean?** If the tape recorder is used every day, cleaning should be performed *at least* once a month. A good time to clean is just before making an important recording.

**What to use?** The cleaning can be done with cotton-wool or a piece of flannel wrapped around a small stick and moistened with *pure alcohol, Freon or methylated spirit (Fire risk!)*. A non-flammable kit intended for this purpose, "Tandberg Professional Head Cleaning Kit" is available.

Aerosols (spray cleaners) intended for video tape recorders can be used, but it is **not** sufficient just to spray the parts. Cottonwool buds must also be used.

**NOTE!** Do not use solvents, such as acetone or trichlorethylene, as they may damage the heads. Do not use any sharp objects.

**How to clean?** Remove the two head covers by pulling them straight upwards. Clean the spots indicated in colour in the figure.

**NOTE!** Pay particular attention to the sharp corners of the tape guide posts where deposits tend to settle.

Stubborn deposits on guide-posts should first be softened and afterwards removed with a toothpick.

The pinch roller (A) needs to be cleaned only if the tape motion is uneven or if there are visible deposits on the roller (four to six times a year will be satisfactory for even a frequently used machine). Dry the roller after cleaning.

Finally, remove dust and loose magnetic particles from the area around the parts you have cleaned.

**DO NOT TOUCH THE ADJUSTMENT SCREWS.**

### Degaussing

A marked increase in background noise from the tape may indicate that the heads or other parts in the tape path should have the residual magnetism removed (degaussing).

If required, degaussing should be carried out as follows: Switch off the recorder. Remove the two head covers and move the degausser slowly past each one of the metal parts normally in contact with the tape. Take great care not to let the degausser **touch** the heads or metal parts in the tape path. Do not switch off the degausser until it is at least 3 ft from the recorder. Alternatively, follow the degausser maker's instructions.

### Sel. Sync.

With the aid of Sel.Sync you can record a program on the right channel, synchronized with another program already recorded on the left channel (basic program). The combined two-channel program can be played back in stereo. The recording can be repeated without having any effect on the basic program.

Plug a microphone into the Mic. Left or Mic. Right socket. It makes no difference which socket is used. Prepare for a mono recording on the left channel (Rec. Select Left switch to On) and zero the counter.

Set the Monitor switch to Source (program monitoring) and the Playback Mode switch to Stereo.

**NOTE!** The Sel. Sync. switch must be in the Off position when this recording is made.

Start recording by pressing the Record button and adjust the level on the meters as explained on page 14.

Stop recording on the left channel and wind back to the start of the recording.

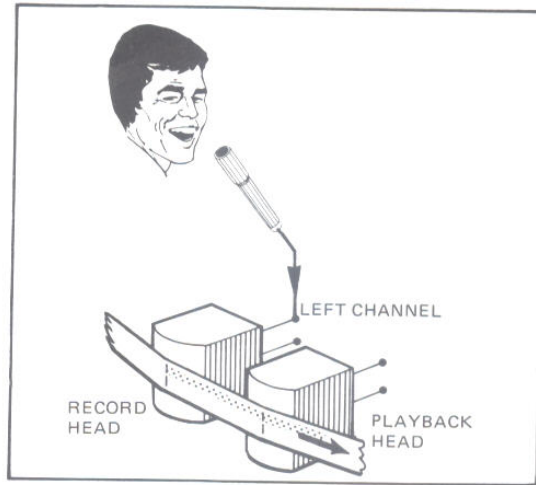
Prepare for a mono recording on the right channel (Rec. Select Right switch to On).

Set the Sel. Sync. switch to On. Start recording. You will now hear the left channel program (basic program) in the headphones, played back from the record head (with reduced quality). At the same time you should speak, sing, or play in a new program on the right channel; see diagram.

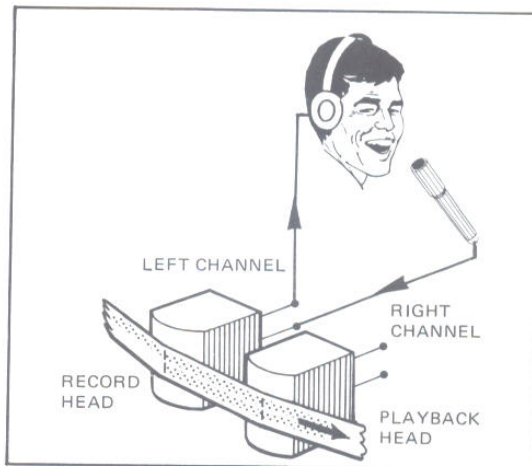
The program recorded on the right channel will now be synchronized with the first (basic) program recorded on the left channel. Stop the recording and wind back to the start.

### Testing the program recorded with the Sel. Sync. facility

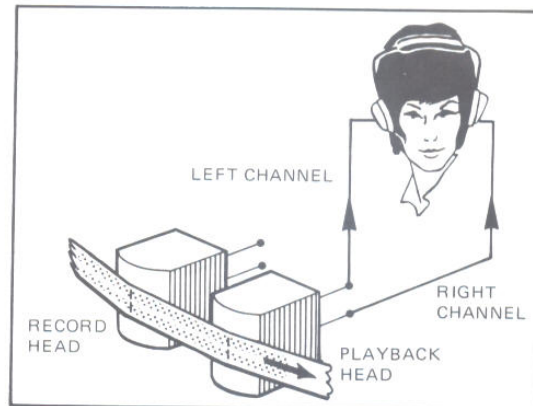
Set the Sel. Sync. switch to Off. Set the Monitor switch to Tape. Play back the tape in stereo (Playback Mode switch to Stereo). The program on the left channel (first recording) and the program on the right channel (second recording) will now be played back from the playback head without any time displacement.



*Recording on the left channel*



*Monitoring the program on the left channel using the record head, and recording on the right channel*



*Testing the program in stereo*



## Sound on Sound

Sound on Sound is a special recording technique where a mono program is played back from one track and at the same time it is combined with a new program and the two programs are recorded on another track.

Plug the microphone into one of the Mic. sockets and the headphones into the Headphones socket.

### First recording

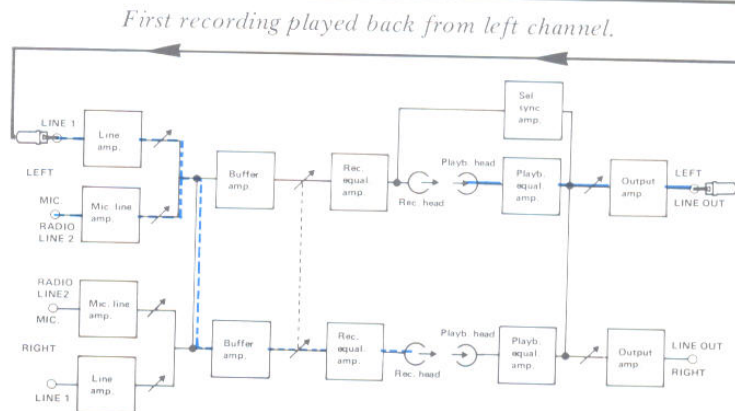
Record the first voice on the left track.

### Second recording

Connect a short phono lead between LINE 1 L and the LINE OUT L sockets.

#### Switch positions

*Rec. Select L* : Off  
*Rec. Select R* : On  
*Playback Mode* : Left  
*Monitor* : Tape



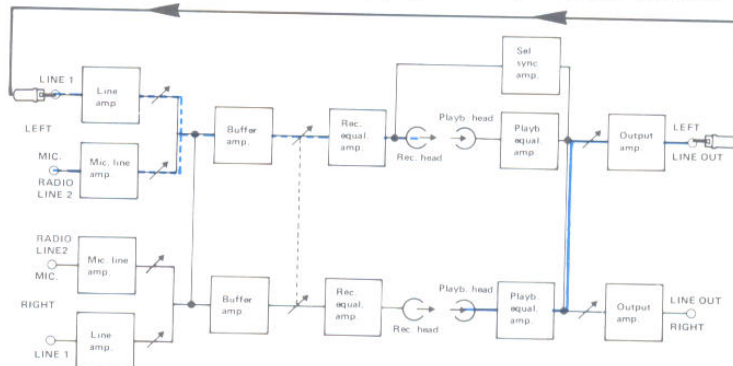
Second voice recorded on right channel and simultaneous transfer of first voice from left channel to right channel.

### Third recording

*First and second recording played back from right channel.*

#### Switch positions

*Rec. Select L* : On  
*Rec. Select R* : Off  
*Playback Mode* : Right  
*Monitor* : Tape

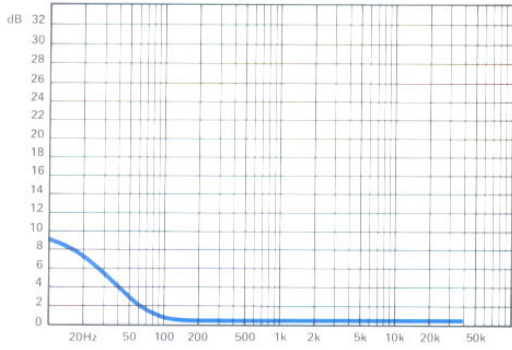


Third voice recorded on the left channel and at the same time the first and second voices transferred from the right channel to the left channel.

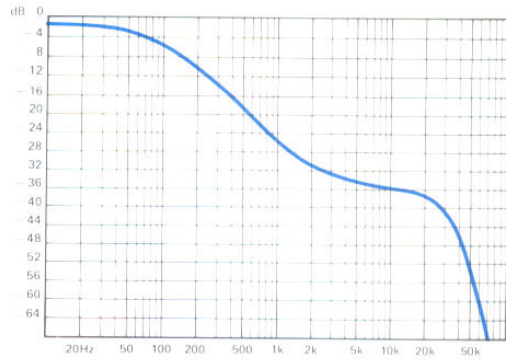
A **fourth** voice can be added in the same way as the second voice. A **fifth** voice can be added in the same way as the third voice, and so on.

With several transfers the signal/noise ratio will eventually deteriorate.

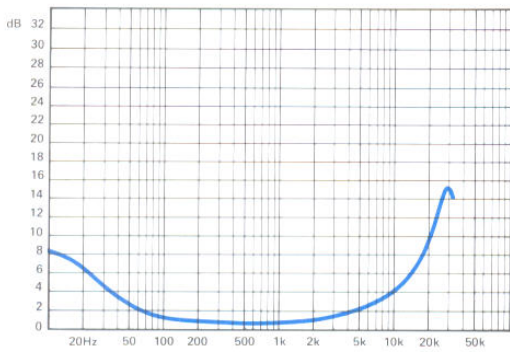
Record and Playback curves



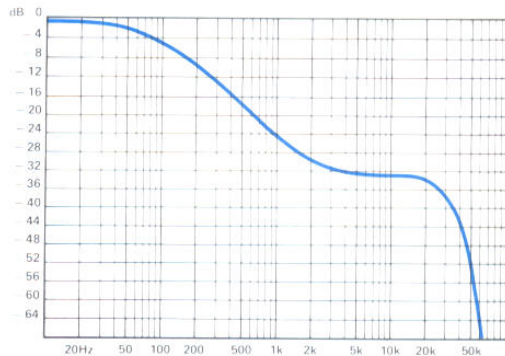
Record curve 15''



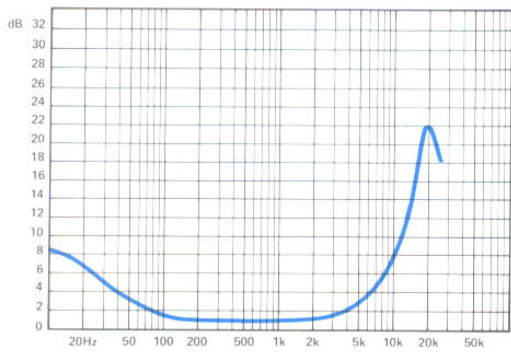
Playback curve 15''



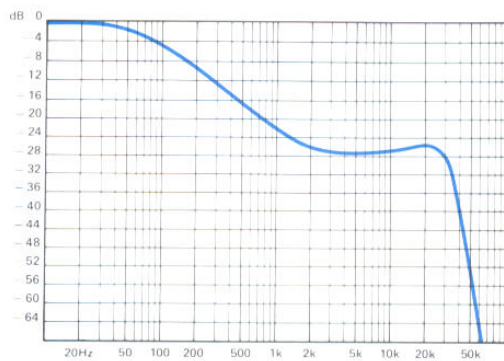
Record curve 7 1/2''



Playback curve 7 1/2''



Record curve 3 3/4''



Playback curve 3 3/4''

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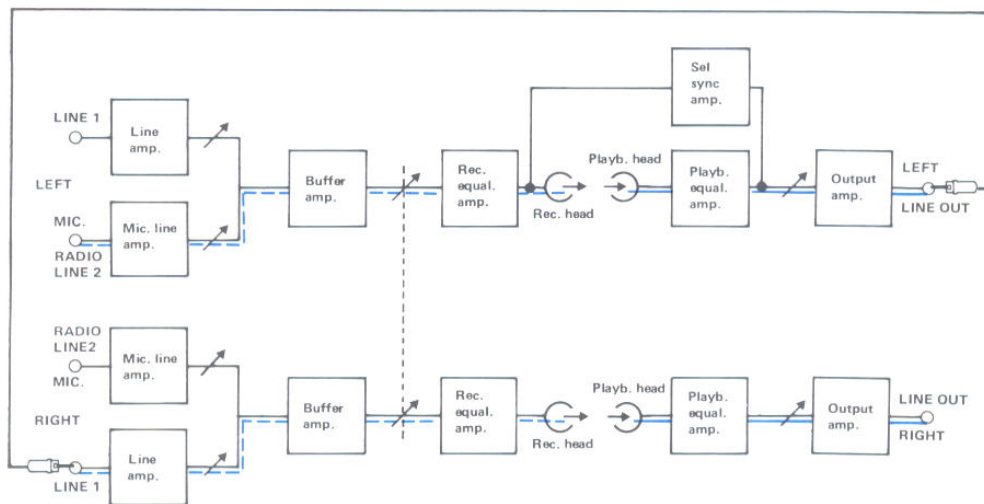
## Echo

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Connect the short phono leads (packed with the TD 20A) between the input sockets (LINE 1) and output sockets (LINE OUT) as shown in the diagram. Adjust the echo level with Input Left and Input Right, Line 1 and the Output Left and Output Right controls.

The echo length depends on the tape speed. The highest tape speed will normally give the most "natural" echo. It pays to experiment with microphone(s) and headphones.

### Simple "Echo"



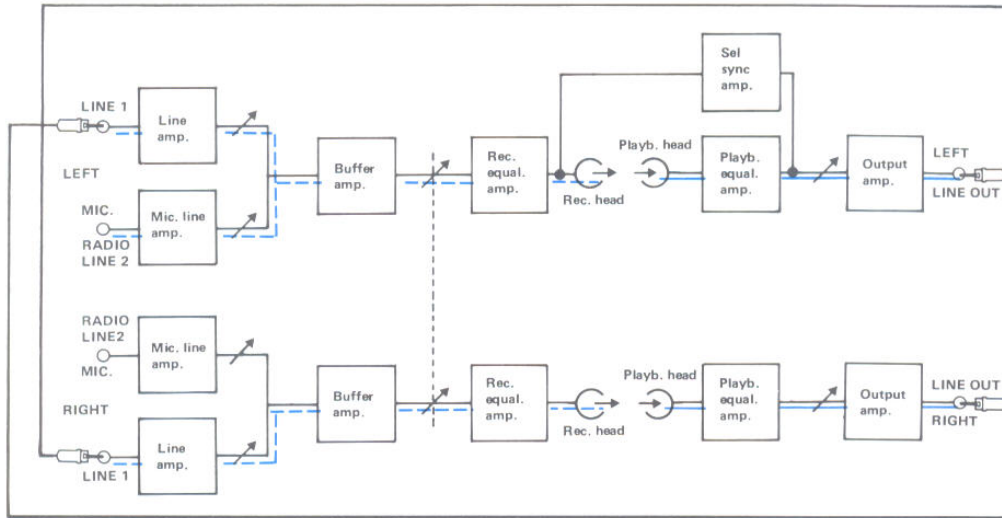
*Mono program source. Stereo recording and playback.*

*LINE OUT L connected to LINE 1 R.*

An echo recording can also be made from program sources other than microphones. The program source must then be connected to the LINE 2 (L and/or R) or the RADIO socket.



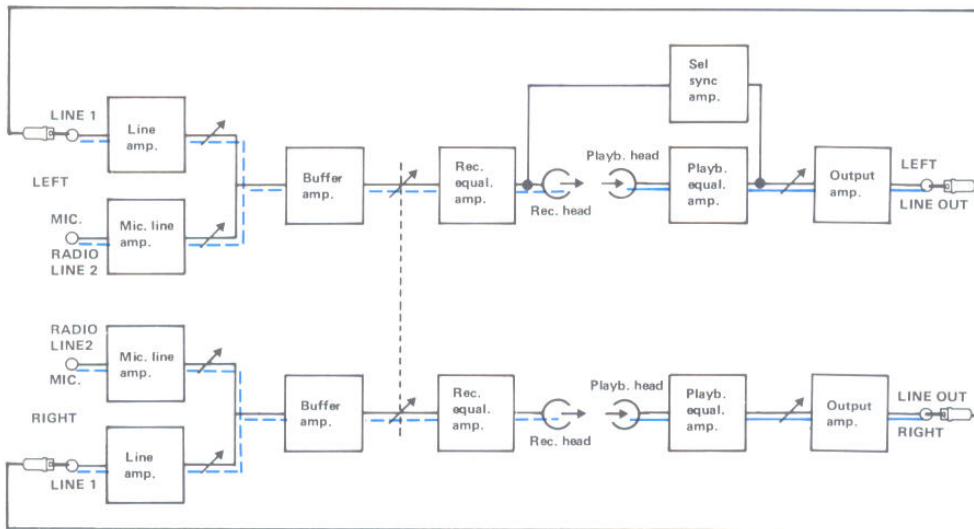
Cross-connected "Echo" in stereo



*Stereo or mono program source.  
Stereo recording and playback.*

*LINE OUT L connected to LINE 1 R,  
LINE OUT R connected to LINE 1 L.*

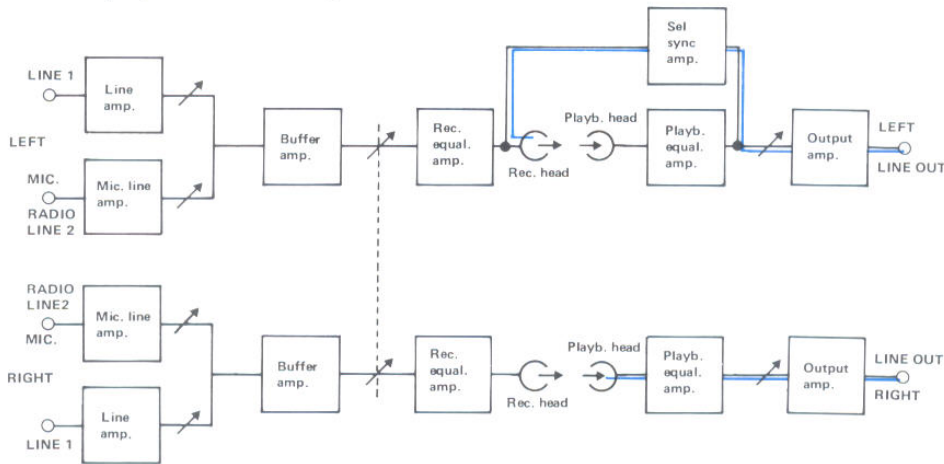
"Echo"



*Stereo or mono program source.  
Stereo or mono recording or playback.*

*LINE OUT L connected to LINE 1 L,  
LINE OUT R connected to LINE 1 R.*

### Special effect with playback of stereo tape



If you wish an echo-effect on pre-recorded tape the buttons should be set as described on the right.

The left channel which is played back from the record head is reproduced with reduced quality.

#### Switch positions

Rec. Select Left or Right	: Off
Playback Mode	: Stereo
Monitor	: Tape
Sel. Sync.	: On

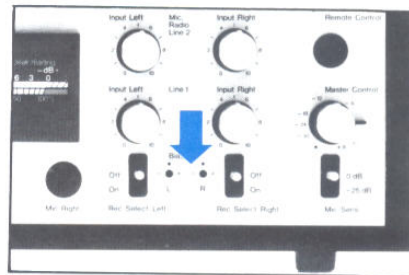
### Adjusting the Bias

When the TD 20A leaves the factory it is adjusted to suit Maxell UD XL tape. This means the bias adjustment potentiometer is in the mid-position. The holes are sealed underneath the top panel.

Since there is constant research and development to improve magnetic tapes, new types of tape will always be coming onto the market. To meet this situation we have provided facilities for external bias adjustment on the TD 20A.

If you want to adjust the TD 20A to suit a special tape, you can make the adjustment without dismantling the cabinet. To obtain the best results the adjustment should be carried out by a qualified technician using a low frequency generator and a valve voltmeter.

If you want to use a special tape, and there is a marked audible difference in the frequency response between the Source and Tape tests, you



#### Adjusting the bias

can adjust the Bias Adj.pots with a thin screwdriver. If this adjustment does not give satisfactory results, set the Bias Adj.pots back to the mid-position and entrust the adjustment to a qualified service technician.

## Technical data

All data better than DIN 45500

Supply voltage	230 V $\pm$ 10%, 50 Hz 115 V $\pm$ 10%, 60 Hz			
Power consumption	110 watts			
Tape speeds	15'' and 7½'' per sec., 2-track version 7½'' and 3¾'' per sec., 4-track version			
Speed tolerance, maximum*	$\pm$ 0,5%			
Speed variations, maximum	2-track		4-track	
Peak	15''	7½''	7½''	3¾''
Weighted RMS record/playback	0.06%	0.08%	0.08%	0.14%
	0.03%	0.05%	0.05%	0.10%
Frequency range Hz (IEC playback corr.) DIN 45500 $\pm$ 3 dB	15-34000 20-30000	15-30000 20-25000	15-30000 20-25000	15-20000 20-18000
Signal/tape noise, max. measured at highest speed with Maxell UD XL II tape IEC A-curve DIN 45500 (Geräuschspannung) IEC Linear RMS DIN 45500 (Fremdspannung)	69 dB 60 dB		66 dB 60 dB	
Channel separation (attenuation) at 1 kHz, min.	Mono 64 dB		Stereo 60 dB	
THD from tape with 0 dB record level	2%			
Inputs: Input impedance/sensitivity/max. volts at 400 Hz MICROPHONE** (Mic. Sens. in 0 dB position) MICROPHONE (Mic. Sens. in -25 dB position) RADIO (Mic. Sens. in 0 dB position) RADIO (Mic. Sens. in -25 dB position) LINE IN 1 LINE IN 2	800 ohms/ 0.2 mV - 20 mV 15 k ohms/ 3 mV - 300 mV 22 k ohms/ 5 mV - 500 mV 38 k ohms/10 mV - 1 V 150 k ohms/50 mV - 5 V 250 k ohms/50 mV - 5 V			
Outputs: Minimum load impedance/maximum voltage with unloaded output RADIO LINE OUT Headphones	5 k ohms/775 mV 100 ohms/ 1.5 V 8 ohms/ 1.3 V			

\* With nominal mains voltage/frequency and normal operating temperature.

\*\* The microphone inputs are matched to dynamic microphones and the sensitivity matches itself automatically to the impedance of the microphone.



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Operator's trouble shooting guide


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Trouble:	Possible cause:
No light in meters when machine switched on.	Power cable not connected to power socket (not plugged in).
Tape does not start when Play button is pressed.	Tape not properly inserted (see page 6).
Tape starts, but stops again.	Transparent leader tape in front of photo electric end stop sensor (see page 7).
Tape does not start when Record button is pressed.	Rec. Select switch(es) not in On position.
Rewind, Wind, and Play buttons do not work.	Tape recorder is in the Free-position (see page 6).
Tape is slack when starting.	The o/O Reel button is not pressed in when you are using large reels (10½").
Bad sound reproduction, drop-outs.	Tape not laid over left tape tension arm (see page 7). Tape path needs cleaning (see page 21).
No sound in headphones or speakers during playback.	Monitor switch in Source position. Output Level controls in zero position (turned right down).
No sound in speakers during playback.	TAPE button on connected tuner/amplifier not pressed in.
Input Left and Input Right controls must be set to different positions to obtain same deflection on two meters during stereo recording.	This can be correct (see page 11).
Uneven tape flow, wow, flutter, drop-outs.	Tape path needs cleaning (see page 21).
Meter deflection during playback is less than during recording.	This is normal (see page 16).
"Clicking" sound when machine switched off.	This is normal. The sound is due to the motor which moves back and forth when switching off.

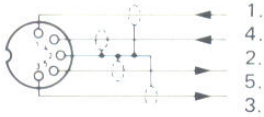


## Plugs

The plugs must be connected as shown below.

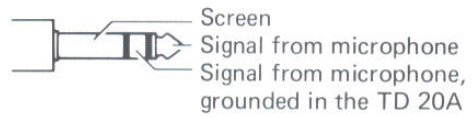
The DIN plugs are seen from this side. 

## RADIO



1. Signal from tuner/amplifier, left channel
4. Signal from tuner/amplifier, right channel
2. Common lead (screen)
5. Signal to tuner/amplifier, right channel
3. Signal to radio/amplifier, left channel

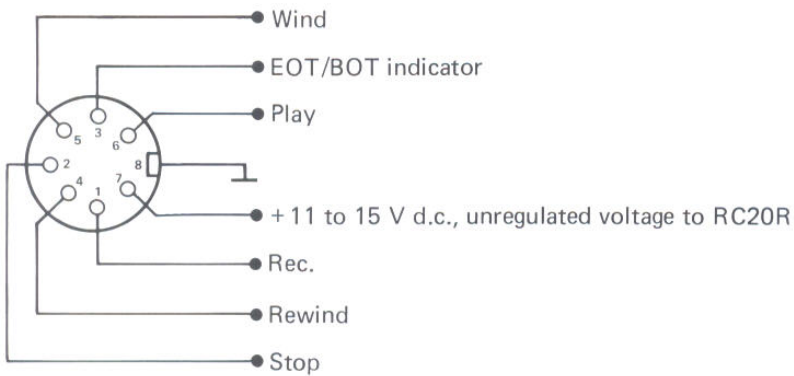
## MIC



## HEADPHONES



## REMOTE CONTROL



The inputs are activated when connected to ground (pin 8)



**What are the controls for?**

**Left tape tension arm**

Lay the tape as shown:



**Right tape tension arm**

Lay the tape as shown:



**Reel o/O.** Press the button in when using 10 1/2" reels. The button must be out for smaller reels. Use reels of same size.

**Speed Low/High.** Tape speed selector. Press the button in for highest tape speed (stated on the back panel of the machine).

**Power On/Off.** Mains switch. Press the button in to switch the machine on.

**Output Left and Right.** Output level controls for left and right channels.

**Playback Mode.** Output selector.  
Left position: Left channel to right and left outputs.  
Right position: Right channel to right and left outputs.  
Stereo position: Stereo output.

**Monitor.** Switch for testing the program.  
Source Position: Program source.  
Tape Position: Playback from tape.

**Sel. Sync.** Set this switch to Off for normal record and playback. The On setting is for special facilities, see back page.

**Edit/Cue.** Set this switch to On for tape monitoring during fast winding and when the reels are turned by hand.

**Headphones.** Socket for headphones, minimum impedance 8 ohms.

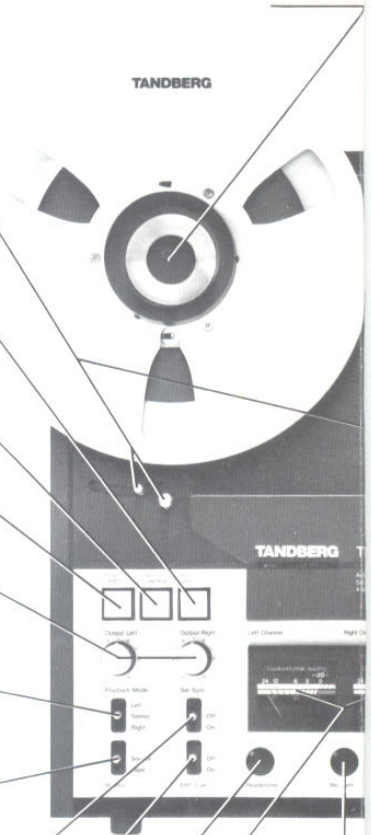
**Program meters.** Indicate program level during record and playback.

**Mic. Left and Mic. Right.** Sockets for microphones for left and right channels.

**Rec. Select, Left and Right.** Record selector for left and right channels.

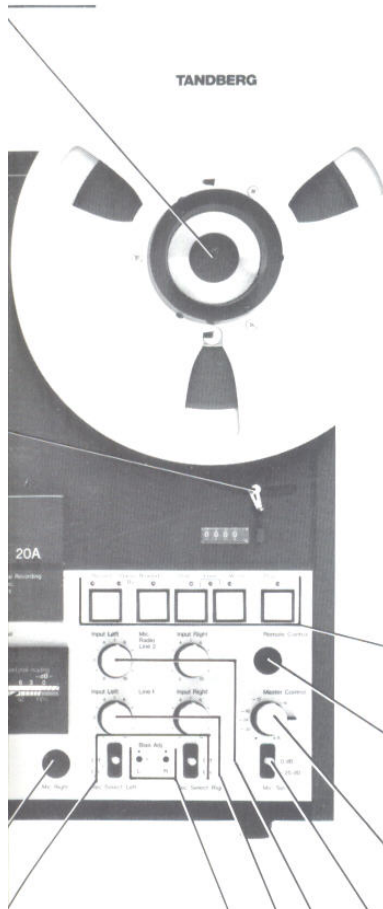
Stereo record. Set both Rec. Select selectors to On.  
Mono record. Set Rec. Select selector for required channel to On.

**Reel locks.** The reel locks must be engaged when the machine is in use. Turn after the reels are fitted.





Always be in the locked position  
both reel locks through 60°



**Record.** Press to record. The button will only work when one or both Rec. Select selectors are in the On position and the lamp over the Stop button is on.

**Stand By.** Comes on when the machine is ready to record i.e. when one or both Rec. Select selectors are in the On position and the machine is in the Stop (with tape) or Play mode.

**Rewind.** Fast backward winding.

**Stop.** Stops the tape, cancels the Free-condition.

**Free.** Hold the Stop button in and press the Wind button. Release the buttons and the machine is in the Free condition (the brakes are taken off the reel turntables). Press the Stop button to cancel the Free condition.

**Wind.** Fast forward winding.

**Play.** Playback.

**Flying Start.** Direct transfer from Playback to Record and vice versa without stopping the tape.

From Play to Record: Hold the Play button in and press the Record button.

From Record to Play: Press the Play button.

**Remote Control.** Socket for remote control unit (accessory).

**Master Control.** Main input control for controlling program levels on all the inputs. Adjust in the region 0 to +6 dB before you adjust the separate controls. Markers can be set to predetermined positions on the scale to indicate particular levels e.g. for fading in a program.

**Mic. Sens.** Microphone sensitivity. In the -25 dB position it reduces the sensitivity of the Mic. input by 25 dB, and the RADIO input by 6 dB.

**Input Left and Right, Mic., Radio, Line 2.** Input controls. Use for recording from a microphone or from a program source connected to the RADIO or LINE 2 sockets at the back of the machine.

**Input Left and Right, Line 1.** Input controls. Use for recording from program sources connected to LINE 1 sockets at the back of the machine.

**Bias Adj. L and R.** Adjustment for record bias. Useful when you use types of tape other than Maxell UD XL which the machine is adjusted for. Ask your dealer for advice.

## SPECIAL FACILITIES

### Finding a program on the tape

The Edit/Cue facility enables you to find a particular part of the tape for splicing, editing, or a precision start for record or playback.

### Finding a program during fast winding

- Edit/Cue switch to On.
- Monitor switch set to Tape.

You can now monitor a tape program while it is fast winding. The high speed will distort the sound, but you will still find it possible to recognise pauses and characteristic transitions in the music. To slow down the tape, hold the button for the required wind direction down and then alternately press and release the button for the opposite wind direction.

When the Wind and Rewind buttons have been operated simultaneously, the machine automatically stops when the buttons are released.

### Precision start for playback of a program

- Locate the program during fast winding, see above. Stop the tape as near as possible to the required place.
- Turn the reels by hand (if necessary use the Free position) and listen on loudspeakers or headphones to locate the exact part of the tape you require.
- If you remove the head covers (lift them straight up) you can mark the exact part of the tape with a felt pen right in front of the playback head, see figure 1.

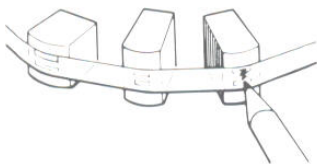


Figure 1

### Precision start for recording a program

- Locate the part of the tape where the recording will start as explained above (head covers removed) and mark it with a pen.
- Turn the reels by hand so that the mark on the tape lies directly opposite the record head, see figure 2.



Figure 2

1656 - 4 - 79 Part No. 377399  
Printed in Norway by Sem & Stenersen A/S

### Sel. Sync.

With the Sel. Sync. facility you can record a program on the right channel synchronized with a program that was earlier recorded on the left channel (basic program). The combined two-channel program can be played back in stereo. The recording on the right channel can be repeated without disturbing the basic program.

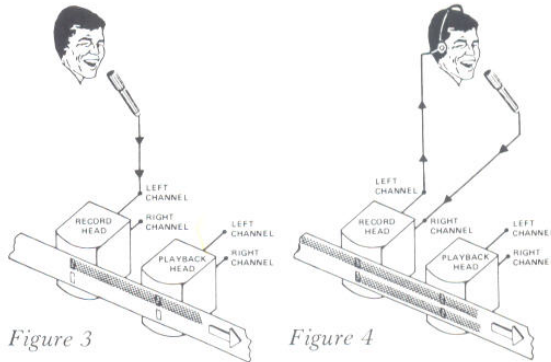


Figure 3

Figure 4

- Record the basic program on the left channel e.g. from a microphone, see figure 3.
- Connect headphones to the Headphones socket.
- Wind the tape back to the start point.
- Set the Sel. Sync. switch to On. This connects the left channel of the record head for playback.
- Set the Rec. Select Left to Off.
- Set the Rec. Select Right switch to On and prepare for recording on the right channel e.g. from a microphone.
- Start recording. You will now hear the program on the left channel (basic program) played back by the record head (with reduced quality). At the same time you should talk, sing, or play a new program into the right channel, see figure 4.
- Wind back to the start of the program, set the Sel. Sync. switch to Off, and play back the new recording in stereo, see figure 5.

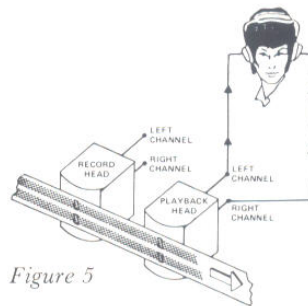


Figure 5

TANDBERG A/S  
P.O. Box 55, Bogerud  
N - OSLO 6 - Norway



# TANDBERG® TD20A-SE Tape Deck

Operating Instructions

Notice d'Utilisation

Bedienungsanleitung

Gebruiksaanwijzing

Bruksanvisning

Bruksanvisning





---

### For your safety!

To prevent electrical shock or fire, do not expose electronic products to rain or moisture and do not remove covers (or back). If anything fails, leave the repairs to a qualified technician.

Pull out the power plug during thunderstorms and when you are away for a long time (e.g. holidays, etc.).

### Specially for the United Kingdom:

**IMPORTANT!** The wires in this mains lead are coloured in accordance with the following code:

BLUE:	NEUTRAL (N)
BROWN:	LIVE (L)

If the wire colours in this mains lead do not correspond with the terminal identification of your plug, connect as follows:

**Blue** wire to terminal coded **N** or coloured **Black**.  
**Brown** wire to terminal coded **L** or coloured **Red**.

Do not make any connection to the larger terminal coded **E** or coloured **Green** or **Green and Yellow**.

---

### Pour votre sécurité!

Pour éviter les électriques ou le feu, ne laissez pas les matériels électroniques exposés à la pluie ni à l'humidité et n'enlevez pas le couvercle (ni le panneau arrière). En cas de panne, faites réparer par un technicien qualifié.

Débranchez la prise secteur en cas d'orage et quand vous vous absentez pour longtemps (vacances etc.).

---

### Zu Ihrer Sicherheit!

Zu Ihrer persönlichen Sicherheit und der Vermeidung von Brandgefahr müssen elektronische Geräte vor Feuchtigkeit geschützt werden. Keinerlei Abdeckungen z.B. Rückwände und Bodenplatten selbst entfernen. Jegliche Eingriffe in das Gerät dürfen nur von einem qualifizierten Service-Techniker vorgenommen werden.

Netzstecker bei Gewitter, und bei längerer Abwesenheit (z.B. Urlaubsreisen u.s.w.) herausziehen.

---

### Voor Uw eigen veiligheid!

Om elektrische schokken en brand te voorkomen, mogen elektrische apparaten niet in de regen of bij hoge vochtigheid worden gebruikt. Dekplaten om het apparaat mogen niet worden verwijderd. Laat alle service uitvoeren door een technicus.

Als U op vakantie gaat, of bij onweer, kunt U het beste de netstekker uit zijn contact trekken.

---

### For Deres sikkerhet!

For å unngå elektrisk støt eller brann må elektroniske apparater ikke utsettes for regn eller fuktighet. Apparatets deksler (kapsling) må ikke fjernes. Overlat enhver service til kvalifisert servicepersonell.

Dra ut nettplugg i tordenvær og ved lengre tids fravær (f.eks. ferier, etc.).

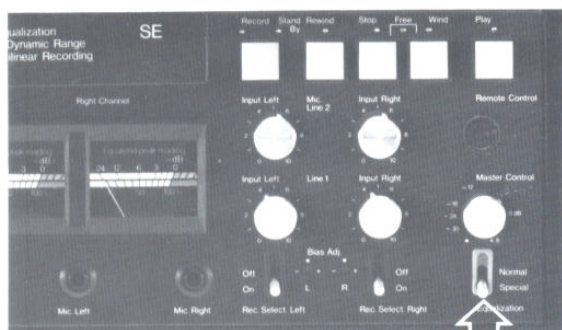
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### För Er egen säkerhet!

För att förhindra elektrisk stöt eller eld – utsätt inte elektroniska apparater för regn eller fuktighet och avlägsna inte apparatens skydd. Försök inte att reparera själv utan kontakta en fackman.

Drag ut kontakt i åskväder och vid längre tids uppehåll (t.x. semester, etc.).

See the operating instructions for the TD 20A for a complete description.



Correction: Normal  
Special

### Special correction

Until now the tape noise on analog open-reel tape recorders has been limited by the standard record and playback correction curves. By changing the correction curves so that the TD 20A-SE can take full advantage of the latest tapes, the tape noise is reduced to as low as -80 dB.

### Equalization selector

#### Normal:

This position is used for playback of tape which has not been recorded with special-correction, and for recording on tape which will be played back on tape recorders without special-correction.

#### Special:

This position is used for playback of tape recorded with special-correction, and for recording on tape which will be played back on tape recorders with special-correction. This position gives a improved signal/noise ratio.

Equalization	Special record EQ	Playback
7½ ips	Normal	50 µs
	Special	50/25 µs
15 ips IEC	Normal	35 µs
	Special	35/10 µs
15 ips NAB	Normal	50 µs
	Special	35/10 µs

### Choice of tape

When your TD 20A-SE leaves the factory it is adjusted to give the best performance with tape types Maxell UD XL, TDK GX, and Ampex Grand Master 456. Maxell UD XL is used for the factory adjustment.

Tape such as e.g. Agfa PEM 369, Agfa 468, BASF SPR 50 HL, Scotch 226, and Scotch 227 can be used after a small re-adjustment of the machine.

### The record electronics

The excellent record quality on the TD 20A-SE is due to two techniques originally developed by Tandbergs — the DYNEQ® and ACTILINEAR® systems.

Because of its treble lift, a conventional record amplifier will give a linear frequency response and acceptable distortion at middle and low signal levels. On the other hand, at high signal levels treble lift will produce overloading and distortion. This is unfortunate since distortion-free reproduction is more important than a linear frequency response.

It is precisely to combat this problem that Tandberg engineers have recently developed the DYNEQ® and ACTILINEAR® recording systems.

The DYNEQ® circuit automatically adjusts the gain at the high frequencies and prevents the tape from being overloaded. This means that intermodulation distortion is substantially reduced and the record level on the line and microphone inputs can therefore be increased.

The ACTILINEAR® amplifier is an active current generator with more than 20 dB overload reserve. Intermodulation distortion caused by the slew rate is reduced because the amplifier operates at a low voltage level. The ACTILINEAR® amplifier also provides electrical isolation between the correction amplifier and the bias signal. This also reduces the intermodulation distortion. Altogether this amplifier significantly reduces distortion and improves the transient response in the record mode.

*Scotch 250?*  
*Ampex 601 246?*

Pour une description complète, voir le manual d'emploi du TD 20A.



Correction: Normale  
Spéciale

### Sélecteur d'égalisation

#### Normal:

Cette position est utilisée pour la lecture d'une bande qui n'a pas été enregistrée en correction spéciale, et pour l'enregistrement d'une bande qui est destinée à être lue sur un enregistreur non muni de la correction spéciale.

#### Special:

Cette position s'utilise pour la lecture d'une bande enregistrée avec correction spéciale et pour l'enregistrement d'une bande qui sera lue sur un enregistreur muni de la correction spéciale. Cette position permet l'obtention d'un meilleur rapport signal - bruit.

Egalisation		Enregistrement EQ special	Lecture
7½ ips	Normal		50 µs
	Special	50/25 µs	25 µs
15 ips IEC	Normal		35 µs
	Special	35/10 µs	10 µs
15 ips NAB	Normal		50 µs
	Special	35/10 µs	10 µs

### Choix de bande

Votre TD 20A-SE quitte l'usine réglé pour donner les meilleurs résultats avec les bandes type Maxell UD XL, TDK GX et Ampex Grand Master 456. La Maxell UD XL est utilisée pour les mises au point en usine.

Des bandes telles que par exemple Agfa PEM 369, Agfa 468, BASF SPR 50 HL, Scotch 226 et Scotch 227 peuvent être utilisées après un léger réglage de votre appareil.

### Correction spéciale

Jusqu'à présent, le bruit de fond résiduel des bandes utilisées avec un enregistreur analogique a été limité par les courbes standard de correction d'enregistrement et de lecture. En modifiant les courbes de correction de manière à ce que le TD 20A-SE puisse exploiter tous les avantages des dernières formulations des bandes, le bruit de fond a été ramené à - 80 dB.

### L'électronique d'enregistrement

Les excellentes performances du TD 20A-SE sont dues à l'application de deux techniques développées à l'origine par Tandberg: les systèmes DYNEQ® et ACTILINEAR®.

Un amplificateur d'enregistrement conventionnel permet l'obtention d'une réponse en fréquence linéaire et d'une distorsion acceptable à des niveaux sonores moyens et bas. Par contre, à haut niveau, la saturation des aigus provoquera des surcharges et de la distorsion. Ceci est particulièrement regrettable car une lecture exempte de distorsion est préférable à une linéarité parfaite de la réponse en fréquence.

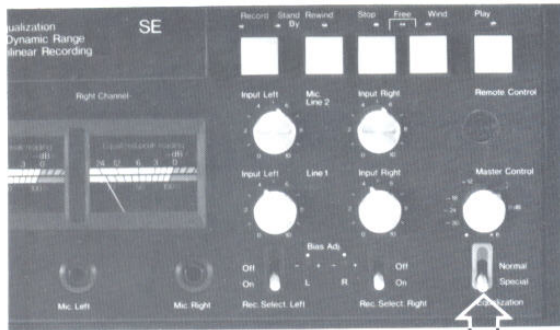
C'est précisément pour combattre ce problème que les ingénieurs de Tandberg ont récemment développé les systèmes d'enregistrement DYNEQ® et ACTILINEAR®.

Le circuit DYNEQ® quant à lui, ajuste automatiquement le gain aux fréquences élevées et évite ainsi la saturation de la bande. Cela signifie que la distorsion d'intermodulation est substantiellement réduite et que le niveau d'enregistrement des entrées ligne et micro pourra être augmenté.

L'amplificateur ACTILINEAR® est un générateur actif de courant avec plus de 20 dB de réserve de saturation. La distorsion d'intermodulation qui apparaît normalement est ici réduite parce que l'amplificateur fonctionne à bas niveau de tension. L'amplificateur agit aussi comme isolant électrique entre l'amplificateur de correction et le signal de polarisation. Ceci aussi réduit la distorsion d'intermodulation. Dans l'ensemble, cet amplificateur réduit la distorsion de manière drastique, et améliore la réponse aux transitoires en mode d'enregistrement.



Siehe auch Bedienungsanleitung TD 20A für eine komplette Beschreibung.



Entzerrung: Normal  
Spezial

### Entzerrungs-Wahlschalter

#### Normal:

Diese Schalterposition wird für die Wiedergabe von Tonbändern benutzt, welche nicht mit der Spezialentzerrung aufgenommen wurden. Ebenso müssen in dieser Schalterstellung Aufnahmen gemacht werden, die auf Geräten wiedergegeben werden sollen, die keine Spezialentzerrung besitzen.

#### Spezial:

Diese Schalterstellung dient zur Wiedergabe von Tonbändern, die mit Spezialentzerrung aufgenommen wurden. Bandaufnahmen, die über Tonbandgeräte mit Spezialentzerrung wiedergegeben werden, sind ebenfalls in dieser Schalterstellung zu machen. Bei dieser Schalterstellung erreicht man einen besseren Geräuschspannungsabstand (Dynamik).

Entzerrung	Spezial-Aufnahmeentzerrung	Wiedergabe
7½ ips	Normal	50 µs
	Spezial	50/25 µs
15 ips IEC	Normal	35 µs
	Spezial	35/10 µs
15 ips NAB	Normal	50 µs
	Spezial	35/10 µs

### Geeignetes Bandmaterial

Werksseitig ist die TD 20A-SE so eingemessen, daß sie bei nachstehend aufgeführten Tonbändern bestmögliche Aufnahmequalität erzielt. Maxell UD XL, TDK GX und Ampex Grand Master 456. Normalerweise wird Maxell UD XL als Bezugsband für den Werksabgleich verwendet.

Folgende Bänder können nach geringer Neujustierung ebenfalls benutzt werden: Agfa PEM 369, Agfa 468, BASF SPR 50 HL, Scotch 226 und Scotch 227.

### Spezialentzerrung

Bis zum heutigen Tage war der Rauschabstand bei analogen Spulentonbandgeräten u.a. durch die standardisierten Aufnahme- und Wiedergabeentzerrungen begrenzt. Durch eine bessere Anpassung der Entzerrung an die verbesserten Eigenschaften moderner Bänder erweitert die TD 20A-SE den Geräuschspannungsabstand auf 80 dB.

### Die Aufnahmeelektronik

Die hervorragende Aufnahmequalität der TD 20A-SE wurde durch zwei spezielle Tandberg-Entwicklungen, DYNEQ® und ACTILINEAR®, ermöglicht.

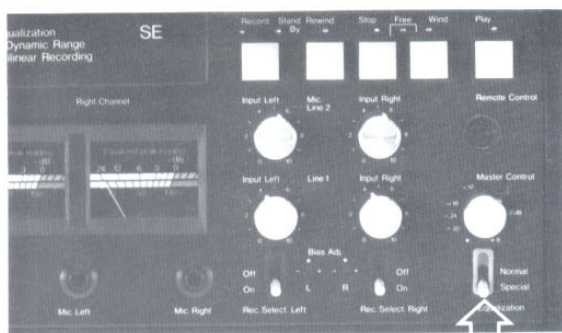
Aufnahmeverstärker konventioneller Bauweise haben eine feste Anhebung im oberen Frequenzbereich und erreichen zufriedenstellende Klirrfaktoren bei mittleren und niedrigen Pegeln. Andererseits können hierbei leicht Übersättigungen und Verzerrungen bei großen Signalpegeln auftreten. Dies ist umso schwerwiegender, da bei großen Pegeln möglichst verzerrungsarme Wiedergabe wichtiger ist als ein linearer Frequenzgang.

Genau das ist der Grund dafür, daß die Tandberg Ingenieure Aufnahmesysteme wie DYNEQ® und ACTILINEAR® entwickelt haben.

Die dynamische Entzerrerschaltung DYNEQ® regelt automatisch die Verstärkung im oberen Frequenzbereich und vermeidet somit Übersättigungen. Damit werden die Intermodulationsverzerrungen drastisch reduziert; Aufnahmepegel für Line- und Mikrofon-Eingänge können entsprechend höher angesetzt werden.

Das ACTILINEAR® Aufnahmesystem beinhaltet einen aktiven Stromgenerator mit über 20 dB Übersteuerungsreserve. Intermodulationsverzerrungen, deren Ursache in der "slew rate" zu suchen sind, werden reduziert, da diese System mit niedriger Spannung arbeitet. Das ACTILINEAR® Aufnahmesystem verbessert die Entkoppelung zwischen Korrekturverstärker und Vormagnetisierungs-Oszillator. Auch dadurch werden Intermodulationsverzerrungen reduziert. Durch dieses Aufnahmesystem wird die gesamte Signalverarbeitung und damit die Aufnahmequalität entscheidend verbessert.

Voor een complete beschrijving, zie ook de gebruiksaanwijzing van de TD 20A.



Correctie: Normaal  
Speciaal

### Speciale correctie schakelaar

#### Normaal:

Deze stand wordt gebruikt voor het opnemen en weergeven van tape's die geen speciale correctie behoeven, ook moet deze stand gebruikt worden voor het opnemen van tape's die naderhand worden weergeven op andere recorders.

#### Speciaal:

Deze stand wordt gebruikt voor het weergeven van tape's die opgenomen zijn met een speciale correctie, en voor het opnemen van tape's die naderhand weergeven worden op recorders met een speciale correctie. Deze stand geeft de beste signaal/ruis verhouding.

Egalisatie		Opnemen EQ speciaal	Weergeven
7½ ips	Normal		50 µs
	Special	50/25 µs	25 µs
15 ips IEC	Normal		35 µs
	Special	35/10 µs	10 µs
15 ips NAB	Normal		50 µs
	Special	35/10 µs	10 µs

### Tape keuze

Alvorens Uw TD 20A-SE de fabriek verlaat is deze afgeregeld met Maxell UD XL. Goede resultaten worden ook bereikt met TDK GX en Ampex Grand Master 456 tape.

Tape's zoals: Agfa PEM 369, Agfa 469, BASF SPR 50 HL, Scotch 226 en Scotch 227 zijn bruikbaar, maar de recorder moet daarvoor eerst afgeregeld worden.

### Speciale correctie

Tot op heden was de tape ruis bij analoge band-recorders afhankelijk van de opname- en weergave correcties (NAB en IEC normen). Door gebruik te maken van speciale opname- en weergave correcties in de TD 20A-SE kan men nu met de verkrijgbare moderne tape's een signaal/ruis verhouding van 80 dB bereiken, waarmede het gebruik van deze moderne tape's volledig tot hun recht komt.

### Opname electronica

De excellente opname-kwaliteit van de TD 20A-SE wordt verkregen door twee, in de Tandberg laboratoria ontwikkelde, unieke systemen, n.l. DYNEQ® en ACTILINEAR®.

#### DYNEQ®

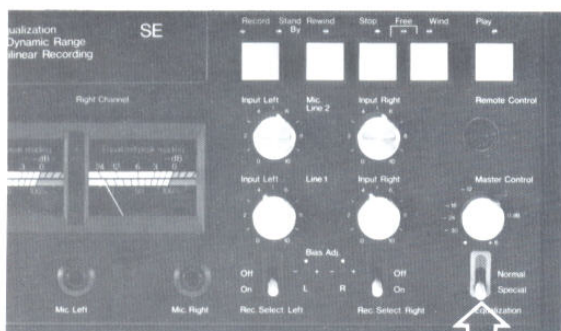
Voor het verkrijgen van een rechte frequentie-karakteristiek bij weergave hebben conventionele opname versterkers een oplopende versterkings-factor voor de hogere frequenties. Dit geeft voor de lage- en midden frequenties een acceptabele vervorming maar voor de hogere frequenties (transients) een oversturing van de tape, met als gevolg een aanzienlijke intermodulatievervorming. Om nu het bovenstaande gedrag te voorkomen, hebben de Tandberg ingenieurs het dynamische egalisatie systeem ontwikkeld. Afgekort DYNEQ®.

#### ACTILINEAR®

De versterkingsfactor voor de hogere frequenties van deze zelf-regulerende versterker is afhankelijk van hetingangssignaal. Het resultaat van dit systeem is een drastisch vermindering van de intermodulatievervorming bij alle typen van muziek en voorkomt tevens oversturing van de tape ook bij complexe audio signalen. De ACTILINEAR® versterker is een actieve stroom generator met een belastingsreserve dan meer dan 20 dB. Met deze versterker wordt tevens bereikt dat de voormagnetspanning (Bias) volledig geïsoleerd wordt van de opname versterker met als gevolg een lage intermodulatie vervorming en minimale interferenties met de wisselfrequentie.



Se bruksanvisning til TD 20A for fullstendig beskrivelse.



Korreksjon: Normal

Special

### Korreksjonsvelger (Equalization selector)

#### Normal:

Stillingen brukes ved avspilling av bånd som ikke er spilt inn med spesial-korreksjon og ved innspilling av bånd som skal spilles av på båndopptakere uten spesial-korreksjon.

#### Special:

Stillingen brukes ved avspilling av bånd spilt inn med spesial-korreksjon og ved innspilling av bånd som skal spilles av på båndopptakere med spesial-korreksjon. Stillingen gir bedre signal/støyforhold.

Korreksjon		Spesial innspillingskorreksjon	Avspilling
7½ ips	Normal		50 µs
	Special	50/25 µs	25 µs
15 ips IEC	Normal		35 µs
	Special	35/10 µs	10 µs
15 ips NAB	Normal		50 µs
	Special	35/10 µs	10 µs

### Valg av bånd

Når TD 20A-SE forlater fabrikken er den justert slik at den gir optimale resultater med båndtypene Maxell UD XL, TDK GX og Ampex Grand Master 456. Maxell UD XL er brukt ved justering.

Bånd som f.eks. Agfa PEM 369, Agfa 468, BASF SPR 50LHL, Scotch 226 og Scotch 227 kan benyttes etter en mindre omjustering av apparatet.

### Spesial korreksjonen

Båndstøyen på analoge spolebåndopptakere har til nå vært begrenset av den standardiserte inn- og avspillerkorreksjonen. Ved å forandre korreksjonen slik at TD 20A-SE utnytter dagens spolebånd fullt ut, gjør dette at båndstøyen reduseres til - 80 dB.

### Innspillingselektronikken

Den gode opptaks kvaliteten som oppnås på TD 20A-SE er takket være Tandbergs to original-utviklede innspillings teknikker DYNEQ® og ACTILINEAR®.

En konvensjonell innspillingsforsterker vil med sin diskanthevning gi en rettlinjet frekvensgang og akseptabel forvrengning ved midlere og lave signalnivåer. Ved høye nivåer, derimot, vil diskanthevningen føre til overstyring og forvrengning. Dette er uheldig da en forvrengningsfri gjengivelse er viktigere enn en rettlinjet frekvensgang.

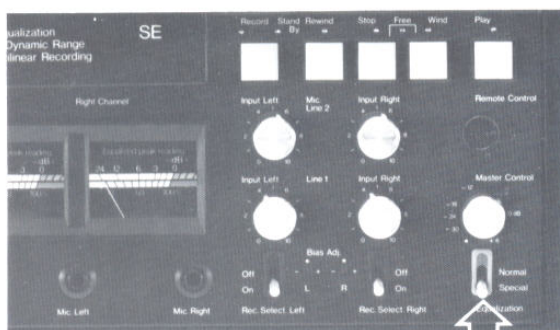
Det er på grunn av dette problemet at Tandbergs ingeniører nylig har utviklet innspillings systemene DYNEQ® og ACTILINEAR®.

DYNEQ®-kretsen justerer automatisk forsterkningen av de høye frekvensene og hindrer overbelastning av båndet. Dette gjør at intermodulasjonsforvrengningen reduseres kraftig og man kan dermed øke innspillingsnivået både på linje- og mikrofon-inngangene.

ACTILINEAR®-forsterkeren er en aktiv strømgenerator med over 20 dB overstyringsreserve. Fordi den arbeider med lave spenningsnivåer blir det mindre intermodulasjonsforvrengning som skyldes begrenset effektstighet (slew rate). ACTILINEAR®-forsterkeren gir også et elektrisk skille mellom korreksjonsforsterkeren og bias-signalet. Det gir også mindre intermodulasjonsforvrengning. Tilsammen gir denne forsterkeren mindre forvrengning og bedre transient respons ved innspilling.



Se bruksanvisning TD 20A för fullständig beskrivning.



Korrektion: Normal  
Special

### Korrektionsomkopplare (Equalization selector)

#### Normal:

Användes vid avspelning av band som inte är inspelat med specialkorrektion, och vid inspelning av band som skall spelas av på bandspelare utan specialkorrektion.

#### Special:

Användes vid avspelning av band inspelat med specialkorrektion och vid inspelning av band som skall spelas av på bandspelare med specialkorrektion. Special-läget ger bättre signal/stör-förhållande.

Korrektion	Special-inspelningskorrektion	Avspelning
7½ ips	Normal	50 µs
	Special	50/25 µs
15 ips IEC	Normal	35 µs
	Special	35/10 µs
15 ips NAB	Normal	50 µs
	Special	35/10 µs

### Val av band

När TD 20A-SE lämnar fabriken är den justerad för att ge optimala resultat med bandtyperna Maxell UD XL, TDK GX och Ampex Grand Master 456. Maxell UD XL är använt vid justering.

Agfa PEM 369, Agfa 468, BASF SPR 50LHL, Scotch 226 och Scotch 227 kan användas efter en mindre justering.

### Specialkorrektionen

Bandbruset på analoga spolbandspelare har tidigare varit begränsat av den standardiserade in- och avspelningskorrektionen. Genom att förändra korrektionen som på 20A-SE utnyttjas dagens spolband optimalt. Bandbruset är nu möjligt att begränsa till - 80 dB.

### Inspelningselektroniken

Den höga inspelningskvaliteten som uppnås på TD 20A-SE kan tillskrivas Tandbergs två original-utvecklade inspelningsystem DYNEQ® och ACTILINEAR®.

En konventionell inspelningsförstärkare med sin diskantförstärkning ger en rak frekvensgång och acceptabel distorsionsnivå vid låga och medelhöga nivåer. Vid höga nivåer däremot förorsakar diskantförstärkningen överstyrning och förvrängning. Detta är olämpligt då en distorsionsfri återgivning av kraftiga diskantsignaler är viktigare än en rak frekvensgång.

Dessa problem har Tandbergs ingenjörer löst genom de nyutvecklade inspelningsystemen DYNEQ® och ACTILINEAR®.

DYNEQ®-kretsen justerar automatiskt förstärkningen av de höga frekvenserna och hindrar därmed överstyrning av bandet. Detta gör att intermodulationsförvrängningen reduceras kraftigt och man kan därmed öka inspelningsnivån både på linje- och mikrofoningångarna.

ACTILINEAR®-förstärkaren är en aktiv strömgenerator med en överstyrningsreserv över 20 dB. Genom att den arbetar med lägre spänningsnivåer blir det mindre intermodulationsförvrängning på grund av begränsad effektstigtid (slew rate). ACTILINEAR®-förstärkaren ger också en elektrisk separering av korrektionsförstärkaren och bias-signalen. Även detta minskar intermodulationsförvrängningen. Tillsammans ger denna förstärkare mindre distorsion och bättre transientåtergång vid inspelning.

## Technical data (Two track – High speed model at 15 ips)

<b>Operating voltage:</b>		230 V/50 Hz $\pm$ 10%
		115 V/60 Hz $\pm$ 10%
<b>Power consumption:</b>		110 W
<b>Speed tolerance, max. *:</b>		$\pm$ 0.5%
<b>Tracks:</b>		2
<b>Tape speed, inches per second:</b>		15 – 7½ or 3¾ – 7½
<b>Speed variations, max. (Wow &amp; Flutter)</b>		
W.R.M.S.	15 ips.:	0.03%
	7½ ips.:	0.05%
<b>Frequency ranges</b>		
$\pm$ 2 dB	15 ips.:	20–30,000 Hz
	7½ ips.:	20–25,000 Hz
<b>Signal/tape noise ratio</b> minimum at max. speed,		
IEC-A-Curve (3% THD):		80 dB
IEC linear R.M.S.:		70 dB
<b>Cross talk</b> at 1000 Hz, minimum	Mono:	64 dB
	Stereo:	54 dB
<b>Harmonic distortion, max.</b>		
From tape at 320 nWb/m recording level:		0.5%
<b>Inputs.</b> Input impedance/sensitivity/maximum voltage at 400 Hz. (The sensitivity of the microphone inputs adjusts itself according to the impedance of the microphone.)		
Microphone:		800 ohms/ 0.2 mV – 20 mV
Line In 1:		150 kohms/50 mV – 5 V
Line In 2:		250 kohms/50 mV – 5 V
<b>Outputs.</b> Min. load impedance/voltage by unloaded output.		
Line Out:		100 ohms/ 1.5 V
Headphones:		8 ohms/1.3 V
<b>Dimensions,</b>	Width:	17 1/8" (43.5 cm)
	Height:	17 3/4" (45.0 cm)
	Depth:	7 3/4" (19.5 cm)
	Weight:	37.5 lbs (17.0 kg)

\* With nominal voltage/frequency and normal operating temperature.

- Specifications are subject to change for further improvement without notice.



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Tandberg - The European Alternative

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