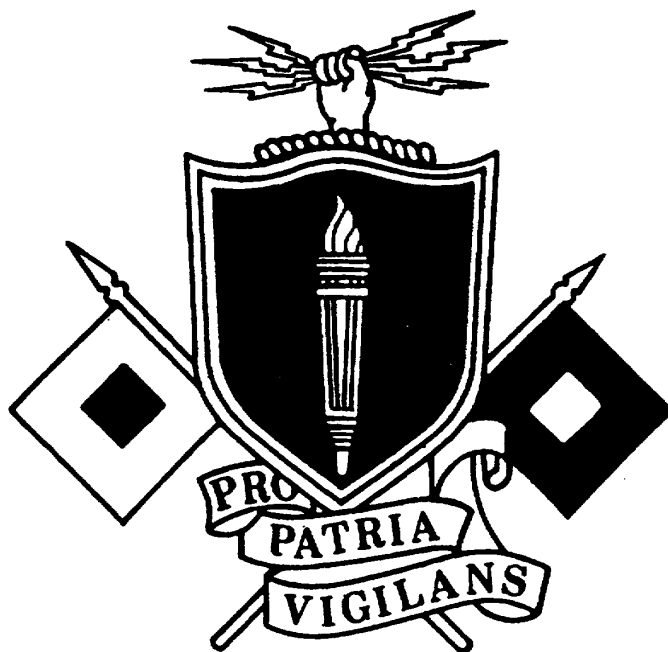


FUNDAMENTALS OF VIDEO TAPE RECORDER (VTRS)



**THE ARMY INSTITUTE FOR PROFESSIONAL DEVELOPMENT
ARMY CORRESPONDENCE COURSE PROGRAM**

**A
I
P
D**

**READINESS /
PROFESSIONALISM**



**THRU
GROWTH**

U.S. ARMY AUDIO TELEVISION SPECIALIST
84F SKILL LEVEL 2

AUTHORSHIP RESPONSIBILITY:

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FUNDAMENTALS OF VIDEO TAPE RECORDERS (VTRs)

SUBCOURSE NO. SS0546-6
(Developmental Date: 30 Jun 86)

U.S. ARMY SIGNAL SCHOOL
FORT GORDON, GEORGIA

Two Credit Hours

GENERAL

The Fundamentals of Video Tape Recorders (VTRs) subcourse, part of the Audio/Television Specialist, MOS 84F, Skill Level 2 Training, is designed to teach the knowledge necessary for performing tasks related to proper operation and maintenance practices of basic television video tape recorders. Information is provided on several tasks which are performed at increasing levels of difficulty at Skill Levels 1, 2, and 3. The information provided in this subcourse can be utilized for transition or merger training for all soldiers, and specifically for MOS 41E and 84C personnel involved in the CMF 25 restructure. The subcourse is presented in three lessons, corresponding to terminal objectives as indicated below.

Lesson 1: DESCRIBE BASIC OPERATION OF HELICAL SCAN VIDEOTAPE RECORDERS

TASK: Describe the principles of helical scan videotape recorders.

CONDITIONS: Given information and illustrations about theory, terminology, and principles relating to helical scan videotape recorders.

STANDARDS: Demonstrate competency of the task skills and knowledge by correctly responding to 85% of the multiple-choice test covering theory terminology and principles of helical scan videotape recorders.

(This objective supports Soldier Training Product (STP) tasks listed at the end of this section.)

Lesson 2: DESCRIBE BASIC FUNDAMENTALS OF TAPE TRANSPORT AND PROPER OPERATION/
MAINTENANCE PRACTICES

TASK: Describe theory and terminology of how tape is transported in various types of videotape recorders (VTRs) with single or multiple tachometer outputs, and perform the proper operation and maintenance practices for videotape recorders.

CONDITIONS: Given videotape recorder information and illustrations about terms relating to VTR transport systems, single or multiple tachometer outputs and operation and maintenance practices for VTRs.

STANDARDS: Demonstrate competency of the task skills and knowledge by correctly responding to 85% of the multiple-choice test covering tape transport, tachometers, operation and maintenance practices for VTRs.

Lesson 3: DESCRIBE HOOKUP AND INTERCONNECTION PROCEDURES OF VIDEO TAPE RECORDERS

TASK: Describe hookup and interconnection procedures of video tape recorders.

CONDITIONS: Given information and illustrations about hookup and interconnection procedures of video tape recorders.

STANDARDS: Demonstrate competency of the task skills and knowledge by correctly responding to 85% of the multiple-choice test covering hookup/interconnection procedures of video tape recorders.

THE OBJECTIVES FOR THIS SUBCOURSE SUPPORT STP TASKS:

113-577-9011	Clean Video Tape Recorder/reproducer Heads
113-577-4025	Operate Video Cassette Player Unit
113-577-4027	Operate Video Reel-to-reel Recorder/reproducer
113-577-4028	Operate Video Tape Cassette Recorder/reproducer

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Whenever pronouns or other references denoting gender appear in this document, they are written to refer to either male or female unless otherwise indicated.

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INTRODUCTION TO FUNDAMENTALS OF VIDEO TAPE RECORDERS (VTRS)

Because there are four different sizes of tape format, (2-inch, 1-inch, 3/4-inch, and 1/2-inch) you should know how each of these popular formats affect the image quality of your production.

The job of the video tape recorder is to transfer the video signal (with or without audio) to magnetic tape so that the information that is recorded may be retrieved at another time. The VTR transfers this information to the video tape by sending pulses of energy to video heads, which are very small electromagnets.

The magnetic recorder is a major unit, since today mostly everything produced for television is prerecorded on tape. In the 1940s, the British Broadcasting Corporation and Decca in England, also Radio Corporation of America and Ampex in the United States, began work on VTRs. Units that were first produced were very large, they required very high speed tape, were too costly, and needed very large reels of tape. Some of the first taped programs to be aired in England needed the use of a reel of tape 5 feet in diameter for a 30-minute program.

This indicated that more research had to be done or the VTR was doomed. With this in mind, firms began working on developing a rotating head.

With the introduction on the scene of the rotating head, the quad-head recorder was later produced by Ampex in 1956. It was quickly adopted by the television industry throughout the world.

Since then a wide selection of VTRs has been produced, both for home entertainment and television broadcast, by such names as RCA and Sony.

To develop a complete understanding of television not only requires a knowledge of receivers and transmitters, but a knowledge of its associated equipment. One of those items is the VTR. This subcourse will enable you to have a better understanding of video tape recorders and their importance to the television industry. It is also meant to assist in merger or cross-training of personnel from any MOS into the 84F Audio Television Specialist career field.

LESSON 1
DESCRIBE BASIC OPERATION OF HELICAL SCAN VIDEOTAPE RECORDERS

TASK

Describe the principles of helical scan videotape recorders.

CONDITIONS

Given information and illustrations about theory, terminology and principles, relating to helical scan videotape recorders.

STANDARDS

Demonstrate competency of the task skills and knowledge by correctly responding to 85% of the multiple-choice test covering theory terminology and principles of helical scan videotape recorder.

REFERENCES

None

Learning Event 1:

DESCRIBE THE PURPOSE AND USE OF THE SINGLE HEAD MACHINE

1. General information of helican scan videotape recorders. In recent years, video tape has become an increasingly important part of many television systems. Low cost and simplified operations are two of the main reasons for the great success of the helical scan video tape recorder.

a. Terminology and requirement standards relative to helical scan equipment have been up to the discretion of the purchaser and manufacturer for some years. The initial standard for quality television recordings was the quadruplex recorder/producer designed for studio use.

b. The quadruplex equipment, developed by various manufacturers, tend to be compatible. However, this compatibility has not been a feature among helical scan equipment manufacturers. Manufacturers chose drum speeds, longitudinal tape speeds, and tape widths that suited their own purpose. This meant that the helix angle varied between recorders. A tape recorded on one machine could not be played back on another. Recently, Japanese manufacturers have established a common standard, based on the Electronic Image Access (EIA) type VTR tape pattern.

c. The longitudinal tape speed is 7.5 inches-per-second (ips) and the width is normally 1/2 inch. One-inch tape is also used. This standard applies only to open reel-to-reel video recorders. Due to their specialized recording format, helical scan recorders require a relatively high writing (head to tape) speed. (Writing speed is the term used to describe the electronic impulses laid on the video tape.)

d. The exact speed will depend on the machine configuration and the width of the tape used. With single-head systems, the writing speed is approximately two-thirds of the single-head speed.

2. Helical scan means "in a spiral formation," a line around a cylinder at an angle other than parallel with the axis. Thus, we gain a mental picture of the tape path around the head assembly of the helical scan recorder/ producer (fig 1-1).

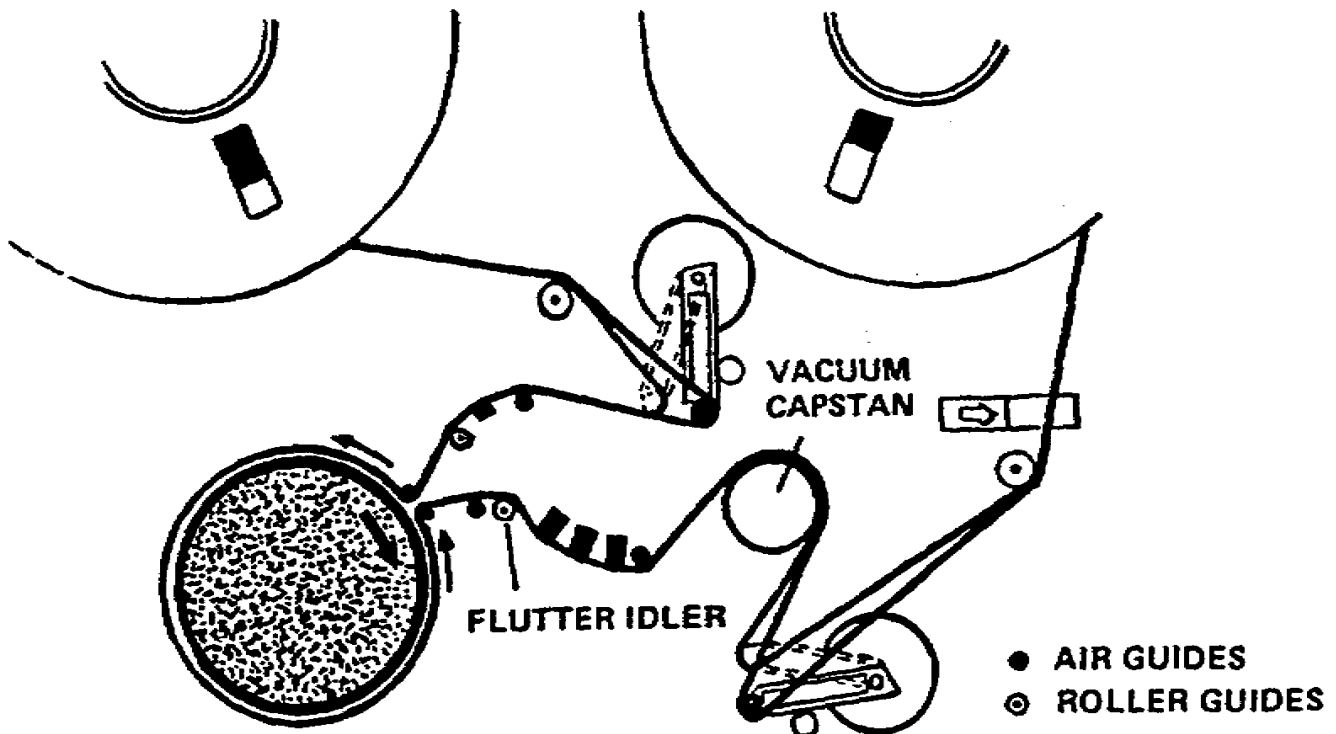


Figure 1-1. Helical scan videotape transport

3. The basic design features for helical scan videotape magnetic recorders must satisfy the requirements of a very large market. They must have a frequency response wide enough to handle the standard television signal, specialized closed-circuit video, high-bit-rate digital, radar-type signals, and high frequency type signals, and high frequency pulse code modulation (PCM). They must be portable enough to provide easy handling. They must also be simple enough to operate with a minimum amount of maintenance.

4. These recorders are divided into two classes, single and dual head machines. Single-head recorders use either the alpha or omega type of wrap (fig 1-2).

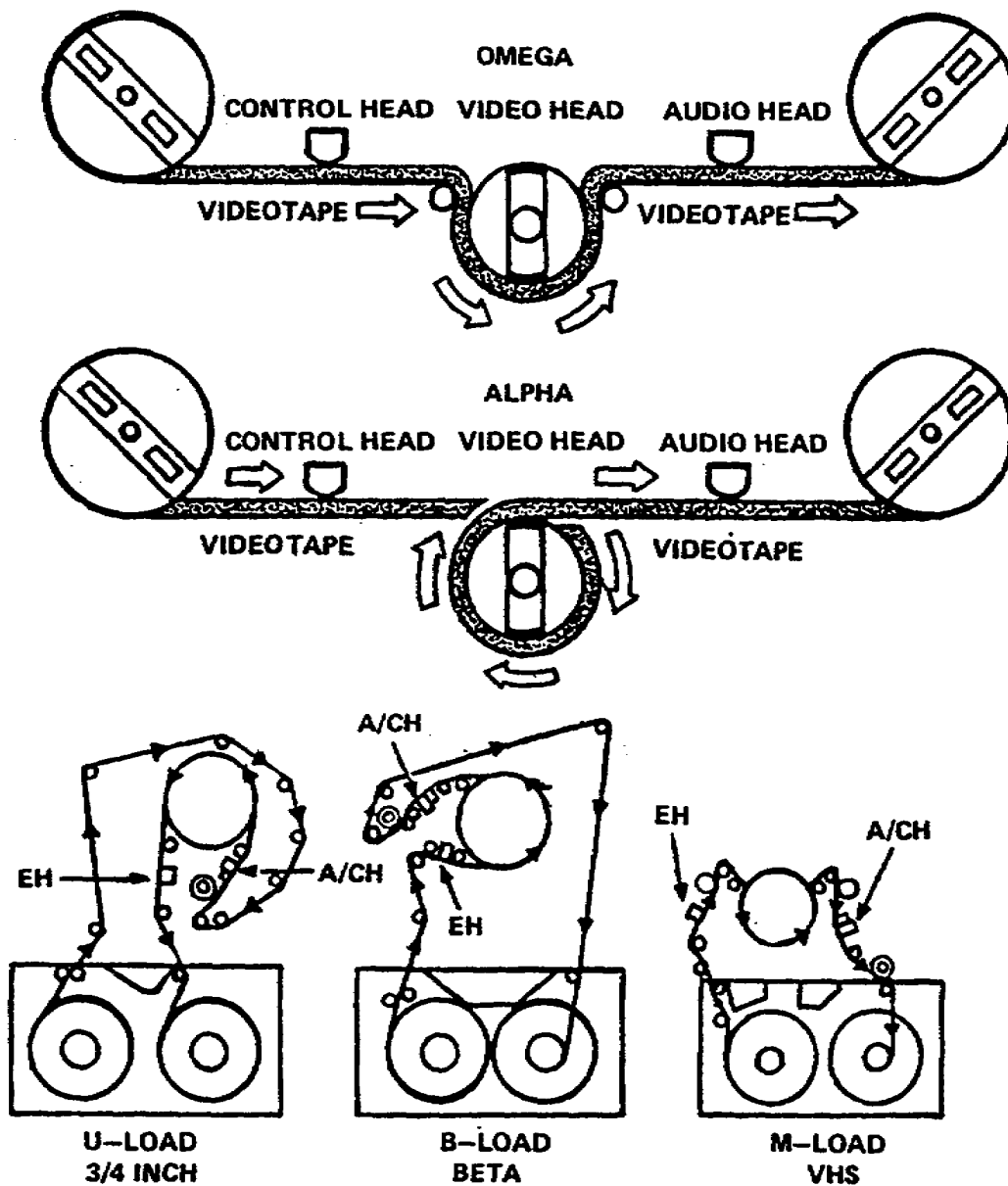


Figure 1-2. Two popular methods of tape transport in helical scan machines

5. The single-head format is used with a processing amplifier when a break in the information can be tolerated. The rotational velocity of the record/ produce is normally governed to make certain that this dropout video signal is shifted to the lowermost section of the screen, thus making the dropout unobserved. This method of recording is sometimes referred to as a full helical scanning system complete spiral around the rotating head.

Learning Event 2:

DESCRIBE THE PURPOSE AND USE OF THE DUAL HEAD RECORDERS

1. Dual head recorders use two rotating heads spaced 180 degrees apart, each sweeping the same arc, respectively. In this case, the tape need not be wrapped in a complete loop around the head drum assembly. It should be noted that one head will be in contact with the tape at all times. The heads are electrically switched so that the head that is in contact with the tape at all times. The heads are electrically switched so that the head that is in contact with the tape is continuously active during its pass. The long single dropout that was present in the previous example is eliminated. Head switching may also occur during vertical blanking when it will not be visible. This type of scanning is referred to as the half-helical or two-head helix method of video recordings.

2. When two heads are used, extreme care must be taken to place the heads accurately with respect to each other. Mechanical tolerances are critical and placement errors are easily introduced.

3. When the heads are not exactly 180 degrees apart, the error induced is called dihedral error. If this error is large, it makes tape interchange between machines impossible.

Lesson 1
Learning Events 1 and 2
PRACTICE EXERCISE

1. What does helical scan mean?
 - a. In a zig-zag pattern
 - b. In a spiral formation
 - c. In a straight line
 - d. Using a vacuum capstan

2. What type of wraps are used in single head recorders?
 - a. Alpha, Beta, Omega
 - b. Alpha, Beta, and VHS
 - c. VHS, Beta
 - d. Alpha and Omega

3. What must be used in single-head format to allow the break in information to be tolerated?
 - a. A line amplifier
 - b. A time base corrector
 - c. A processing amplifier
 - d. An amplitude suppressor

4. What type of wrap is used for the 3/4-inch, Beta and VHS systems of tape transport?
 - a. Alpha wrap
 - b. Beta wrap
 - c. Omega wrap
 - d. U-load wrap

5. On a dual head recorder, how often is a head in contact with the tape?
 - a. Continuously
 - b. Intermittently
 - c. At 30 millisecond intervals
 - d. At 60 millisecond intervals

Lesson 1
Learning Events 1 and 2
ANSWERS TO PRACTICE EXERCISE

1. B
2. D
3. C
4. C
5. A

Learning Event 3:

DESCRIBE HOW FREQUENCIES ARE RECORDED ON VIDEOTAPE

1. Frequencies. Before we go any further into helical scan videotape recorders, we must understand how frequencies are recorded on tape. The video signal frequency range for television tape extends from very low frequencies, approaching DC, to the upper limit of 4mHz. The size of the head gap becomes very important in the magnetic recording of higher frequencies.

a. For a given gap size and tape speed, there is a frequency above which recording is impossible. This condition occurs when the recorded wavelength of the signal frequency just equals the width of the head gap.

b. In Figure 1-3, note that the positive and negative portions of the cycle appear across the gap simultaneously and cancel each other. Maximum output is obtained when the recorded wavelength is twice the width of the head gap.

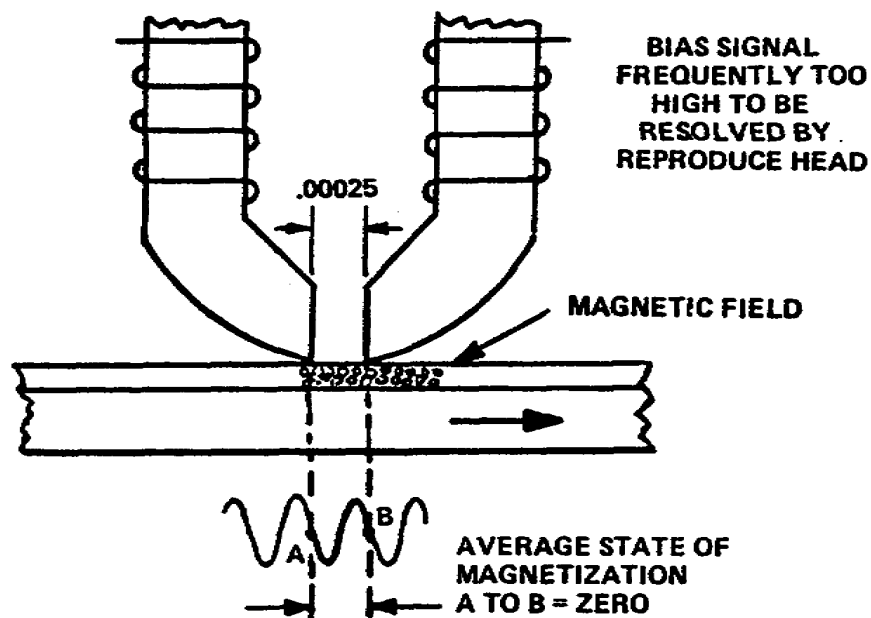


Figure 1-3. Gap effect at high frequencies

2. The relationship between recorded wavelength, frequency and velocity of the tape is expressed by the formula: $\lambda = \frac{V}{F}$

where λ = recorded wavelength (in), V = tape speed (ips) and F = frequency (Hz) of the signal. From this formula it may be determined that as the velocity of the tape increases, the recorded wavelength also increases.

3. The original approach to recording the higher video frequencies was simply to increase the speed of the tape so that the wavelength became a usable size. Video recorders that use extremely narrow gap heads and very rapidly moving tape are called longitudinal recorders. Longitudinal video recorders have many drawbacks. Primarily, the picture quality (resolution) is poor because the active read/write speed is limited by the tape-handling capabilities of the transport including problems of spooling the tape and avoiding tape overthrow. Also, an excessive amount of tape is required.

4. Another approach to recording of the higher video frequencies consists of pulling the tape at a practical speed past a rotating head, resulting in an increase of head-to-tape velocity. Systems that use the rotating head principle also apply other techniques to improve the recording of video signals.

a. One of these techniques is to use frequency modulation (FM) for recording the signal information. The FM technique solves the problem of bandwidth. The largest frequency span that can be accommodated by direct recording is 10 octaves (15Hz - 15KHz). Since the video signal has a span greater than 18 octaves (0 - 4mHz), direct recording is not practical.

b. This difficulty is overcome by using a frequency modulator to change the video information into an FM signal, with a full lower sideband.

c. In one application the video signal is frequency modulated onto a carrier from 1 to 7mHz wide a span of only 3 octaves. The reduction in the span of frequencies is important in the designing of the inductors used in the record/playback heads. The use of FM permits the recording of the signal at constant amplitude.

5. The constant level FM can be amplified and limited in playback to reduce the effect of signal dropout. Signal dropout is due primarily to tape surface defects. These tape surface defects result in poor contact between the head and tape resulting in substantial loss of signal (fig 1-4). Another technique is to allow the head to penetrate or intimately contact the tape.

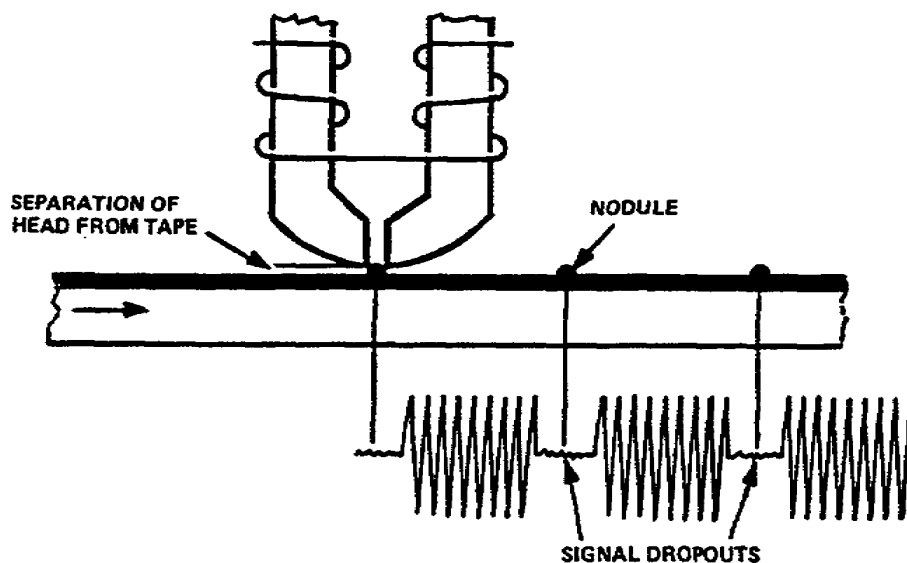


Figure 1-4. Effect of surface defects

Learning Event 4:

DESCRIBE HOW VIDEO AND AUDIO FREQUENCIES ARE USED IN THE OPERATION OF VIDEO TAPE MACHINES

1. There are two major video frequency bands. One is the 3.5mHz band which is referred to as low band and is used by most monochrome recorders. The other is the 5.5mHz to 6.6mHz band, the high band used by recorders with color capability. Figure 1-5 illustrates that slanted 3°6' angle of the recorded video information and other dimensions.

NOTE: The azimuth method of recording eliminates guard bands between scan lines for recording each track at a slightly different angle from the other.

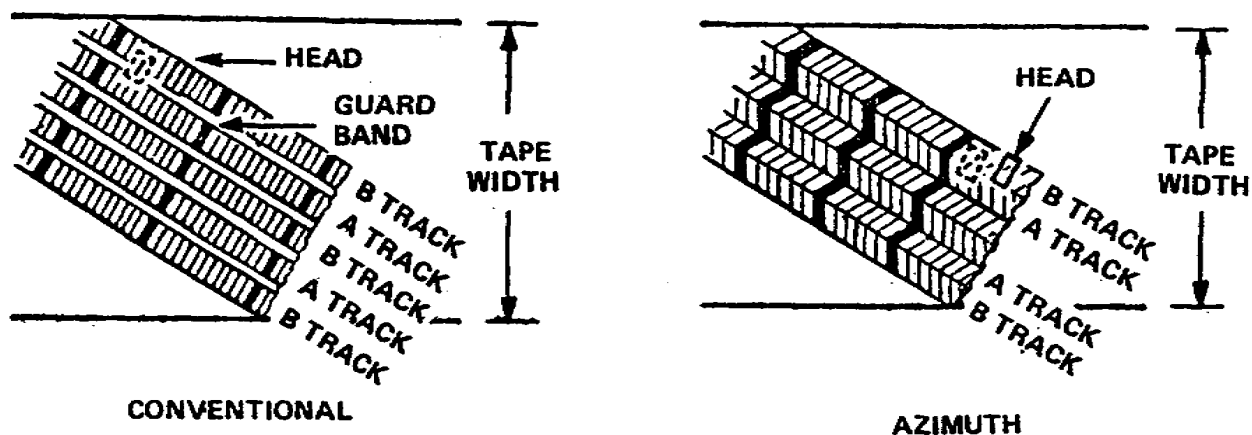


Figure 1-5. One-inch helical scan video tape showing scan tracks

2. There are two categories of audio frequencies. Audio frequencies record the narrative portion of the presentation and audio frequency establishes the control track signal pulse.

a. The control track signal pulse is obtained from the vertical sync pulse. In some instances, a third audio track is used as a cueing track or for other pertinent information.

b. The third audio track may be on the edge of the tape near to the primary audio track, or it may be on the side next to the control track.

c. All of the audio tracks (narrative, recording, control track signal pulses and cueing) are recorded longitudinally on the tape as illustrated (fig 1-6).

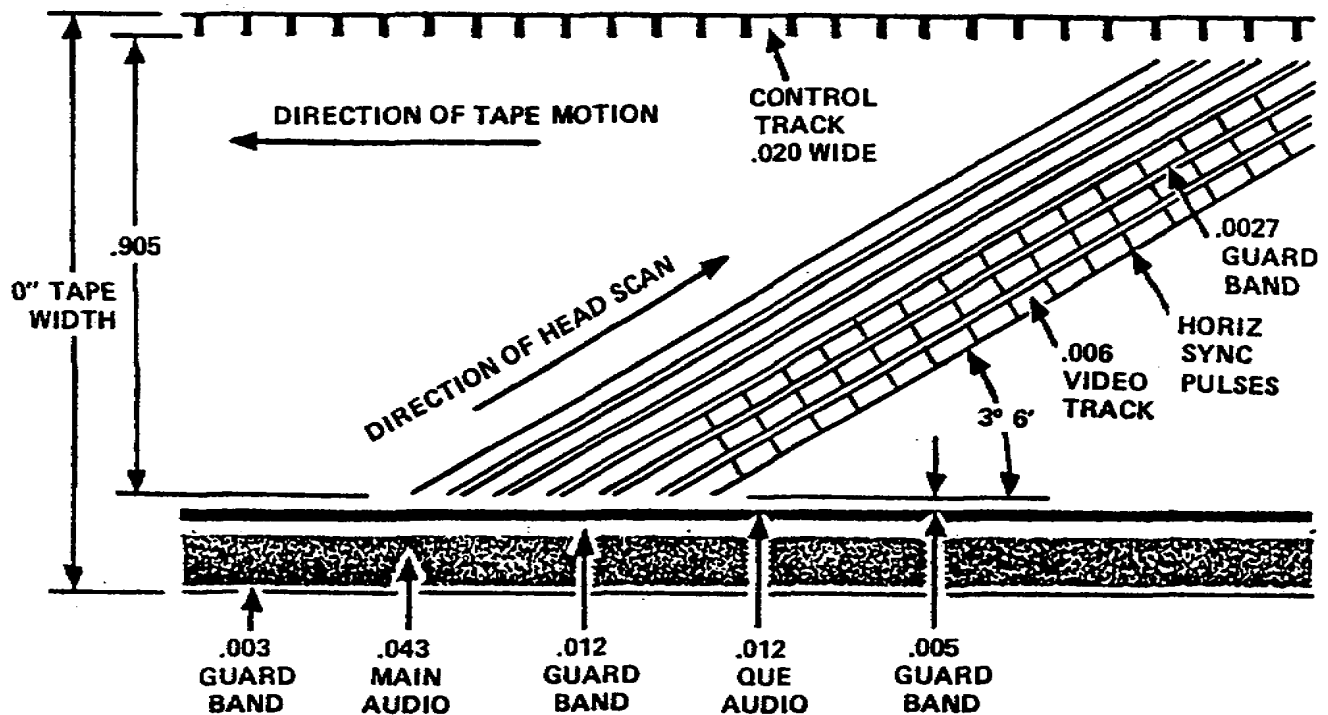


Figure 1-6. One-inch helical scan video tape showing all dimensions and relative positions on the tape

3. The 5.5 to 6.5mHz bias signal is used in a number of ways. The bias signal is applied to each of the erase heads for erasing the tape, i.e.; to rearrange the magnetic pattern of iron oxide particles to a neutral signal impression (fig 1-7).

a. Thus, the pattern of the old information is removed and the tape is ready for a new recording.

b. The bias signal provides recording bias power throughout the equipment.

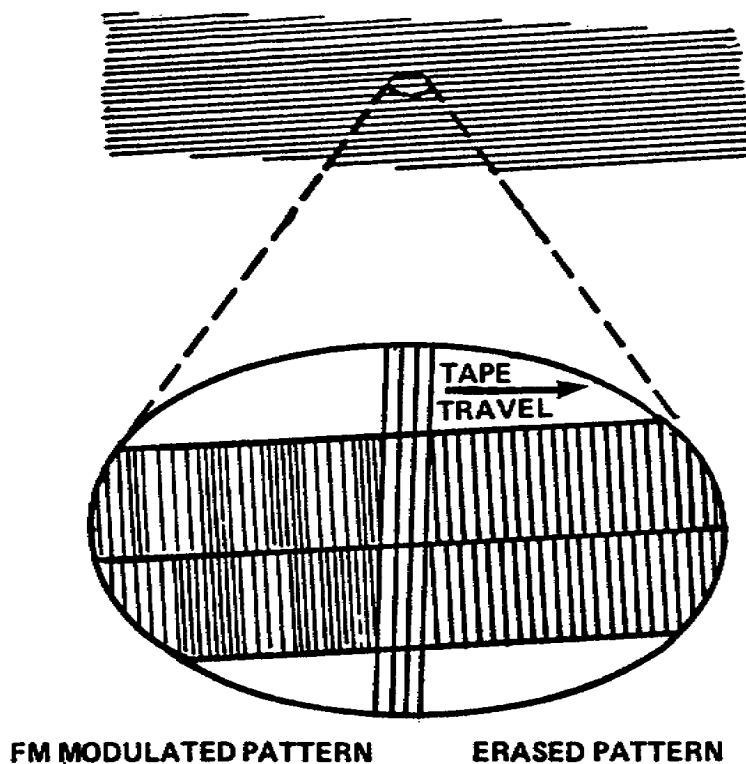


Figure 1-7. Segment of helical scan video tape as it is being erased

4. For recording the audio, the bias signal is used for the same purpose as in a standard audio recorder.

a. The bias signal provides bias power for the control track head; it is modulated by the vertical sync and recorded as control track pulses.

b. In the video record mode, the bias signal provides a carrier signal for recording the video. This is made possible (even though the video frequencies cover a much wider range than audio) by the use of video signals to control the frequency of an FM modulator.

c. The resulting FM signal is applied to the bias oscillator frequency, which establishes the voltage level, for FM recording of the video on the magnetic tape.

5. Servo frequencies are a combination of several other frequency inputs. The servo frequencies can be best described by indicating their various inputs sources.

a. The tachometer, plus the tachometer pickup, generates a frequency input to the servo. The tachometer frequency will vary among manufacturers and even among recorders in a model series.

b. Check the specific model of recorder and its maintenance manual to determine if the tachometer (tach) signal is 64Hz, 32Hz, 16Hz or other frequency. You should also determine the mode of operation, because in the record/record standby mode, you have a vertical sync input which also controls the servo frequency.

c. In the playback mode, you have a delayed type of control track input which determines the servo frequency.

d. Also during play/standby you have a 60Hz signal from the power supply.

e. The servo frequency is a combination of two or more frequencies (fig 1-8). Either or both may be variable, and this combination of frequencies is used to control the speed of the head drum motor.

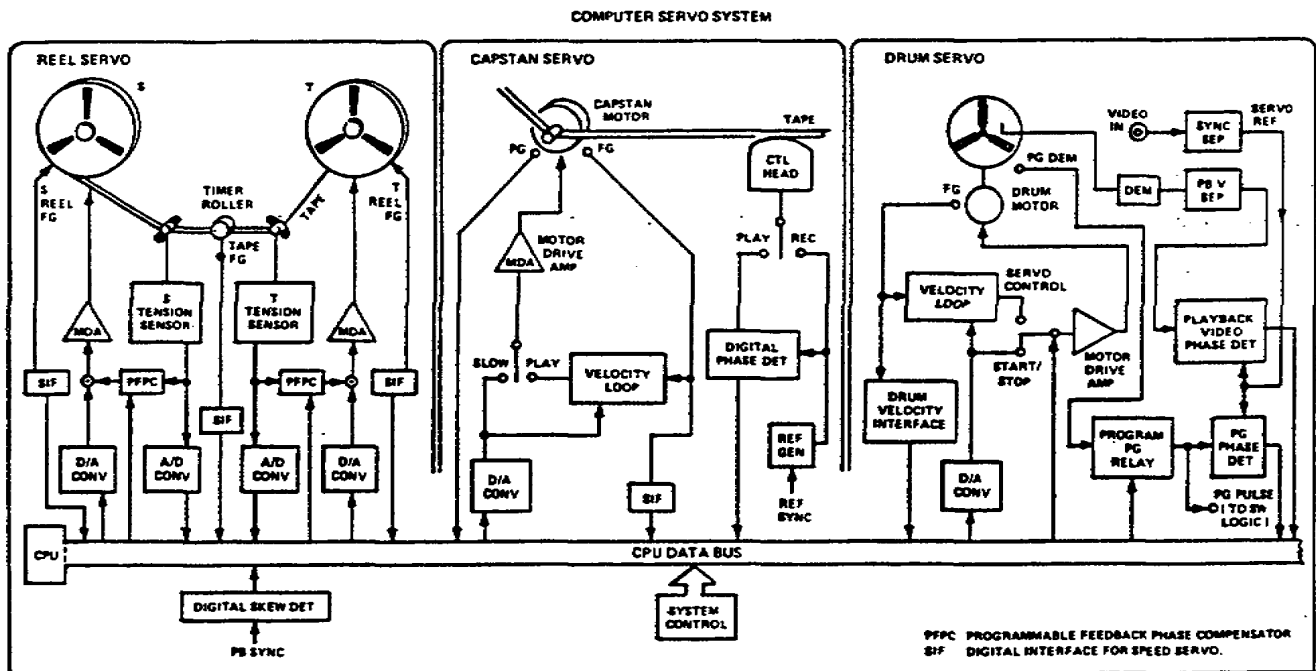


Figure 1-8. Block diagram of servo signal source

Lesson 1
Learning Events 3 and 4
PRACTICE EXERCISE

1. What is a recorder called that has extremely narrow gap heads and very rapidly moving tape?
 - a. Open reel-to-reel video recorder
 - b. Specialized recording format recorders
 - c. Longitudinal recorders
 - d. Single head recorders

2. Which of the following is not a drawback of longitudinal recorders?
 - a. Picture quality
 - b. Uses very little tape
 - c. Spooling problems
 - d. Problems with tape overthrow

3. What is the primary cause of video signal dropout?
 - a. Tape surface defects
 - b. Constant level of FM
 - c. Too low signal strength
 - d. Improper bandwidth

4. In some instances, what is the third audio track used for?
 - a. A primary audio track
 - b. A cueing track
 - c. Signal pulse track
 - d. A special effects track

5. What is the basic signal frequency for play/standby mode provided from the power supply?
 - a. 25Hz
 - b. 40Hz
 - c. 60Hz
 - d. 90Hz

Lesson 1
Learning Events 3 and 4
ANSWERS TO PRACTICE EXERCISE

1. C
2. B
3. A
4. B
5. C

Learning Event 5:

DESCRIBE THE PURPOSE AND USE OF VIDEO TAPE TRANSPORT MECHANISMS

1. Transport mechanism. All tape machines require some type of mechanism to move the tape past the record and playback heads. Such mechanisms have been given various names, but tape handlers is the term used to designate machines for fast start-stop operation.

a. These fast start-stop machines are usually a type of computer or laboratory tape transport which requires the tape to start or stop instantaneously.

b. In contrast, the standard machine requires about 1 second to reach full speed and perhaps 5 to 10 seconds to fully stabilize.

2. Good quality tape transports have the features of the mechanisms illustrated (fig 1-9a and 1-9b).

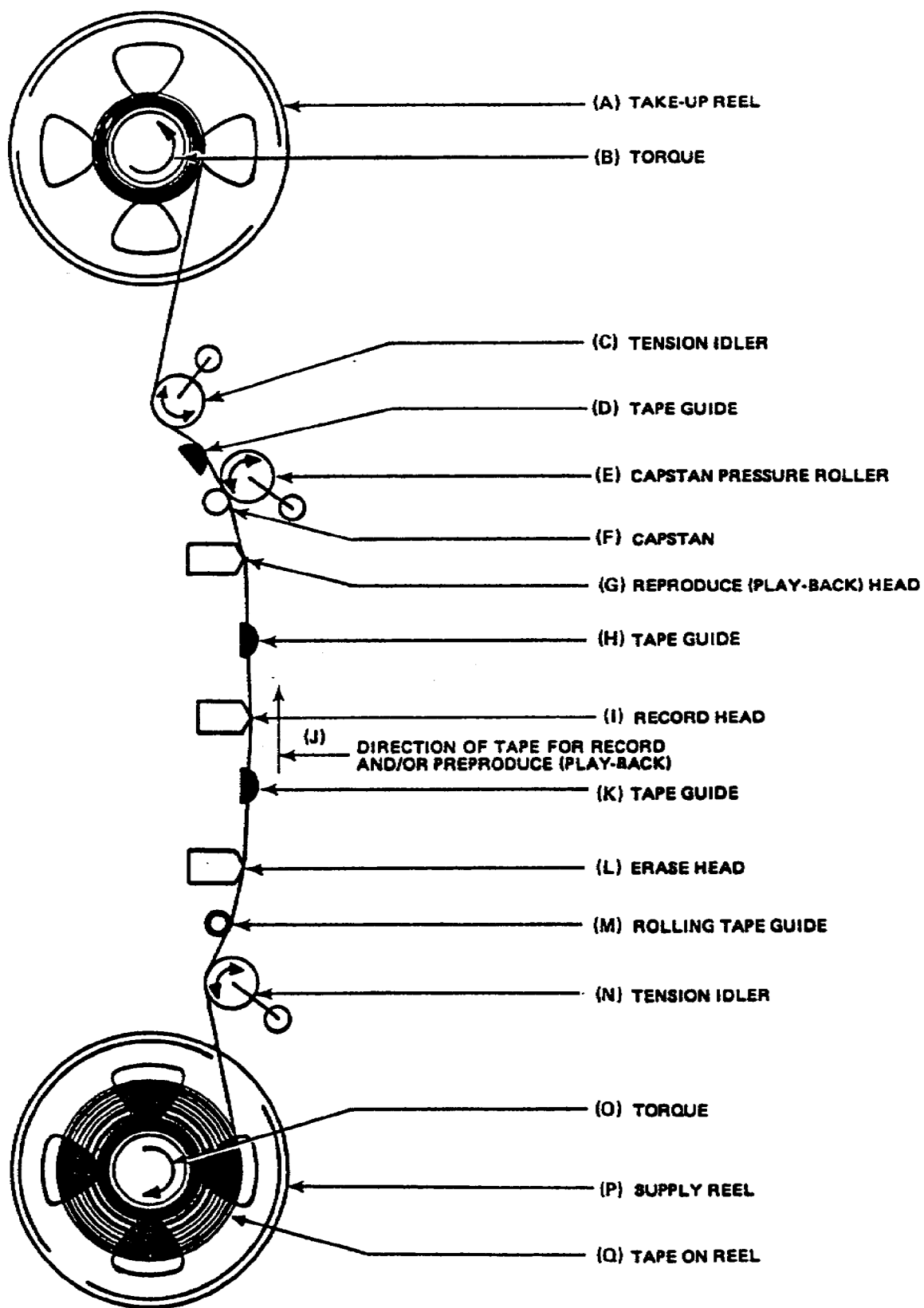


Figure 1-9a. Tape transport mechanism

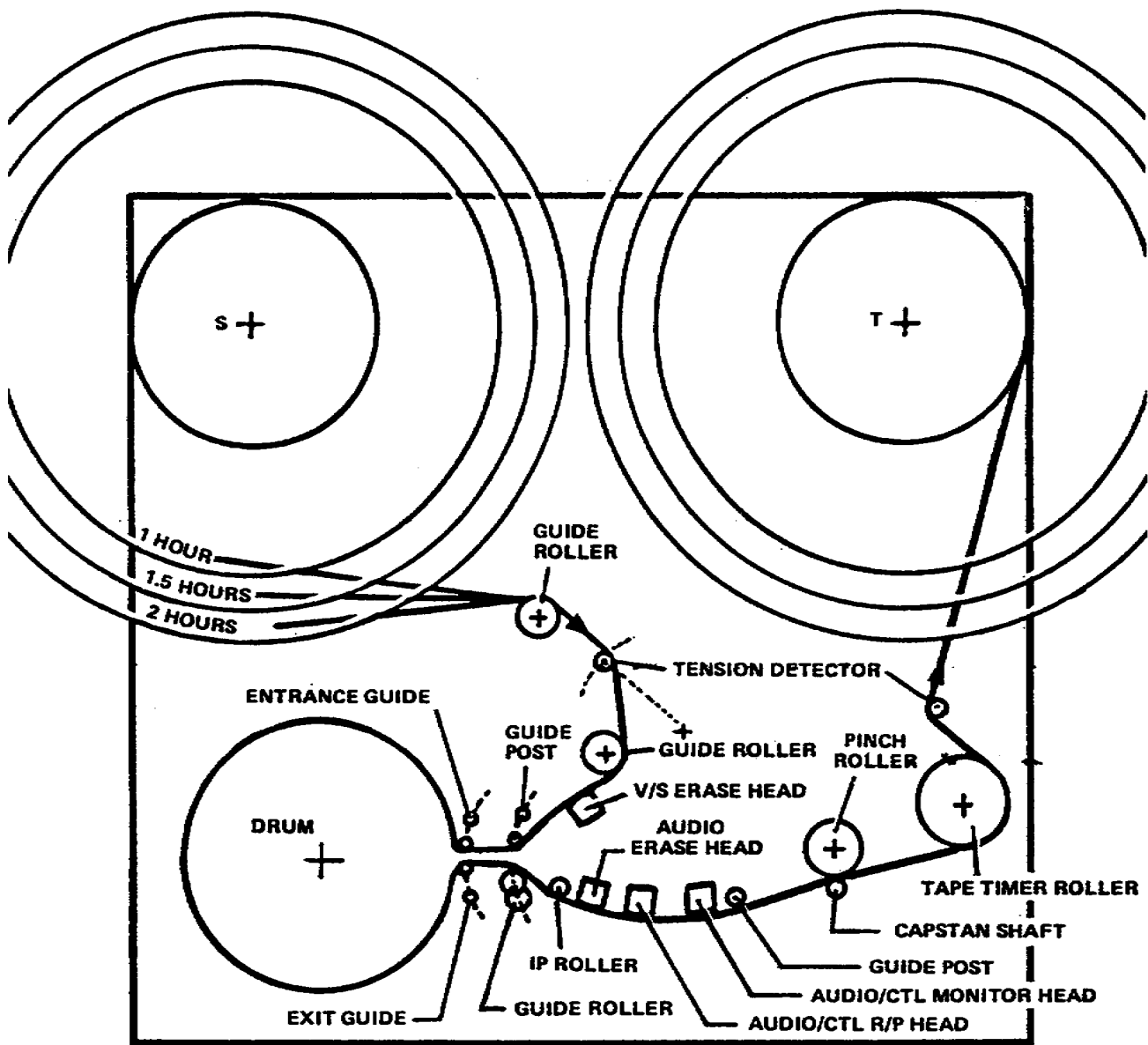


Figure 1-9b. Helical scan videotape transport

a. These features include the tape supply reel, which is provided with either a friction brake or an active back torque. The back torque is supplied by the drive system of a torque motor. Back tension (torque) is necessary to keep the tape from becoming tangled due to the inertia of the tape reel.

b. The tension idler ((c), fig 1-9a) holds a certain amount of tape in its loop. This spare amount of tape is temporarily let out during quick starts.

c. A slight delay in time is allowed for the supply reel, which has appreciable inertia, to start turning at operating speed.

d. The tension idler ((m), fig 1-9b) and back-torque work together to smooth out irregularities caused by the rubbing of the tape against the supply reel ((p), fig 1-9a) sides, sticking together of tape layers, or other causes.

3. Again looking at Figure 1-9a, note that the tape is drawn from the tension idler, across the rolling tape guide, erase head, tape guide, record head, tape guide, and reproduce head. The force, which draws the tape across the heads at a constant speed, is provided by the capstan and the capstan pressure roller.

a. The combination of the capstan, the tension idler, and the reverse torque of the supply reel keeps the tape under constant tension. There is friction between the tape and the stationary heads. This friction is a source of vibration. Attempts to eliminate this vibration are included in the design of the transport mechanism by using a rigid base on which to mount the transport components.

b. Other causes of vibration are the amount of wrap around the head, smoothness of head faces, tape tension, tape condition, tape composition, temperature and humidity.

c. The capstan may be either the shaft of the drive motor or a shaft driven through a speed-reducing mechanism. The capstan and any associated mechanism must be made with precision or it will cause problems during both record and playback.

d. This requirement for precision components includes the drive motor, as it must drive the capstan mechanism at a constant speed.

4. Immediately following the capstan and the capstan pressure roller is another tape guide. Each tape guide serves to keep the tape in alignment with the heads at all times.

a. If the tape guides permit any vertical variation of the tape, a possibility exists of attenuation of the recorded signal during reproduction.

b. In extreme cases the signal could be lost entirely, or the erase head would either fail to erase or improperly erase when a recording is made.

c. The tension idler near the takeup reel serves the same purpose as the other tension idler. The torque on the takeup reel changes according to the amount of tape on the reel.

Learning Event 6:

DESCRIBE THE PURPOSE AND USE OF MAGNETIC HEADS

1. Magnetic heads. No assembly in a magnetic recording system is more important than the heads. These convert the electrical current to a magnetizing force during the record operations, and convert the magnetizing force to an electrical current during playback.

a. If a core of permeable material is inserted within a coil of wire with direct current running through it, a magnetic field is set up that will influence any nearby material that is capable of being magnetized.

b. In the record head, alternating current is used. This is not sine wave AC but current, which is varying in amplitude, and frequency, to conform with a person's voice or music.

c. The core (item 1, fig 1-10) is shaped like an incomplete ring. The discontinuity forms the gap (item 3, fig 1-10) which is inserted in a coil (item 2, fig 1-10) of wire.

d. When the signal to be recorded is converted to an electric current and passed through the coil, a strong magnetic field is created across the gap.

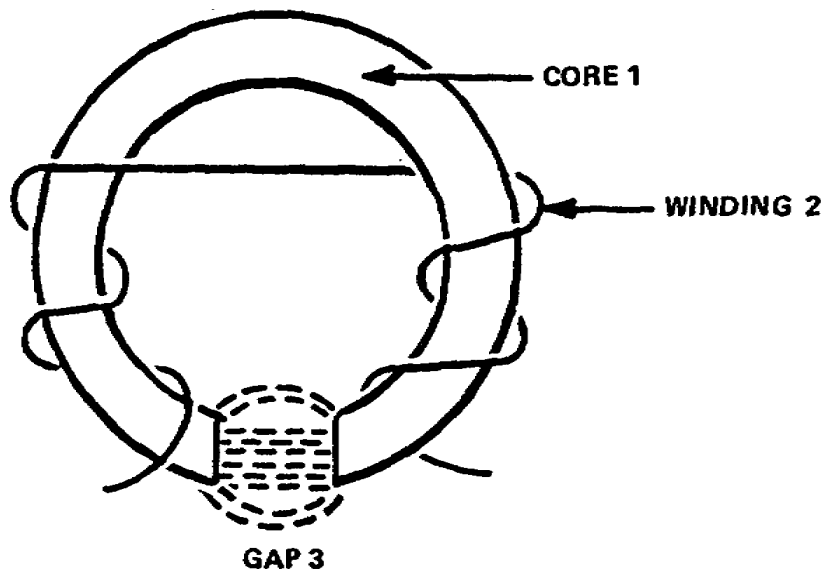


Figure 1-10. Record head

e. If the magnetic tape is passed across the gap (fig 1-11) oxide particles in the tape will be magnetized in a pattern which is a function of the magnitude and polarity of the original signal. Understand that these particles do not physically move, but are simply magnetized by the flux at the head gap so that each individual particle contributes to an overall magnetic pattern.

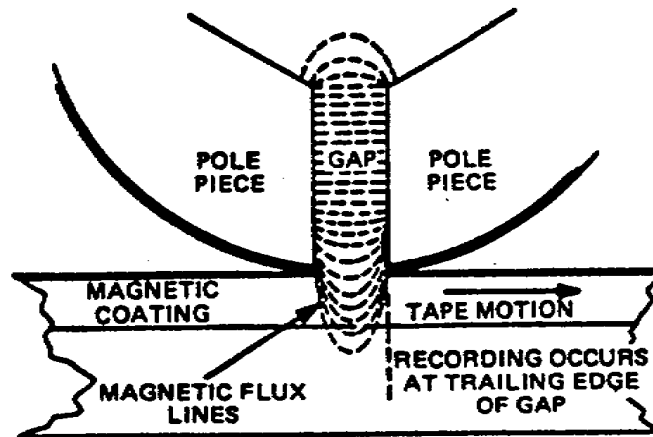


Figure 1-11. Flux lines in a recording gap

2. Three tape heads may be used on the more expensive tape machines. Some machines, such as those designed for home use, use the same head for record and reproduce. It is possible to use the same head for erasing the tape; however, if the same head is used for erasing as well as recording and reproducing, it will require an additional run through of the tape.

3. Although one tape head can be used for three purposes of erasing, recording and reproducing, there are some differences in construction of the heads. The basic construction of the heads (fig 1-11) is the same -- that is, the head consists of a core of permeable material which is wound with a coil of wire. The core material is usually of a laminated construction (as shown in (fig 1-12) rather than nonlaminated. The nonlaminated heads are cheaper to contract, but they usually produce poorer results. The laminations, by reducing magnetic losses due to eddy currents, produce a better response to higher frequencies.

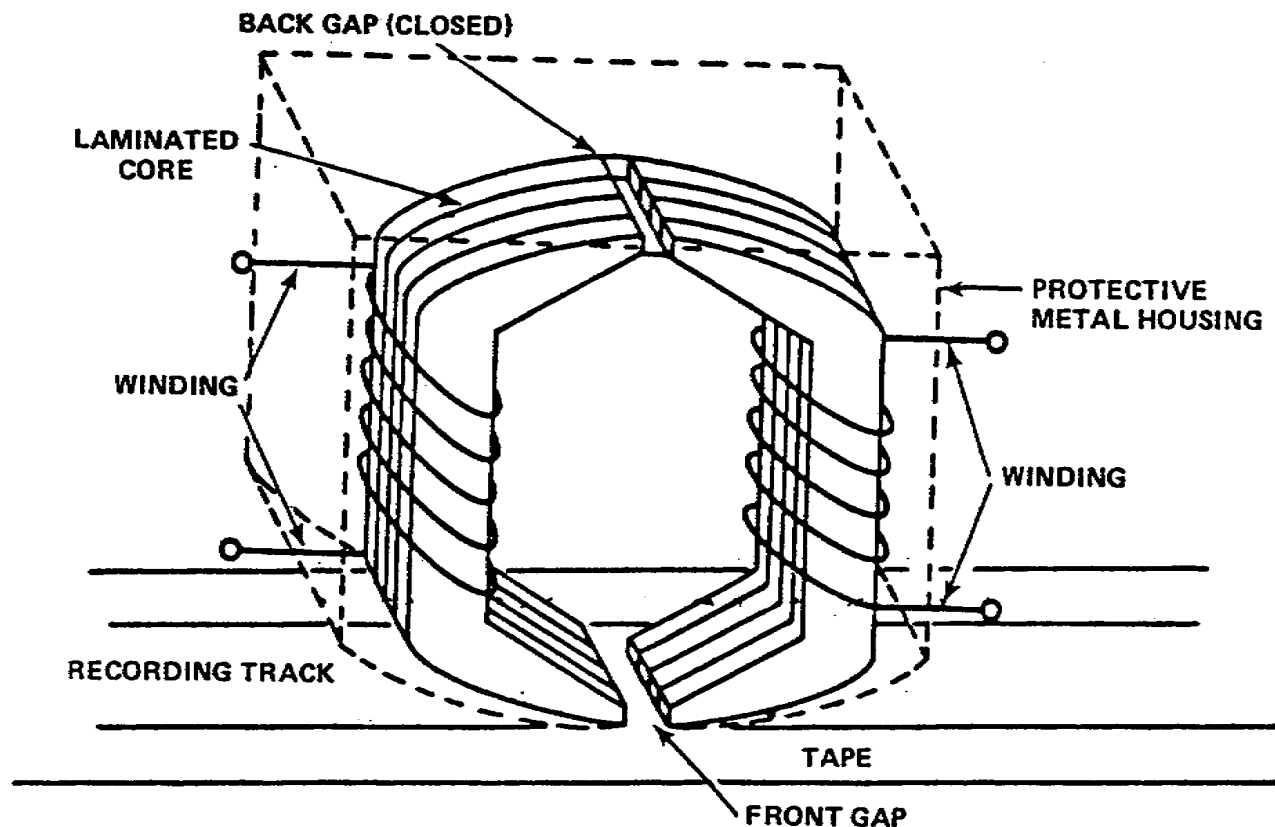


Figure 1-12. Laminated core tape head

4. The core of the head is wound with a number of turns of wire, but the number of turns will depend on the purpose for which the head is designed.

a. The manner in which the core is wound will be dictated by the head use. There are two winding designs, one winding on each side of the gap.

b. In most of the newer designs the two windings will be terminated externally, thus they may be connected in a parallel or series arrangement as desired.

c. The core and winding are enclosed in a protective metal housing to prevent the winding from picking up hum emanating from motors, transformers, etc.

5. Construction and operation of erase head. The erase head removes any prior recording and leaves the tape quiet so that it may be used again.

a. The erase head functions exactly the same as the record head. It is constructed with a relatively large gap, which allows the flux to leak out over a relatively large longitudinal area in the tape path.

b. We send a high-frequency AC to the head. As a point on the tape approaches the gap, the alternating magnetic field gets stronger and stronger until a maximum magnitude is reached directly at the gap.

c. The high frequency sent to the head is far above the audio range. The erasing field will disappear before out point on the tape approaches the record head.

6. Construction and operation of reproduce head. Although the reproduce head is constructed almost the same as the record head, it functions more like an electric generator.

a. When we move a conductor through a magnetic field, as we do in a generator, we induce in that conductor a voltage whose amplitude and polarity are functions of the magnitude and direction of the magnetic field.

b. We can, of course, achieve the same results by passing the magnetic field across a stationary conductor, as the only requisite is that the conductor must cut the lines of force.

7. When we move the recorded tape past the gap in a reproduce head (fig 1-13) the magnetic flux on the moving tape will induce a voltage in the head coil.

a. This induced voltage will be proportional to the number of turns on the head coil, the permeability of the core material and the time rate of change of the magnetic flux.

b. In reproducing information from a recorded tape, one important factor is the dimension of the reproduce head gap. The gap in the reproduce head is .00025 inch.

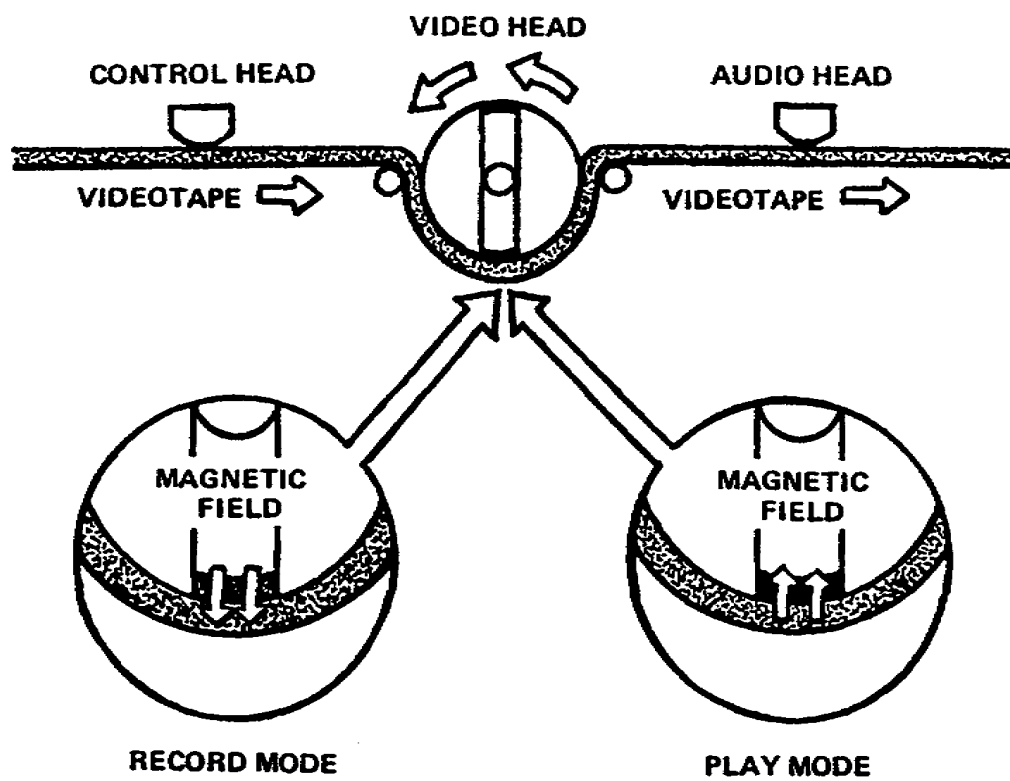


Figure 1-13. Position of erase, record, and play (reproduce) heads

Lesson 1
Learning Events 5 and 6
PRACTICE EXERCISE

1. How long does it take the standard recorder to fully stabilize?
 - a. 1 - 2 seconds
 - b. 2 - 5 seconds
 - c. 3 - 8 seconds
 - d. 5 - 10 seconds

2. Which of the following is not a cause of vibration in the tape transport system?
 - a. The amount of wrap around the head
 - b. The smoothness of the head faces
 - c. The temperature and humidity
 - d. The size of the takeup reel

3. Of what is the core of a magnetic head made?
 - a. Permeable material
 - b. Steel
 - c. Aluminum
 - d. Tin

4. What is the core shaped like?
 - a. A ring
 - b. A square
 - c. A triangle
 - d. An incomplete ring

5. What is the dimension of the reproduce head gap?
 - a. .00010 inch
 - b. .00025 inch
 - c. .00050 inch
 - d. .00125 inch

Lesson 1
Learning Events 5 and 6
ANSWERS TO PRACTICE EXERCISE

1. D
2. D
3. A
4. D
5. B

Learning Event 7:

DESCRIBE THE PURPOSE AND USE OF VIDEO AND AUDIO TAPE HEADS (ERASE, RECORD, AND PLAYBACK)

1. Types of erase heads (video or audio).

a. Video erase head. An electromagnetic head which usually spans the width of the tape and has a wide gap between pole pieces. The wide gap permits an extended time of influence for clean erasing of the tape (fig 1-14).

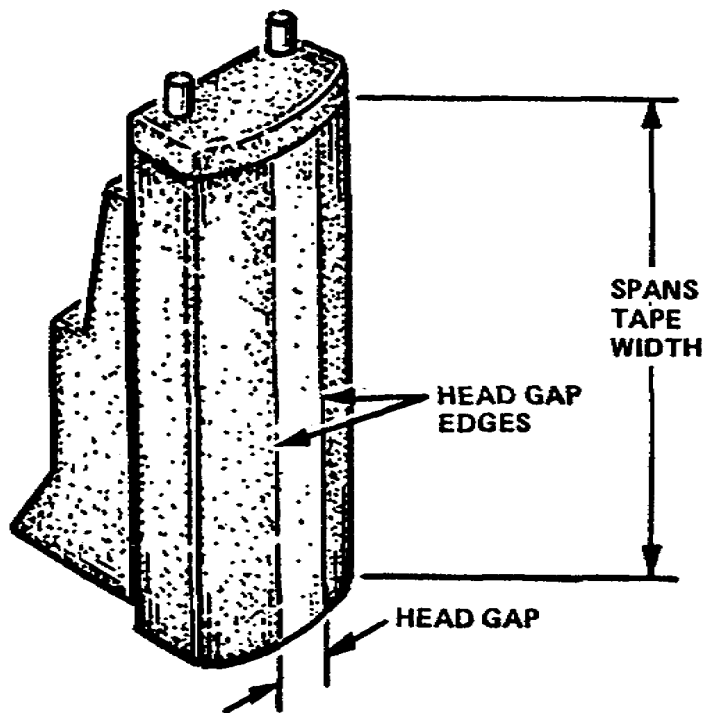


Figure 1-14. Video erase head

b. Audio erase head. An electromagnetic head (fig 1-15) is constructed in several configurations, and may cover the entire width of the tape or a small portion. The active portion of the head is just wide enough (a few mils) to cover the space for audio recording plus a guard band on each side of the audio track.

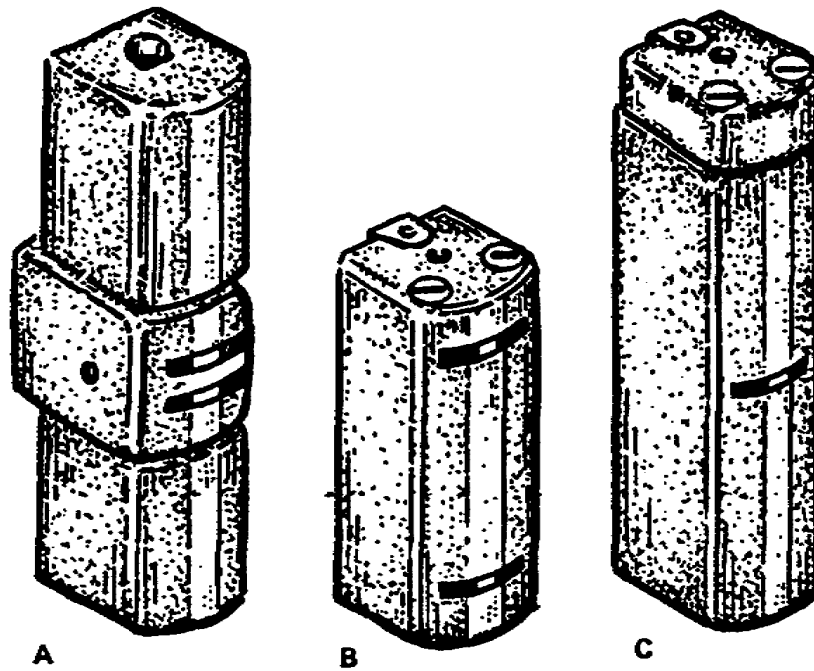


Figure 1-15. Audio erase head configurations

c. Control track erase head. An electromagnetic head has the same configuration as the audio erase head, except for a different physical location of placement of the heads. The frequency response is in the audio range.

2. Types of record playback heads (video or audio).

a. Video record/playback head. An electromagnetic head (fig 1-16) of a refined design, capable of responding to the high frequencies present in the video signal being recorded. Also, it is made of the best material to withstand the wear encountered in high-speed recording and playback.

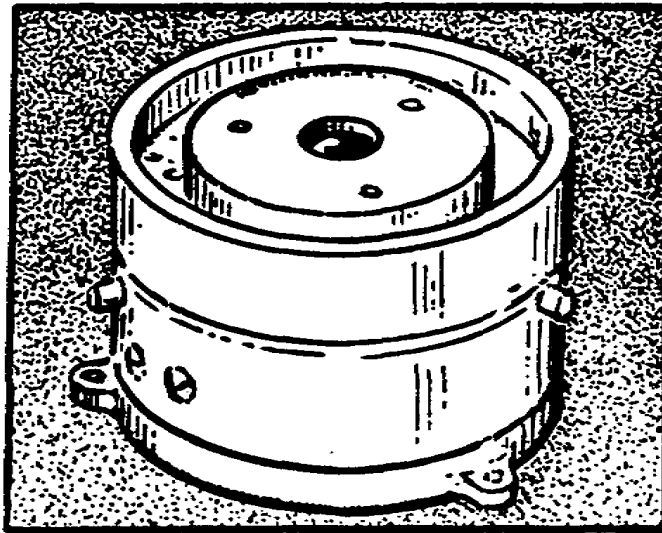


Figure 1-16. Video record/playback head

b. Audio record/playback head. An electromagnetic head (fig 1-17) is designed for the audio-frequency range. The physical dimensions track width of .012 to .043 mils varies according to specific designs, mountings, etc.

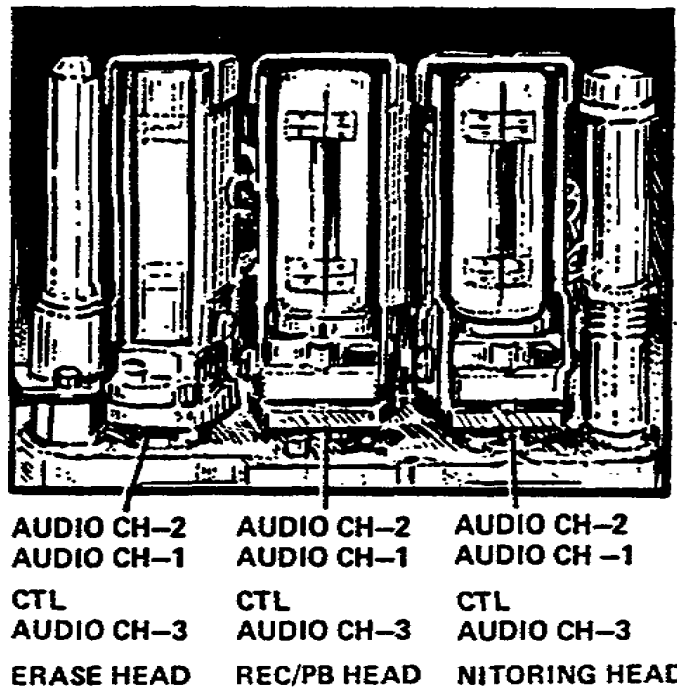


Figure 1-17. Audio record/playback head (typical)

3. Control track record/playback head. An electromagnetic head (fig 1-18) is designed for the audio-frequency range.

a. However, it is not required to have a wide frequency response.

b. A difference may be noted in the depth, width, and length of the control track head as compared to the normal audio head due to reduced fidelity requirements; i.e., .020 mils for a control track head as compared to .040 to .045 for a standard audio head.

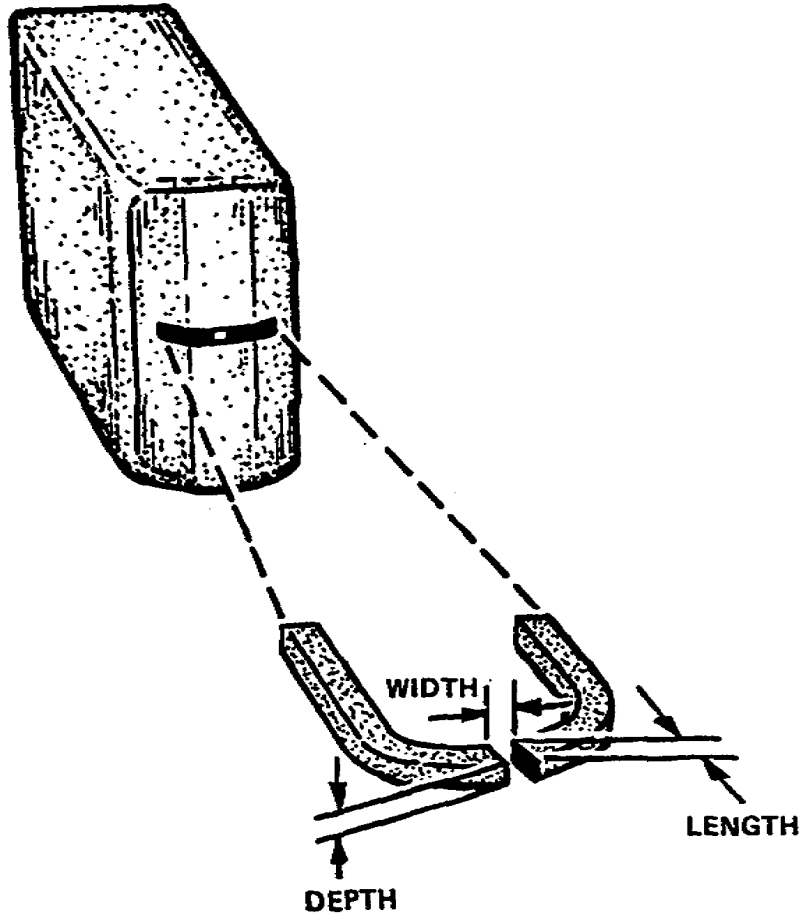


Figure 1-18. Control track record playback head showing width, depth and length measurement

Learning Event 8:

DESCRIBE CONSTRUCTION PRINCIPLES OF VARIOUS TYPE HEADS

1. Construction principles of various type heads.

a. Basically, all heads are constructed on the same principles, that is two identical core valves made of very thin laminations of special magnetic alloy. Each of these core valves is wound with nonmagnetic separators and a minute gap at the front. The front part of the head traces the tape.

b. The video helical scan record/playback head is different from the audio head in appearance and physical dimensions. In Figure 1-5, an enlarged illustration of 1-inch wide tape, you received an idea of the pattern recorded by the video head. Figure 1-17 illustrates the manner of placing all information by means of the various heads on the tape.

2. Figure 1-19 illustrates the guard bands as well as audio control, cue, and video. The guard bands serve to prevent crosstalk between tracks. You will note the small width of the video track, .006 mils, and the smaller guard band of .0027 mils.

a. You will also note in this illustration that the main audio track is seven times the width of the video, or .043 mils. Even the cue audio track is twice as wide as the video track, or .012 mils.

b. Also, the control track is more than three times as wide as the video track, or .020 mils. These comparisons will give you an idea of the precise construction of the video head.

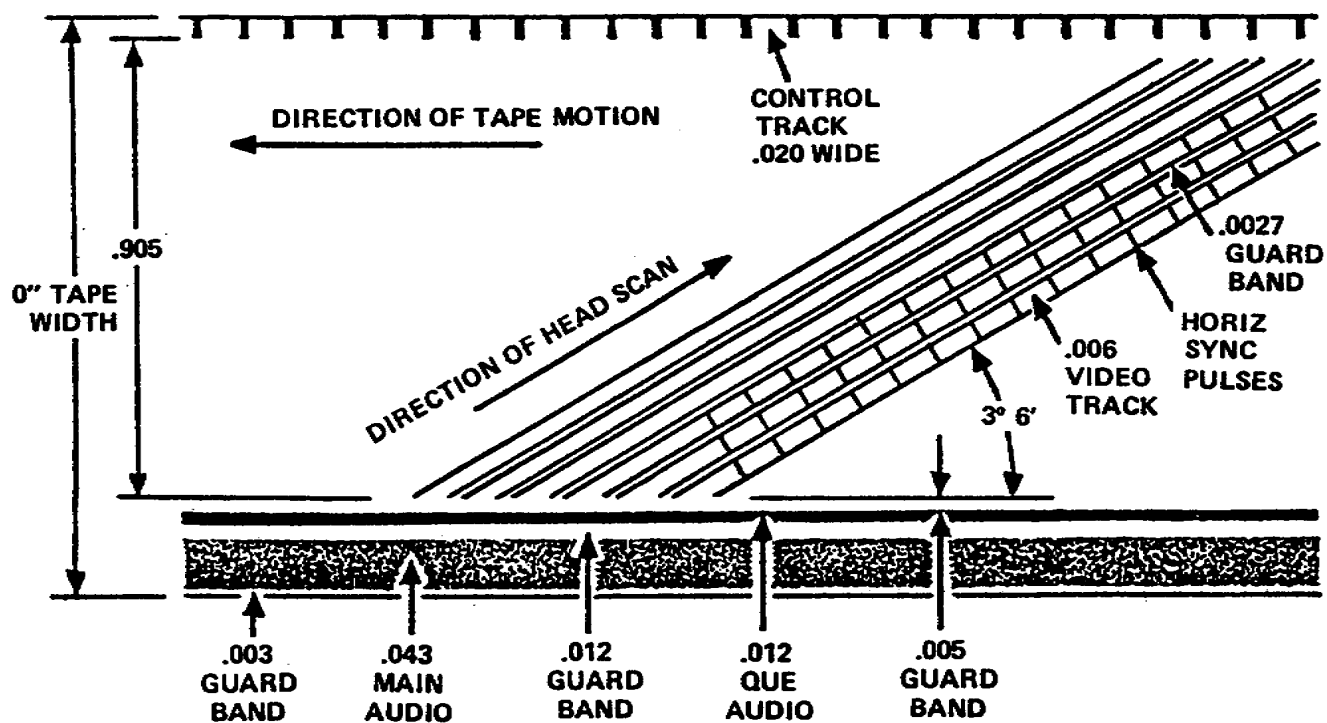


Figure 1-19. One-inch helical scan video tape, showing all dimensions and relative position on the tape

Learning Event 9:

DESCRIBE THE PURPOSE AND USE OF HEADS ON TAPE RECORDERS, AND EXPLAIN HOW TO REPAIR DAMAGED TAPE

1. Purpose and use of heads. The total number of heads on a specific tape recorder/producer will be governed by the actual video, audio, control, and cueing channels designed into the equipment.

a. Certain helical scan equipment requires a single video record/reproduce head. There will be a video erase head which wipes the full width of the tape.

b. Normally, an erase head is provided for each of the audio, control, and cueing tracks. This could be one or two audio, one control, and one cueing.

c. Or, it could be a minimum of one audio and one control. For each of the required erase heads, there is a corresponding record/reproduce head.

d. The recorder may have as many as 10 heads or as few as 5 heads if one erase head were used to wipe both the audio and control tracks during recording.

2. All the heads except the video record/reproduce head are of the fixed or stationary head design. The only tape penetration by the fixed heads will be a very minute amount resulting from design, or caused by the wearing and grooving of the plastic around the head gap.

a. The video record/reproduce head does have a designed head-to-tape negative clearance of approximately 3 to 4 mils. This means that the head actually protrudes into the tape, ensuring contact at all times.

b. If, during operation, the tape is stopped, the head will continue to turn for only a brief period of time. If the head drum is left in motion and the tape is stopped, the tape may be cut by the video head as it continues to trace the same path across the tape.

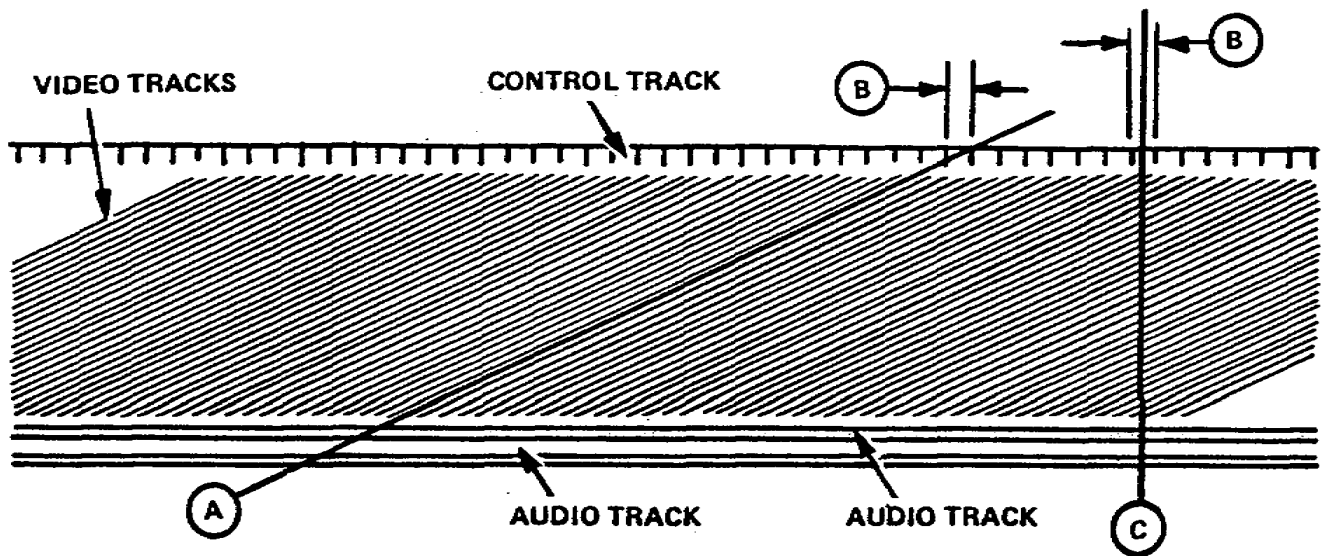
c. Damage may also be done to the head if the gap becomes clogged with oxide particles. This will render the head ineffective for any further use. If it is desirable to stop the tape for an extended period of time, then the head drum should also be stopped or the tension on the tape released.

3. If it becomes necessary to repair a tape because of some type of damage such as a broken tape or a crumpled tape which required cutting and splicing, then it is very important that the tape be spliced precisely (fig 1-20).

a. If the tape is cut on a 90° angle (fig 1-20c), and all tracks are precisely aligned, the effect, theoretically, would be a vertical wipe with no roll or tear visible in the picture.

b. If the tape is cut on the 3°6' angle (fig 1-20a), an instantaneous transition from one scene to another will occur.

c. It should be noted, however, you do not splice unless there is no other way of correcting the problem.



- A. CUT AS INDICATED FOR AN INSTANTANEOUS TRANSITION FROM ONE SCENE TO ANOTHER.**
- B. THE MAXIMUM CONTROL TRACK DISTURBANCE BETWEEN THE TWO PIECES OF TAPE MUST NOT EXCEED .001 INCH.**
- C. CUT AS INDICATED FOR A TRANSVERSE SPLICE IF A DISTURBANCE BETWEEN SCENES IS PERMISSIBLE;**

Figure 1-20. Helical scan tape splicing

4. In most of the audio tape recorders, the tape is always wound on the reels with oxide coating on the inside. The video tape transport may wind the tape either with the oxide to the inside or outside.

a. Audio tape may be recorded in both directions, but the video tape is recorded across the entire width of the video tape in only one direction.

b. This means that the video tape must be rewound onto the storage reel after each playing to prepare it for replay.

Lesson 1
Learning Events 7, 8, and 9
PRACTICE EXERCISE

1. What is the distance covered by the video erase head covers?
 - a. 1/4 tape width
 - b. 1/2 tape width
 - c. 3/4 tape width
 - d. 1 tape width

2. What are the physical dimensions track width of an audio record/play back head?
 - a. .0012 to .0043 miles
 - b. 0.12 to .043 mils
 - c. .12 to .43 mils
 - d. 1.2 to 4.3 mils

3. To what frequency range is the control track record/playback head set?
 - a. High frequency range
 - b. Video-frequency range
 - c. Audio-frequency range
 - d. FM-frequency range

4. With what is each core value wound?
 - a. Nonmagnetic separators
 - b. Special magnetic alloy
 - c. Steel wire
 - d. Tin wire

5. What is the head-to-tape negative clearances on a video record/reproduce head?
 - a. Approximately 1 to 2 mils
 - b. Approximately 2 to 3 mils
 - c. Approximately 3 to 4 mils
 - d. Approximately 4 to 5 mils

Lesson 1
Learning Events 7, 8, and 9
ANSWERS TO PRACTICE EXERCISE

1. D
2. A
3. C
4. B
5. C

LESSON 2
DESCRIBE BASIC FUNDAMENTALS OF TAPE TRANSPORT
AND PROPER OPERATION/MAINTENANCE PRACTICES

TASK

Describe theory and terminology of how tape is transported in various type VTRs with single or multiple tachometer outputs, and perform the proper operation and maintenance practices for VTRs.

CONDITIONS

Given information and illustrations about terms relating to VTR transport systems, single or multiple tachometer outputs, and operation and maintenance practices for VTRs.

STANDARDS

Demonstrate competency of the task skills and knowledge by correctly responding to 85% of the multiple-choice test covering tape transport, tachometers, operation, and maintenance practices for VTRs.

REFERENCES

None

Learning Event 1

DESCRIBE HOW TAPE IS TRANSPORTED IN VARIOUS TYPES OF VIDEO TAPE RECORDERS

1. The tape is transported from supply reel to takeup reel at a fixed rate of speed, determined by the capstan drive speed. This speed will also vary between different pieces of equipment. On the transport, the tape is held closely in alignment by guide rollers (cone-shaped or inverted cones (figs 2-1 and 2-2), or other mechanical devices so that it will not shift vertically during transport.

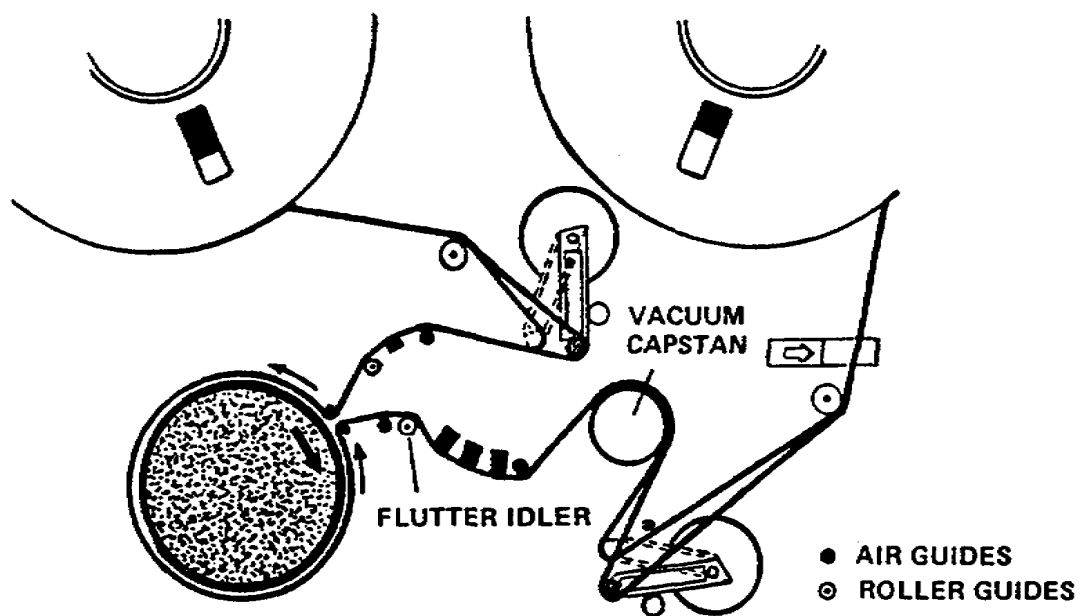


Figure 2-1. Helical scan, tape transport

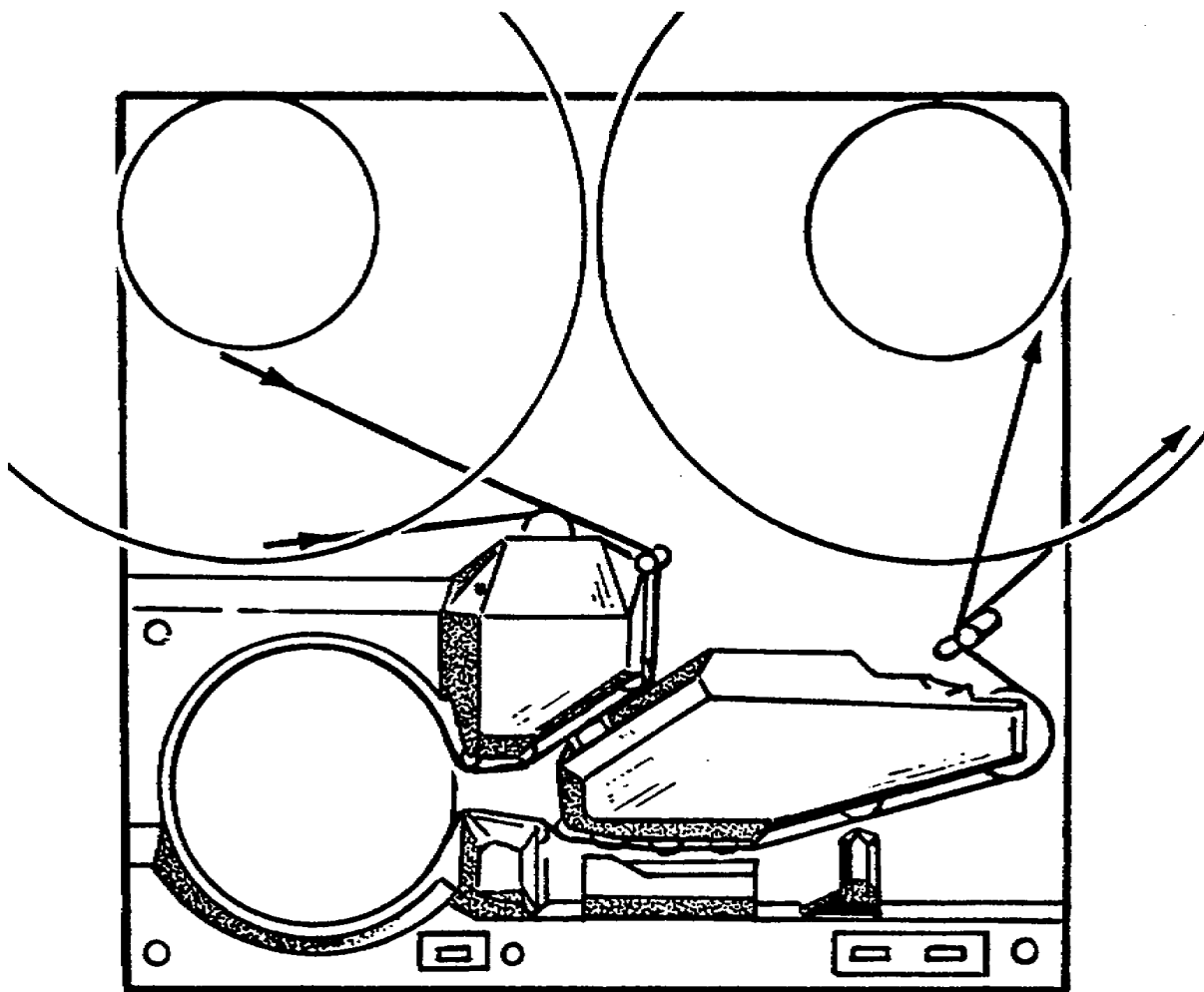


Figure 2-2. Heliscan scan, tape transport

a. The location of the capstan will vary from manufacturer to manufacturer and therefore, may be located either prior to the tape contacting the head drum assembly, or after the head drum assembly, or both (figs 2-1 and 2-2). In any case, it will meter the tape past the head drum assembly.

(1) The combination of the capstan and the reel drive holdback tension works together in a designed electromechanical combination to maintain proper tension on the tape to keep the tape taut against the head drum assembly and in good physical contact with the rotating video head.

(2) Both the takeup torque adjustments and holdback tension adjustments require checking. The exact amount of these adjustments will be peculiar to specific machines.

2. As the tape leaves the transport reel, it passes a fixed head which erases the full width of the tape during the record mode.

a. The tape then passes the video head, which is rotating at a high speed (approximately 3600 rpm). This combination of tape speed and head speed gives a tape-to-head speed of approximately 1000 ips. This is the speed at which the picture and horizontal sync information is placed on the tape after modulating an FM signal, as previously indicated.

b. Following the rotating head and its signal application, the tape passes a fixed head where a control track pulse is applied near the edge. This control track record head is preceded by an erase head which clears a track for the recording of the control track pulses and a path for the audio track. However, on some recorders, the other edge of the tape may be used for audio recording, and therefore, the erase is on the opposite end of this fixed head stack.

c. In still another variation, two audio record tracks are present and consequently, erase and record heads for audio are required on both ends of fixed head stack. Once the path has been erased for the audio recording path, the audio may be recorded in the usual manner. The audio tracks are positioned to prevent interference with the video control track pulses and the video signal which is already recorded.

3. The quadruplex recorder has a head that rotates in a plane 90 degrees to the tape travel and therefore records a track approximately 90 degrees to the longitudinal axis of the tape. The helical scan recorder head rotates in a plane just a few degrees from the parallel of the direction of tape travel. The video tracks are applied to the tape in a pattern approximately 3 degrees to 4 degrees from the longitudinal axis of the tape, depending upon the basic design by the manufacturer.

Learning Event 2:

DESCRIBE SINGLE OR MULTIPLE TACHOMETER OUTPUTS OF VIDEO TAPE RECORDERS

1. Comparison. To compare the recording of a field, or 262 1/2 lines of picture information, with a frame which is two fields on the quadruplex and helical recorders, we will examine the number of lines on the tape involved.

a. The quadruplex recorder requires 16 transverse tracks to record one field or 32 transverse tracks to record one frame which is a complete television picture.

b. The helical recorder uses one diagonal track to record one field or two tracks to record a complete frame.

c. Where the quadruplex recorder uses a track of less than 2 inches in length, the helical scan recorder uses a track which is approximately 19 inches long.

d. With the helical recorder putting the entire television frame on two diagonal lines, you can see how even a slight misalignment or improper spacing of tracks at the various points on the tape could cause a pronounced effect on the picture when it is displayed on a monitor.

2. Location. Below the top deck of the transport is the location of the motor or motors which drive the wheels and pulleys necessary to turn the tape spools and capstan, the necessary tape guide mounting assemblies, the head supports, and other mounting castings. All of these components are a part of the tape transport.

3. Single or multiple motors. The number of motors used to operate the transport mechanism may be one, two, three, or four.

a. In the single motor applications, belts and drive wheels are used to obtain the proper drive speeds on capstan and reels.

b. Some recorders/reproducers use two motors, one motor for the capstan drive and the other providing reel torque.

c. Other models use four motors, one for set feed reel (provides hold-back torque and rewind power), and one set for take-up reel torque.

d. The most common motor is the standard wire-wound synchronous motor. Recently, a new type of motor has been developed. It is the printed circuit motor illustrated in Figures 2-3 and 2-4.

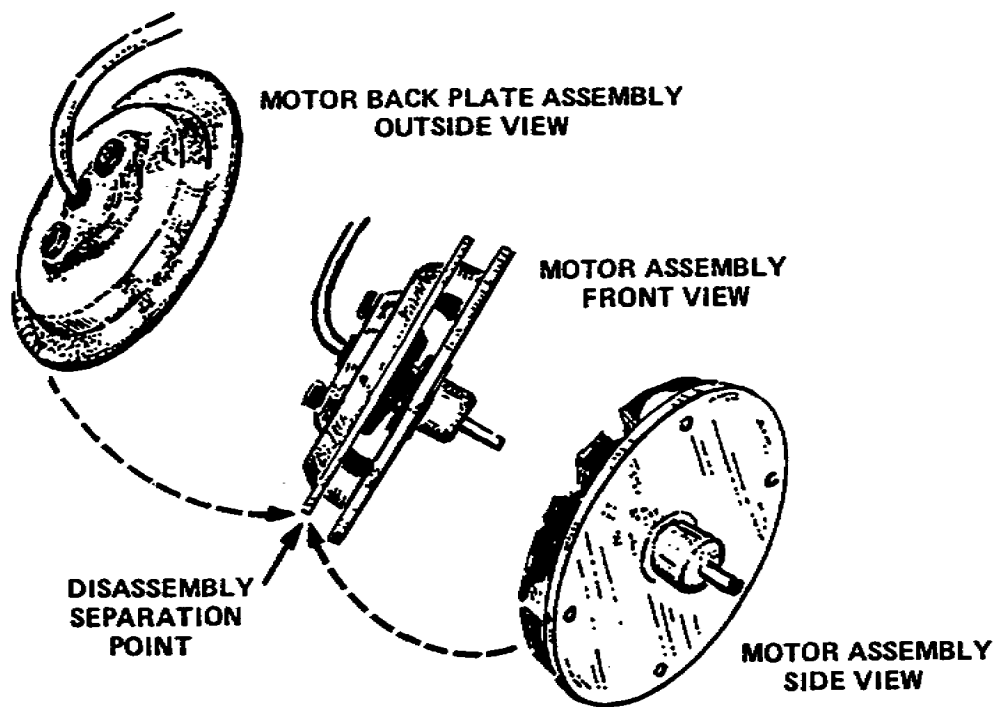


Figure 2-3. Printed circuit motor, outside view

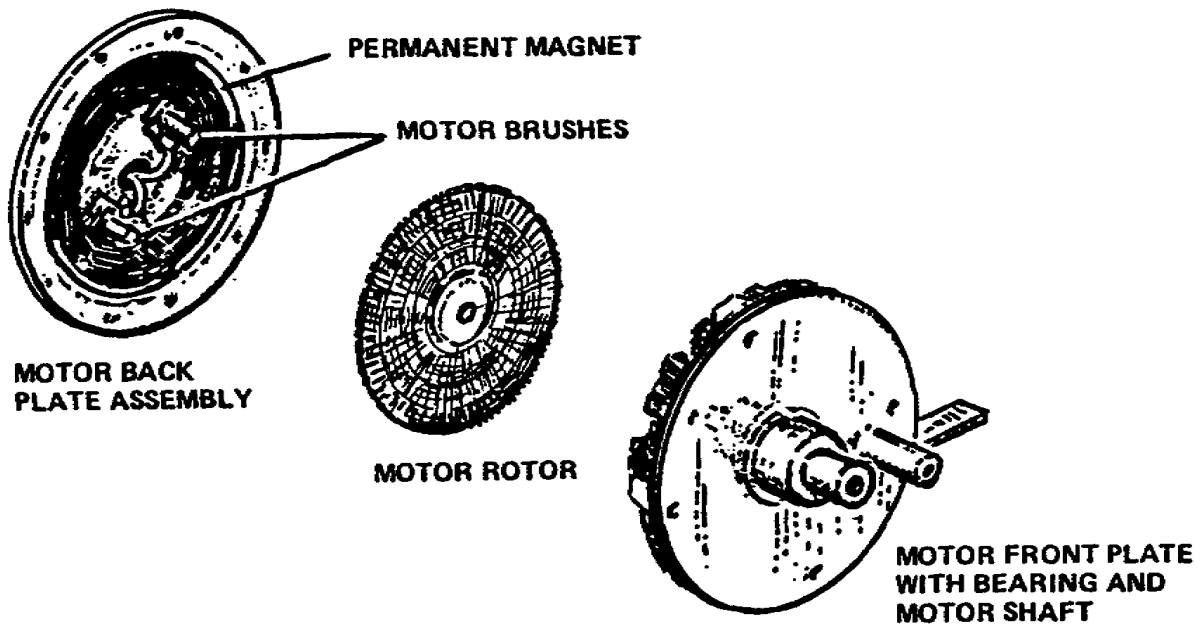


Figure 2-4. Printed circuit motor, exploded view

4. Design. The tape spools are made of heavy aluminum or plastic, designed to prevent warping or damage to the tape. Do not attempt to use any reels/ spools which are not designed to fit the reel turntable. Also, do not attempt to use reels for a different width of tape.

5. Type of tape required. Tape used for recording a new program may be either unused tape or tape that is already recorded. The erasing of tape on the recorder requires the tape to move across the erasing head and takes the same time as recording the tape. However, for faster and more complete erasing of a prerecorded tape, it is best to use a good bulk eraser. With a bulk erase, the entire reel of tape may be erased at one time.

a. In the record mode, normally, the erase heads are all active to provide paths for each of the recording heads. There are variations to this when it is desired to add additional narration without changing the original audio. Depending on the model recorder/reproducer available, various capabilities are available in the record mode. You should refer to and study the operations and maintenance manuals for a specific model for accuracy of operations and maintenance.

b. The playback mode will normally find the erase heads deactivated. The record/reproduce heads are switches to act as input to an amplifier for playback. Again, a selection of activities or mode variations is available, depending on the model of recorder/reproducer in use. For example, one variation of the playback mode found on some recorders/reproducers is that the narration may be recorded while the video is being played back.

6. Speed and types of tachometers. Since the video head is considered the heart of the transport, the speed at which it operates is also important. The audio recorder/reproducer can tolerate some variations in speed, but the video unit cannot.

a. To control the speed of the head, the head drum is controlled by the output of the servo circuit. As previously discussed under frequencies, the servo frequency is a combination of frequency inputs. One of these is the tachometer input used in combination with one or more of the other inputs. The actual design of the tachometer varies among many models. It may be a single magnetic pickup with a single tach detector (fig 2-5) or it may be a wheel with multiple tach detector serrations (fig 2-6) set equally around its circumference to generate pulse into a transducer pickup.

b. The tachometer then mechanically generates pulses relative to the speed of the capstan. Thus, if the actual speed is too slow, an error voltage is generated. The error voltage causes a change in the oscillator frequency that changes the output of the servo-amplifier, and the motor speed increases.

c. The instantaneous correction keeps the transport at the correct speed. On some models a manual tracking control changes the oscillator frequency enough to delay or speed up the drive motor to synchronize it with the tape tracks previously recorded on tape.

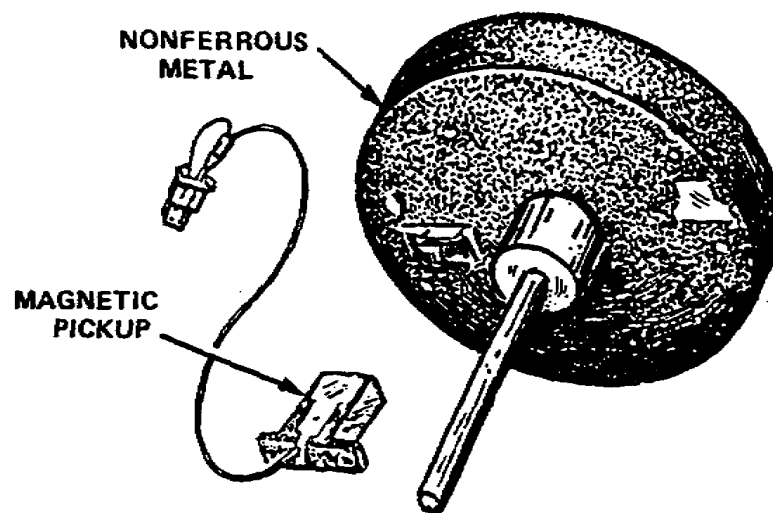


Figure 2-5. Tachometer with single pulse output

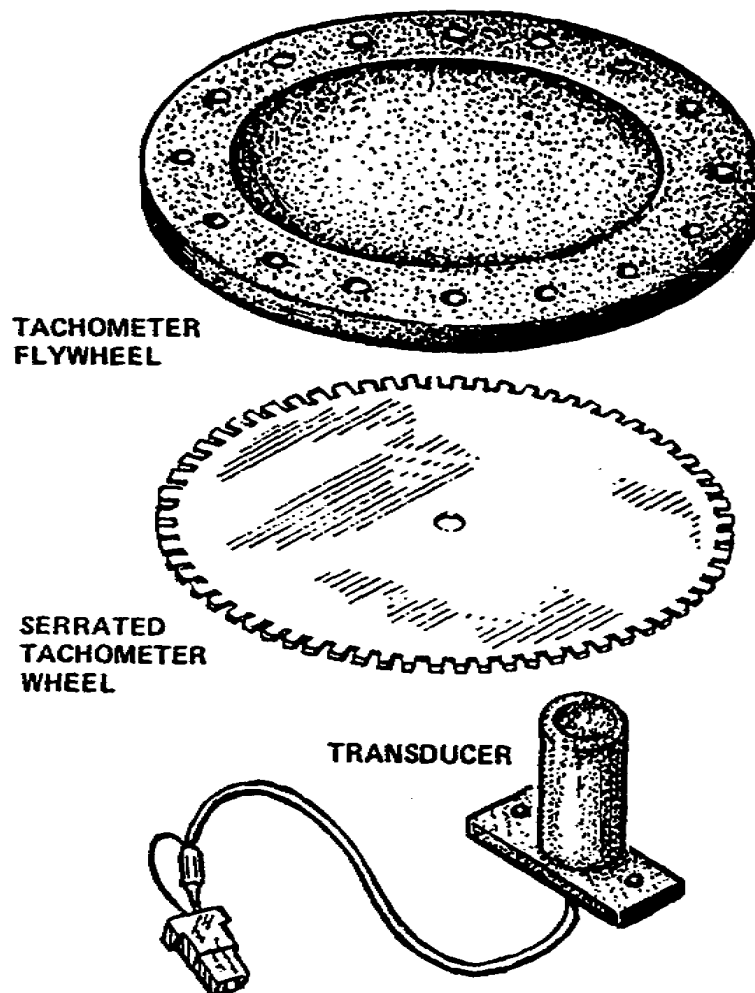


Figure 2-6. Tachometer with multiple pulse output

Lesson 2
Learning Events 1 and 2
PRACTICE EXERCISE

1. What determines the rate of speed by which tape is transported from the supply reel to the take-up reel?
 - a. Main motor drive speed
 - b. Capstan drive speed
 - c. Guide rollers
 - d. Other mechanical devices

2. Where is the capstan located on most machines?
 - a. Before the head drum assembly
 - b. After the head drum assembly
 - c. May vary from machine to machine
 - d. Before and after the head drum assembly

3. On the quadruplex recorders, the head rotates at how many degrees of angle to the tape?
 - a. 23 degrees
 - b. 45 degrees
 - c. 65 degrees
 - d. 90 degrees

4. How many lines of picture information is recorded per field of the tape?
 - a. 150 lines
 - b. 250 lines
 - c. 262 1/2 lines
 - d. 300 lines

5. In the playback mode, how many erase heads are activated normally?
 - a. 1 head is active
 - b. 3 heads are active
 - c. 4 heads are active
 - d. None. All heads deactivated

Lesson 2
Learning Events 1 and 2
ANSWERS TO PRACTICE EXERCISE

1. B
2. C
3. D
4. C
5. D

Learning Event 3:

DESCRIBE PROPER OPERATION AND MAINTENANCE PRACTICES FOR VIDEO TAPE RECORDERS

1. Just as periodic preventive maintenance can reduce the chance of major equipment failure, so can proper adjustments and preoperational procedures lead to good recordings and playbacks. Make visual checks to see that heads are clean (fig 2-7) and that nothing appears bent or otherwise damaged.

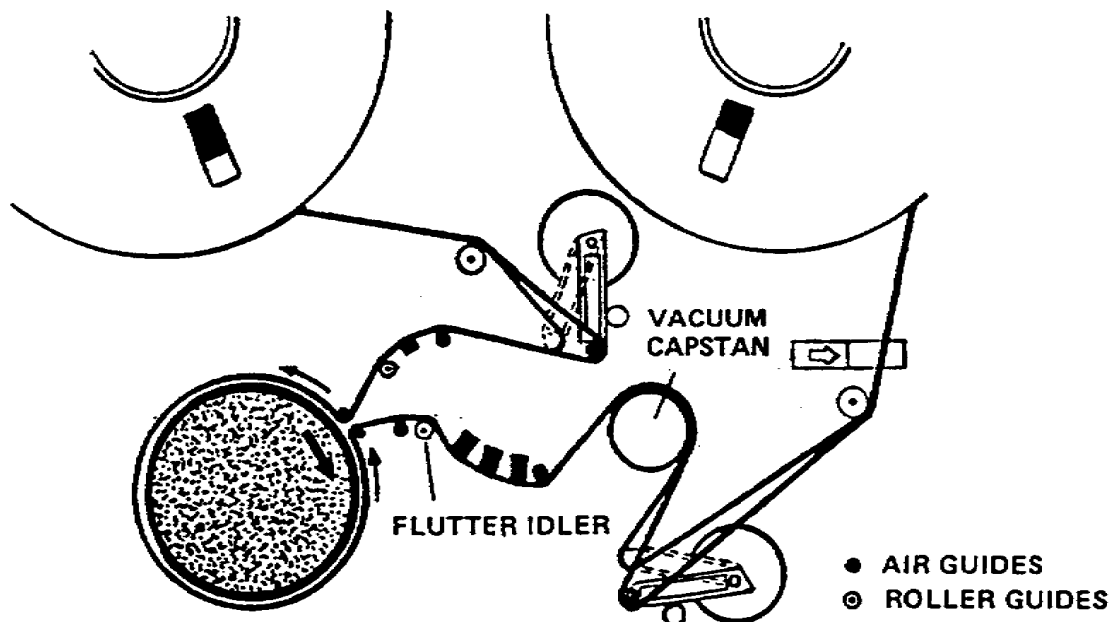


Figure 2-7. Helical scan tape transport, showing points which should be cleaned

a. Be sure that all controls are off prior to applying power; if cords or cables appear damaged, do not use the recorder. Inspect for broken bits of tape or oxide deposits on all of the heads.

b. Once a visual inspection has been made and the unit seems to be in an operable condition, a prerecorded tape may be put on the machine. Figures 2-8 and 2-9 show the method of threading tape on one model video recorder/reproducer. Always reference the manual on the specific model you are using.

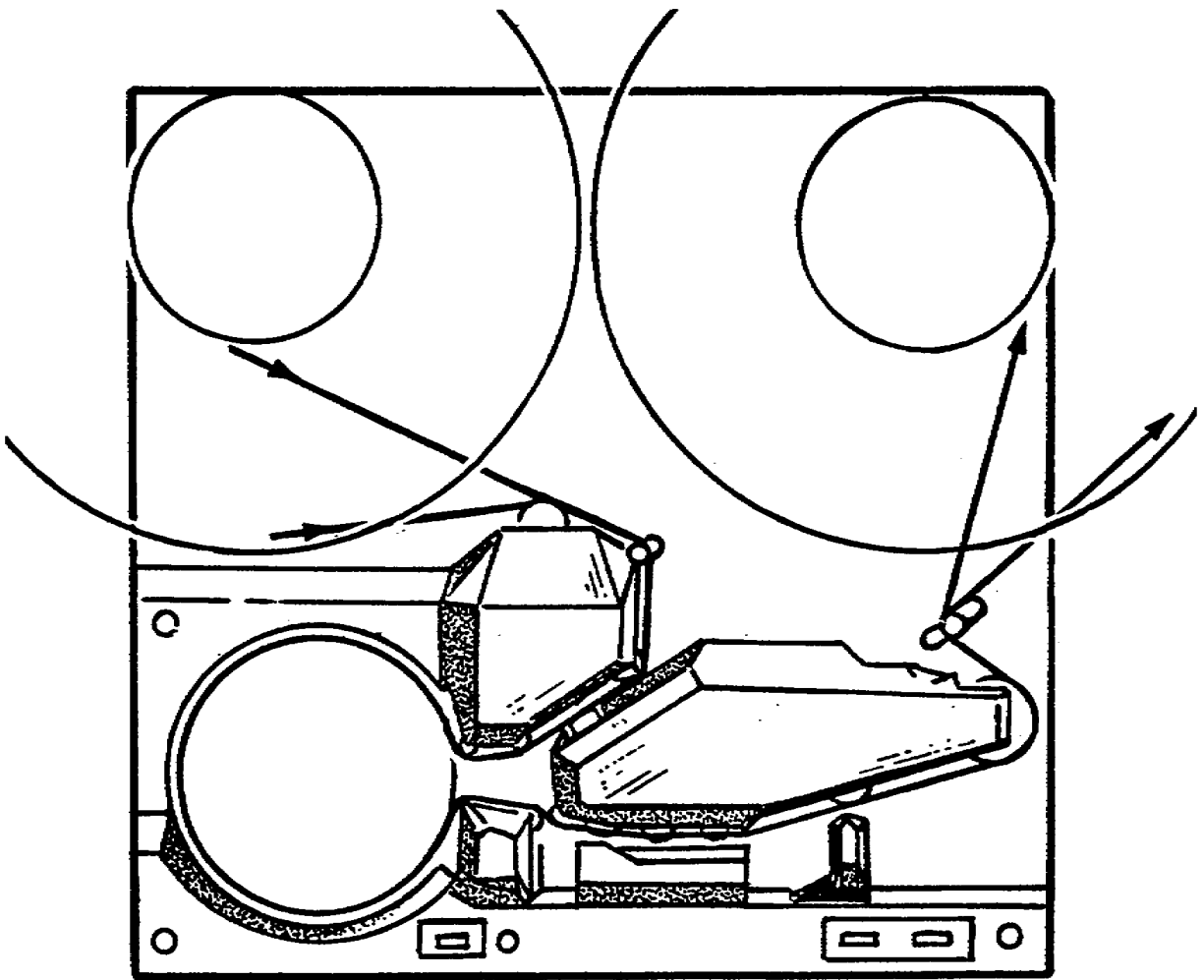


Figure 2-8. Helical scan, tape transport

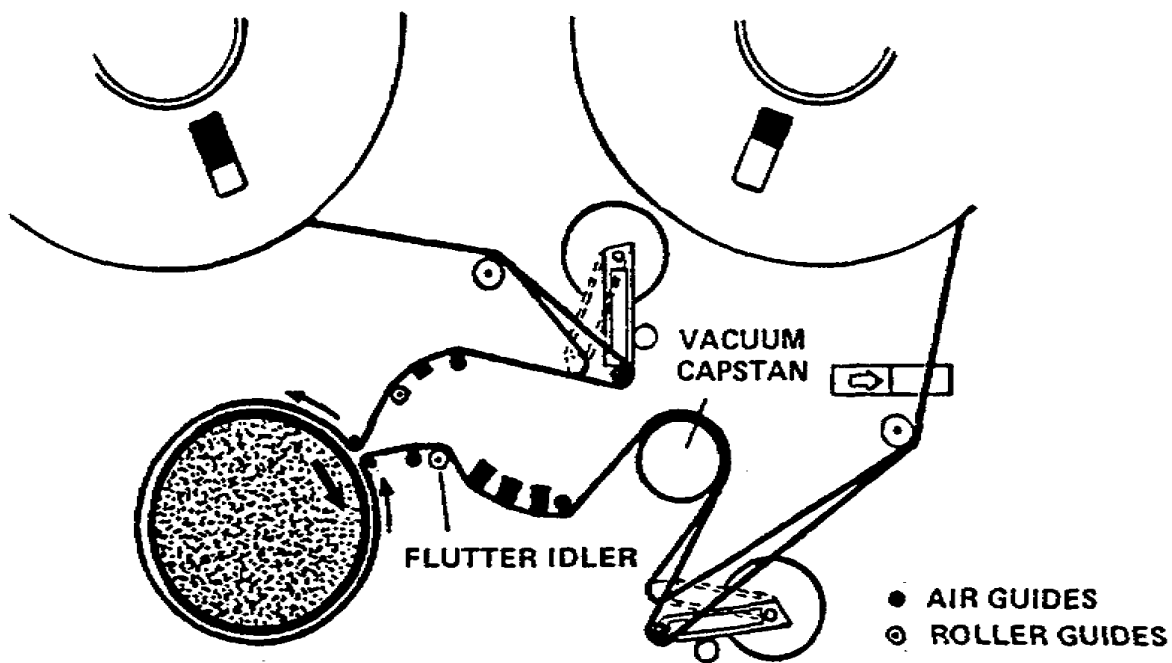


Figure 2-9. Helical scan, tape transport

c. With a tape in position, the machine properly terminated with a monitor, and all controls set for playback, you may test the machine. With a picture on the monitor and sound from the speaker, an overall evaluation of the unit's playback quality can be made.

(1) With a known good tape on the machine and if, during playback, severe picture dropout occurs, check for dirty brushes or commutator, or a clogged video head.

(2) The tracking control may be out of adjustment and require adjustment. Excessive horizontal motion of the monitor picture during a playback could be caused by low-frequency flutter, excessive capstan drive pressure, or possibly a damaged capstan drive wheel.

(3) If the head drum (fig 2-8) will not rotate, check power and fuses or check to see if the tape is too tight around the drum.

(4) If the picture appears noisy, or the playback level is low but the sound is normal, then check for a clogged video head. Also, check for a rough edge on a video head gap which possibly can be corrected by contouring tape. If the problem persists, it may be necessary to replace the head.

(5) If there is a bend at the top of the picture, correct for best vertical linearity by adjusting the tension control on the recorder/reproducer.

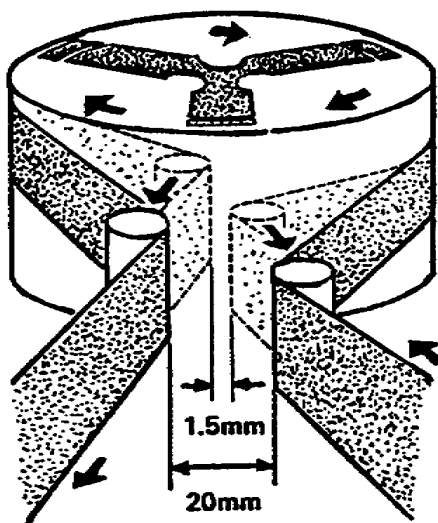


Figure 2-10. Helical scan head drum, showing direction of rotation compared to direction of tape travel

2. Many maintenance problems can be prevented by the analysis of maintenance records and by following recommended maintenance practices, or by the use of the experience you have had with a specific model of machine.

a. As an example, it is recommended on some models to adjust the video head after 100 hours of operation. It would perhaps be appropriate to check the head every additional 100 hours of operation until replacement is necessary.

b. The proper cleaning of heads and visual inspection prior to each day's use eliminates many of the problems caused by dirty heads. This is true for both the video and audio heads.

c. Follow the manufacturer's recommendations for cleaning materials, or the military standard material that has been approved for cleaning the parts.

d. Be sure to use the correct type of cleaner. Some cleaners will dissolve plastic parts or otherwise damage parts.

3. For more extended maintenance, it is wise to follow recommendations for internal inspections, checking reel torque, belt tension, shim clearance, clean drive surfaces, clutch pressure, and many other items for the specific model recorder/reproducer in use. In the event of problems beyond your maintenance authority (operator's level), have your supervisor call a qualified technician.

a. Also, various voltage checks are made in the power supply and on other modules in the unit. Check the maintenance manual for the specific model; be sure that it covers all model or circuit changes, such as replacement of the printed circuit boards which have been modified and/or updated.

b. Use an oscilloscope to check waveform envelope, horizontal blanking balance, interchange envelopes, sync pulses, and other areas as required.

4. When doing maintenance work on equipment and you are doubtful about the shape, size or position of parts, refer to the ILLUSTRATED PARTS BREAKDOWN for a comparison.

a. This may lead to the discovery of a bent, misaligned, worn or grooved part which would not be noticed otherwise.

b. Remember that the oxide coating on the tape will cause wear on the metal parts of the recorder/reproducer and give it a polished appearance. So if parts are too shiny where they should be dull or have uneven surfaces where they should be smooth, then it is time to look for a cause.

Lesson 2
Learning Event 3
PRACTICE EXERCISE

1. You make a visual check of a video recorder to ensure heads are clean. What else must you look for?
 - a. Capstans are greased or lubed
 - b. Proper torque on takeup reel
 - c. Nothing appears bent or damaged
 - d. Tape is in proper position
2. Which of the following is not an element of a playback check of the recorder?
 - a. Controls in playback
 - b. Recorder connected to switches
 - c. Picture on monitor
 - d. Sound coming from the speaker
3. With a known good tape, which of the following could cause severe picture dropout?
 - a. Dirty tension arms
 - b. Dirty capstan poles
 - c. Clogged audio and video erase head
 - d. Clogged video heads
4. How often should the heads of the recorder be cleaned?
 - a. At the beginning of each program
 - b. At the end of each program
 - c. Prior to each day's use
 - d. After each day's use
5. If parts are too shiny where they should be dull or have uneven surfaces, what should you do?
 - a. Nothing. It's just normal wear.
 - b. Look for a cause
 - c. Replace the parts
 - d. Have someone else look at it
6. With the tape in position and the monitor properly terminated, what else must you do to perform a playback test of the recorder?
 - a. Set all controls to record
 - b. Set all controls to pause
 - c. Set all controls to playback
 - d. Set all controls to rewind

Lesson 2
Learning Event 3
ANSWERS TO PRACTICE EXERCISE

1. C
2. B
3. D
4. C
5. B
6. C

LESSON 3
DESCRIBE HOOKUP AND INTERCONNECTION PROCEDURES
OF VIDEO TAPE RECORDERS

TASK

Describe hookup and interconnection procedures of video tape recorders.

CONDITIONS

Given information and illustrations about hookup and interconnection procedures of video tape recorders.

STANDARDS

Demonstrate competency of the task skills and knowledge by correctly responding to 85% of the multiple-choice test covering hookup and interconnection procedures of video tape recorders.

REFERENCES

None

Learning Event 1:

DESCRIBE INTERCONNECTIONS AND HOOKUP OF VIDEO TAPE RECORDERS

1. TV equipment must be connected in order to work. Equipment requires interfacing with other components to perform its designated tasks. Cables are needed to connect or interface the camera to the VTR, electrical outlet or to the monitor.

2. For every signal you want to run between two points, there are two cable connections to be made. Generally one of the two wires inside the cable (fig 3-1a and 3-1b), is the ground wire and the other is the hot conductor. The ground wire is usually wrapped around the hot wire. There is insulation to keep them from touching (fig 3-1c). In order that the signal can flow from point A to point B, the ground and hot wires must be touching the points where the signal originates and where it is being delivered.

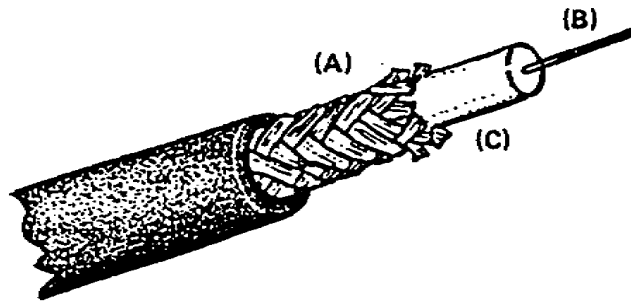


Figure 3-1. RG-59 coaxial cable

3. The input/output plugs marked for audio and possibly for microphones will be of a certain diameter and size depending on the model and the manufacturer (figs 3-2, 3-3, and 3-4 for differences). Before you start assembling cables, you must determine what kind of plugs the equipment will take. Examine the jack panel located on your VTR, monitor and other equipment. Plugs vary in size and design although they all perform the same connection function.



Figure 3-2. The RCA phono plug

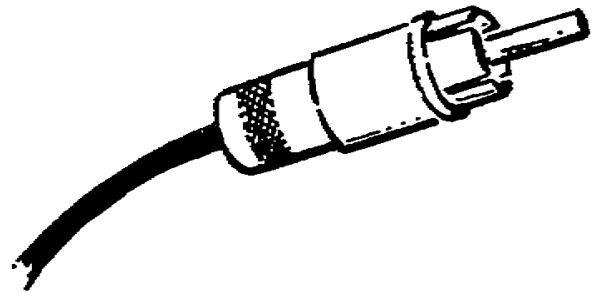


Figure 3-3. XLR plug often referred to as a common plug

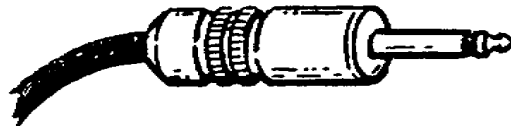


Figure 3-4. The Sony mini-plug

4. Plugs mount on the end of the cable and attach the internal components of the units to each other. The total plug unit includes a male jack (the plug itself) and a female receptacle (the mounting hole that goes on the equipment). Plugging a jack into its receptacle is known as patching. Two jacks plus the cable in between them are known as a patch cord (fig 3-5). When you want to connect a VTR with a monitor you "patch" them together (fig 3-6).



Figure 3-5. Patch cord

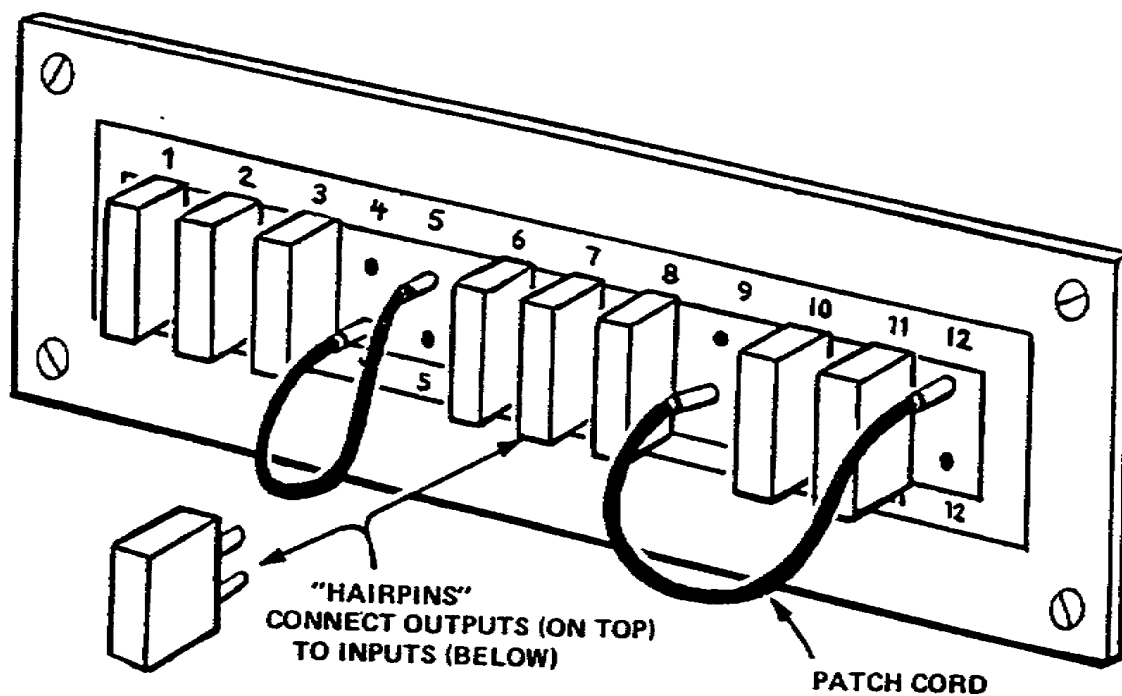


Figure 3-6. Patch panel

a. The mini plug and the phone plug are the two familiar audio plugs. The mini plug is a smaller version of the phone plug (fig 3-7).

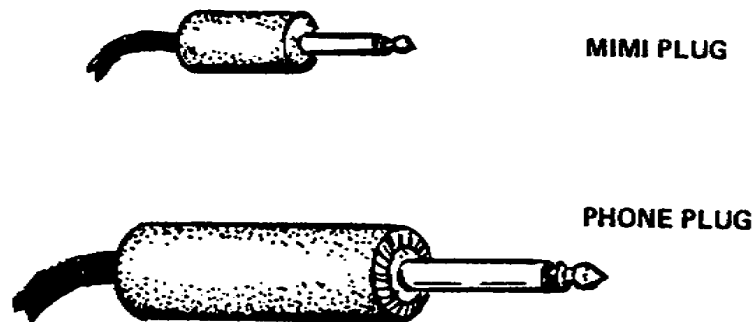


Figure 3-7. Mini plug and phone plug

b. You will also find plug receptacles on some monitors and 1-inch VTRs. These plugs are heavy-duty plugs originally designed to connect microphones to control consoles in recording studios. The plugs and associated receptacles can be either male or female, depending on the manufacturer. These plugs are three-conductor plugs with three pins sticking out of the male jack or receptacle (fig 3-8). There are three holes in the female jack or receptacle. Pin No. 1 of the three-conductor terminals is designed to be used as an overall shield connection. Pin No. 2 is used for the signal conductor, and pin number three for the ground (fig 39).

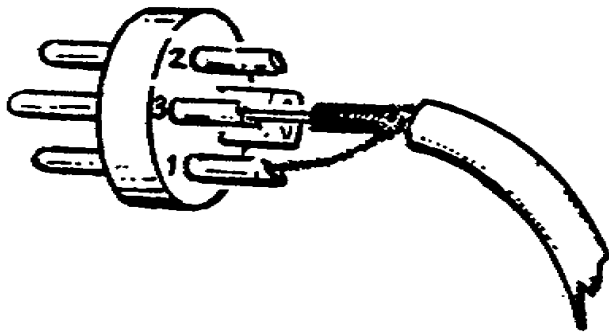


Figure 3-8. Three-conductor plug, male

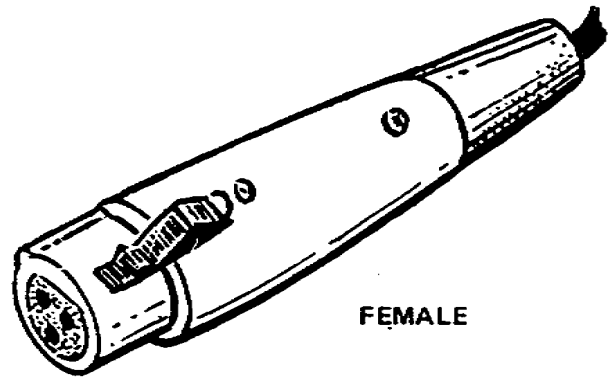
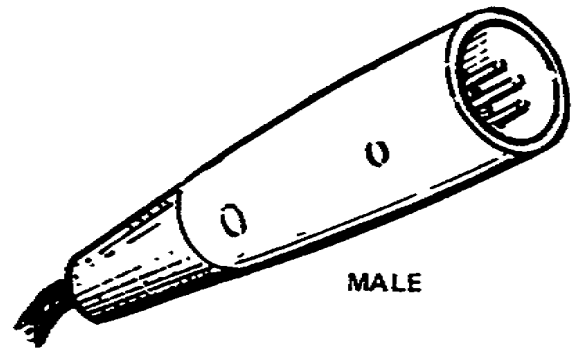


Figure 3-9. Male and female jacks (receptacles)

c. There are several types of video cables and a variety of different plugs. The most common video cable is called coaxial cable. Coaxial cable has a hot conductor which is solid copper wire in the center of the cable. The ground is a mesh of wires encircling the copper wire. There is an insulating material between the hot wire and the ground. The ground itself acts as a shield against extraneous signals.

d. Every coaxial cable has a certain impedance. It will resist the flow of a signal along it to a certain degree and thus, in reverse logic, will maintain a certain signal strength as that signal is conducted along it. The impedance is determined by the construction of the cable, the thickness of the hot conductor and ground, and the distance between the inner core conductor and the outer ground. In essence, impedance is the resistance to signal flow along a given length of cable. The following cautions should be observed:

(1) Do not bend, knot, twist or step on your cables.

(2) Never tug on the cable itself. Always insert and remove them from the receptacles by gripping the jack.

(3) Store cables by looping them into large coils and storing them out of the way. Exceptionally long cables whose full length is not always needed can be stored on 16mm film reels.

Learning Event 2:
DEFINE TYPES OF VIDEO OUTPUTS

1. Two types of video outputs are provided on most machines. One is a standard pure video output (fig 3-10) which is a fully composite video signal, suitable for connecting directly to a monitor. The other output is an RF signal (fig 3-11 and 3-12), suitable for connecting to the antenna terminals of a home TV set. When the tape is in the playback mode a video signal is always present at both the video out and the RF out. In the record and editing modes, the input signals to the machine are seen at both outputs.

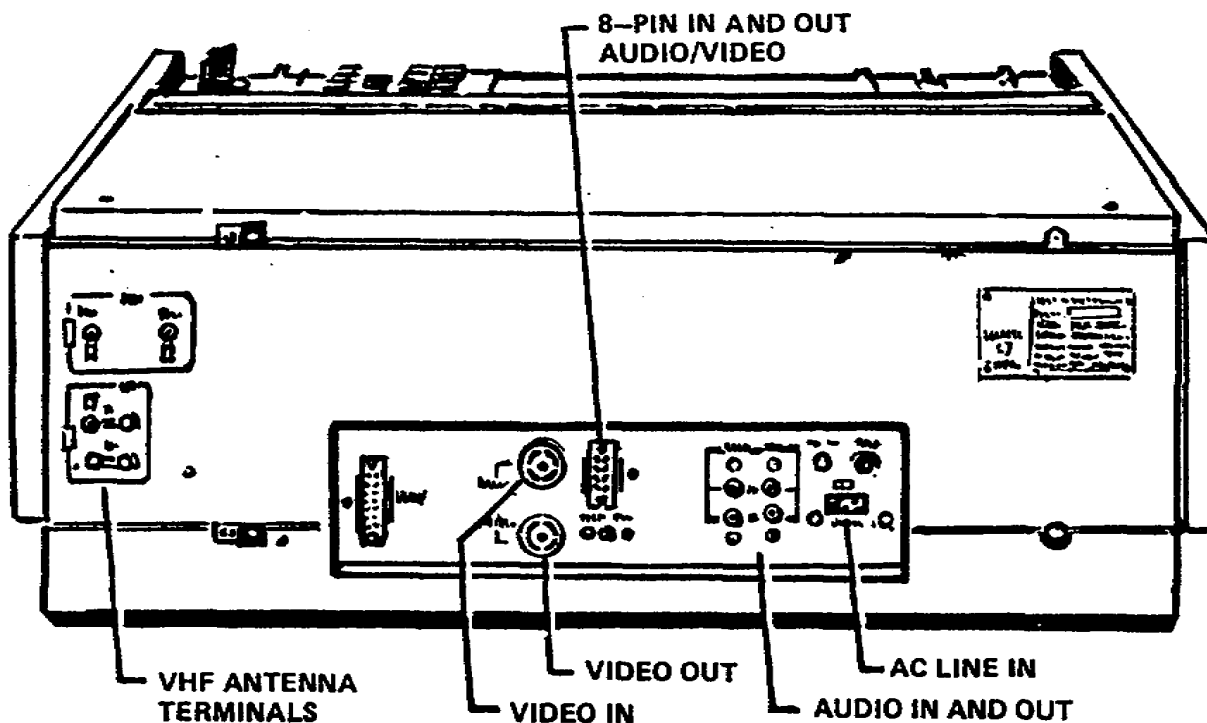


Figure 3-10. Standard pure video output

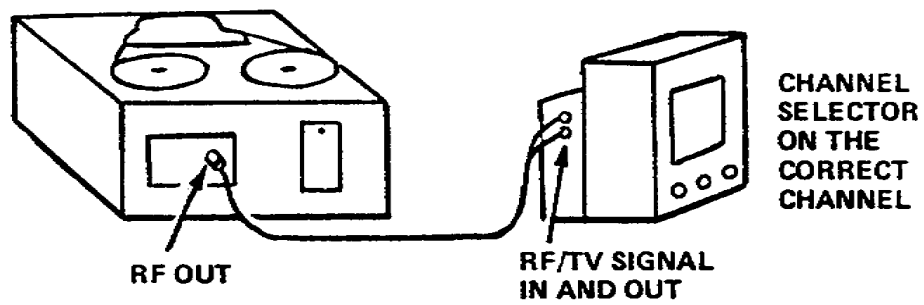


Figure 3-11. RF signal output

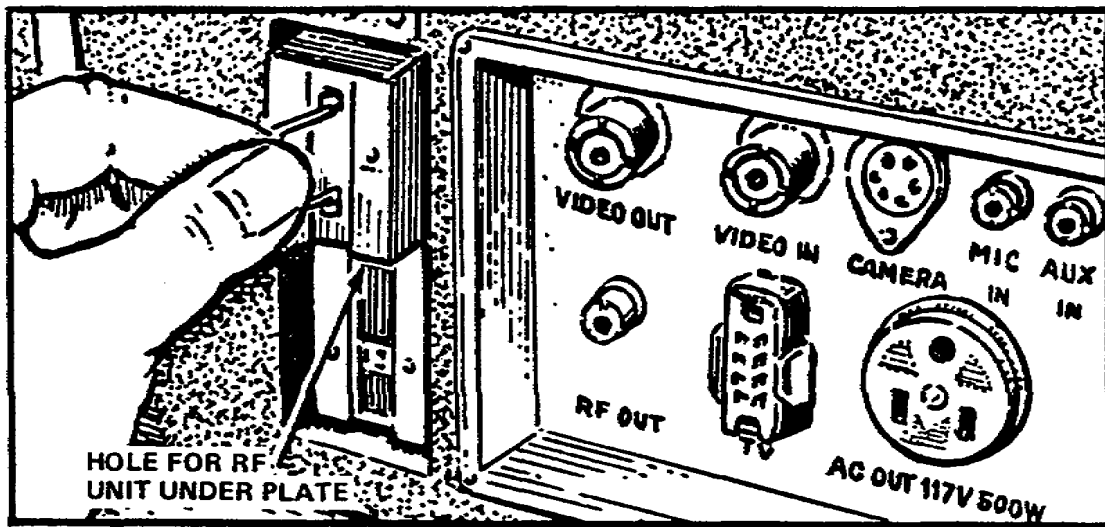


Figure 3-12. Place where RF generator plugs into a Sony 3600 VTR

a. In most of the cassette machines two identical audio channels are provided, one for each of the tracks on the tape. Each has an independent line output socket. The output of the channel is present whenever power is turned on. Many models have an audio monitor jack, the output of which is selected by a switch on the front panel and can be either Channel 1, Channel 2, or a mixture of both (fig 3-13).

b. The video out of the cassette machine is connected to the video in of the monitor (fig 3-13). If there are two video inputs to the monitor, the either can be used. The TV monitor will have an audio input. This is connected by a separate cable to the line out of the machine. Use the output of the channel with the audio recorded on it. If no sound is heard, then try the other line out socket (fig 3-14).

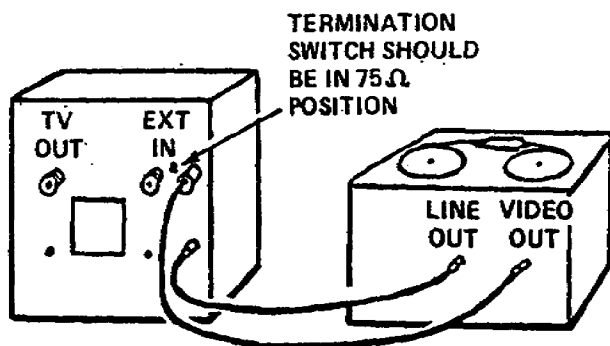


Figure 3-13. Wiring separate audio and video to your monitor

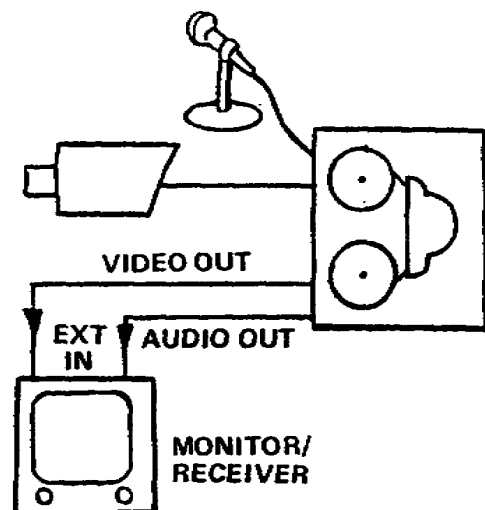


Figure 3-14. Separate audio and video cables from VTR

c. Recording on a video cassette requires video and audio inputs. When recording, the connections to the machines must be made in addition to those required in playback. A difficult aspect of recording is in making the proper connection (fig 3-15).

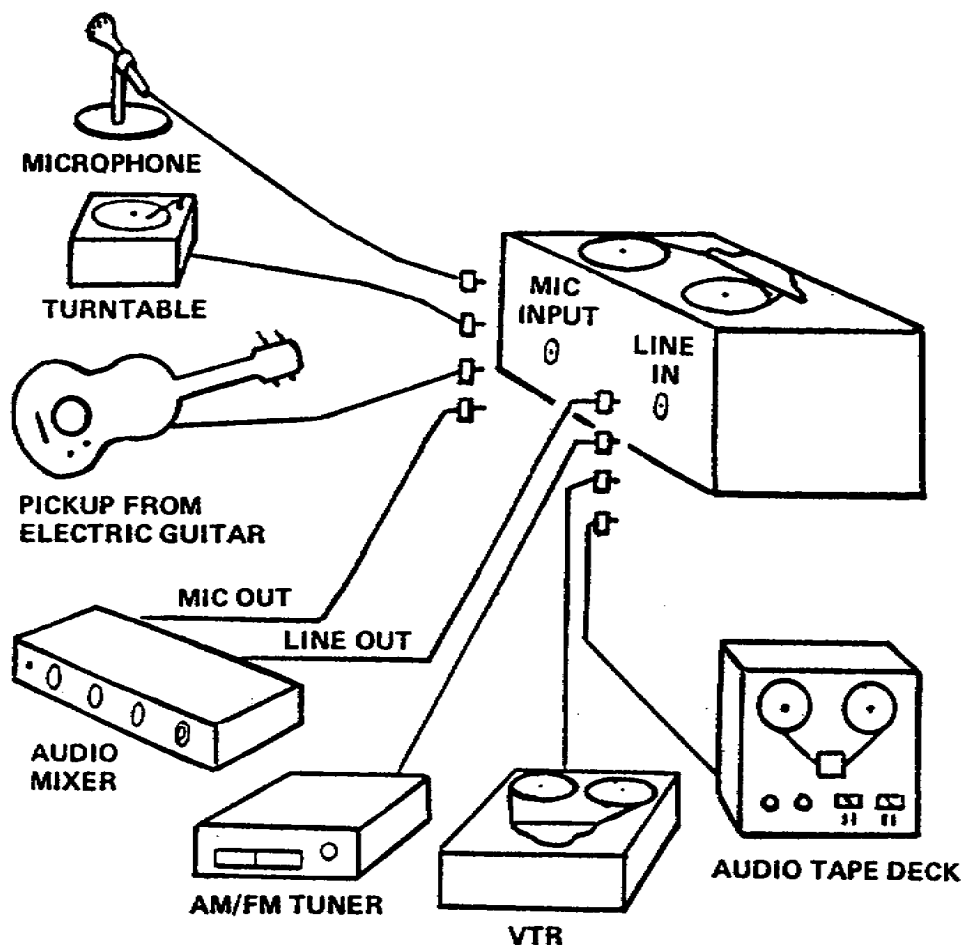


Figure 3-15. High and low level audio sources

d. Two video inputs are provided to the record electronics on the machines. The simplest for the operator is that from the internal TV tuner. This requires no connections other than the antenna at the rear of the machine, where a normal TV or CATV antenna or lead is connected. The input select switch is set to the int or TV position, and this switches the video and audio to the input of the machine. The other video input is a video in socket which enables various external sources to be connected. In this mode the select switch is set to the ext position, which routes the video and audio inputs to the record amplifiers (fig 3-15).

e. A microphone can be plugged into the mic input (fig 3-15). Either channel can be used in the normal record mode, but only Channel 1 if audio dubbing. Most microphones will work but it is advisable to check with a test recording first. Levels and the impedance may not be suitable.

f. Small mixers will be encountered frequently. Most have a line out or a high level output, which will be around 0 level. Both balanced and unbalanced outputs will be found on different models. These should be connected to the line in or aux in of the cassette machine. Not all mixers have a meter or a master level control, so sometimes the exact level out will be in doubt. Again, a test recording is advised in these circumstances (fig 3-16).

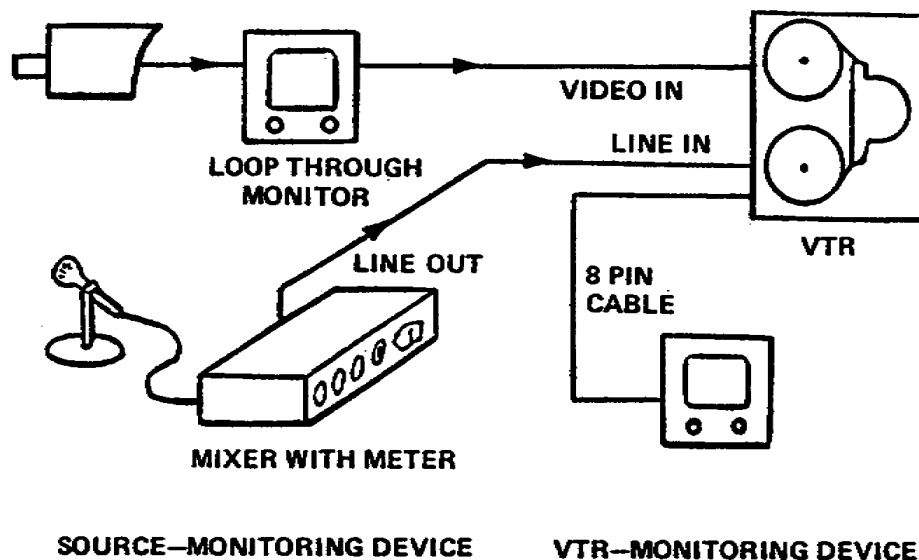


Figure 3-16. Source-monitoring device and VTR-monitoring device

g. The test line should be connected directly to the line in or aux in. In most cases the impedances and levels will be suitably matched and no difficulties should be encountered in the connection of the testline.

Lesson 3
Learning Events 1 and 2
PRACTICE EXERCISE

1. What are the purposes of the two (2) wires in a coaxial cable?
 - a. Hot wire, B+ lead
 - b. Hot ground, hot wire
 - c. Ground conductor, hot wire
 - d. Hot conductor, ground wire

2. What are the purposes of each of the three pins in a three conductor plug?
 - a. Ground, conductor and connection
 - b. B+, signal shield and hotwire
 - c. Signal wire, hot wire, safety shield
 - d. Male plug, female plug, and neutral plug

3. What term would you use when referring to the connection of a recorder to an input or output source?
 - a. Interconnecting
 - b. Patching
 - c. Plugging
 - d. System mounting

4. What are the two types of video outputs on most recorders?
 - a. Patched video and line in out
 - b. Record video and playback video
 - c. Composite video signal and RF signal
 - d. Sync video and AFC signal

5. Coaxial cable impedance is determined by cable construction, the thickness of the hot conductor and ground, and what other factor?
 - a. Signal strength input
 - b. Number of line amplifiers needed in a circuit
 - c. Distance between the inner core conductor and outer ground
 - d. Number of connections required on a distribution circuit

Lesson 3
Learning Events 1 and 2
ANSWERS TO PRACTICE QUESTIONS

1. D
2. A
3. B
4. C
5. C