



8

OTHER SOUND EQUIPMENTS

8.1 INTRODUCTION

In the previous lesson, you have studied the details about loudspeakers. Now, let us learn about the other sound equipment. In this lesson, we will cover what are the other sound equipment are like amplifiers and their types, working, and other recording and playback equipment. Other sound equipment like CD player, DVD Player, sound mixers have become part and parcel of the overall sound system may be in a home or a big auditorium.

8.2 OBJECTIVES

After reading this lesson, the learner will be able to :

- understand basics of audio recorders and DVD players etc.
- describe pre-Amplifiers and amplifiers
- explain frequency response of sound equipment
- explain Total Harmonic Distortion and Signal to Noise Ratio(SNR)

8.3 PRE-AMPLIFIERS

A preamplifier (preamp) is an electronic amplifier that prepares a small electrical signal for further amplification or processing. A preamplifier is required to amplify a signal, when the source level is too low and has to be pre-amplified in order to be able for further processing, control or any other use. The short form used for preamplifier, *preamp*, has become more used in spoken and written language simply because it is shorter. Other spellings are *pre amp* / *pre-amp* and *pre amplifier* / *pre-amplifier*.



DO YOU KNOW?

A preamplifier *measures signals from sensors or other devices in a variety of situations such as sound, temperature, light, movement, pressure etc. In the equipments for industrial, scientific, telecommunications, space, fiber optics or data links, the frequency range may cover from dc up to many hundred GHz.*

REMEMBER

Preamplifiers are of three types:

- the current-sensitive preamplifier
- the parasitic-capacitance preamplifier
- Charge sensitive preamplifier

8.4 WORKING OF PRE-AMPLIFIERS

Voltage and Current

A pre-amplifier, or preamp, takes electrical current from a transducer and increases its voltage gain to a higher level.

Audio signals

Many electronic audio devices have weak audio signal output. A preamp boosts that signal to what is called line-level. Line-level essentially means, the sound coming through the speakers or amplifier is loud enough to be heard at the sound systems' nominal voltage output level or good enough to be fed to main amplifier.

8.5 AUDIO AMPLIFIERS

DO YOU KNOW?

The audio amplifier was invented in 1909 by Lee De Forest when he invented the triode vacuum tube. The triode was a three terminal device with a control grid that can modulate the flow of electrons from the filament to the plate. The triode vacuum amplifier was used to make the first AM radio. Audio power amplifiers based on transistors became practical with the wide availability of inexpensive transistors in the late 1960s.



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8.6 POWER AMPLIFIER

A power amplifier is an electronic device that receives an electrical signal and reprocesses it to amplify, or increase, its power. The boost in power is achieved by significantly increasing the input signal's voltage. A power amplifier is used to power an output source, such as a stereo speaker, a relay or a motor. Its applications include public address systems, theatrical and concert sound reinforcement systems too.

Amplifier classification

- Class A: Single-ended; the amplifier device is biased about the center of the input signal swing.
- Class B: Push-pull; each device conducts over half the input signal swing.
- Class AB: Push-pull; each device conducts over slightly more than half the input signal swing to simplify crossover.
- Class C: Used in radio-frequency applications, the output device drives a resonant “tank” circuit consisting of an inductor and one or two capacitors. It conducts for only a short portion of each input cycle.
- Class D: It's found primarily in audio applications – either in vehicles, where it achieves high output levels, or in personal audio devices, where its efficiency contributes to long battery life. In a class D amplifier, power field-effect transistors (FETs) are driven to produce an output square-wave that switches between a high and low level at a frequency outside the range of human hearing. Instead of modulating the amplitude, internal circuitry modulates the duty cycle of the square-wave at a rate corresponding to the level of the input signal when the output is filtered down to audio band.

Classes E and F are subsets of Class C. Classes G and H are like class AB amplifiers, but with multiple power rails.

INTEXT QUESTIONS 8.1

1. A preamplifier is a/an amplifier that prepares a small electrical signal

(a) electronic	(b) electrical
(c) electro-static	(d) magnetic
2. A pre-amplifier takes electrical current from a

(a) transistor	(b) capacitor
(c) transducer	(d) timer



3. The audio amplifier was invented in 1909 by
 - (a) C Das
 - (b) Lee De Forest
 - (c) J C Bose
 - (d) James Watt
4. Most audio amplifiers areamplifiers
 - (a) linear
 - (b) parallel
 - (c) modular
 - (d) parabolic
5. A power amplifier is used to power an
 - (a) input source
 - (b) alternate source
 - (c) output source
 - (d) external source

8.7 FREQUENCY RESPONSE

Frequency response is the quantitative measure of the output spectrum of a system or device in response to a stimulus, and is used to characterize the dynamics of the system. Frequency response is a specification used in amplifiers, pre-amplifiers, CD players, tape decks and other audio components to measure how uniformly it reproduces sounds from the lowest tones to the highest.

Expression of Frequency Response

Frequency response is usually measured within the range of hearing, from a low of 20Hz to a high of 20kHz, although some believe that frequencies above and below this range, known as wideband frequency response are equally important. Frequency response specifications indicate how well the device remains uniform. For example, a frequency response specification of 20Hz-20kHz +/- 3dB indicates that the maximum variation in level or volume from the lowest to the highest tone (frequency) will not exceed three decibels. A range of three dB is common in frequency response specifications.

Uniform or flat frequency response is important because every instrument or voice should be heard as originally recorded. The delicate sound of a triangle should be heard as well as the crash of a cymbal. The amplifier or other device should not raise or lower the level of any sound from the original recording.

Nonlinear Frequency Response

If the system under investigation is nonlinear then applying purely linear frequency domain analysis will not reveal all the nonlinear characteristics. To overcome these limitations generalized frequency response functions, and nonlinear output



frequency response functions have been defined that allow the user to analyze complex nonlinear dynamic effects. The nonlinear frequency response methods reveal complex resonance, inter modulation and energy transfer effects that cannot be seen using a purely linear analysis and are becoming increasingly important in a nonlinear world.

Need for Wideband Frequency Response

As you are already aware, frequency is a term used to describe tone and it is measured in Hertz. Low tones are known as bass, midrange tones are in the range of the human voice, and high tones are musical instruments such as a cymbal. The human ear is capable of hearing low tones from approximately 20 Hertz (abbreviated 20Hz) to high tones up to 20 kilohertz (abbreviated 20 kHz). 20 Hz is very low, deep bass and 20 kHz is probably beyond the range of human hearing. The range of human hearing is dependent on the health of the ear and age. As we age, our range of hearing is reduced.

8.8 TOTAL HARMONIC DISTORTION (THD)

Total Harmonic Distortion or THD is an amplifier specification that compares the output signal of the amplifier with the input signal and measures the level differences in harmonic frequencies between the two. The difference is called total harmonic distortion.

Total harmonic distortion is measured as a percentage, such as 0.004% THD. This means that the level of harmonic distortion is 0.004% of the total output signal. Lower percentages are better.

DO YOU KNOW?

In reality, total harmonic distortion is hardly perceptible to the human ear. Every component adds some level of distortion, but most distortion is insignificant and small differences in specifications between components mean nothing. Some components have distortion so low it cannot be accurately measured. Listening to a component and evaluating its sound characteristics is the most important way to judge a product. Other considerations, such as room acoustics and selecting the right speakers are more important than the percentage of total harmonic distortion

8.9 SIGNAL TO NOISE RATIO (SNR)

Signal to noise ratio is a specification that measures the level of the audio signal compared to the level of noise present in the signal. Signal to noise ratio

specifications are common in many components, including amplifiers, phonograph players, CD/DVD players, tape decks and others. Noise is described as hiss, as in tape deck, or simply general electronic background noise found in all components.

The signal to noise ratio is the difference between the noise floor and the reference level. The reference level is determined by the person making the measurements. For amplifiers, the reference may be full power, one volt, and one watt into a given load or any number of other things. For you to compare two pieces of equipment which were tested by different methods, you must know precisely what reference was used.



Notes

8.10 RECORDING AND PLAYBACK EQUIPMENT

Turn table

Turntablism is the art of manipulating sounds and creating music using phonograph turntables and a DJ mixer. The word *turntablist* was coined in 1995 by DJ Babu to describe the difference between a DJ who just plays records and one who performs by touching and moving the records, stylus and mixer to manipulate sound. The new term coincided with a resurgence of the art of hip hop style-style DJ-ing in the 1990s. John Oswald described the art: “A phonograph in the hands of a ‘hip hop/scratch’ artist, who plays a record like an electronic washboard with a phonographic needle as a plectrum, produces sounds which are unique and *not* reproduced the record player becomes a musical instrument.” Some turntablist DJs use turntable techniques like beat mixing/matching, scratching and beat juggling. Some turntablists seek to have themselves recognized as traditional musicians capable of interacting and improvising with other performers.

Operation of a Turntable:

1. Lift the dust cover from the turntable
2. Place the record onto the platter
3. Put the platter into motion
4. Lift or cue the tone arm
5. Lower the stylus onto the record
6. Put the tone arm back into place when the record is over

8.11 GRAMOPHONE RECORD

A gramophone record is a type of analog storage medium. It stores recorded music (or other sounds). It was popular during most of the 20th century.



Notes

Gramophone records are played on a phonograph (“record player”) shown in Fig 8.1. A gramophone record is a flat disk that is made of plastic. The sound is recorded on a very fine line or groove which goes around and around in a spiral from the outside edge of the disk to the center. The phonograph plays the sound with a needle that touches the groove. A record usually has different music on each side. When made of vinyl they were also known as vinyl records. Most music made in the 20th century used this format.



Fig. 8.1: Gramophone record player

8.12 AUDIO TAPE RECORDER

An audio tape recorder is an audio storage device that records and plays back sounds, including articulated voices, usually using magnetic tape, either wound on a reel or in a cassette, for storage. In its present day form, it records a fluctuating signal by moving the tape across a tape head that polarizes the magnetic domains in the tape in proportion to the audio signal. Figure 8.2 and 8.3 below show cassette and spool tape recorders respectively.



Fig. 8.2: Cassettee Tapr Recorder



Fig. 8.3: Spool Tape recorder

An audio tape recorder, tape deck or tape machine is an audio storage device that records and plays back sounds, including articulated voices, usually using magnetic tape, either wound on a reel or in a cassette, for storage. In its present day form, it records a fluctuating signal by moving the tape across a tape head that polarizes the magnetic domains in the tape in proportion to the audio signal. Tape-recording devices include reel-to-reel tape deck and the cassette deck.



Notes

REMEMBER

Earliest variant: non-magnetic wax strip recorder

The earliest known audio tape recorder was a non-magnetic, non-electric version invented by Alexander Graham Bells' Volta laboratory and patented in 1886 (U.S. Patent 341,214)

Photoelectric variant

In 1932, after six years of developmental work, Merle Dust on, a Detroit radio engineer created a tape recorder that used a low-cost chemically treated paper tape, capable of recording both sounds and voice.

Magnetic recording

Magnetic recording was conceived of as early as 1877 by the American engineer Oberlin smith and demonstrated in practice in 1898 by Danish engineer Valdemar Poulsen. Analog magnetic wire recording, and its successor, magnetic tape recording, involve the use of a magnetizable medium.

Steel wire magnetic recorder variant

The first wire recorder was the Valdemar Poulsen Telegraphone of the late 1890s, and wire recorders for law/office dictation and telephone recording were made almost continuously by various companies (mainly the American Telegraphone Company) through the 1920s and 1930s.

8.13 COMPACT DISC

Compact disc, or CD for short, is a digital optical disc data storage format. The format was originally developed to store and play back sound recordings only (CD-DA), but was later adapted for storage of data (CD-ROM). Several other formats were further derived from these, including write-once audio and data storage (CD-R), rewritable media (CD-RW), Video Compact Disc (VCD), Super Video Compact Disc (SVCD), Photo CD, Picture CD, CD-i, and Enhanced Music. Audio CDs and audio CD players have been commercially available since October 1982. Standard CDs have a diameter of 120 milli metres (4.7 in) and can



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hold up to 80 minutes of uncompressed audio or 700 MiB (actually about 703 MiB or 737MB) of data. The Mini CD has various diameters ranging from 60 to 80 milli metres (2.4 to 3.1 in); they are sometimes used for CD singles, storing up to 24 minutes of audio or delivering device drivers. Figure 8.4 shows a CD player.



Fig. 8.4: A C D Player

Variations of compact discs designed for use with computers include CD-ROM, CD-R, CD-RW, DVD-ROM, DVD-RAM, DVD-R, DVD+RW and Photo CD

DO YOU KNOW?

The first CD recorders were made available in 1988, but were not an option for the average home recorder because, with the requisite hardware and software, they cost upwards of \$100,000. At a weight of 600 pounds, the Meridian Data CD Professional was the first CD recorder. Today's CD recorders typically weigh a few pounds and can be bought for less than \$300.

8.14 DVDS

DVD is a digital optical disc storages format, invented and developed by Philips, Sony, Toshiba, and Panasonic in 1995. DVDs offer higher storage capacity than compact discs while having the same dimensions.

Formats

DVD-Video is the format designed for full-length movies that work with your television set.

DVD-ROM is the type of drive and disc for use on computers. The DVD drive will usually also play regular CD-ROM discs and DVD-Video disks. Fig. 8.5 below.



Fig. 8.5: A DVD

DVD-RAM is the writeable version.

DVD-Audio is a CD-replacement format.

8.15 RECORDING AND EDITING SOFTWARES

Audacity is a free, easy-to-use, multi-track audio editor and recorder for Windows, Mac OS X, GNU/Linux and other operating systems. The interface is translated into many languages. You can use Audacity to:

Features of Audacity

- Record live audio.
- Record computer playback on any Windows Vista or later machine.
- Convert tapes and records into digital recordings or CDs.
- Edit WAV, AIFF, FLAC, MP2, MP3 or Ogg Vorbis sound files.
- Cut, copy, splice or mix sounds together.
- Change the speed or pitch of a recording.
- Import and Export Import sound files, edit them, and combine them with other files or new recordings. Export your recordings in many different file formats, including multiple files at once. Import and export WAV, AIFF, AU, FLAC and Ogg Vorbis file
- Sound Quality Supports 16-bit, 24-bit and 32-bit (floating point) samples (the latter preserves samples in excess of full scale). Sample rates and formats are converted using high-quality resampling and dithering..Tracks with different sample rates or formats are converted automatically in real time



8.16 WHAT HAVE YOU LEARNT

- A preamplifier (preamp) is an electronic amplifier that prepares a small electrical signal for further amplification or processing.
- An Audio amplifier can be classified into many classes depending upon the class of operation like A , B , AB , C , D , E f and G
- Frequency response is the quantitative measure of the output spectrum of a system or device in response to a stimulus, and is used to characterize the dynamics of the system.
- Frequency response is usually measured within the range of hearing, from a low of 20Hz to a high of 20kHz
- Total Harmonic Distortion or THD is an amplifier specification that compares the output signal of the amplifier with the input signal and measures the level differences in harmonic frequencies between the two. The difference is called total harmonic distortion.
- Signal to noise ratio is a specification that measures the level of the audio signal compared to the level of noise present in the signal.
- Turntablism is the art of manipulating sounds and creating music using phonograph turntables and a DJ mixer.
- A gramophone record is a type of analog storage medium. It stores recorded music (or other sounds).
- An audio tape recorder is an audio storage device that records and plays back sounds, including articulated voices, usually using magnetic tape, either wound on a reel or in a cassette, for storage.
- Compact disc, or CD for short, is a digital optical disc data storage format.
- DVD is a digital optical disc storages format, invented and developed by Philips, Sony, Toshiba, and Panasonic in 1995.
- Audacity is a free, easy-to-use, multi-track audio editor and recorder for Windows, Mac OS X, GNU/Linux and other operating systems

8.17 TERMINAL QUESTIONS

1. Describe the history and operation of a turntable
2. Give classification of Audio amplifier on the basis of class of operation in brief.

3. Explain the term signal to noise ratio (SNR) .
4. Describe Audacity highlighting the various features of Audacity.



Notes

8.18 ANSWER TO IN TEXT QUESTIONS

8.1

1. (a) 2. (c) 3. (b) 4. (a) 5. (c)