Dr. Babasaheb
Ambedkar
Open University

BCADES-105
DIGITAL AUDIO

Block

1

ELEMENTS FOR SOUND

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ROLE OF SELF INSTRUCTIONAL MATERIAL IN DISTANCE LEARNING

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To ensure effective instruction, a number of instructional design ideas are used and these help students to acquire knowledge, intellectual skills, motor skills and necessary attitudinal changes. In this respect, students' assessment and course evaluation are incorporated in the text.

The nature of instructional activities used in distance education self- instructional materials depends on the domain of learning that they reinforce in the text, that is, the cognitive, psychomotor and affective. These are further interpreted in the acquisition of knowledge, intellectual skills and motor skills. Students may be encouraged to gain, apply and communicate (orally or in writing) the knowledge acquired. Intellectual- skills objectives may be met by designing instructions that make use of students' prior knowledge and experiences in the discourse as the foundation on which newly acquired knowledge is built.

The provision of exercises in the form of assignments, projects and tutorial feedback is necessary. Instructional activities that teach motor skills need to be graphically demonstrated and the correct practices provided during tutorials. Instructional activities for inculcating change in attitude and behavior should create interest and demonstrate need and benefits gained by adopting the required change. Information on the adoption and procedures for practice of new attitudes may then be introduced.

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Divide and to bring this Self Instructional Material as the best teaching and communication tool. Instructional activities are varied in order to assess the different facets of the domains of learning.

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All the best for your studies from our team!

DIGITAL AUDIO

Block 1 ELEMENTS FOR SOUND

Unit 1 BASIC OF SOUND

Learning Objectives:

- Understanding Sound Waves & Properties
- Understanding Waves interaction
- Understanding Sound systems

UNIT 2 EXPLAINING TOOL BOX

Learning Objectives:

- Knowing Audio Cables

Block 2 SOUND RECORDING

UNIT 1 WORKING WITH MICROPHONES 1

Learning Objectives :

- Understanding Microphones

UNIT 2 WORKING WITH MICROPHONES 1

Learning Objectives:

- Understanding Microphones

Block 3 SOUND MIXING TECHNIQUES

UNIT 1 SOUND MIXIER 1

Learning Objectives:

- Understanding Channels

UNIT2 SOUND MIXIER 2

Learning Objective

- Understanding Channels

Block 4 AUDIO PROCESSING

UNIT 1 AUDIO PROCESSING 1

Learning Objective

- How to go for compression
- How to go for equalization
- How to go for Limiting
- How to go for Reverb
- How to go for Phasing
- How to go for Flanging
- How to go for Chorus

UNIT 2 AUDIO PROCESSING 2

Learning Objective

- How to go for compression
- How to go for equalization
- How to go for Limiting
- How to go for Reverb
- How to go for Phasing
- How to go for Flanging
- How to go for Chorus

Block 5: AUDIO FILE FORMATS

UNIT 1 DIGITAL AUDIO FORMATS 1

Learning Objective

- Understand the various digital audio file formats

UNIT 2 DIGITAL AUDIO FORMATS 2

Learning Objective

- Understand the various digital audio file formats

UNIT 1

BASICS OF SOUND

❖ **Learning Objectives:**

- Understanding Sound Waves & Properties
- Understanding Waves interaction
- Understanding Sound systems

: Structure :

1.1 Introduction

Here you study few key principles of Sound. You will come to know what are sound waves and various properties of sound wave. You will know what is wave interaction and then various types of sound systems.

1.2 What Is Sound

Our ears can hear sound as waves of fast changing air pressure caused by a vibrating object, such as a keyboard note.

Because of the continuous cycles of higher and lower pressure coming from the vibrating object you get sound waves.

Frequency or pitch of a sound = number of times / second

The amplitude or intensity of sound is the size of the variations.

Fig 1.1: Sound As An Impact *Courtesy Google*

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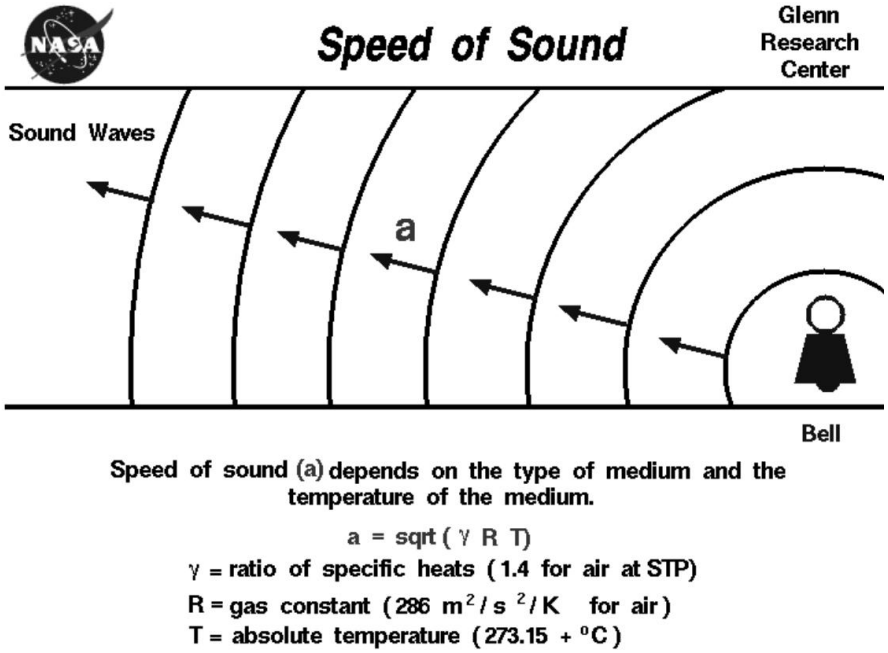

Fig 1.2: Speed Of Sound *Courtesy NASA*

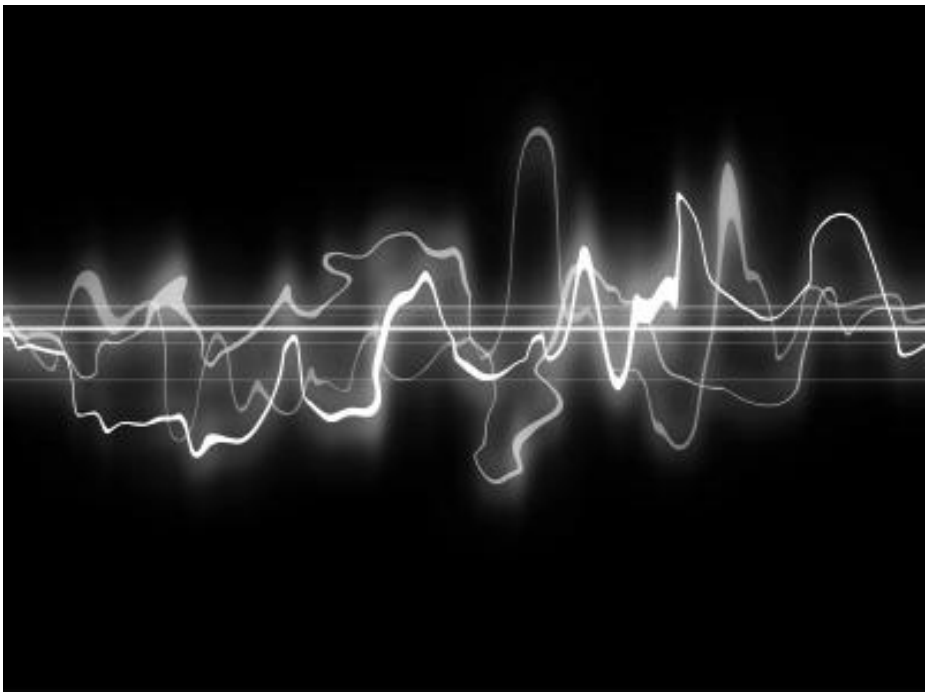

Fig 1.3: Sound As A Wave *Courtesy Google*

1.3 Sound Waves

There is a sine wave pattern for a single frequency wave.

Distance = velocity x time

With the wavelength as distance

l = vT.

f = 1/T gives the standard wave relationship

$$V = f\lambda$$

Fig 1.4: Velocity WithFreq Relationship

1.4 Periodic Motion

Due to periodic motion source object you get a sustained musical sound

- Elasticity that is the capacity to return precisely to the original configuration after being distorted.
- A source of energy

Description of Periodic Motion

Motion which repeats itself precisely can be described with the following terms:

* Period: Time required to complete a full cycle, T in seconds/cycle
* Frequency: Number of cycles per second, f in 1/seconds or Hertz (Hz)
* Amplitude: Maximum displacement from equilibrium A
* Velocity of propagation: v
* Wavelength: Repeat distance of wave λ

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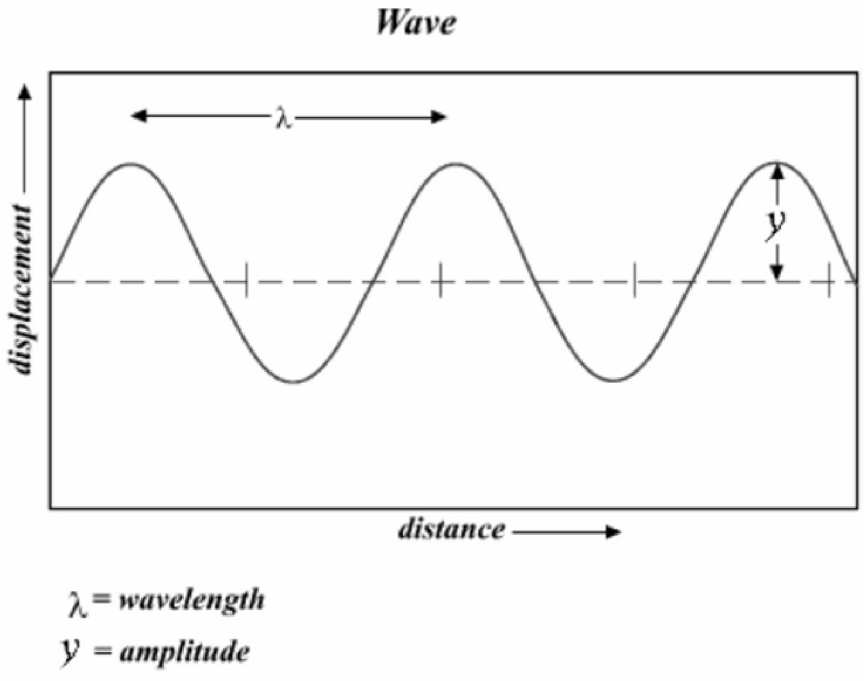
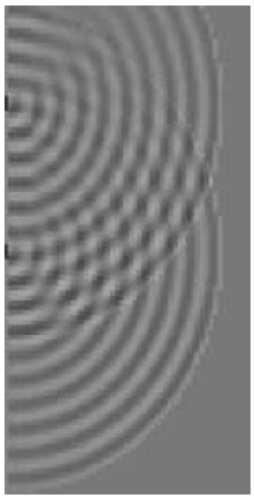


Fig 1.5: Wave As A Graph Courtesy Google

1.5 Wave Interaction



The sound coming from ultrasonic transducer comes from multiples points. This creates a sound field with many waves interfering with each other.

During interaction these waves superimpose and the amplitude of the sound pressure is the total of the amplitudes of the waves.

The waves spread from the ultrasonic transducer in a circular wave form.

1.6 Sound Systems

Sound systems are:

- Musical instruments
- Hearing devices
- Broadcasting systems
- Sound reproduction system
- Loudspeakers
- PA System
- Microphones
- Signal processors
- Amplifiers

Fig 1.6: Musical Instruments *Courtesy Google*

Fig. 1.7: Musical Instrument Guitar Courtesy Google

Fig 1.8: Indian Musical Instruments *Courtesy Google*

Fig 1.6: Musical Instruments *Courtesy Google*

Fig 1.7: Hearing Device *Courtesy Google*

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Fig 1.8: Hearing Device *Courtesy Google*

Fig 1.9: Hearing Device *Courtesy Google*

Fig 1.10: Hearing Device *Courtesy Google*

Fig 1.11: Broadcasting System *Courtesy http://*

www.360systems.com/

Fig 1.12: Broadcasting System *Courtesy http://*

www.360systems.com/

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Fig 1.13: Broadcasting System *Courtesy http://*

www.360systems.com/

Fig 1.12: Sound Reproduction System *Courtesy Google*

Fig 1.13: Sound Reproduction System *Courtesy Google*

Fig 1.14: Sound Reproduction System *Courtesy Google*

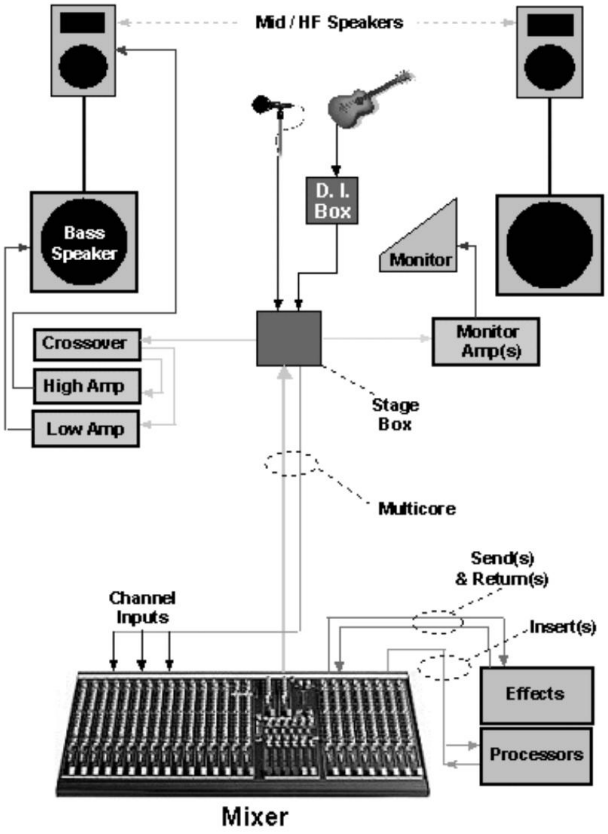

Fig 1.15: PA System*Courtesy Google*

Fig 1.16: PA System*Courtesy Google*

Fig 1.17: PA System*Courtesy Google*

Fig 1.18: Microphone *Courtesy Google*

Fig 1.19: Microphone *Courtesy Google*

Fig 1.20: Microphone *Courtesy Google*

Fig 1.21: Microphone *Courtesy Google*

Fig 1.22: Amplifier *Courtesy Google*

Fig 1.24: Amplifier *Courtesy Google*

Summary

All waves have certain properties. The three most important ones for audio work are shown here:

1. Wavelength
2. Amplitude
3. Frequency

Self Assessment Test

Broad Questions –

1. Write down Sound Wave Properties
2. What is Sound Wave?
3. What is Sound System?

Further Reading

- http://www.mediacollege.com/audio/01/wave-properties.html
- http://www.studyphysics.ca/newnotes/20/unit03_mechanicalwaves/chp141 516_waves/lesson49.htm
- http://mysite.du.edu/~jcalvert/waves/soundwav.htm

Digital Audio

UNIT 2 AUDIO CABLES AND CONNECTORS

❖ **Learning Objectives:**

- Knowing Audio Cables

: Structure :

2.1 Introduction

2.2 Audio Cables

2.3 Single Core / Shielded Cable

2.4 One Pair / Shielded Cable

2.5 Audio Connectors

2.6 3-pin XLR

2.7 ¼" Jack (6.5mm Jack)

2.8 RCA

2.1 Introduction

There are two main types of audio cable:

- Single core / shielded (unbalanced)
- One pair / shielded (balanced).

2.2 Single Core/Shielded Cable

In a single core / shielded cable, the single core is used for the +ve, or 'hot', and the shield is used for the -ve, or 'cold' used for unbalanced audio signals.

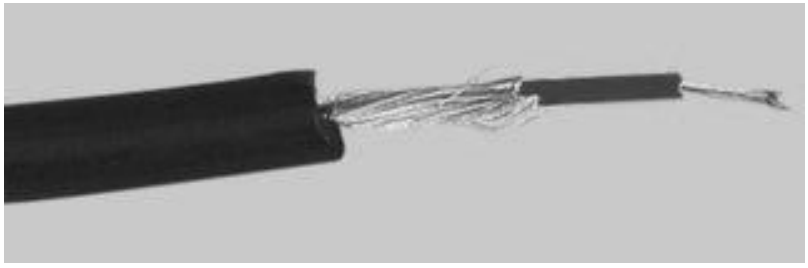

Fig 2.1: Single Core Screened Audio Cable - E638 - Pro Power

Fig 2.2: Shielded Cable*Courtesy Google*

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Fig 2.3: Shielded Cable*Courtesy Google*

Fig 2.4: Shielded Cable*Courtesy Google*

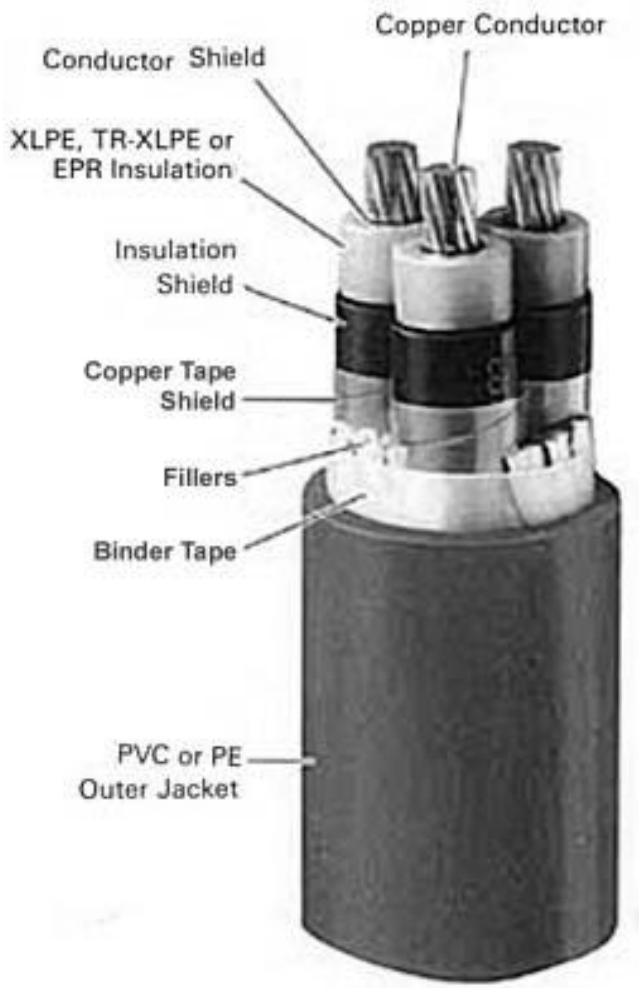

Fig 2.5: Shielded Cable*Courtesy Google*

2.3 One Pair/Shielded Cable

A one pair / shielded cable has one core as the +ve, and the other core is - ve. The shield is earthed used for balanced audio signals.

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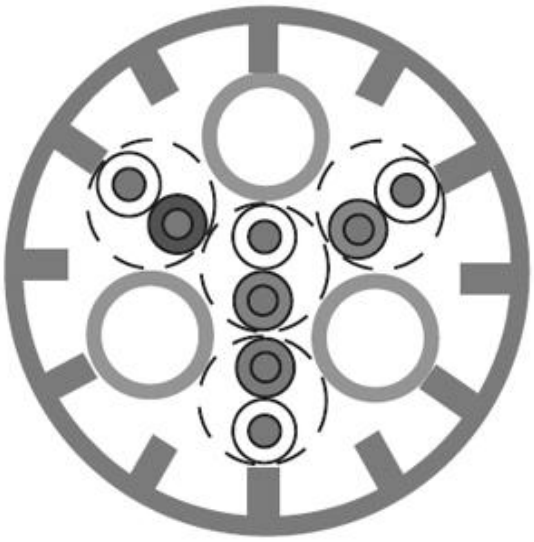

Fig 2.6: Single Pair Cable*Courtesy Google*

Fig 2.7: Single Pair Cable*Courtesy Google*

Fig 2.8: Single Pair Cable*Courtesy Google*

2.4 Audio Connectors

Most common audio connectors are 3-pin XLR, RCA and 6.5mm jacks.

3-pin XLR

3-pin XLR connectors are for balanced audio signals and they reduce interference risk.

- Pin 1 is the earth (or shield)
- Pin 2 is the +ve (or 'hot')
- Pin 3 is the -ve (or 'cold).

There are a number of different XLR's - 3-pin, 4-pin, 5-pin etc

6.5mm Jacks

- Mono: Tip(+ve) and a sleeve(-ve)
- Stereo: Ring, a tip(+ve, left is the left, right is the right) and a sleeve(-ve).

Jacks sizes 6.5mm (¼"), 3.5mm, 2.5mm.

RCA

- Used for stereos
- Used for Videos
- Used for DVDs
- Carry audio or video
- Wired like mono jack
- Center pin(+ve)
- Outer ring(-ve or shield)

Fig. 2.9: Audio Connector*Courtesy Google*

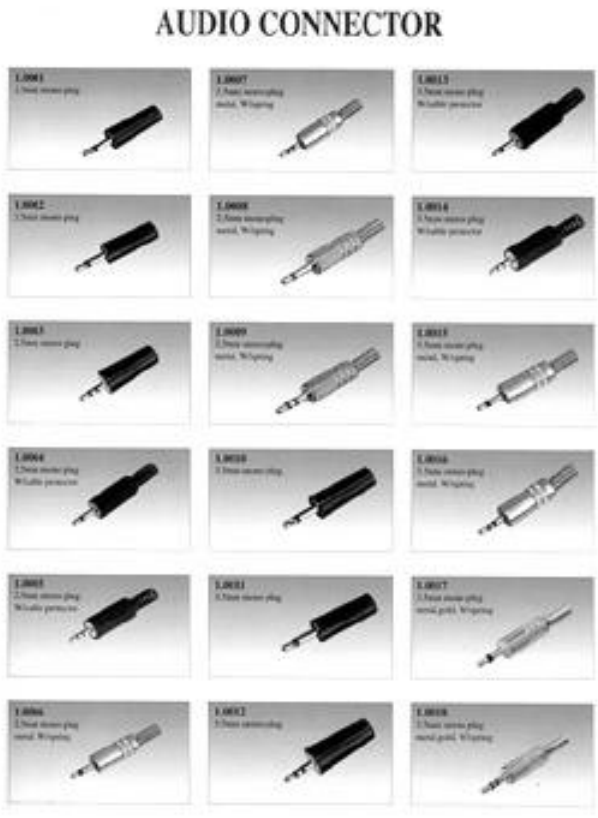

Fig 2.10: Audio Connector*Courtesy Google*

Summary

Thus there are two main types of audio cable we will look at: Single core / shielded and One pair / shielded. There are a variety of different audio connectors available. The most common types are 3-pin XLR, RCA, and 6.5mm jacks.

Self Assessment Test

1. Which cables are used for unbalanced audio signals?

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2. Which cables are used for balanced audio signals?

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3. Name all the audio connectors.

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4. Write down few lines for each audio connector.

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Further Reading

- http://www.mediacollege.com/audio/connection/
- http://www.audiogear.com/audio-connectors-cable.html
- http://support.radioshack.com/support_tutorials/audio_video/audfaq-2C.htm

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2

SOUND RECORDING

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- Understanding Microphones

UNIT 2 WORKING WITH MICROPHONES 1

Learning Objectives:

- Understanding Microphones

Block 3 SOUND MIXING TECHNIQUES

UNIT 1 SOUND MIXIER 1

Learning Objectives:

- Understanding Channels

UNIT2 SOUND MIXIER 2

Learning Objective

- Understanding Channels

Block 4 AUDIO PROCESSING

UNIT 1 AUDIO PROCESSING 1

Learning Objective

- How to go for compression
- How to go for equalization
- How to go for Limiting
- How to go for Reverb
- How to go for Phasing
- How to go for Flanging
- How to go for Chorus

UNIT 2 AUDIO PROCESSING 2

Learning Objective

- How to go for compression
- How to go for equalization
- How to go for Limiting
- How to go for Reverb
- How to go for Phasing
- How to go for Flanging
- How to go for Chorus

Block 5: AUDIO FILE FORMATS

UNIT 1 DIGITAL AUDIO FORMATS 1

Learning Objective

- Understand the various digital audio file formats

UNIT 2 DIGITAL AUDIO FORMATS 2

Learning Objective

- Understand the various digital audio file formats

UNIT 1

WORKING WITH MICROPHONES I

❖ **Learning Objectives:**

- Understanding Microphone

: Structure :

1.1 Introduction

1.2 Types of Microphone

1.3 Mic Level & Line Level

1.4 Dynamic Microphones

1.1 Introduction

Here we will study different types of microphones and their properties as microphones are very useful to convert acoustical sound waves to electrical audio signal.

1.2 Location Of Microphone Diaphragm

The diaphragm remains common in all microphones. This is a thin piece of material made out of as paper, plastic or aluminium that vibrates when it is struck by sound waves. In a hand-held mic the diaphragm is located in the head of the microphone. Due to vibration of diaphragm other components vibrate and these vibrations are converted into an electrical current which becomes the audio signal.

Fig 3.1: Micorphone Diaphragm*Courtesy Google*

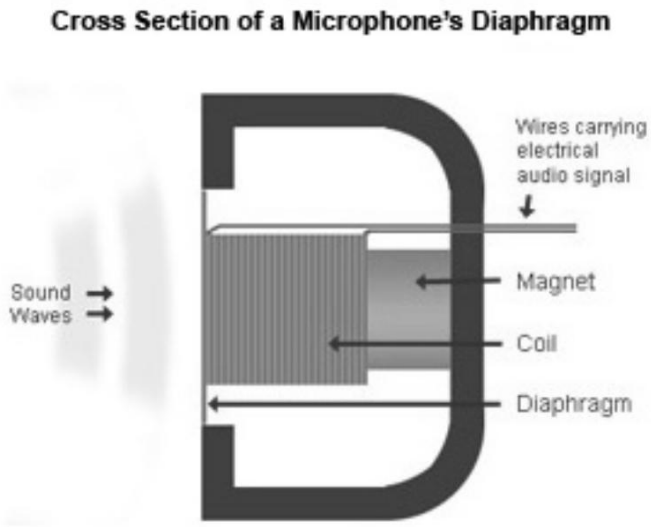

Fig 3.2: Microphone Diaphragm Cross Section*Courtesy Google*

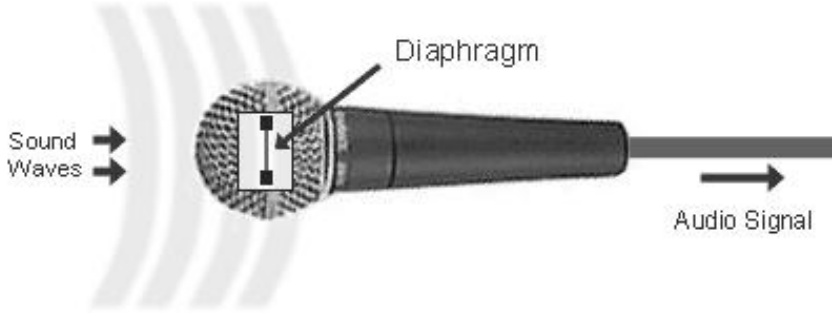

Fig 3.3: Microphone Diaphragm*Courtesy Google*

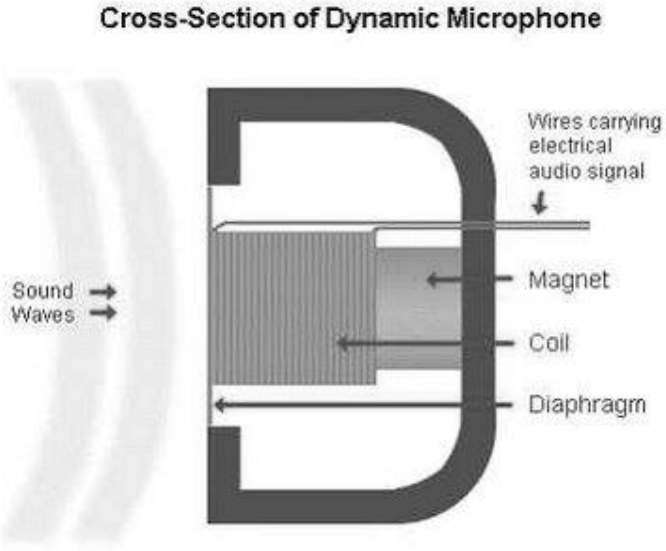

Fig 3.4: Dynamic Microphone Diaphragm

Cross Section*Courtesy Google*

1.3 Types Of MicroPhone

Microphones can be divided into 2 area:

1. The type of conversion technology they use:

   This is the technical method the mic uses to convert sound into electricity.

2. The type of application they are designed for:

   Some mics are designed for general use and can be used effectively in many different situations. Others are specific and are only really useful for their intended purpose.

Mic Level & Line Level

Mirophone signals being small have to be amplified to make them as strong signal which are then used by audio processing devices and common domestic devices.

This amplification is achieved in one or more of the following ways:

1. Tiny in-built amplifiers that boost the signal to a high mic level or line level.
2. Mic is then fed through a small boosting amplifier also called a line amp.
3. Attenuators accommodate mics of varying levels and adjust them all to an even line level.
4. Audio signal is fed to a power amplifier with a specialized amp that boosts the signal enough to be fed to loudspeakers

Dynamic Microphones

- Adaptable and best for general-purpose use.
- Simple design with few moving parts.
- Sturdy and resilient to rough handling.

- Better suited to handle high volume levels
- Have no internal amplifier
- Do not require batteries or external power.

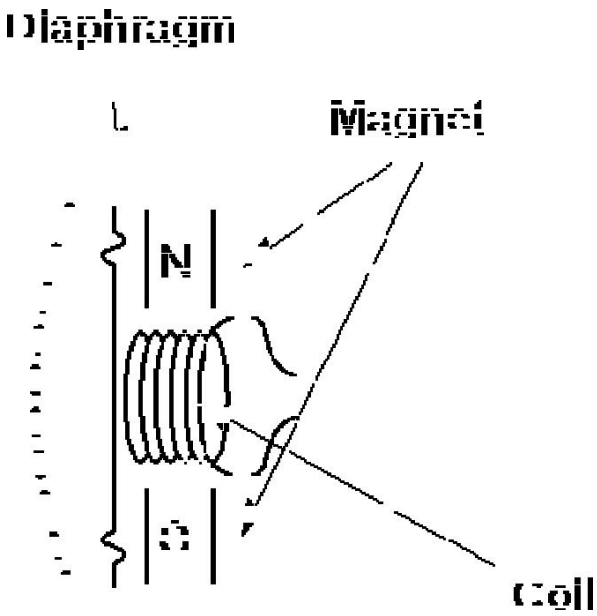

Fig 3.5: Dynamic Microphone*Courtesy Google*

Fig 3.6: Dynamic Microphone*Courtesy Google*

Fig 3.7: Dynamic Microphone*Courtesy Google*

How Dynamic Microphones Work

Dynamic microphone works on electromagnet principle. The diaphragm is attached to the coil and as the diaphragm vibrates due to the sound waves coming in the coil starts moving moving backwards and forwards across the magnet and so the current in the coil is generated and this current then passes from the microphone along the wires.

1.4 Directional Properties

Directionality property is there in every microphone. This tells us jhow sensitive a microphone is to sound coming from various directions. Types of directionality are:

1. Omnidirectional
2. Unidirectional
3. Bidirectional

Omnidirectional

- Captures sound equally from all directions.
- Captures ambient noise

Cardioid

- Cardioid means “heart-shaped
- Picks sound mostly from the front, but to a lesser extent the sides as well.
- Emphasizes sound from the direction the mic is pointed whilst leaving some latitude for mic movement and ambient noise.

Hypercardioid

- This is overstated version of the cardioid pattern.
- Very directional and eliminates most sound from the sides and rear.
- Also known as shotgun microphones.
- Isolates the sound from a subject or direction when there is a lot of ambient noise
- Picks up sound from a subject at a distance
- Removes all the ambient noise, unidirectional sound
- It may help to add a discreet audio bed from another mic (i.e. constant background noise at a low level).
- You need to be careful to keep the sound consistent. If the mic doesn’t stay pointed at the subject you will lose the audio.
- Shotguns can have an area of increased sensitivity directly to the rear.

Bidirectional

- Bidirectional uses a figure-of-eight pattern

- Picks up sound equally from two opposite directions.
- Used in interview with two people facing each other

Summary

Thus a microphone is a kind of a transducer Sound information exists as patterns of air pressure. The microphone changes this information into patterns of electric current. In singing stream SURE SM-57, 58 are a good choice for microphone.

Self Assessment Test

1. What is an audio signal?

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2. What are dynamic microphone?

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3. What do you mean by directionality?

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4. What is impedance?

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5. Write a few lines on Condenser Mircophones.

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Further Reading

http://arts.ucsc.edu/EMS/music/tech_background/TE-20/teces_20.html

http://www.mediacollege.com/audio/microphones/how-microphones-work.html

UNIT 2

WORKING WITH MICROPHONES II

❖ **Learning Objectives:**

- Understanding Microphone Part II

: Structure :

2.1 Introduction

2.2 Microphone Impedance

2.3 Microphone Frequency Response

2.1 Introduction

Here we will study different types of microphones and their properties as microphones are very useful to convert acoustical sound waves to electrical audio signal.

2.2 MicroPhone Impedance

- In order to get best quality and reliable audio impedance should be right.
- Its better to work with low impedance than high impedance.

What is Impedance?

- Impedance measures the total of opposition a device has to an AC current.
- Impedance = capacitance, inductance, and resistance on a signal.
- Impedance is measured in ohms ?.

What is Microphone Impedance?

- Impedance spec is written on the mic itself.
- mics with a hard-wired cable and 1/4" jack have high impedance,
- mics with separate balanced audio cable and XLR connector have low impedance.

- Low impedance microphones should be preferred.

General classifications for microphone impedance

1. Low Impedance (less than 600?)
2. Medium Impedance (600? - 10,000?)
3. High Impedance (greater than 10,000?)

Matching Impedance with Other Equipment

- Microphones aren't the only things with impedance.
- Other equipment, such as the input of a sound mixer, also has an ohms rating.
- System calls "low impedance" may not be the same as your low impedance microphone - you really need to see the ohms value.
- A low impedance microphone should generally be connected to an input with the same or higher impedance.
- If a microphone is connected to an input with lower impedance, there will be a loss of signal strength.
- In some cases you can use a line matching transformer, which will convert a signal to a different impedance for matching to other components.

4.3 MicroPhone Frequency Response

Frequency response shows how a microphone responds to different frequencies. Higher value leads to exaggeration of frequency and lower value leads to frequency attenuation, but if the frequency response is flat then there is no exaggeration or attenuation and this is the original sound. Flat frequency response is used when you want pure audio signal. Avoid response patterns which stress the wrong frequencies. You will often see frequency response as a range between two figures and so its

easy to know which frequencies a microphone is capable of capturing effectively.

Condenser vs Dynamic

Condenser microphones have flatter frequency responses than dynamic. A condenser is more preferable for accurate sound.

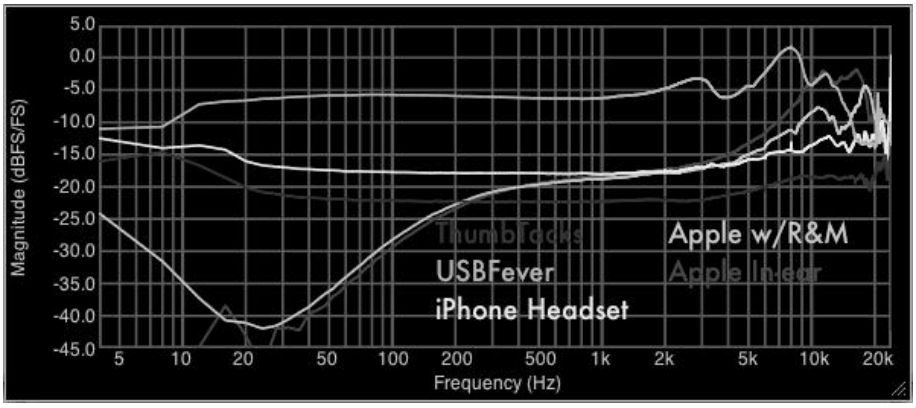

Fig 4.1: Microphone Frequency Chart*Courtesy Google*

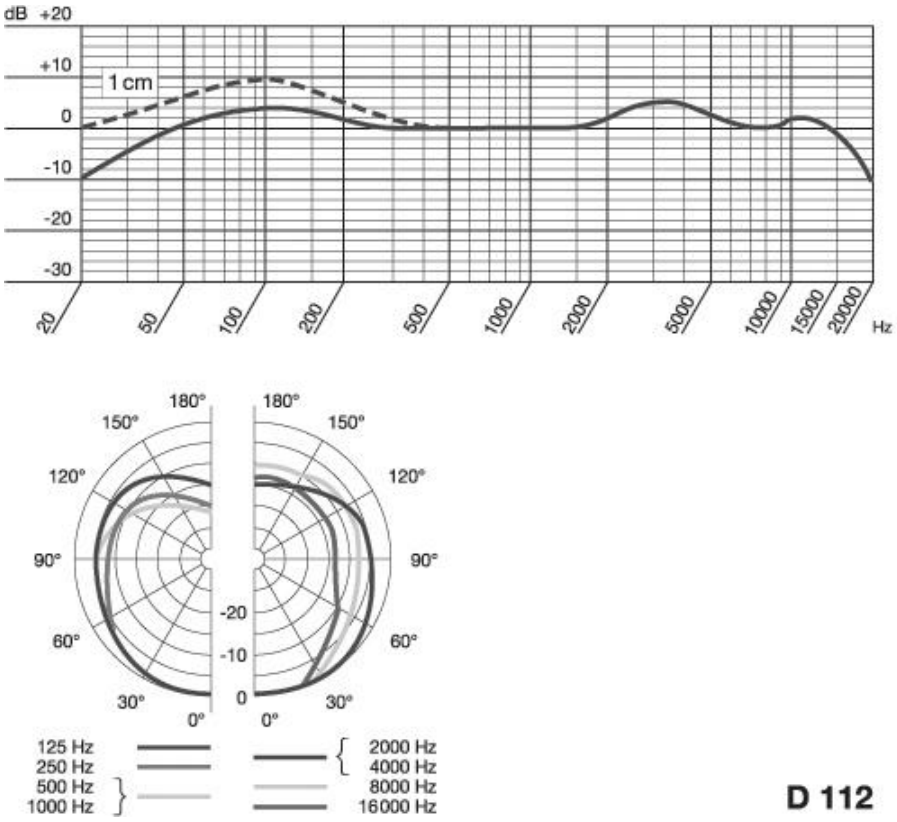

Fig 4.2: Microphone Frequency Chart*Courtesy Google*

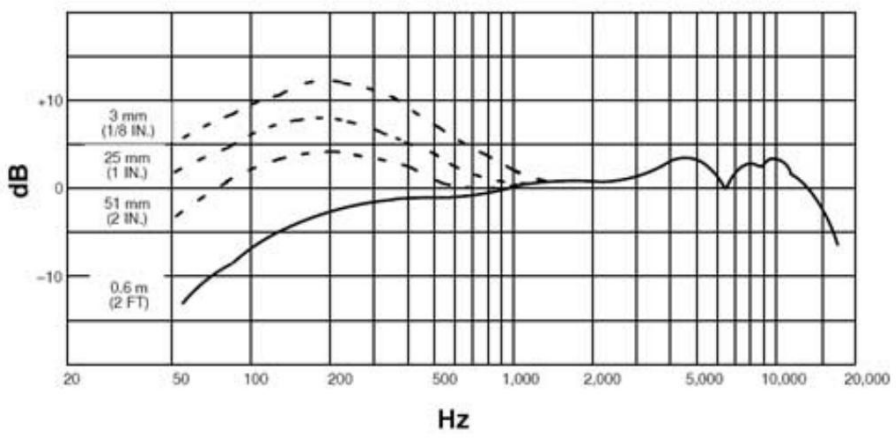

Fig 4.3: Microphone Frequency Chart*Courtesy Google*

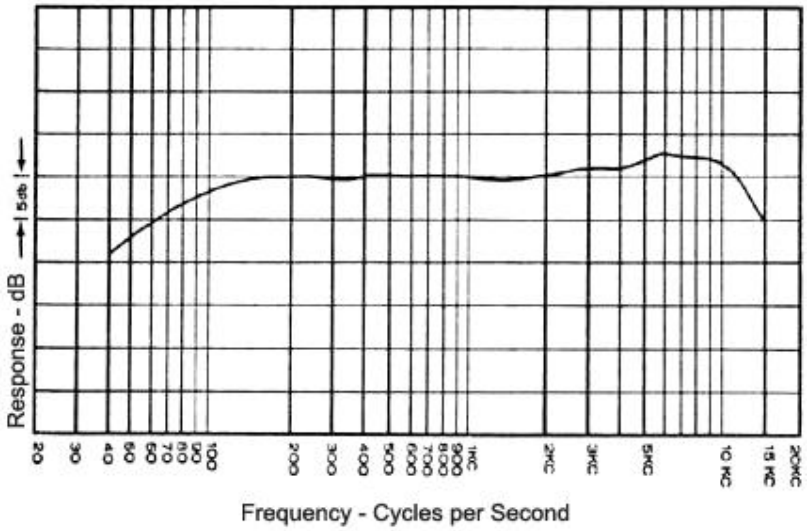

Fig 4.4: Microphone Frequency Chart*Courtesy Google*

Summery

Thus a microphone is a kind of a transducer Sound information exists as patterns of air pressure. The microphone changes this information into patterns of electric current. In singing stream SURE SM-57, 58 are a good choice for microphone.

Self Assessment Test

1. What is an audio signal?

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2. What are dynamic microphones?

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3. What do you mean by directionality?

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4. What is impedance?

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5. Write a few lines on Condenser Mircophones.

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Further Reading

- http://arts.ucsc.edu/EMS/music/tech_background/TE-20/teces_20.html
- http://www.mediacollege.com/audio/microphones/how-microphones-work.html

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3

SOUND MIXING TECHNIQUES

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- Understanding Sound Waves & Properties
- Understanding Waves interaction
- Understanding Sound systems

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Block 2 SOUND RECORDING

UNIT 1 WORKING WITH MICROPHONES 1

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- Understanding Microphones

Block 3 SOUND MIXING TECHNIQUES

UNIT 1 SOUND MIXIER 1

Learning Objectives:

- Understanding Channels

UNIT2 SOUND MIXIER 2

Learning Objective

- Understanding Channels

Block 4 AUDIO PROCESSING

UNIT 1 AUDIO PROCESSING 1

Learning Objective

- How to go for compression
- How to go for equalization
- How to go for Limiting
- How to go for Reverb
- How to go for Phasing
- How to go for Flanging
- How to go for Chorus

UNIT 2 AUDIO PROCESSING 2

Learning Objective

- How to go for compression
- How to go for equalization
- How to go for Limiting
- How to go for Reverb
- How to go for Phasing
- How to go for Flanging
- How to go for Chorus

Block 5: AUDIO FILE FORMATS

UNIT 1 DIGITAL AUDIO FORMATS 1

Learning Objective

- Understand the various digital audio file formats

UNIT 2 DIGITAL AUDIO FORMATS 2

Learning Objective

- Understand the various digital audio file formats

UNIT 1

SOUND MIXER I

❖ **Learning Objectives:**

- Understand channels

: Structure :

1.1 Introduction

A sound mixer is a device that takes two or more audio signals mixes them and gives one or more output signals. You can adjust levels, increase sound with EQ and effects, create monitor feeds, and record various mixes by combining signals.

1.2 Sound Mixer Channels

Each input source comes through a channel in the mixer so if you have more channels the mixer will accept more sources.

Mixer's compliment of channels:

12-channel	12 input channels.
16x2	16 input channels, 2 output channels.
24x4x2	24 input channels, 4 subgroup channels and two output channels.

Sound Desk Channels

Input Channels

Rows of knobs are channels.

Controls on a mixer channel are:

Input Gain / Attenuation: Input gain is the level of the signal when it enters the channel, this is the potentiometer knob though which you can adjust the level to an ideal level for the mixer. You can even have a switch or pad through which you can increase or decrease the level by a specific amount.

Phantom Power: Turns phantom power on or off for the channel.

Equalization: Normally you will find 2 EQ controls at least in any mixer. Good mixers have parametric equalization.

Auxiliary Channels: Aux channels send a copy of the channel signal. This provides a separate monitor feed or to add effects. Also known as aux channels.

Pan & Assignment: Each channel can be panned left or right on the master mix.

Solo / Mute / PFL: These switches control channel monitoring.

Channel On / Off: Turns the entire channel on or off.

Slider: The level of the channel signal.

Subgroup Channels

You will find more sets of subgroups in bigger sound systems such that they provide a method to sub-mix groups of channels before sending to the main output mix.

Fig 5.1: Sound Mixer*Courtesy Google*

Fig 5.2: Sound Mixer*Courtesy Google*

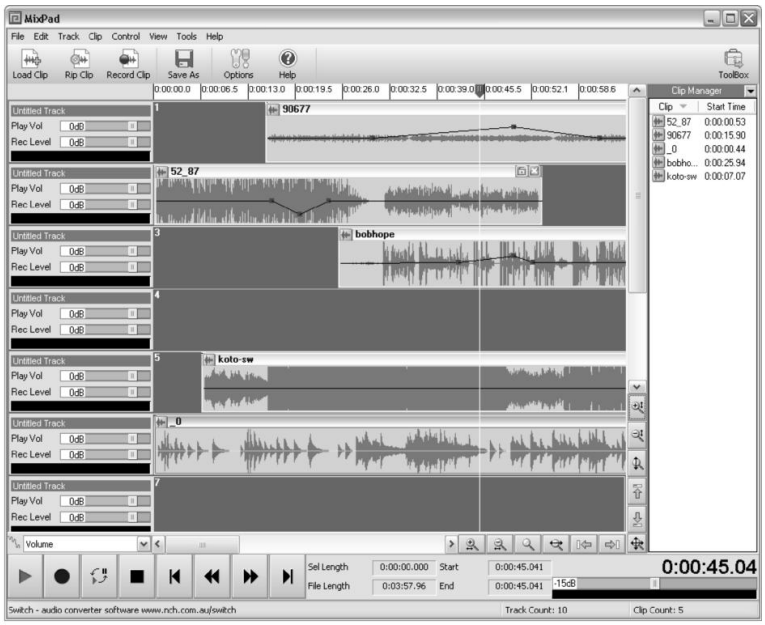

Fig 5.3: Sound Mixer*Courtesy Google*

1.3 Sound Mixers: Channel Inputs

The input socket is a pathway to each channel this is where the sound source is plugged into the mixer. Most input sockets are XLR, 6.5mm Jack and RCA. You will find Input sockets on the rear panel of the mixer or on the top above each channel.

Input Levels

Level of an audio signal = Voltage level of the signal

Signals categories:

1. Mic-level produced by microphones
2. line-level produced by disc players
3. loudspeaker-level produced by amplifiers

Input Gain

At the time of a signal entering the mixer the first control that is controlled in the input gain which you can adjust with a knob and this adjusts the signal level. Normally you set the input gain once when the source is plugged in and then it's left at the same level. If you have to do any volume setting you do with channel fader.

Other Controls and Considerations

Phasing: The wires in the cable which carry the signal are arranged differently. This will kill any sound from that source. To get rid of this problem some mixers have a phase selector which will change the phasing at the input stage.

Phantom Power: Phantom power is a media that distributes DC current via audio cables in order to provide power for microphones and other devices. The voltage supplied is between 12 V- 48 V

1.4 Sound Mixers: Channel Equalization

- Most mixers have equalization controls for each channel. Channel equalizers use knobs and range from simple tone controls to multiple parametric controls.
- The upper knob adjusts high frequencies (treble) and the lower knob adjusts low frequencies (bass).
- The top and bottom knobs are simple high and low frequency adjustments (HF and LF).
- The middle controls consist of two pairs of knobs. These pairs are parametric equalizers and each pair works together to adjust a frequency range chosen by the operator.
- The brown knob selects the frequency range to adjust and the green knob makes the adjustment.
- The top pair works in the high-mid frequency range (0.6KHz to 10KHz), the lower pair works in the low-mid range (0.15 to 2.4KHz).
- The “EQ” button controls the equalization on and off for this channel.
- It is common for mixers with parametric equalizers to combine each pair of knobs into a single 2-stage knob with one on top of the other. This saves space which is always a bonus for mixing consoles.

Summary

Sound mixers are very common audio equipment in audio production. Thus you need to know what a sound mixer is and how to use it.

Self Assessment Test

1. What is attenuation?

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2. What are auxiliary channels?

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3. What do you mean by voltage level of a signal?

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4. What is Phasing?

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5. Write a note on PFL.

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Further Reading

- http://www.mediacollege.com/audio/mixer/
- http://www.audioutilities.com/sound-mixer/sound-mix.htm

UNIT 2

SOUND MIXER II

❖ **Learning Objectives:**

- Understand channels

: Structure :

2.1 Introduction

2.2 Auxiliary Channels

2.3 Assigning and Panning

2.4 PFL (Pre-Fade Listen)

2.5 Faders

2.1 Introduction

A sound mixer is a device that takes two or more audio signals mixes them and gives one or more output signals. You can adjust levels, increase sound with EQ and effects, create monitor feeds, and record various mixes by combining signals.

2.2 Sound Mixers: Auxiliary Channels

Most of the sound systems have one or more aux channels and because of this you can send a secondary feed of an input channel's audio signal to another destination which is independent of the channel's main output.

Auxiliary Channel

Applications for auxiliary channels:

* Multiple separate monitor feeds.

* Private communication.

* Incorporating effects.

* Recording different mixes.

Aux Controls with Pre/Post Selectors

- The auxiliary output from each channel are of 2 type
  - o pre-fader : independent of the channel fader
  - o post-fader : dependent on the fader level

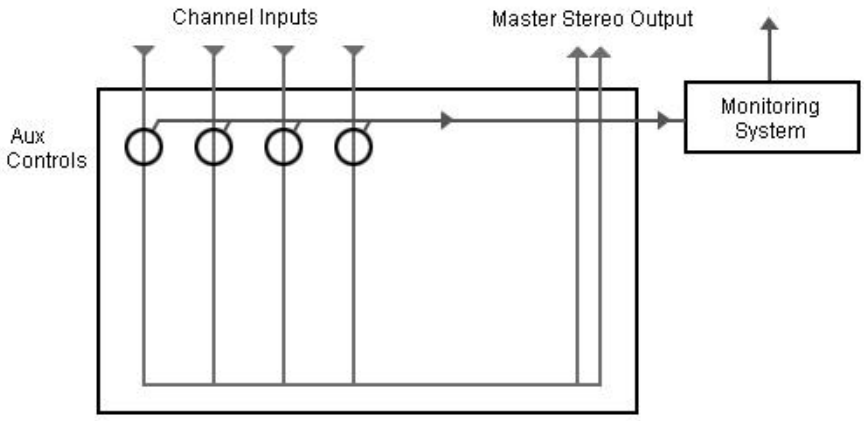

Fig 6.1: Auxiliary Channel*Courtesy Google*

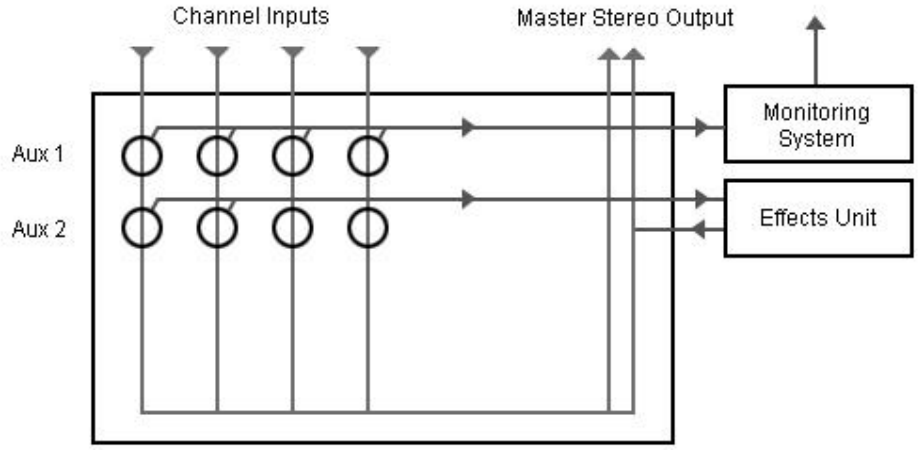

Fig 6.2: Auxiliary Channel*Courtesy Google*

Fig 6.3: Auxiliary Channel*Courtesy Google*

2.3 Sound Mixer: Channel Assigning & Panning

- Stereo mixers give you feature of panning and this is done by a knob that goes from left to right fully and here the channel signal appears on the master mix. If the knob is turned left, the channel audio will come through the left speaker only in the final mix and vice versa
- All smaller mixers do not have this assign option. The assign buttons decide where the channel signal is sent
- Mix: The channel goes straight to the main stereo mix
- 1-2: The channel goes to subgroup 1 and/or 2. The channel goes

only to subgroup 1 if you set the pan control fully left otherwise to subgroup 2 i.e. if the pan control is set fully right and if centered the channel goes to subgroups 1 and 2 equally.

- 3-4: Same as 1-2.
- Use subgroups in sets i.e. in pairs for stereo application to maintain stereo separation.

2.4 Sound Mixer: PFL

- PFL means Pre-Fade Listen and this is a button located above the channel fader. It is used to listen to the channel's audio at a point before the fader takes effect.
- The output of the main monitor stops and only the PFL channel will be selected on press of PFL button also PFL button will not affect the main output mix.
- PFL reflects the pre-fade level so you can use it to set the starting input gain of a channel

PFL vs Solo

PFL is similar to the solo button.

1. PFL is pre-fader, solo is post-fader.
2. PFL does not affect the master output but soloing a channel does.

2.5 Sound Mixer: Channel Faders

- Sliders / Faders: To adjust the volume of the channel's signal before it is sent to the next stage each channel has own fader.
- Potentiometer varies the amount of resistance and therefore the signal level.
- Fader should be around the 0dB mark for optimum sound quality.
- You can adjust a channel's level by the input gain or the output fader.

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4

AUDIO PROCESSING

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UNIT 1 SOUND MIXIER 1

Learning Objectives:

- Understanding Channels

UNIT2 SOUND MIXIER 2

Learning Objective

- Understanding Channels

Block 4 AUDIO PROCESSING

UNIT 1 AUDIO PROCESSING 1

Learning Objective

- How to go for compression
- How to go for equalization
- How to go for Limiting
- How to go for Reverb
- How to go for Phasing
- How to go for Flanging
- How to go for Chorus

UNIT 2 AUDIO PROCESSING 2

Learning Objective

- How to go for compression
- How to go for equalization
- How to go for Limiting
- How to go for Reverb
- How to go for Phasing
- How to go for Flanging
- How to go for Chorus

Block 5: AUDIO FILE FORMATS

UNIT 1 DIGITAL AUDIO FORMATS 1

Learning Objective

- Understand the various digital audio file formats

UNIT 2 DIGITAL AUDIO FORMATS 2

Learning Objective

- Understand the various digital audio file formats

UNIT 1

AUDIO PROCESSING 01

❖ **Learning Objectives:**

- How to go for compression
- How to go for equalization
- How to go for Limiting
- How to go for Reverb
- How to go for Phasing
- How to go for Flanging
- How to go for Chorus

: Structure :

1.1 Introduction

Audio Processing is changing the characteristics of an audio signal. You do processing to enhance audio, fix problems, separate sources, create new sounds, compress, store and transmit data. As audio signals may be electronically represented in either digital or analog format, signal processing may occur in either domain. Analog processors operate directly on the electrical signal, while digital processors operate mathematically on the binary representation of that signal.

1.2 Audio Compression

Bandwidth has always been a bottleneck in networks. So by increasing bandwidth and compressing data engineers are coming to solving this problem. These days cable modems and ASDL are designed to have higher bandwidth and compression schemes such as JPEG and MPEG have been developed for more data.

MP3 provides approximately 10:1 without significant loss of quality. So MP3 are ideal for PC, CD, CD players.

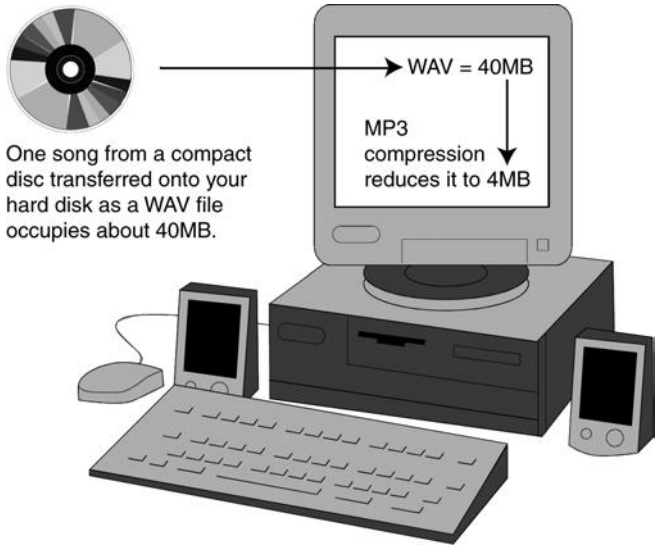
Format	28.8 k Modem	56 k Modem	Dual ISDN 128 kbps	Cable 1.5 Mbps	T1 Line 1.5 Mbps	ADSL 500 kbps+
CD Audio	3.6 hrs	2 hrs	44 min	4 min	4 min	7 min
MP3 at 128 kbps	19.7 min	9 min	4 min	20 sec	20 sec	39 sec

MPEG has even higher levels of compression and good sound quality.

Self Instructional Material

Lossy vs. Lossless Compression

Fig 5.1: Typical MP3 Compression



There are two types of compression: lossless and lossy. Lossless compression encodes repetitive pieces of information with symbols and equations that take less space and provide entire information required to reconstruct an exact copy of the original. Lossy compression discards unwanted and duplicate information and applies lossless compression techniques for further size reduction.

Dynamic Range Compression

Dynamic range compression reduces the range in dB ranging between the lowest signal level and highest signal level without affecting the file size or bandwidth requirement.

1.3 Audio Equalization

- Equalization / EQ boost or attenuate the levels of different frequencies in a signal.
- The most basic type of equalization familiar to most people is the treble/bass control on home audio equipment. The treble control adjusts high frequencies; the bass control adjusts low frequencies.
- Advanced equalization systems provide a fine level of frequency control. It is used to adjust a narrower range of frequencies without affecting neighboring frequencies.
- Equalization is most commonly used to correct signals which sound unnatural.

1.4 Shelving EQ

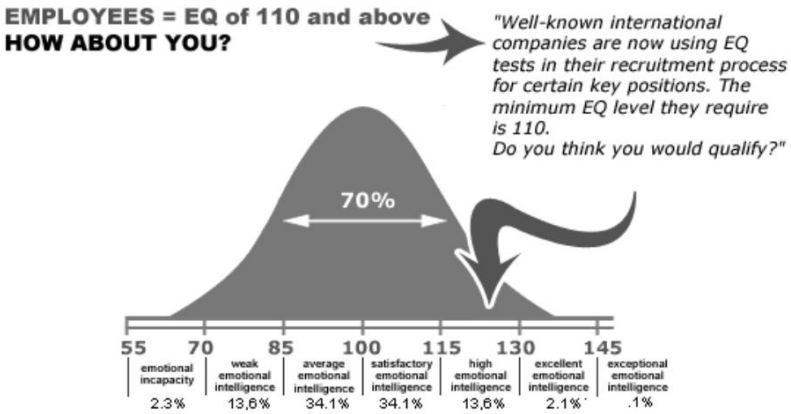
All frequencies above or below a certain point are boosted or attenuated equally. This creates a shelve graph

1.5 Bell EQ

Boosts or attenuates a range of frequencies centered on a certain point. The specified point is affected the most; frequencies further ahead from the point are affected less.

Fig 7.2: Bell EQ Graph*Courtesy Google*

Self Instructional Material



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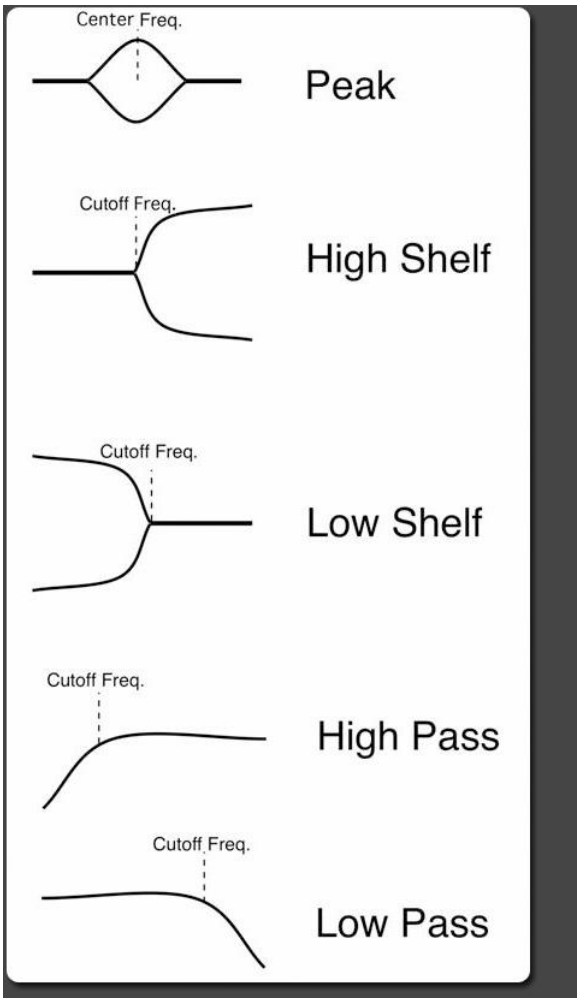

Fig 7.4: Bell EQ Graph*Courtesy Google*

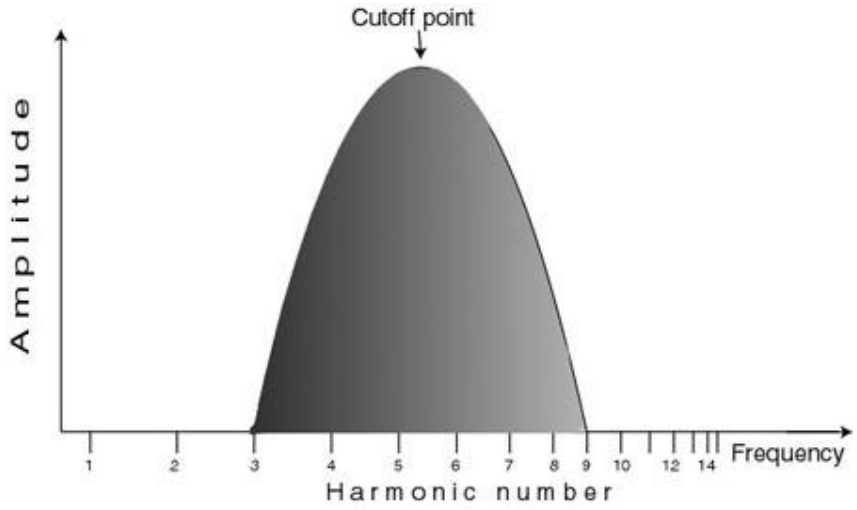

Fig 7.5: Bell EQ Graph*Courtesy Google*

Fig 7.6: Bell EQ Graph*Courtesy Google*

1.6 Graphic EQ

Separate slider controlling different frequencies is laid out in such a way that represents the frequency spectrum. Each slider adjusts one frequency band so if you have more sliders you have more control.

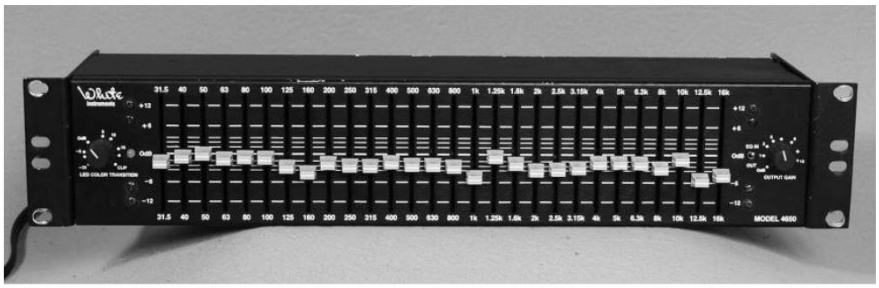

Fig 7.7: Graphic EQ*Courtesy Google*

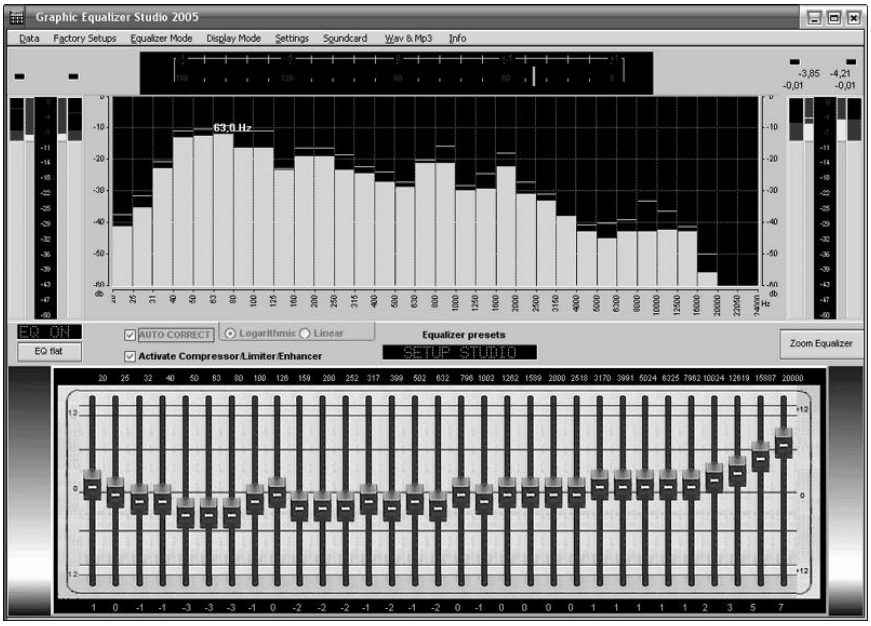

Fig 7.8: Graphic EQ*Courtesy Google*

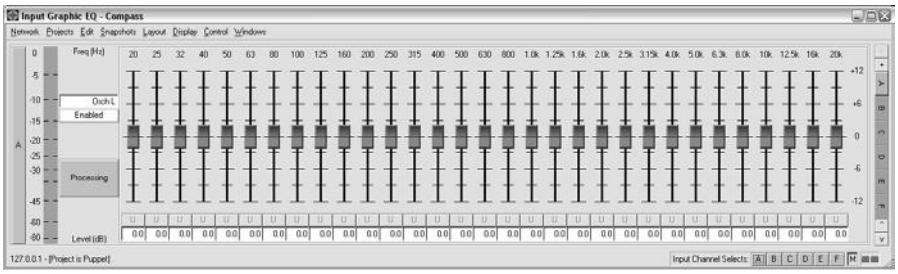

Fig 7.9: Graphic EQ*Courtesy Google*

1.7 Parametric EQ

This uses bell equalization with knobs for different frequencies. You can select the frequency that is to be adjusted.

1.8 Center Frequency

Allows you to specify exactly which mid-range frequency you want to boost or reduce so you get higher flexibility and accuracy.

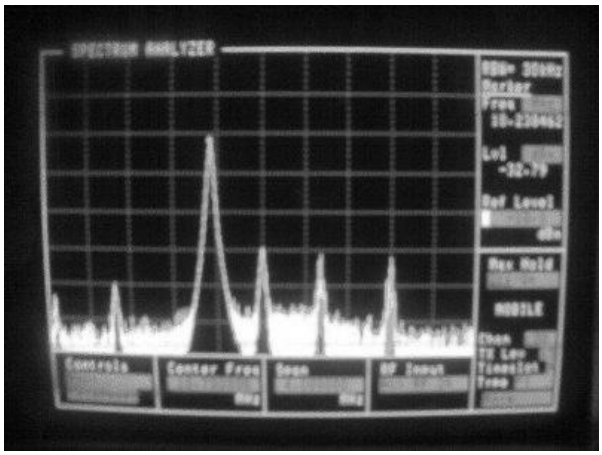

Fig 7.10: Center Frequency*Courtesy Google*

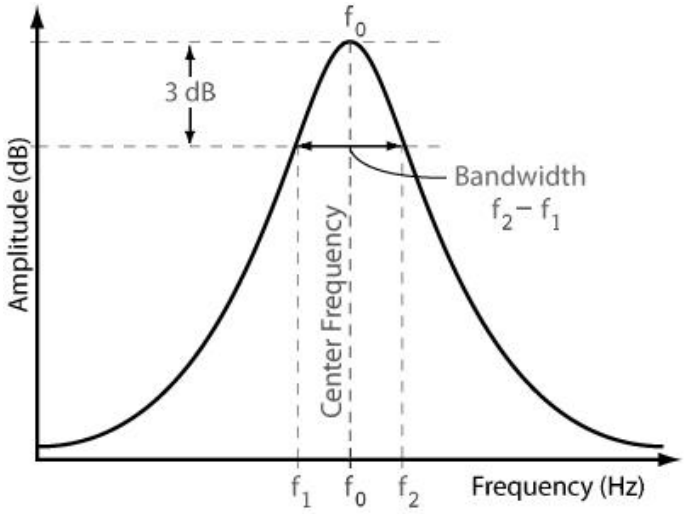

Fig 7.11: Center Frequency*Courtesy Google*

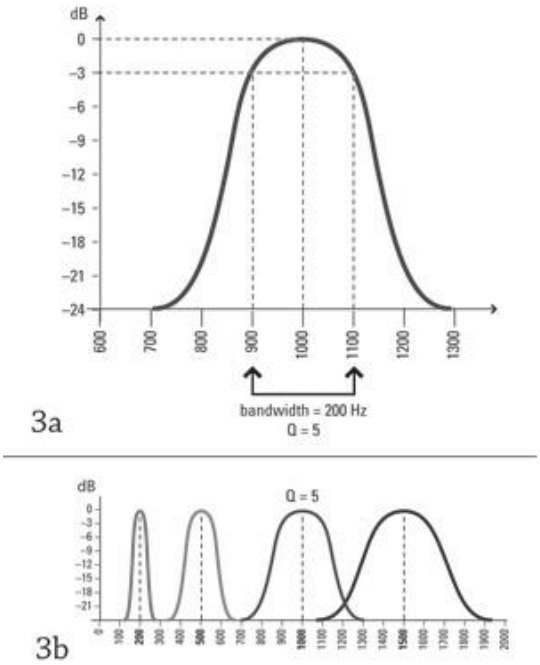

Fig 7.12: Center Frequency*Courtesy Google*

1.9 Bandwidth Control (Q)

If you want to know how far above and how much below the centre frequency will affect you can think of Bandwidth Control.

1.10 Audio Limiters

A limiter is a compressor that limits the level of a signal to an assured threshold. A limiter will completely prevent any additional gain above the threshold. A limiter is like a compressor set to a very high compression ratio. Limiters are used as a safeguard against signal clipping. They prevent occasional signal peaks which would be too loud or distorted.

Reverb

The sound that arise from reflections from surrounding walls or objects is simulated by reverb.

Summary

Audio processing covers Compression, Equalization, Limiting, Reverb, Phasing, Flanging, and Chorus. All of these you shall come across practically while studying Sound Forge.

Self Assessment Test

1. What is lossy compression

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2. What is lossless compression

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3. What is equalization?

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4. Name various types of EQ.

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5. What is reverb?

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6. What is Flanging?

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Further Reading

- http://www.dspguide.com/ch22.htm
- http://en.wikipedia.org/wiki/Audio_signal_processing

UNIT 2

AUDIO PROCESSING II

❖ **Learning Objectives:**

- Understand the various digital audio file formats

: Structure :

2.1 Introduction

2.2 Phasing

2.3 Flanging

2.4 Chorus

2.1 Introduction

Audio Processing is changing the characteristics of an audio signal. You do processing to enhance audio, fix problems, separate sources, create new sounds, compress, store and transmit data. As audio signals may be electronically represented in either digital or analog format, signal processing may occur in either domain. Analog processors operate directly on the electrical signal, while digital processors operate mathematically on the binary representation of that signal.

2.2 Phasing

When the sound waves interact with each other and when they are out of phase, phasing comes to picture. You can quite interesting effects by splitting an audio signal into two signals and changing the relative phasing between them. Phasing uses notch and boost filters to to phase?shift frequencies over time.

2.3 Flanging

Flanging is another kind of phasing. Flanging mixes the original signal with a varying slightly delayed version of the signal. The original and delayed signals are mixed equally.

2.4 Chorus

You get a feel that the sound is coming from similar multiple sources slightly out of of time and tune. This is a chorus effect. Chorus adds multiple short delays to the signal and instead of repeating the same delay it delays each by different length & pitch. This creates a kind of delay.

Summary

Bandwidth has always been a bottleneck in networks. So by increasing bandwidth and compressing data engineers are coming to solving this problem. These days cable modems and ASDL are designed to have higher bandwidth and compression schemes such as JPEG and MPEG have been developed for more data.

MP3 provides approximately 10:1 without significant loss of quality. So MP3 are ideal for PC, CD, CD players.

Dynamic range compression reduces the range in dB ranging between the lowest signal level and highest signal level without affecting the file size or bandwidth requirement.

Equalization / EQ boost or attenuate the levels of different frequencies in a signal.

Shelving EQ All frequencies above or below a certain point are boosted or attenuated equally. Thiscreates a shelve graph

Bell EQ Boosts or attenuates a range of frequencies centered on a certain point. The specifiedpoint is affected the most; frequencies further ahead from the point are affected less.

Graphic EQ Separate slider controlling different frequencies is laid out in such a way thatrepresents the frequency spectrum. Each slider adjusts one frequency band so if you have more sliders you have more

control.

Parametric EQ This uses bell equalization with knobs for different frequencies. You can select thefrequency that is to be adjusted.

Center Frequency Allows you to specify exactly which mid?range frequency you want to boost orreduce so you get higher flexibility and accuracy.

Bandwidth Control (Q) If you want to know how far above and how much below the centrefrequency will affect you can think of Bandwidth Control.

A limiter is a compressor that limits the level of a signal to an assured threshold. A limiter will completely prevent any additional gain above the threshold. A limiter is like a compressor set to a very high compression ratio. Limiters are used as a safeguard against signal clipping. They prevent occasional signal peaks which would be too loud or distorted.

Reverb allows you to recreate the space that is typically lost with close?miking techniques. It may also be used Digitalto createAudio effects by placing sounds in spaces where they would normally Self Instructional never be heard. Material

When the sound waves interact with each other and when they are out of phase, phasing comes to picture. You can quite interesting effects by splitting an audio signal into two signals and changing the relative phasing between them. Phasing uses notch and boost filters to to phase?shift frequencies over time.

Flanging is another kind of phasing. Flanging mixes the original signal with a varying slightly delayed version of the signal. The original and delayed signals are mixed equally.

Chorus adds multiple short delays to the signal and instead of repeating

the same delay it delays each by different length & pitch. This creates a kind of delay.

Self Assessment Test

Broad Questions

1. Write a detailed note on EQ

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2. Write a detailed note on Flanging

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Short Notes

3. Write a short note on lossy compression
4. Write a short note on lossless compression
5. Write a short note on equalization
6. Write a short note on reverb
7. Write a short note on chorus

Dr. Babasaheb
Ambedkar
Open University

BCADES-105
DIGITAL AUDIO

Block

5

AUDIO FILE FORMAT

Acknowledgment

Every attempt has been made to trace the copyright holders of material reproduced in this book. Should an infringement have occurred, we apologize for the same and will be pleased to make necessary correction/ amendment in future edition of this book.

The content is developed by taking reference of online and print publications that are mentioned in Bibliography. The content developed represents the breadth of research excellence in this multidisciplinary academic field. Some of the information, illustrations and examples are taken "as is" and as available in the references mentioned in Bibliography for academic purpose and better understanding by learner.'

ROLE OF SELF INSTRUCTIONAL MATERIAL IN DISTANCE LEARNING

The need to plan effective instruction is imperative for a successful distance teaching repertoire. This is due to the fact that the instructional designer, the tutor, the author (s) and the student are often separated by distance and may never meet in person. This is an increasingly common scenario in distance education instruction. As much as possible, teaching by distance should stimulate the student's intellectual involvement and contain all the necessary learning instructional activities that are capable of guiding the student through the course objectives. Therefore, the course / self-instructional material are completely equipped with everything that the syllabus prescribes.

To ensure effective instruction, a number of instructional design ideas are used and these help students to acquire knowledge, intellectual skills, motor skills and necessary attitudinal changes. In this respect, students' assessment and course evaluation are incorporated in the text.

The nature of instructional activities used in distance education self- instructional materials depends on the domain of learning that they reinforce in the text, that is, the cognitive, psychomotor and affective. These are further interpreted in the acquisition of knowledge, intellectual skills and motor skills. Students may be encouraged to gain, apply and communicate (orally or in writing) the knowledge acquired. Intellectual- skills objectives may be met by designing instructions that make use of students' prior knowledge and experiences in the discourse as the foundation on which newly acquired knowledge is built.

The provision of exercises in the form of assignments, projects and tutorial feedback is necessary. Instructional activities that teach motor skills need to be graphically demonstrated and the correct practices provided during tutorials. Instructional activities for inculcating change in attitude and behavior should create interest and demonstrate need and benefits gained by adopting the required change. Information on the adoption and procedures for practice of new attitudes may then be introduced.

Teaching and learning at a distance eliminates interactive communication cues, such as pauses, intonation and gestures, associated with the face-to-face method of teaching. This is particularly so with the exclusive use of print media. Instructional activities built into the instructional repertoire provide this missing interaction between the student and the teacher. Therefore, the use of instructional activities to affect better distance teaching is not optional, but mandatory.

Our team of successful writers and authors has tried to reduce this.

Divide and to bring this Self Instructional Material as the best teaching and communication tool. Instructional activities are varied in order to assess the different facets of the domains of learning.

Distance education teaching repertoire involves extensive use of self- instructional materials, be they print or otherwise. These materials are designed to achieve certain pre-determined learning outcomes, namely goals and objectives that are contained in an instructional plan. Since the teaching process is affected over a distance, there is need to ensure that students actively participate in their learning by performing specific tasks that help them to understand the relevant concepts. Therefore, a set of exercises is built into the teaching repertoire in order to link what students and tutors do in the framework of the course outline. These could be in the form of students' assignments, a research project or a science practical exercise. Examples of instructional activities in distance education are too numerous to list. Instructional activities, when used in this context, help to motivate students, guide and measure students' performance (continuous assessment)

PREFACE

We have put in lots of hard work to make this book as user-friendly as possible, but we have not sacrificed quality. Experts were involved in preparing the materials. However, concepts are explained in easy language for you. We have included many tables and examples for easy understanding.

We sincerely hope this book will help you in every way you expect.

All the best for your studies from our team!

DIGITAL AUDIO

Block 1 ELEMENTS FOR SOUND

Unit 1 BASIC OF SOUND

Learning Objectives:

- Understanding Sound Waves & Properties
- Understanding Waves interaction
- Understanding Sound systems

UNIT 2 EXPLAINING TOOL BOX

Learning Objectives:

- Knowing Audio Cables

Block 2 SOUND RECORDING

UNIT 1 WORKING WITH MICROPHONES 1

Learning Objectives :

- Understanding Microphones

UNIT 2 WORKING WITH MICROPHONES 1

Learning Objectives:

- Understanding Microphones

Block 3 SOUND MIXING TECHNIQUES

UNIT 1 SOUND MIXIER 1

Learning Objectives:

- Understanding Channels

UNIT2 SOUND MIXIER 2

Learning Objective

- Understanding Channels

Block 4 AUDIO PROCESSING

UNIT 1 AUDIO PROCESSING 1

Learning Objective

- How to go for compression
- How to go for equalization
- How to go for Limiting
- How to go for Reverb
- How to go for Phasing
- How to go for Flanging
- How to go for Chorus

UNIT 2 AUDIO PROCESSING 2

Learning Objective

- How to go for compression
- How to go for equalization
- How to go for Limiting
- How to go for Reverb
- How to go for Phasing
- How to go for Flanging
- How to go for Chorus

Block 5: AUDIO FILE FORMATS

UNIT 1 DIGITAL AUDIO FORMATS 1

Learning Objective

- Understand the various digital audio file formats

UNIT 2 DIGITAL AUDIO FORMATS 2

Learning Objective

- Understand the various digital audio file formats

UNIT 1

DIGITAL AUDIO FORMATS I

❖Learning Objectives:

•Understand the various digital audio file formats

: Structure :

1.1 Introduction

There are various kinds of digital formats that are available today in the market. Depending on the kind of applications you are making and into you need to decide which format will be working best for you. With the advent of various digital audio formats available there is quite a hue challenge to the audio equipment manufacturing industry as they need to design equipments that support these digital formats. So let's study these various formats and you will mainly come across their definitions.

The content of this Unit is courtesy MP3HandBook

1.2Digital Audio Files

WAV

WAV is the default format for digital audio on Windows PCs. WAV files are usually coded in PCM format, which means they are uncompressed and take up a lot of space. WAV files can also be coded in other formats, including MP3.

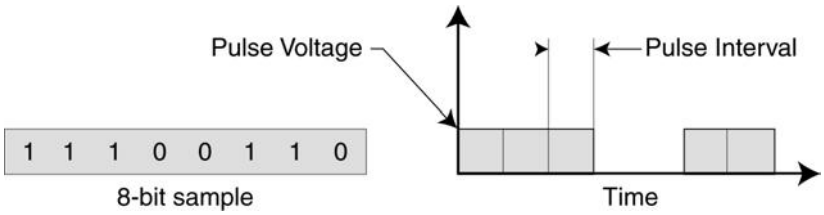
AIFF and AU

AIFF is the default audio format for the Macintosh, and AU is the default format for SUN systems. Both of these formats are supported on most other platforms and by most audio applications. Each of these formats can be compressed, but compression sometimes creates compatibility problems with other platforms.

Streaming Audio

Streaming audio avoids many of the problems of large audio files. Instead of having to wait for the entire file to download, you can listen to the sound as the data arrives at your computer.

Figure 2 - Pulse Code Modulation



1.3Standard Formats

Standard formats make it easier for software developers and equipment manufacturers to produce products that are less costly and more compatible with each other. The compatibility provided by standard formats helps assure consumers that their music and equipment won't become obsolete.

PCM

PCM (Pulse Code Modulation) is a common method of storing and transmitting uncompressed digital audio. Since it is a generic format, it can be read by most audio applications—similar to the way a plain text file can be read by any word-processing program. PCM is used by Audio CDs and digital audio tapes (DATs). PCM is also a very common format for AIFF and WAV files.

PCM is a straight representation of the binary digits (1s and 0s) of sample values. When PCM audio is transmitted, each "1" is represented by a positive voltage pulse and each "0" is represented by the absence of a pulse. Figure 26 shows how binary data is converted to a PCM signal.

DPCM

DPCM (Differential Pulse Code Modulation) is a simple form of lossy compression that stores only the difference between consecutive samples. DCPM uses 4 bits to store the difference, regardless of the resolution of the original file. With DCPM, an 8-bit file would be compressed 2=1, and a 16-bit file would be compressed 4=1.

ADPCM

ADPCM (Adaptive Differential Pulse Code Modulation) is similar to DCPM except that the number of bits used to store the difference between samples is varied depending on the complexity of the signal. ADPCM works by analyzing a succession of samples and predicting the

value of the next sample. It then stores the difference between the calculated value and the actual value.

u-law Compression

u-law (pronounced "mew-law") is a common lossy compression scheme, similar to ADPCM, which can be used on AU, AIFF and WAV files.

MPEG Audio

MPEG Audio is a family of open standards for compressed audio that includes MP2, MP3 and AAC.

MPEG-Based Proprietary Formats

Several proprietary formats are based on MPEG audio. Some of these are used in special applications, such as voice mail systems, high definition TV and satellite radio. Others compete directly with MP3 and are based on AAC or MP3, with proprietary wrappers. The sound quality of some of these is very good, but their proprietary nature makes them incompatible with many programs and portable players.

a2b

AT&T's a2b music is a sophisticated music distribution system with many features, such as watermarking and encryption, to support copyright protection and royalty tracking. It is based on the MPEG-2 AAC Low Complexity Profile. The Policy Maker feature of a2b is a flexible electronic licensing system, which can control how music is used and distributed. Music encoded with a2b can include artwork, credits, lyrics and links to the artist's Web site.

Summary

•Digital Audio Files

•Streaming Audio

•MPEG Audio

•Non-MPEG Proprietary Formats

•Windows Media Audio

Self Assessment Test

1.Define WAV, AIFF

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2.Give full forms of PCM, DPCM, ADPCM

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3.What s a2b?

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4.What is EPAC?

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5.What is TwinVQ?

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UNIT 2

DIGITAL AUDIO FORMATS II

❖Learning Objectives:

•Understand the various digital audio file formats

: Structure :

2.1 Introduction

There are various kinds of digital formats that are available today in the market. Depending on the kind of applications you are making and into you need to decide which format will be working best for you. With the advent of various digital audio formats available there is quite a hue challenge to the audio equipment manufacturing industry as they need to design equipments that support these digital formats. So let's study these various formats and you will mainly come across their definitions.

The content of this Unit is courtesy MP3HandBook

2.2 Proprietary Formats

Proprietary formats can generate enormous profits for the developer if the format becomes a de facto standard. The marketplace, which tends to favor open standards like MPEG, will ultimately decide which formats will prevail.

MP4

Global Music Outlet uses the term MP4 to describe its proprietary music delivery system. It's based on an enhanced version of MPEG AAC and includes an embedded player (each song is an .EXE file). Album graphics and links to the artist's Web site can be embedded in the file.

Liquid Audio

Liquid Audio is a sophisticated music distribution system based on Dolby Digital and MPEG AAC. It supports both downloadable and streaming audio and uses watermarking and encryption for copyright protection. Music encoded with Liquid Audio can include artwork, lyrics, notes and pricing, along with links to a Web site where the song or album can be purchased. Liquid Audio has a playlist feature and allows you to burn songs to a CD if you have a supported CD-R drive.

Apple QuickTime

QuickTime is a widely used multimedia format from Apple Computer that supports both streaming audio and streaming video. Much of the MPEG-4 standard is based on QuickTime, and it is widely used for streaming video on the Web.

Non-MPEG Proprietary Formats

Several digital audio formats exist that are entirely proprietary. Many of these are quite good and are widely used.

Dolby Digital (Formerly AC-3)

Dolby Digital is a very high quality audio encoding and noise reduction system that is the audio component of High Definition Television (HDTV) and digital broadcast TV (DTV). It is also used in DVDs, laser discs, digital cable and direct broadcast satellite (DBS) systems.

EPAC

EPAC is a perceptual audio encoding scheme based on PAC—developed by Bell Labs, the research and development arm of Lucent Technologies. EPAC is reported to produce quality indistinguishable from the original CD at 128 kbps. However, I participated in one listening test where the audience was able to consistently tell the difference between original CD tracks and the same tracks encoded in EPAC at 160 kbps.

Windows Media Audio

Microsoft's Windows Media Audio (WMA) format is a relatively late entry into the field of proprietary audio formats. WMA performs very good at lower bit-rates and is reported to produce quality indistinguishable from the original CD at 128 kbps. WMA is supported by most full-featured player programs and by many portable players. WMA is royalty-free when incorporated into software that runs on the Windows platform.

Real Audio

Real Audio was the first widely used system for streaming audio and video over the Internet. It is a proprietary format, but it is used by many online music stores for sample clips of songs. The RealPlayer also provides support for MP3.

TAC

TAC (Transparent Audio Compression) is a high-quality perceptual encoding scheme developed by K+K Research. TAC uses Adaptive Bit-rate Management (ABM), which is similar to VBR (variable bit-rate) encoding. TAC was developed as part of K+K Research's MP02 (Music Publisher 02) software.

TwinVQ (VQF)

TwinVQ (Transform-domain Weighted Interleave Vector Quantization) is an encoding scheme developed by the NTT Human Interface Lab in Japan.

TwinVQ is reported to provide higher quality than MP3, but encoding times are reported to be much longer, and CPU utilization is reported to be higher during playback.

Summary

•Digital Audio Files

•Streaming Audio

•MPEG Audio

•Non-MPEG Proprietary Formats

•Windows Media Audio

Self Assessment Test

1.Define WAV, AIFF

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2.Give full forms of PCM, DPCM, ADPCM

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5.What is TwinVQ?

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Glossary / Key Terms

Courtesy: http://www.audiolimits.com/html/terminology.html

A-B Test

Comparing the performance of two or more models of equipment such as amplifiers or speaker systems by listening and switching quickly from one to the other.

Absorption

The ability of a room to take up or absorb the acoustic energy radiated within it. There are many types of absorption since it can be frequency

dependent. There are certain materials such as acoustical ceilings that may absorb more high frequencies than lows. Diaphragmatic absorptions (caused by loose wall panels or cavities behind the panels) cause certain low frequencies to be absorbed.

AC Mains

110-120 Volts alternating current (60 Hz)

Acoustic

Relating to the production, effects and transmission of sound waves; the transmission of sound waves through various mediums. Pertaining to the act or sense of hearing, the science of sound, or the sound heard.

Acoustical

Sound or properties of sound; the acoustical response of a room has to do with the way that room responds to sound.

Acoustic Treatment

The application of acoustic or sound absorbing material to a room or enclosure to obtain the desired acoustic characteristics.

Active

A type of electronic circuitry that can increase the gain or amplitude of a signal.

Active gain controls. Active Equalization. Active Direct Boxes. Active Crossover.

ADA

The Americans with Disabilities Act. A federal law enacted in 1990 designed to end discrimination against persons with handicaps and to provide full accessibility for persons with handicaps. With respect to sound systems, the ADA requires all large public facilities to provide for the needs of hearing impaired individuals by offering assistive listening devices. [see ALS]

ALS

Assistive Listening System. This term refers to systems used to augment the regular sound system to allow hearing impaired persons to more clearly hear. These can be either hardwired (earphones) or wireless (inductive loop, FM, infrared). The FM and infrared wireless systems are most common and allow the user to have individual control of the listening volume.

Ampere

Named after Andre Ampere (1775-1836), French scientist. A unit of measurement of electrical current (I). One amp of current represents 6.2818 x 10 electrons flowing past a given point in one second, and is equal to one coulomb.

Amplification

An increase in signal magnitude from one point to another, or the process causing this increase.

Amplifier

A device capable of increasing the gain (magnitude) or power level of a voltage or current that is varying with time (frequency), without distorting the wave form of the signal. An amplifier is used to increase weak signals (such as those from a program source) to a level sufficient to drive loudspeakers.

Analog

A physical variable which remains similar to another variable insofar as the proportional relationships are the same over some specified range. The electrical signal produced by a microphone is an electrical analog of the acoustic sound that the microphone is reproducing. The continuous electrical signal that the nonelectrical acoustic information impressed on the transducer. The electrical signal is analogous to the acoustical sound that the microphone reproduces, i.e., the voltage that the microphone produces is the electrical analog of the acoustic sound source.**Anechoic**

Refers to a room in which all surfaces are lined with acoustic absorption material to such an extent that the room absorbs sound energy instead of reflecting it around the room (no echo). A room that offers nearly total absorption is called an Anechoic Chamber and must be quite large in order to accommodate low frequencies.

Attenuation

A decrease in signal magnitude from one point to another, or the process causing this decrease.

Attenuator

An adjustable passive network which reduces the power level of a signal without introducing any appreciable distortion.

Audio Chain

The order of sequence for connecting audio components, i.e., microphone, preamplifier (mixer), effects device, graphic equalizer, crossover, amplifier, and speaker.

Audio Description

A service to allow vision impaired individuals to better enjoy live and televised performances by providing narration of visual aspects of the performance. In live performances, the audio description is delivered to the listeners via wireless receivers similar to those used for hearing impaired individuals. [see ALS]

Audio Frequency

Any frequency corresponding to a normally audible sound wave.**Audio Range**

20 Hz to 20,000 Hz. (Twenty cycles per second to twenty thousand cycles per second). The frequency response spectrum of human auditory perception.

Automatic Gain Control (AGC)

A process by which gain is automatically adjusted as a function of the input level or other parameter. A device used to automatically control the level of a sound system based on the input level.

Aux Input / Aux Output

An auxiliary input or output that is generally a direct connection to the device's internal signal bus. These are used to interconnect devices which have the same signal level. That is, where gain is not required such as when connecting a microphone to a mixer. Typical devices that operate at "aux level" are tape decks, CD players, equalizers, signal processors, etc.

Baffle

The panel on which the speaker is mounted within the speaker enclosure. The term derives from its original use in preventing or baffling the speaker's rear sound waves from interfering with its front waves.

Balanced Cable

A cable consisting of a pair of wires surrounded by either a braided shield or foil wrap with a drain wire.

Balanced Line

A transmission line consisting of two conductors plus a shield, capable of being operated so that the voltages of the two conductors are equal in magnitude (voltage) and opposite in polarity with respect to ground. A balanced line offers common mode rejection, or cancellation by attenuation, of signals electromagnetically induced into the signal lines. [see Common Mode Rejection]

Bandpass

Refers to a type of filter that passes a certain band of frequencies uniformly and attenuates or reduces the level of frequencies below and above the specified bandpass.

Bandwidth

Response characteristic in which a definite band of frequencies having a low frequency and high frequency limit are transmitted or amplified uniformly.

Bass Reflex

A type of speaker enclosure in which the speaker's rear sound wave emerges from a critically dimensioned auxiliary opening, or port, to reinforce the bass tones.

Biamp

Separating the audio spectrum into two bands, i.e., high frequencies (high pass) and low frequencies (low pass) by means of an electronic crossover and using two separate amplifiers or channels of an amplifier. One amplifier or channel passes the high pass signals (high frequencies) to drive the high frequency component or horn of the speaker system. The other amplifier or channel passes the low pass signals (low frequencies) and drives the woofer or low frequency component of the speaker system. The advantage to biamp operation of a sound system is increased headroom and dynamic range.

Boost

A term used to indicate an increase in gain of a frequency or band of frequencies when equalizing an audio signal. Opposite of cut.

Bridge Mode (Mono)

Operating a stereo amplifier in mono via the bridge mode switch, which typically makes Channel A output the positive power rail and Channel B

output the negative power rail. Since the signal swings between A and B Channels, the output of the amplifier is twice that of single channel operation.

Bridging

Connecting one electrical circuit in parallel with another. Typically used to describe the process or connecting the output of a single device to the inputs of multiple other devices.

Bus

A conductor that serves as a common connector to several signal sources, most often associated with a mixer. A separate signal routing to a specified output.

Capacitor

A device which consists essentially of two conductors (such as parallel metal plates) insulated from each other by a dielectric (a material in which an electric field can be sustained with a minimum dissipation in power) and which introduces capacitance into a circuit, stores electrical energy, blocks the flow of direct current (DC), and permits the flow of alternating current (AC), to a degree dependent on the capacitor's capacitance and the current frequency.

Cardioid

A type of microphone having a heart shape pickup pattern that picks up sound better from the front (on axis) than back (off axis). [See Unidirectional]

Clipping

Amplifier overload causing a squaring off or undesirable change in the wave form resulting in distortion or perceptible mutilation of audio signals.

Cluster

An array of loudspeakers or horns designed to act as a single or point source of sound.

Coincident

Two signals are said to be coincident when they correspond exactly, fall upon or meet at the same point. Coinciding or occurring in space or time in exact agreement.

Comb Filter

When two combining sound waves have different amplitudes, phases, and frequencies, the resultant soundwave develops many nulls or spaces where the energy has cancelled. When viewed on a graphic recorder the resultant frequency response resembles a comb due to the nulls or notches of information that have

Combining Unit

Typically used with microphones to combine two or more mics into a single input of a mixer. These devices are usually passive transformer or resistive circuits, but active versions are available which provide a higher degree of isolation between the multiple inputs..

Common Mode Rejection

The ability of an amplifier to cancel a common mode signal (such as interference) that is applied equally to both input terminals of a balanced amplifier, while responding to a signal from the source that is constantly changing direction (alternating current) so it is out of phase with respect to the two balanced signal lines; therefore it is not common mode and will be passed and not rejected.

Compander

A combination of a compressor at one point of a signal path for reducing the level of the signal, followed by an expander at another point for a complimentary increase in signal level.

Compression

Reduction of the effective gain of an amplifier at one level of signal with respect to the gain at a lower signal level.

Conductor

A wire, cable or other material (metal, liquids, gases, or plasma) that is suitable for carrying electric current

Continuous Power

This power rating represents the most conservative statement of the capability of an amplifier. It is also called “RMS” power. It denotes the amount of power an amplifier can deliver when amplifying a constant steady tone. It is usually measured at a signal frequency of 1kHz for a specific distortion. Continuous power in watts is expressed as: W = V2/

R Power in watts equals the voltage squared divided by the resistance of the load.

A signal, such as speech or music, that contains voltages continuously changing in both frequency and voltage (time and amplitude).

Contour

A circuit which adds a bass boost to attain equal loudness at lower volumes. Also known as Loudness.

CPS

Abbreviation for "Cycles per second", the units for expressing frequency. The term "CPS" has been obsoleted and replaced by "Hertz". Hertz = Cycles per second. 1 kHz = 1 Kc.

Critical Distance

The point within a room where the sound level of the direct field radiating from the loudspeaker and the reverberant field within the room become equal in intensity or level.

Crossover (X-OVER)

An electronic device that is used to separate an audio signal into two or more bands of frequencies or component signals above and below a certain frequency, said to be the crossover frequency or crossover point. Crossovers can be active or passive.

Crossover, Active

Electronic or active crossovers are used in biamplified sound systems where two amplifier channels are used to individually operate the woofer(s) and horn(s) of the speaker system. The active crossover is placed in the audio chain just ahead of the amplifiers, and separates the audio signal into low and high frequency groups. Some active crossovers separate the signal into low, mid and high frequency bands for 3-way or triamplified speaker systems. The advantages of active crossovers and biamplification are low distortion, increased headroom and better control over the relative levels of the low and high frequency sections of the speaker system. Disadvantages include the need for additional amplifier channels, higher cost of the crossover compared to passive units and multiple wire runs from the amplifiers to the speakers.**Crossover, Passive**

A passive crossover is built into most speaker cabinets in order to sepa-

rate the full range signal from the output of a power amplifier into low frequency and high frequency bands to operate the woofer and horn (or tweeter) respectivly. Some speakers utilize a 3-way crossover which separates the signal into low, mid and high frequency bands. The advantages of passive crossovers are that a single amplifier channel can be used and they can be relatively inexpensive.

Disadvantages include higher potential for low frequency distortion caused by saturation of the inductors used in the low frequency section and excess amplifier power consumption due to heat losses within the passive components.

Crosstalk

Interaction of adjoining channels or circuits. Crosstalk can occur by being induced electromagnetically or electrostatically. Crosstalk is a common specification for mixing consoles.

Current

(I)The rate of flow (measured in amperes) of electricity in a conductor or circuit. The amount of current that flows is determined by the voltage or electrical pressure applied and the conductivity of the substance or material (which also determines the resistance or opposition to current flow).

Cut

A term used to indicate the reduction in gain or attenuation of a frequency or band of frequencies when equalizing an audio signal.

Cycle or Hertz

A unit of motion referenced to a time period of one second. The frequency of a vibration or oscillation in units per second. 100 Hertz or 100 c.p.s. (cycles per second) refers to the number of times a second (100) a string is vibrated or an amplifier is swinging between its positive and negative supply voltage.

Damping Factor

The ratio of the speaker impedance to the amplifier's internal output impedance. Damping factor is a measure of how well an amplifier can actually control the movement of a speaker cone or diaphragm by preventing it from moving farther than it is supposed to. Damping factor is arrived at by dividing the speaker impedance by the amplifier's internal

output impedance. The internal output impedance of any amplifier is determined by the transconductivity (internal resistance) of the output devices. Everything connected in the speaker line (including the speaker cable itself or a crossover) looks to the speaker like an increase in the output impedance of the amplifier, thus lowering the effective damping factor. Because any speaker is a mechanical device, it will have its own resonant frequencies, which will cause the cone to continue in motion after the electrical signal has stopped. [see transient distortion]. An amplifier with a high damping factor will damp out the unwanted speaker cone excursion.

dB (Decibel)-

A unit for describing the ratio of two voltages, currents, or powers. The decibel is based on a logarithmic scale; when measuring differences in sound pressure level (SPL), the amount of change in sound pressure level perceivable is directly proportional to the amount of stimulus (the more sound present, the greater the change must be, to be perceived).

The Decibel

The origin of the decibel is the “bel” which was named in honor of Alexander Graham Bell. It was a logarithmic term called the “transmission unit” which was used to express the transmission losses of long telephone lines. The “bel”, being too large for practical use, was later changed to “decibel”. The decibel has no actual numerical value, but is used only to express a ratio between two voltages, currents, powers, or impedances. The decibel uses logarithms to the base 10 called LOG. This should not be confused with the natural logarithm to the base “e” called LN used in many electronic formulas. Examples of decibel calculation: To calculate for voltage, current, SPL, distance: 20 Log X1/X2. To calculate for power = 10 Log P1/P2**.**

NotesDecay

The gradual reduction in sound energy once the sound source is turned off.

Diaphragm

A thin flexible sheet that can be moved by sound waves as in a microphone, or can produce sound waves when moved as in a loudspeaker or compression driver.

Differential Amplifier

An amplifier whose output is proportional to the difference between the voltages applied to its two inputs. Used to balance or offer common mode rejection of interference signals.

Diffraction

The bending or redistribution of acoustic sound waves in a room caused by some obstacle, such as a column or divider. Only low frequency wave forms can be diffracted.

Diffusion

The scattering of sound waves by a solid object.

Digital

Refers to the processing of audio signals as having discrete values as opposed to a continuous analog audio signal. In digital audio the continuous analog signal is converted to an encoded discrete value or digital word.

Dip

A reduction (attenuation or cut) in gain at a certain frequency also called a notch.

Directivity

Area of coverage of a speaker or microphone.

Dispersion

The spread or distribution or coverage of sound generated from a horn or loudspeaker. For any given frequency, the area of dispersion is defined as that area between the -6 dB down points of that frequency plotted against amplitude. It is measured in degrees related to an imaginary line descending from the center of the speaker cone. As you move away from the imaginary line, up or down, right or left, the loudness level of the sound decreases. When the sound level decreases rapidly on either side of the imaginary line, the dispersion in degrees is relatively small and the speaker is said to be highly directional.

Distortion

Any undesired change in the wave form of an electrical signal passing through a circuit or transducer. Any distortion can be defined as deviation from the original sound, the discrepancy between what the ampli-

fier should do and what it actually does. All distortion is undesirable. Distortion occurs when the amplifier alters the original sound in the process of amplification so that what comes out of an amplifier is no longer a true replica of what went in. Performers, however, will sometimes desire the application of electronically induced distortion for extra-musical effect in the production of their "sound". The undesirability of inherent distortion is associated with high fidelity and should not be confused with the desirability of distortion as it is expected to be produced through circuitry. When reproducing sound, distortion is unwanted.

Driver

The motor structure portion of a horn loaded loudspeaker system that converts electrical energy into acoustical energy and feeds that acoustical energy into the entry of a horn throat or the narrow end of the horn. Most often used when referring to a high frequency compression driver, called a driver for short. The definition also includes the loudspeaker in a horn loaded woofer or mid bass horn.

Dynamic Range

In a musical instrument, the dynamic range is the difference in decibels between the loudest and softest level of notes that can be played on that instrument. In electronic equipment, dynamic range is the difference in decibels between the highest (overload level) and lowest (minimum acceptable) level compatible with that piece of equipment.

Echo

A wave which has been reflected or otherwise returned with sufficient magnitude and delay to be perceived as a distinct wave, separate from the original wave. A delay in sound of more than 50 milliseconds resulting in a distinct repeat or number of repeats of the original sound.**Efficiency**

The ratio, usually expressed as a percentage, of the useful power output to the power input of a device. The efficiency of a speaker system is the SPL the unit produces at a 1 W RMS input power level measured 1 meter from the unit.

Doubling the input power raises the SPL 3 dB. Doubling the number of enclosures raises the SPL 3 dB. Doubling the input power and the number of enclosures raises the SPL 6 dB. Doubling the distance (near field) lowers the SPL 6 dB.

Electronically Balanced Input

A differentially balanced amplifier; an amplifier whose output is proportional to the difference between the voltages applied to its two inputs. Offers common mode rejection or attenuation of interference signal that was introduced electromagnetically in the signal carrying conductors.

Enclosure

An acoustically designed housing or structure for a speaker.

Equalization

The act of obtaining a desired overall frequency response through the implementation of graphic equalizers or tone controls.

Equalizer

A device designed to compensate for an undesired amplitude-frequency characteristic of a system or speaker.

Excursion

Movement of the cone of a loudspeaker or the diaphragm of a compression driver. The higher the voltage or amplitude of the signal applied, the greater the movement or excursion of the loudspeaker or diaphragm.**Exponential Horn**

A speaker designed to reproduce the high frequencies. An exponential horn has a flare rate that increases with the square of the distance from the entry to the horn throat.

Far Field

That portion of the direct field that is at least twice the distance of a frequency's wavelength.

Feedback

(Electronic) The return of a portion of the output of a circuit to its input. (Acoustic) A squeal of a sound system caused by the regeneration of a signal from the output of a sound system into a microphone input.

Filter

An electrical or electronic device that permits certain frequencies to pass while obstructing others. Examples include loudspeaker crossovers, equalizers, feedback reducers and even simple bass and treble controls.

Flutter Echo

A multiple echo in which the reflections occur in rapid succession caused by large surfaces being acoustically parallel to each other.

Frequency

The number of vibrations or oscillations in units per second. Measured in cycles or Hertz per second. The rate of repetition in cycles per second (Hertz) of musical pitch as well as of electrical signals. For example, the number of waves per second a vibrating device such as a piano or violin string moves back and forth each second of time to produce a musical tone.

Frequency Response

A measure of the effectiveness with which a circuit, device or system transmits the different frequencies applied to it. The way in which an electronic device (mic, amp or speaker) responds to signals having a varying frequency. This is a measurement of how well an amplifier reproduces and amplifies a specified audible range with equal amplitude or intensity, for example, 30 to 16,000 Hz.

Full Range

The entire audio spectrum, 20 Hz - 20 kHz.

Gain

An increase in strength or amplitude (voltage) in a signal. The increase in signal power that is produced by an amplifier; usually given as the ratio of output to input voltage, current, or power expressed in decibels.**Ground**

A heavy cable connected to earth via a metal copper stake for the purpose of grounding electrical equipment. In the U.S. a third wire in our electrical system is connected to this earth ground to provide a means of connecting the chassis of electrical equipment to the earth ground and thus provide protection against hazardous electrical shock.

Ground Loop

Hum caused by return currents or magnetic fields from relatively high-powered circuits or components which generate unwanted, noisy signals in the common return of relatively low-level signal circuits. A potentially detrimental loop formed when two or more points in an audio system that are nominally at ground potential are connected by a conducting path.

Haas Effect

Refers to the condition of the human auditory system that permits a listener to merge all the information arriving in the first 20 milliseconds as a single event.

This is sometimes called the precedent effect.

Harmonic

One of a series of sounds, each of which has a frequency which is an integral multiple of some fundamental frequency.

Headroom

The difference between the average operating power level of an amplifier circuit and the point at which clipping or severe distortion occurs.

Hearing

The human hearing system is very well designed. It has a dynamic range of over 120 dB. Contemporary digital recording techniques can only achieve a dynamic range of about 90 dB. The typical threshold of pain is around 140 dB, with discomfort starting around a sound level of 118 dB. The normal hearing range is considered to be 15 Hz to 20 kHz. The typical Hi-Fi specification range is 20 Hz to 20 kHz. Typically, however, the average person cannot hear 20Hz. Sound reinforcement specifications reflect 50 Hz to 15 kHz (sometimes 40 Hz). Interestingly enough, this just happens to be the FCC limits on FM radio. The typical telephone has a frequency response of 400 Hz to 4 kHz. The human ear does not hear all frequencies at the same intensity. It's less sensitive at both the lower and upper ends of the frequency spectrum, and this characteristic varies with both age and sex. The amount of sensitivity is also a function of sound pressure level. The greatest intensity variations occur at very low sound pressure levels. The curve is relatively flat at sound pressures of 90 dB or so (Fletcher-Munson). The decibel is used in acoustic measurements because the human ear responds to the intensity of sound in approximately a logarithmic manner.

Sensitivity: Only 5% of people can hear a 1 dB difference in level (60 dB, 1kHz); about 50% of people can hear a 2 dB change; and almost everyone can hear a 3 dB change. This means that when looking at equipment specifications, 1 dB frequency response specs are good; 3 dB specs are fair.

Relative level: 50% of people say about a 7.5 dB increase in level seems twiceas loud . . . some as low as 5 dB, and some as high as 10 dB. This test is very level and frequency sensitive. Higher sound levels produce lower numbers and frequencies below 1 kHz and above 5 kHz yield higher numbers. The rule of thumb is 10dB. Applied to sound systems, to achieve output levels that appear to be twice as loud the system must produce over eight times more output power!

Hertz (Hz)

A unit of measurement, previously referred to as cycles per second used to indicate the frequency of sound or electrical wave. A unit of motion referenced to a time period of one second. The frequency of a vibration or oscillation in units per second.

High Pass

All signals above a given crossover frequency.

High Z or High Impedance

Any resistance to AC voltage or current generally greater than 2,000 Ohms.

Hiss

Audio-frequency noise having subjective characteristics analogous to prolonged sibilant sounds.

Hum

An electrical disturbance that can occur in sound equipment due to the frequency of the power distribution system or any number of its harmonics. Our power line frequency in the U.S. is 60 Hz. Hum can occur at 60 Hz, 120 Hz, 180 Hz, 240 Hz, etc.

IM (Intermodulation Distortion)

Nonlinear distortion characterized by the appearance of output frequencies equal to the sums and differences of integral multiples of the input frequency components. For instance, an amplifier with high IM distortion amplifying two frequencies of 100 Hz and 2,000 Hz would also generate distortion components of 1,900 Hz and 2,100 Hz.

Impedance

The total opposition to alternating current flow presented by a circuit. The resistance to the flow of alternating current in an electrical circuit, generally categorized as either “high” or “low”, but always expressed in

ohms. Commonly used to rate electrical input and output characteristics of components so that a proper "match" can be made when interconnecting two or more devices, such as a microphone, loudspeaker or amplifier.

Impedance Match

The condition in which the external impedance of a connected load is equal to the internal impedance of the source, thereby giving maximum transfer of energy from source to load, minimum reflection, and minimum distortion.

Impulse

A type of signal that switches on and off as opposed to remaining in a steady state like a continuous sine wave. Music is more impulsive in nature than it is steady state.

Inductance

That property of an electric circuit or of two neighboring circuits whereby an electromotive force is generated (by the process of electromagnetic induction) in one circuit by a change in itself or in the other.

Inductor

A coil of wire used to create an impedance whose reactive component is low, therefore offering low resistance at low frequencies and high resistance at high frequencies. An inductor passes low frequencies and attenuates or rolls off high frequencies.

Infinite Baffle

A baffle that effectively prevents all of the loudspeaker's rear sound waves from interfering with its front waves.

Input Overload

Distortion produced by too strong a signal from the output of a microphone or other signal source connected to the input of a preamplifier.

Insertion Loss

A loss in gain of a system after a component has been added or inserted in the system, usually expressed in decibels.

Jack

A receptacle on a receiver, tape recorder, amplifier or other component into which a mating connector can be plugged.

Kilohertz

A frequency of one thousand cycles per second (1 kHz).

LED

Light emitting diode, a semiconductor device that produces visible light when a voltage of a certain polarity and potential is applied to it.

Limiter

An electronic circuit used to prevent the amplitude of an electronic waveform from exceeding a specified preset level while maintaining the shape of the waveform at amplitudes less than the preset level.

Linear

Having an output that varies in direct proportion to the input.

Linear Frequency Scale

A scale on which each equal length division represents an equal number of Hertz. If you add the equal length division in Hertz to the last division frequency, you get the next frequency in a series.

Line Out

An output connection found on mixers, preamps, tape decks, etc. providing an output at a level sufficient to drive the input of a power amplifier.

Load Impedance

The actual impedance of the load or speaker that a power amplifier is connected to, thus driving a load of a certain impedance.

Logarithmic Frequency Scale

A scale on which each division represent an exponential constant, i.e., each division from a reference point is proportional to its logarithms.

Loudness Control

A volume control with special circuitry added to compensate for the normal decreased hearing ability of the human ear at the extreme ends of the audio range when listening to lower sound levels. A typical loudness control boosts the bass frequencies and to a lesser extent, the high frequencies. Sometimes this control is called contour.

Loudspeaker Efficiency

The ratio, expressed in percentage, of signal output to signal input used to state the power needed to drive a loudspeaker. An example: Power

output 2 watts; Power input 10 watts; Ratio 2/10=20% efficiency. Efficiency can vary from 2% to as high as 25%.

Low Pass

All of the frequencies below a given crossover frequency.

Low Z or Low Impedance

Any resistance to AC voltage or current flow generally less than 2000 Ohms.

Master

Main level or gain control for a device, bus or mix.

Microphone

A microphone is a transducer that changes acoustical energy (sound) into electrical energy.

Mixer

A device in sound reinforcement that has two or more signal inputs and a common signal output. Used to combine separate audio signals in desired proportions to produce an output audio signal.

Mode

Another word for room resonance. When sound energy is restricted by boundaries (such as walls, floor, and ceiling) waves are developed at certain frequencies or wavelengths that are integers of the distance between the room boundaries. Room modes or resonances cause standing waves because once the wave is generated it stands there, i.e., the positive pressure peaks (anti-nodes) and negative pressure troughs (nodes) stay stationary within the boundaries.

Monitor

A loudspeaker or system of loudspeakers that permits the performer to evaluate or monitor his sound alone or in conjunction with other sounds that may be desired and is mixed to the listeners preference by means of a separate monitor or reference mix.

Mono

Monophonic Sound - Sound produced by a system in which one or more microphones feed a single signal to an amplifier(s) whose output is coupled to one or more loudspeakers.

Multimeter

Also called a Volt-Ohm-Meter (VOM). A measuring instrument that can measure different ranges of voltage, current, and resistance. A multimeter can have an analog needle indicator or a digital read out.

Music Power

This is a power rating generally applied to high fidelity amplifiers for tones of short duration. It takes into account the fact that most amplifiers can produce a greater amount of power in short bursts than they can continuously. The rationale is that music is made up of such bursts rather than sustained single frequencies. It is higher than continuous power ratings for the same amplifiers. It is measured at a signal frequency of 1000 Hz for a specified distortion.

Noise

Any extraneous sound or signal that intrudes into the original as a result of environmental noise, distortion, hum, or defective parts in the equipment.

Notch Filter

A band rejection filter that produces a sharp notch in the frequency response of a system, thus reducing the gain or amplitude of a narrow band of frequencies centered on a given frequency.

Octave

The interval between any two frequencies having a ratio of 2 to 1. Example: “A 440" is an octave above “A 220”.

Ohm

The unit of electrical resistance, equal to the resistance through which a current of one ampere will flow when there is a potential difference of one volt across it.

Ohm is the unit of measure used to express opposition to current flow. Every wire or part through which electricity passes has some resistance to that passage.

Omnidirectional

A term usually applied to microphones to refer to uniform pickup of sound from all directions.

Oscilloscope

A test instrument that shows a picture of electrical waveforms by means of a cathode ray tube. An oscilloscope is calibrated to allow measurement of the instantaneous values and waveforms of electrical signals that are changing rapidly or varying as a function of voltage or time. Also known as a Scope.

Output Impedance

The internal output impedance of an amplifier presented by the amplifier to the load. (not to be confused with load impedance.)

Output Power

The power delivered by a system to its load. (i.e. an amplifier driving a loudspeaker system)

Overtone Harmonic

Multiples of frequency of a fundamental waveform.

Pad

A fixed passive network which reduces the electrical level of a signal. An attenuator.

Parallel

An electric circuit in which the elements or components are connected between two points with one of the two ends of each component connected to each point.

Parametric

A type of equalization circuit that has three variable parameters; frequency, cut or boost bandwidth, and Q (the width of the filter).

Passive

An electronic circuit composed of passive elements, such as resistors, inductors, or capacitors, without any active elements, such as vacuum tubes or transistors generally resulting in a signal loss.

Peak

The maximum instantaneous value of a signal amplitude.

Peaking

A term used to indicate an increase in gain of a frequency or band of frequencies when equalizing an audio signal.

Peak Limiter

A device which automatically limits the level of its output signal to approximate a preset maximum value by reducing its gain when the signal exceeds a preset value.

Peak-to-Peak

Amplitude of an alternating voltage measured from negative peak to positive peak.

PFL

Pre Fade Listen. This describes a button on a mixing console that permits a channel or sub to be monitored before that channel or sub's level control or fader.

This allows an operator to listen to a channel without that channel being heard by the audience.

Phase

Phase is the time interval between two related events. Two signals are in phase when they reproduce the same sound or signal simultaneously; they are out of phase to the extent that one leads or lags behind the other in time. A signal is said to be in phase with another when the voltage and current amplitudes begin at the same time and move in the same direction.

Phase Cancellation

Signals that are out of phase will cancel one another according to the difference in phase in degree. A transducer (speaker or microphone) wired out of phase with another will result in reduced output from both; instead of their combined outputs adding, they will subtract due to phase cancellation.

Piezo-Electric

Having the ability to generate a voltage when mechanical force is applied; or to produce a mechanical force when a voltage is applied, as in a piezo-electric crystal.

Point Source

A source of acoustic sound waves having definite position but no extension into space. A point source is an ideal; an imaginary single point in space. This imaginary point source provides a good approximation for

distances from the point source that are much larger compared to the actual dimensions of the source. A cluster or array of horns and loudspeakers is positioned using this imaginary point in space as a reference for the actual source of the sound. Properly configured the array will perform as a single or point source of sound.

Polarity

The quality of having opposite poles. In electro-magnetic-mechanical systems, some form of potential is referenced to one of two poles with different (usually opposite) characteristics, such as one which has opposite charges or electrical

Post

(after) on a mixer; post indicates that the function is derived after the channel slider or gain control.

Power

Electrical energy, measured in watts, such as the current from an amplifier used to drive a loudspeaker. Power in watts is expressed as W = V2/R

Power Amplifier

The final active stage of the audio chain, designed to deliver maximum power to the load or speaker impedance for a given percent of distortion.

PRE

(before) On a mixer, pre fade listen (PFL) indicates that the function is derived before the channel slider or gain control pre monitor send, the monitor send is before and independent of the channel slider or gain control. A pre monitor send is usually pre channel EQ also.

Preamp (preamplifier)

An amplifier whose primary function is boosting or amplifying the output of a low level audio-frequency source, (such as a microphone), so that the signal may be further processed without appreciable degradation of the signal-to-noise ratio of the system. An amplifier which increases electrical signals from a microphone or other instrument to a level usable by a power amplifier. Preamp levels are approximately .1 volt.

Preamp Out

A means of obtaining an output signal from the preamplifier of a channel of a mixer or musical instrument amplifier. The preamp out is actually a line level signal or 1 volt.

Program

This usually refers to a signal source composed of music and/or speech as opposed to sine wave or noise.

Program Level

The level of program material in an audio system expressed in VU.

Proximity Effect

The boost in low-frequency response when a unidirectional or proximity effect microphone is used close to a sound source.

Q

The directivity factor of a transducer (loudspeaker) used for sound emission. The higher the value of Q the more directional the speaker.

Reactance

A resistive like property that offers opposition to electron flow in an alternating current (AC) circuit. There are two types of reactance; capacitive reactance (XC) and inductive reactance (XL). Reactance varies with frequency.

Real Time Analyzer (RTA)

An electronic instrument used to measure the combined response of an audio system and the room in which the system is operating.

Reference Levels

O dB

In the measurement of SPL or Sound Pressure Level, 0 dB is referenced to the threshold of hearing or auditory perception of a tone of 1000 cycles (hertz) per second (1 kHz). 0 dB must always be referenced to some base of measurement. In gain functions 0 dB is unity gain (1).

3 dB

The amount of SPL gained by doubling the power to a speaker. Also the amount gained by doubling the number of speakers.

+/- 3 dB

Plus or minus 3 dB as used to express a measurement of frequency response indicates that the response will be no more than +3 dB and no less than -3 dB belo a given refer ence. It is actua lly a 6 dB wind ow. The Resp onse of 60 Hz to

14 kHz +/-3 dB means that within the bandwidth of sixty cycles per second to fourteen thousand cycles per second, no frequency is +3 dB more nor -3 dB less than a specified reference frequency.

3 dB DOWN (-3 dB)

The point at which a measured power level is 3 dB below the specified level. In an electronic crossover, the point (frequency) at which the high pass signal is -3 dB down in response or power level is considered the crossover point (frequency).

-6 dB

The amount of loss in SPL as you double the distance away from a sound source.

dBm

A decibel scale referenced to 0 dBm = 1 milliwatt of power into 600 Ohms or .775 volts RMS across 600 ohms.

dBu

Primarily a British term for gain referenced to 0 dBu = .775 volts RMS.

dBV

A decibel scale referenced to 1 volt RMS; 0 dBV = 1 volt.

dBW

A term for power gain referenced to 0 dBW = 1 Watt.

Reference Volume

The volume which yields a reading of 0 VU on a standard volume indicator.

Reflection

The bouncing back or return of sound waves from walls or other obstacles which they strike.

Refraction

A change in direction or bending of the propagation of a sound wave when it passes from one medium to another in which the velocity of sound is different.

RegenerationNotes

In audio, regeneration is another word for feedback; when something regenerates it continues or sustains itself as an oscillation. When an electronics engineer designs an oscillator, he takes the output of a gain stage and feeds it back into the input through a tank circuit (an RC, resistor and capacitor or an LC, inductor and capacitor combination); when the circuit is turned on it begins to regenerate or oscillate at a specific frequency determined by the value of the RC or LC combination. When the output of a loudspeaker in a sound reinforcement system is able to get back into a microphone or sound system input, at some level and resonant frequency, the system is going to go into regeneration or feedback oscillation (squeal).

Resistance

Opposition to the flow of electrical current. Measured in ohms.

Resistor

An electronic component designed to have a definite amount of resistance; used in circuits to limit current flow or to provide a voltage drop.

Resonance

A tendency of mechanical parts, loudspeaker cone, enclosure panels or electrical circuits to vibrate at or emphasize one particular frequency, every time that frequency, or one near it, occurs.

Response

The range of frequencies to which an amplifier or speaker will respond, and the relative amplitude or intensity with which these frequencies are reproduced.

Return

An input, typically found on a mixing console, used to patch a signal returning to a particular BUS after having been further processed, such as an echo or effects return.

Reverb (Reverberation, acoustical)

The prolongation of sound at a given point after direct sound from the source has ceased, due to such causes as reflection from physical boundaries. (Electro-mechanical) An electro-mechanical device usually employing springs which randomly reflect as great amount of sound as possible, therefore simulating natural reverberation. (Digital Reverb) An electronic reverberation effects processor that uses digital electronics to introduce the multiple delay paths.

Reverberation

The sustaining of acoustical energy in a room after the reception of the direct field (the sound coming directly from the source) ceases in producing sound. Reverberation is caused by the reflections and scattering of sound energy from the boundary surfaces of the room.

RIAA

Stands for Recording Institute Association of America. A type of preamplifier used for turntables. It is necessary to use an RIAA preamp when using a magnetic cartridge.

Ring Mode

A tone or frequency sounded in a room with a live sound reinforcement system prior to the system breaking into feedback. A ring mode lies just below the threshold of feedback.

RMS (root mean square value)

The square root of the time average of the square of a quantity; for a periodic quantity the average is taken over one complete cycle. RMS voltage is .707 times the peak voltage of a sine wave.

Roll Off

A signal is rolled off when it is attenuated or reduced in level above (high pass roll off) or below (low pass roll off) a certain frequency. The amount of roll off is rated at so many decibels per octave. A signal that is rolled off below 100 Hz at a rate of 18 dB/octave would be reduced in level or attenuated -18 dB at 50 Hz, -36 dB at 25 Hz, etc.

RT60 (Reverberation Time)Notes

The time required for sound to drop to - 60 dB in level once the source of sound has been stopped. The -60 dB is below that of the measured

level while the sound system was on and after any initial transients or fluctuations settled.

Send

An output used to patch a signal from a channel or bus of a mixer to an external signal processor such as an echo or digital delay.

Sensitivity

The minimum input signal required to produce a specified level of output. In an amplifier, the input sensitivity is the amount of voltage at the input necessary to drive the amplifier to its rated power output. Loudspeaker sensitivity is the power level necessary to produce a stated SPL at a given distance from the loudspeaker, usually rated at 1 watt 1 meter.

Series

An arrangement of circuit components, end-to-end, to form a single path for current.

Series-Parallel

A circuit in which some of the components or elements are connected in parallel, and one or more of these parallel combinations are in series with other components of the circuit.

Shelving

A type of equalization circuit that has a shelf-like characteristic at the upper or lower ends of the spectrum. A shelving EQ at 15 kHz, in the boost position, would increase the high frequencies up to 15 kHz where it would shelf.

Signal-to-Noise Ratio (S/N)

The ratio of the amplitude or level of a desired signal at any point to the amplitude or level of noise at the same point.

Sine Wave

A wave whose amplitude varies as the mathematical sine of a linear function of time, also known as the sinusoidal wave.

Slapback Echo

A echo caused from reflections off the rear wall in many auditoriums. Such echo can reduce the intelligibility of a sound reinforcement system, as well as distract speakers and performers on stage. Severe slapback echo is very distracting for a musician, as it can cause confusion that

makes following that beat in time extremely difficult. A professional high quality stage monitor system can mask some of the slapback echo to a certain extent by providing more direct sound from the monitor speaker in the first 25 milliseconds which the performer perceives through auditory fusion as more direct field, thus increasing the ratio of the level of the direct field to that of the slapback echo.

Slew Limiting

The failure of the amplifier's output to move as fast, voltage-wise, as the input would have it move.

Slew Rate

Refers to the ability of an amplifier's output to accurately reflect the input waveforms' rise time transients. An amplifier is said to have a slew rate of so many volts per microsecond. A slew rate of 20 volts per microsecond (20 V/U sec.) means that the amplifier is capable of swinging 20 volts positive or negative in the period of one microsecond.

Snake

A multiconductor shielded input cable which allows a single run between the microphones and the mixing console. Snakes often provide "return" wire pairs to permit the mixer outputs to be sent to amplifiers located on stage.

Sound

A pressure wave motion propagated in an elastic medium (air) producing an auditory sensation in the ear by the change of pressure at the ear. Sound waves are produced by a vibrating body in contact with air.

Sound Level Meter

The instrument used to measure noise and sound pressure levels (SPL), calibrated in decibels.

Sound Fields

Direct Field

The sound that emanates directly from a sound source or loudspeaker.

Indirect Field

That sound perceived from behind a speaker system, i.e. when no direct field is present.

Near Direct Field

The sound field that is generated close to the source or loudspeaker. Generally considered that sound field that is within a distance from the source of less than two wavelengths.

Far Direct Field

The sound field that is perceived at a distance from the source loudspeaker that is greater than 2 wave lengths.

Free Field

That portion of the direct field of a sound source or loudspeaker that is reflection free or not yet affected by boundaries such as walls or ceiling (such as may be encountered with an outdoor sound system).

Reverberant Field

That sound field beyond critical distance where most of the energy arriving at the listener is in the form of reflected energy off the room's boundaries.

Spectrum

Refers to a particular band of frequencies. The normal acoustic sound spectrum is the range of human auditory perception (20 Hz to 20,000 Hz). There is also a Subsonic spectrum (considered to be below about 40 Hz) and an Ultrasonic audio spectrum (above 20,000 Hz).

Spectrum Analyzer

[See Real Time Analyzer (RTA)]

SPL (sound pressure level)

The level or intensity at a point in a sound field (loudness). The deviation above and below normal atmospheric pressure. The unit of measurement of Sound Pressure... the microbar. One microbar is equal to the sound pressure of 1 dyne per square centimeter, which is a sound level of 74 dB above the threshold of hearing (0.0002 microbar.) It is also equal to approximately one-millionth of normal atmospheric pressure. Sound pressure levels are stated in decibels as follows: Where P is the RMS sound pressure in microbars, and the reference is the threshold of hearing of 0.0002 microbars (50% of young men, 1 to 4 kHz).

Splitter

A box which has one microphone or signal input and has two or more

individual outputs available for that signal. Used to connect one signal source to multiple other devices.

Standing Wave

Standing waves occur in rooms because of the boundaries. A standing wave is a soundwave that once excited, stands there, i.e., the positive air pressure peaks (antinodes) and negative air pressure troughs (nodes) remain in the same position within the room's boundaries. Also known as a stationary wave. [see Modes]

Stereo

In a sound reproducing system, stereo refers to the use of two separate signal processing channels driving two separate power amplifiers, which in turn power two separate speaker systems. However, most times in sound reinforcement, a stereo mixer is employed to drive a mono (single channel) system in order to allow separate mixes of the program (such as speaking mics, instrurnents, vocal mics, etc).

Sub-Master

A separate mixing bus assigned to a group of mixing channels that enables the sound mixer to regulate the level of that group with one control called the Sub-Master.

Sub-Mix

A level control preceding the main (master) level control, that regulates the level of an individual sub-mix.

Switching Jack

An input or output jack that performs some switching function in addition to providing an input or output for a signal. These jacks disconnect the normal flow of signal and allow for additional patching capabilities such as inserting equalizers and feedback reducers. Most typically these are 1/4" phone jacks, but some equipment manufacturers are now using switching RCA type phono connectors.

THD (Total Harmonic Distortion)

When a single frequency of specified level is applied to the input of a system, the ratio of the voltage of the fundamental frequency to the voltage of all harmonics observed at the output of the system because of the nonlinearities of the system.

THD is expressed in percent.

Timbre

Timbre is a word that relates to the musical quality of sound. It is the relation of the fundamental frequency to the level and number of the associated harmonics. The human ear can perceive differences in timbre. Two different instruments, such as a saxophone and a flute playing the same note or fundamental at the same loudness, sound different to the listener due to the two instruments different number and level of related harmonics also produced at the same time as the fundamental. The two instruments are said to have a difference in timbre.

Transducer

Any device or element which converts an input signal into an output signal of a different form. A transducer changes energy from one form to another. A microphone is a transducer that changes acoustical energy (sound) into electrical energy (voltage). A loudspeaker is a transducer that changes electrical energy into mechanical energy, producing sound or acoustical energy.

Transformer

An electrical component consisting of multiple turns of wire placed in a common magnetic field (medium) which will transfer electrical energy from one electrical circuit to the next. A transformer will only pass alternating currents (AC) and will not pass direct current (DC). By adjusting turn ratios, a step up or down condition of voltage can be achieved.

Transformer Balanced

An input or output that is coupled by means of a transformer in a configuration that makes it balanced or capable of being operated so that the voltages of the two conductors at any transverse plane are equal in voltage and opposite in polarity with respect to ground. A transformer balanced input or output will offer common-mode rejection, which means any common-mode interference signal will not pass through the transformer because it will be cancelled out.

Transient

Rapidly changing peaks of short duration in the level of sound such as would be produced by a cymbal crash or a rim shot on a snare drum. A wave having a very short or no sustain time.

Transient Distortion

Transient distortion interferes with the ability of an amplifier to accurately follow abrupt changes in volume, such as the sudden burst of sound when an instrument is first played. Minimum transient distortion is vital to clean and crisp overall sound.

Transient Response

Ability of an amplifier or loudspeaker to accurately follow abrupt changes, such as the sudden burst of sound generated by an instrument. Good transient response is vital to "clear" or "crisp" overall sound.

Tri-Amp

Separating the audio spectrum into three bands, i.e., high frequencies, mid-band frequencies and low frequencies by means of an electronic crossover and using three separate power amplifiers to amplify the three outputs of the crossover (high Digital AudioSelf Instructional Material 125 pass, mid pass, low pass outputs) driving three separate components of a speaker system; resulting in increased headroom and dynamic range.

Unbalanced Cable or Line

A single conductor cable with a surrounding shield that connects to ground. Such a system is called unbalanced because it cannot be balanced or offer common mode rejection.

Unbalanced Input

An input in which one of the two terminals is at ground potential or connected to the chassis ground.

Unidirectional

This term commonly refers to microphones which pickup sounds predominately from one direction as opposed to all directions (omnidirectional). Unidirectional microphone types include cardioid, super-cardioid and hyper-cardioid. Unidirectional microphones are most often used in sound reinforcement applications because they are generally less prone to feedback than omnidirectional types.

Velocity

In audio the velocity or speed of sound is approximately 1130 feet per second. The speed of sound changes slightly with changes in temperature, humidity, and altitude.

Voltage

Voltage is a measurement of electrical pressure or the potential to do work. Voltage is sometimes called EMF or Electro Motive Force. The familiar 120 volts at the wall socket is an example of available electrical pressure. If the prefix “m” is used (as in mv) it stands for millivolts, or thousandths of volts. Microvolts, abbreviated “µV”, are millionths of volts.

Volt (voltage)

Potential difference or electromotive force (EMF).

Volume

The intensity or loudness of sound.

VU (volume unit)

A unit for expressing the audio frequency power level of a complex electronic waveform such as that corresponding to speech or music. 0 VU is referenced to 1 milliwatt of power.

VU Meter

A meter than indicates the audio frequency power level or volume units of a complex electronic waveform.

Watt

A unit of measure of power. The electrical wattage of an amplifier describes the power it can develop to drive a speaker. The greater the voltage capability, the higher the wattage. Amplifier wattage requirements are greatly dependent upon the speakers that will be used, the size of the listening room and average loudness that will be played through the speakers. Wattage is expressed as W =V2/R

Wavelength

In audio the wavelength of sound is the actual physical size that one complete cycle of sound energy requires in air for a given frequency. The wavelength is found by dividing the velocity of sound, 1130 ft/sec, by the frequency of interest. The wavelength of 1000 Hz would be calculated as 1130/1000, or 1.13 ft.

Woofer

A speaker designed to reproduce bass or low frequencies.

XLR

A connector (sometimes called a Cannon connector after ITT-Cannon, the original manufacturer) used in interfacing audio components. The connector on a low impedance microphone is an XLR connector.