Ethiopian TVET-System

ELECTRONIC COMMUNICATION AND MULTIMEDIA EQUIPMENT SERVICING Level II

Based on May 2011 Occupational Standards

October, 2019

Module Title: Maintaining and Repairing Audio / Video Equipment

TTLM Code: EEL CMS2TTLM 1019 v1

This module includes the following Learning Guides

LG18: Prepare unit, tools and Workstation

LG Code: EELCMS2M06LO-1LG-18

LG19: Diagnose faults

LG Code: EEL CMS2 M06LO-2 LG-19

LG20: Maintain/repair product

LG Code: EELCMS2 M06LO-3 LG-20

LG21: Test repaired product

LG Code: EEL CMS2 M06LO-4 LG-21

Instruction Sheet	LG18: Prepare unit, tools and Workstation

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Performing complete check-up of audio-video systems and products
- Verifying repair/ maintenance history in line with the company procedures
- Acquiring or finding **service manuals** and ***service information*** required for repair/maintain as per standard procedure
- Preparing workstation for repair job in line with the company requirements and work specifications
- Preparing necessary ***tools, test instruments and personal protective***

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

- Perform complete check-up of audio-video systems and products
- Verify repair/ maintenance history in line with the company procedures
- Acquire or find **service manuals** and ***service information*** required for repair/maintain as per standard procedure
- Prepare workstation for repair job in line with the company requirements and work specifications
- Prepare necessary ***tools, test instruments and personal protective***

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 ,Sheet 4 and Sheet 5.
4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 ,Self-check 4 and Self-check 5” **in page -131, 135, 138, 140 and 1156** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 ” **in page -157-158.**
6. Do the “LAP test” **in page – 159** (if you are ready).

Information Sheet-1	Performing complete check-up of audio-video systems and products

- **Performing complete check-up of audio-video systems and products**

1.1.1 Professional audio/Public-address (PA) systems

Public Address System (PA system) is an electronic sound amplification and distribution system with a microphone, amplifier and loudspeakers, used to allow a person to address a large public, for example for announcements of movements at large and noisy air and rail terminals.

The simplest PA system consists of a microphone, an amplifier, and one or more loudspeakers as shown in fig 1. A sound source such as compact disc player or radio may be connected to a PA system so that music can be played through the system. Microphone is an electrical device required for transformation of sound energy into corresponding electrical energy. It is a kind of transducer. So the acoustic pressure is changed into electrical pulses. The electrical pulse having weak strength. Hence a high gain amplifier is used before further processing or transmission of this electrical signal. A loudspeaker works just like in a reverse process of a microphone. Whose function is to convert electrical pulses into acoustic pressure. There are various types and configurations of loudspeakers are available. As per the requirement different kind of loudspeakers are used. For example, in a public address system when a person is speaking and a large audience is hearing at that moment of time it is the microphone that picks the speaker sound transform into equivalent electrical pulses. With proper amplification and processing, it is the loudspeaker that again converts these amplified electrical signal into the acoustic wave. Thus, the large audience can hear the voice of a speaker by the application of microphone and loudspeaker.

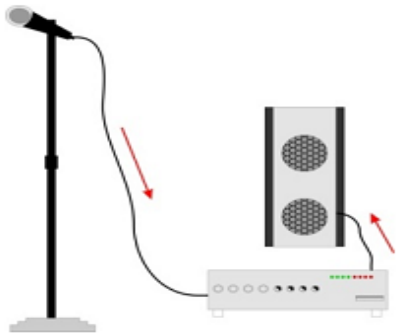


Fig. 1.1: Simple Public address System

PAS is an electronics system in which acoustics sound wave is converts into electrical signal by microphone. The electrical audio signals are amplified and fed into another transducer the loudspeaker which converts the audio signals into the sound wave.

1.1.2 Transducer

A transducer is a device which transforms a non-electrical physical quantity (i.e. temperature, sound or light) into an electrical signal (i.e. voltage, current, capacity…)

Acoustic transduction generally means converting sound energy into an electrical signal, or an electrical signal into sound. Microphones and loudspeakers are acoustic transducers

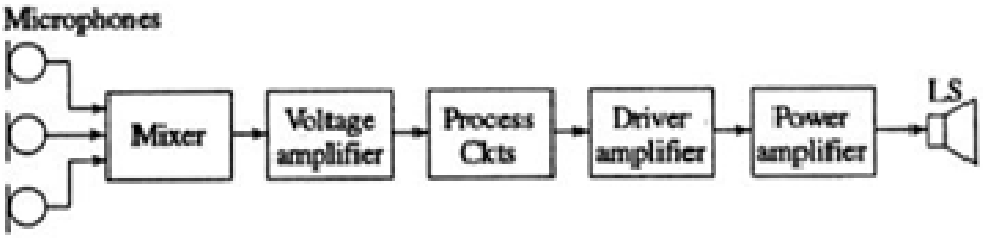


Fig.1.2 Block Diagram of public address system

1.1.3 Microphone:-

- It is a electrical transducer it pick up sound wave and converts into the electrical variations called audio signal.

1.1.4 Mixer:-

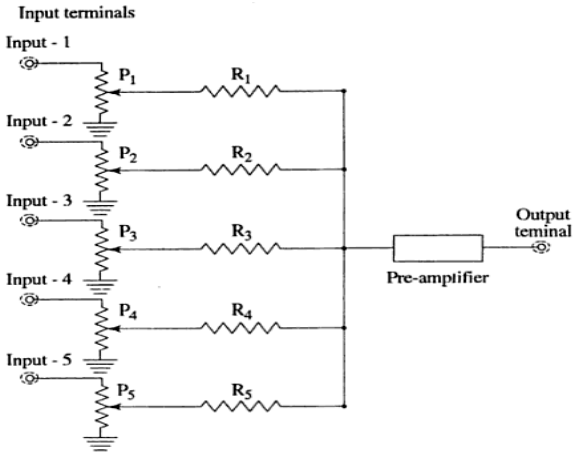
- The output of the microphone is fed into the mixer stage. the mixer stage is to effectively isolate different channels from each other before feeding into the main amplifier.

1.1.5 Voltage amplifier :-

- It further amplifies the output of the mixer.

1.1.5.1 Processing Circuit

- These circuits have master gain control and the tone controls.



1.1.5.2 Driver amplifier

- It is gives voltage amplification to the signal to such an extent that when fed to the next stage the internal resistance of that stage is reduced .

1.1.5.3 Power amplifier:-

- It is gives desired power amplification to the signal. it is push-pull type of circuit in general. the power amplifier connected to the loudspeaker see fig 1 above.

1.1.5.4 Loudspeaker:-

- It converts electrical audio signal into pressure variation resulting in sound.

1.1.5.5 Microphone and Speaker.

Microphone: a means to sense the motion of air particles and create a proportional electrical signal. It convert sound pressure waves into electrical current, while speaker convert electrical current into sound pressure waves.

1.1.6 Types of Microphone

1.1.6.1 Dynamic Microphone:

Dynamic microphones are versatile and ideal for general- purpose use. They use a simple design with few moving parts. When a magnet is moved near a coil of wire an electrical current is generated in the wire. Using this electromagnet principle, the dynamic microphone uses a wire coil and magnet to create the audio signal.

Moving coil microphone is also known as dynamic microphone. It consists of cylindrical magnet, voice coil and diaphragm. It works on the principle of electromagnetic induction. The diaphragm is attached to the coil. When the diaphragm vibrates in response to incoming sound waves, the coil moves backwards and forwards past the magnet. Dynamic microphone consist of a diaphragm suspended in front of a magnet to which a coil of wire is attached. The coil sits in the gaps of the magnet. Vibrations of the diaphragm make the coil move in the gap causing an AC to flow. Coils of wire are used to increase the magnitude of the induced voltage and current. Diaphragm moves a coil of wire through a fixed magnetic field: Faraday's Law indicates that a voltage is produced. Diaphragm is a membrane that can be set into motion by sound waves.

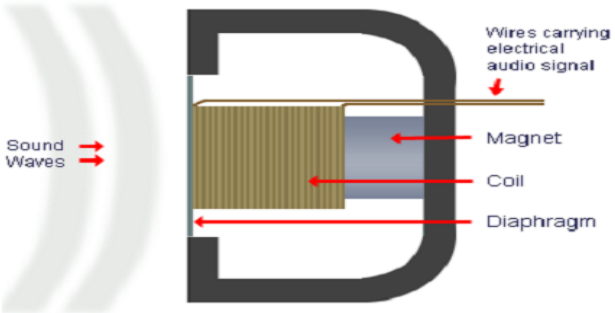


Fig.1.3 Part of Dynamic microphone.

1.6.1.1.Merits

- It is highly sensitive microphone.
- It has uniform frequency range.
- Can be used at higher temperature.
- Does not require external source for its operation.

1.6.1.1.2Demerits

- l It has low impedance.

1.6.1.1.3 Application

Widely used in public meeting and broadcasting.

1.1.6.2. Piezoelectric Microphone

Crystals which demonstrate the piezoelectric effect produce voltages when they are deformed. The crystal microphone uses a thin strip of piezoelectric material attached to a diaphragm. The two sides of the crystal acquire opposite charges when the crystal is deflected by the diaphragm. The charges are proportional to the amount of deformation and disappear when the stress on the crystal disappears.

Piezoelectric microphone is also known as crystal microphone. It works on the principle of
piezoelectric effect. Some of the materials show piezoelectricity. Under some mechanical pressure it exhibit voltage. The vibration or oscillation of pressure produces corresponding electrical signal. It consists of fine crystal that is placed in between electrodes. When a sound
pressure strikes on the electrode, the crystal starts vibrating according to the sound pressure. Consequently, an electrical audio signal is generated. In this way, we get the audio output signal in the form of electrical signal Piezoelectric generating element: certain crystals produce a voltage when distorted (piezo means “squeeze” in Greek). Diaphragm attached to piezo element. Rugged, reasonably sensitive, not particularly linear.

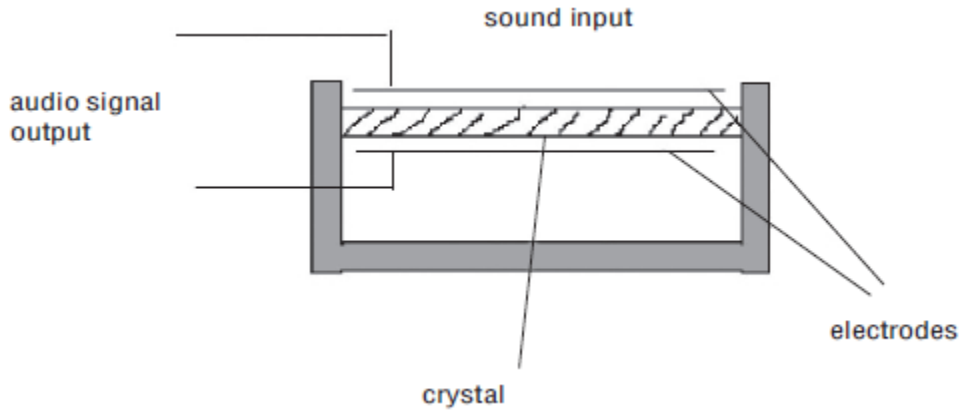


Fig.1.4 Piezoelectric microphone.

1.1.6.2.1 Merits

- It is among light category of microphones.
- It has high impedance.
- It provides uniform frequency response.
- External source is not required for its operation.

1.1.6.2.2 Demerits

- It requires high gain power audio power amplifier.
- It cannot be used at high temperature.

1.1.6.2.3.Application

It is usually used in public meeting, tape recorders etc.

1.1.6.3. Capacitor (Condenser) Microphone

A capacitor has two plates with a voltage between them. In the condenser microphone, one of these plates is made of very light material and acts as the diaphragm. The diaphragm vibrates when struck by sound waves, changing the distance between the two plates and therefore changing the capacitance. Specifically, when the plates are closer together, capacitance increases and a charge current occurs. When the plates are further apart, capacitance decreases and a discharge current occurs.

The resulting audio signal is stronger signal than that from a dynamic. Condensers also tend to be more sensitive and responsive than dynamics, making them well- suited to capturing subtle nuances in a sound. They are not ideal for high- volume work, as their sensitivity makes them prone to distort. The required voltage across the capacitor is supplied either by a battery in the microphone or by external phantom power.

• Variable electrical capacitance

–British use the word “condenser”

• Currently the best for ultra-sensitivity, low noise, and low distortion (precision sound level meters use condenser mics. Difficult to manufacture, delicate, and can be too sensitive for some applications

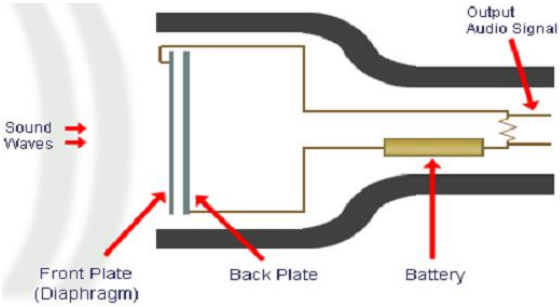


Fig. 1.5 : Cross- Section of a Typical Condenser Microphone

1.1.6.3.1Merits

- It also provides uniform frequency range.
- It can also work for powerful sound wave.

1.1.6.3.2 Demerits

- A DC source is required for it.
- It has high impedance

1.1.6.3.3Application

It is widely used in laboratories to pick-up sound wave to be measured.

1.1.6.4. Wireless or Cordless Microphone

A wireless microphone is a microphone without a physical cable connecting it directly to the sound recording or amplifying equipment with which it is associated. It has a small, battery- powered radio transmitter in the microphone body, which transmits the audio signal from the microphone by radio waves to a nearby receiver unit, which recovers the audio. The other audio equipment is connected to the receiver unit by cable. Wireless microphones are widely used in the entertainment industry, television broadcasting, and public speaking to allow public speakers, interviewers, performers, and entertainers to move about freely while using a microphone to amplify their voices.

Fig 1.6: Wireless Microphone

1.1.7 Advantages

- Greater freedom of movement for the artist or speaker.
- Avoidance of cabling stressing problems common with wired microphones.
- Reduction of cable "trip hazards" in the performance space

1.1.8 Disadvantages

- Some wireless systems have a shorter range, while more expensive models can exceed that distance.
- Possible interference with or, more often, from other radio equipment or other radio microphones.
- Operation time is limited relative to battery life.

1.1.9 Microphone Patterns

• **Omni directional**: pick up sound equally from all directions

• **Unidirectional or Cardioid:** one direction

• **Bi-directional or 'figure 8':** pics up sound almost in equally from front and back, but nearly nothing on each side.

1.1.10 Amplifier

An amplifier in PA equipment is a device, which takes low level input signal from microphones and amplifies to a high level output signal to the desired output power, which will be delivered to the loud speakers at the output stage by suitable connection.

1.1.10.1Audio Mixer Pre- Amplifier

The main amplifier system has limitation of accommodating more number of input devices therefore there is a device called audio mixer pre- amplifier, which accommodates more number of input devices with more no. of individual controls. The combined output of all individual channels will be connected to Aux. input to the main amplifier section. The designing aspect of mixer pre- amplifier will depends upon the requirement of no. of input channels i.e. 2, 4, 5, 8, 9, 12, 14 and 16.

1.1.11 Loudspeaker

Loudspeaker: a means to convert an electrical signal into proportional motion of air particles. A loudspeaker (or "speaker") is an electro- acoustic transducer that produces sound in response to an electrical audio signal input. Loudspeakers may be divided into two main groups:-

i) Cone type - i.e., direct radiator, where cone or diaphragm is directly coupled to air.

ii)Horn- type- i.e, indirect radiator, where the diaphragm is coupled to the air by means of horn. The horn increases the acoustical loading on the diaphragm and

thereby increases the efficiency. It may be described as a device, which transforms acoustical energy at high pressure and low velocity to acoustical energy at low pressure and high velocity.

A horn loudspeaker is a loudspeaker or loudspeaker element which uses a horn to increase the overall efficiency of the driving element, typically a diaphragm driven by an electromagnet. The horn itself is a passive component and does not amplify the sound from the driving element as such, but rather improves the coupling efficiency between the speaker driver and the air. The horn can be thought of as an "acoustic transformer" that provides impedance matching between the relatively dense diaphragm material and the air of low density. The result is greater acoustic output from a given driver.

Fig.1.7. Horn Speaker

iii) Column Speakers use multiple speaker cones create a slim line column offering excellent vertical sound dispersion with a long 'throw', but limited horizontal coverage. For this reason, several column speakers can be mounted in a cluster and are often used around pillars for sound reinforcement. On the axis of the system the sound waves from all the units are in phase and will therefore reinforce each other. Off this axis the different path lengths from the units will tends to cause cancellation. However it will show that phase cancellation can only occur if the wavelengths are comparable with or less than, the length of loudspeaker column.

Fig. 1.8: Column Speakers

1.1.11.1Connecting Four Speakers of 8Ω Impedance

Four speakers of 100 watt each are connected in parallel- series combination as shown. Two groups of two speakers are connected in parallel and then these groups are connected in series. The resulting impedance would be 8 Ω.

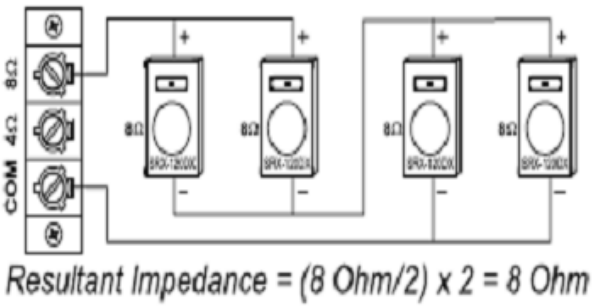


Fig.1.9: Connecting speakers in impedance matching

1.1.12 Audio Cables

Audio cables are used to connect the mics, speakers, mixer, musical devices etc. to one another so that the audio signal can be moved and manipulated as desired. Cables are an often overlooked component in the PA setup. Proper use of cables is equally easy to achieve or neglect, and the result either case can be dramatic. Apart from proper use, the thoughtful presence of cables in quantity and type is also important.

Fig.1.10: Audio Cables

1. 2. Fundamentals of AM & FM Receivers

1.2.1 Radio Communication Systems

A typical radio communication system from a broadcasting station consists of a transmitter. The broadcasting station is allocated with a unique RF carrier wave along with a well-defined channel width. The transmitter transmits the modulated carrier into space through an antenna. These wave propagate through space. Elsewhere in a remote location there exists a receiver which receives the modulated carrier through the receiving antenna with the help of a tuning circuit. The receiver demodulates the

modulated carrier and converts it into speech or intelligence. A block diagram of a typical radio system consisting a transmitter and receiver is as shown in the figure 1.

1.2.1.1Transmission:

The radio transmitter consists of a transducer which converts speech or intelligence into audio frequency electrical signals. These amplified AF signals modulate the radio frequency carrier. The modulator performs the task of modulation. The modulated RF carrier is then amplified and transmitted through an antenna.

Fig. 1: Radio Communication System - Transmission and Reception

1.2.1.2 Reception:

The radio receiver consists of an antenna connected to a tuning circuit. The received modulated RF carrier is amplified and then passed through the demodulator to extract the AF signals. The AF signal is then amplified and fed to transducer which converts it into speech or intelligence.

1.2.2 Super heterodyne AM Receiver

The receiver in a radio communicat

ion system must down convert the pass band received signal down to baseband in order to recover the message. Super heterodyne receivers convert all incoming signals to a lower frequency, known as the intermediate frequency (IF),at which a single set of amplifiers is used to provide a fixed level of sensitivity and selectivity.

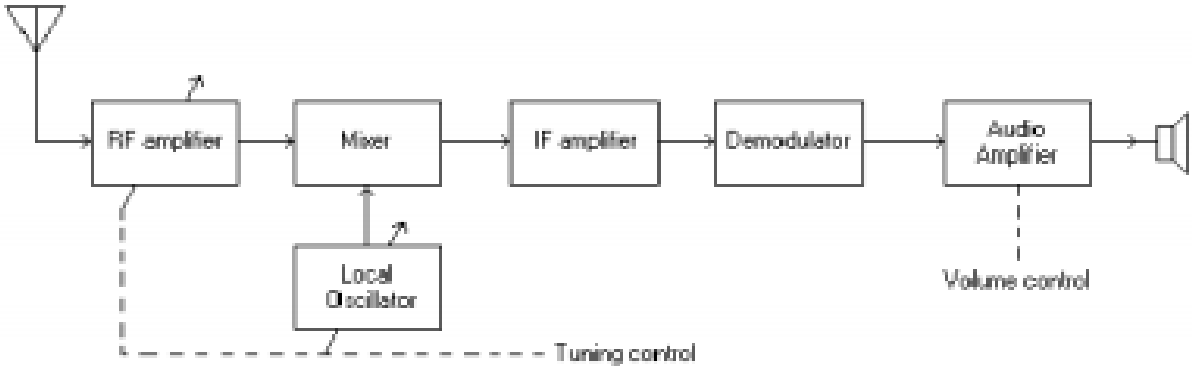


Figure 2 Super heterodyne AM Receiver

1.2.3 RF Amplifier

The modulated RF waves travel through space and reach the antenna of the super heterodyne receiver in situated in a remote location. The receiver is attached to a tuning amplifier circuit which receives and amplifies the modulated RF carrier. The antenna picks up the weak radio signal and feeds it to the RF amplifier, also called a low noise amplifier (LNA). RF amplifiers provide some initial gain and selectivity and are sometimes called pre-selectors.

1.2.4 Mixers and Local Oscillators

The output of the RF amplifier is applied to the input of the mixer. The mixer also receives an input from a local oscillator or frequency synthesizer. The mixer output is the input signal, the local oscillator signal, and the sum and difference frequencies of these signals. A tuned circuit at the output of the mixer selects the difference frequency, or intermediate frequency (IF).The local oscillator is made tunable so that its frequency can be adjusted over a relatively wide range.

1.2.5 IF Amplifiers

The output of the mixer is fed to the IF amplifier which amplifies the modulated IF signal and increases its amplitude without modifying its waveform. The output of the mixer is an IF signal containing the same modulation that appeared on the input RF signal. The signal is amplified by one or more IF amplifier stages, and most of the gain is obtained in these stages.

1.2.6 Demodulators

The amplified IF signal from the IF amplifier is input to the demodulator (Detector). The demodulator consists of a diode circuit which will eliminate the negative portion of the signal. Thus only positive portion of the modulated IF signal is output and fed to the next stage of AF amplification. The demodulator converts the modulated IF into AF signal. The highly amplified IF signal is finally applied to the demodulator, which recovers the original modulating information. The output of the demodulator is then usually fed to an audio amplifier.

1.2.7 AF amplification

The output of the demodulator is fed to AF amplification stage. In this stage the AF signal is amplified.

1. 2.8 Speaker

The amplified AF signal is input to the transducer which is a speaker. Speaker converts the electrical signal to audible signal for the listener. `

1.3. FM Receiver

The FM receiver is the whole unit which takes the modulated signal as input and produces the original audio signal as an output. Radio amateurs are the initial radio receivers. However, they have drawbacks such as poor sensitivity and selectivity. Selectivity is the selection of a particular signal while rejecting the others. Sensitivity is the capacity of detecting a RF signal and demodulating it, while at the lowest power level. To overcome these drawbacks, super heterodyne receiver was invented. This FM

receiver consists of 5 main stages. They are as shown in the following Block diagram.

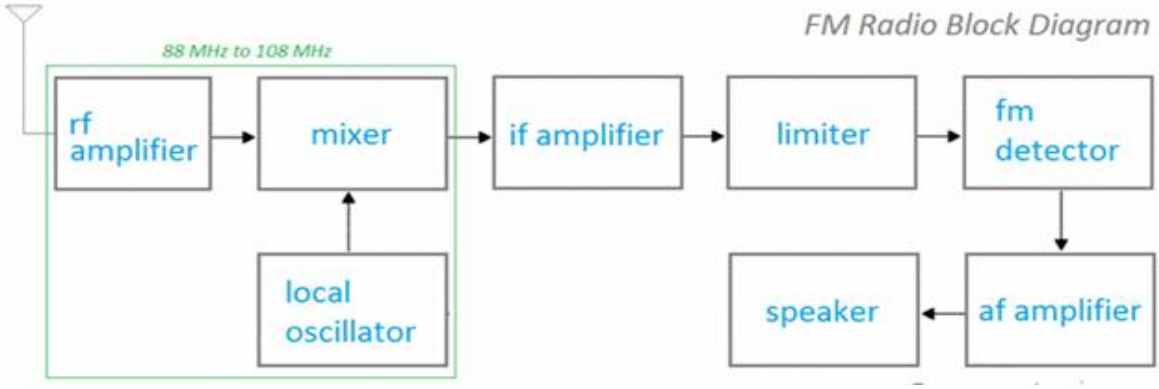


Fig.3.1:Block diagram of FM receiver

1.3.1 Tuner Section

The modulated signal received by the antenna is first passed to the tuner circuit through a transformer. The tuner circuit is nothing but a LC circuit, which is also called as resonant or tank circuit. It selects the frequency, desired by the radio receiver. It also tunes the local oscillator and the RF filter at the same time.

1.3.1.1 RF Mixer

The signal from the tuner output is given to the RF-IF converter, which acts as a mixer. It has a local oscillator, which produces a constant frequency. The mixing process is done here, having the received signal as one input and the local oscillator frequency as the other input. The resultant output is a mixture of two frequencies [(f1 + f2), (f1 − f2)] produced by the mixer, which is called as the Intermediate Frequency (IF). The production of IF helps in the demodulation of any station signal having any carrier frequency. Hence, all signals are translated to a fixed carrier frequency for adequate selectivity.

1.3.2 IF Filter

Intermediate frequency filter is a band pass filter, which passes the desired frequency. It eliminates any unwanted higher frequency components present in it as well as the noise. IF filter helps in improving the Signal to Noise Ratio (SNR).

1.3.3 Demodulator

In FM encoding, the amplitude of the carrier wave remains constant, and it is the variation in frequency where information is stored. Specifically, variation in frequency is proportional to the amplitude of the encoding signal. In many ways, you can think of this as amplitude to frequency conversion. When the encoding signal is in positive phase, the carrier frequency is at maximum, however when it is in negative phase, the carrier frequency is at minimum. Variation in frequency is proportional to the amplitude of the encoding signal. This way we can represent the level of amplitude in terms of frequency. In a radio receiver, the FM detector, also known as discriminator, does the

opposite because it has to decode the encoded signal. Therefore, the FM detector stage converts variations in frequency to variations in amplitude to recover the original signal. Hence, this is very much a frequency to amplitude converter. In electronics, many IC packages can convert frequency to voltage. This is where the voltage is proportional to frequency.

1.3.4 Audio Amplifier

This is the power amplifier stage which is used to amplify the detected audio signal. The processed signal is given strength to be effective. This signal is passed on to the loudspeaker to get the original sound signal. This super heterodyne receiver is well used because of its advantages such as better SNR, sensitivity and selectivity. This super-heterodyne FM radio block diagram shows all the main stages of a modern radio. The first three stages are very similar to an AM Radio block diagram; however, the main difference is in the limiter and FM detector stages, which are crucial to FM reception. These stages are responsible for decoding the frequency-modulated signal. In order to understand them, we need to consider the encoding process because the decoding is simply the reverse.

1.3.5Magnetic Tape Recorder Working Principle:

The major advantage of using a Magnetic Tape Recorder Working Principle is that once the data is recorded, it can be replayed an almost indefinite number of times. The recording period may vary from a few minutes to several days. Speed translation of the data captured can be provided, i.e. fast data can be slowed down and slow data speeded up by using different record and reproduce speeds.

The recordersdescribed earlier have a poor high frequency response. Magnetic tape recorder, on the other hand, has a good response to high frequency, i.e. they can be used to record high frequency signals. Hence, magnetic taperecorders are widely used in instrumentation systems.

Basic Components of a Tape Recorder

A magnetic tape recorder consists of the following basic components.

1. Recording Head
2. Magnetic Head
3. Reproducing Head
4. Tape transport mechanism
5. Conditioning devices

Magnetic Recording

The basic elements of a simple Magnetic Tape Recorder Working Principle system are illustrated in Fig. 1.1.

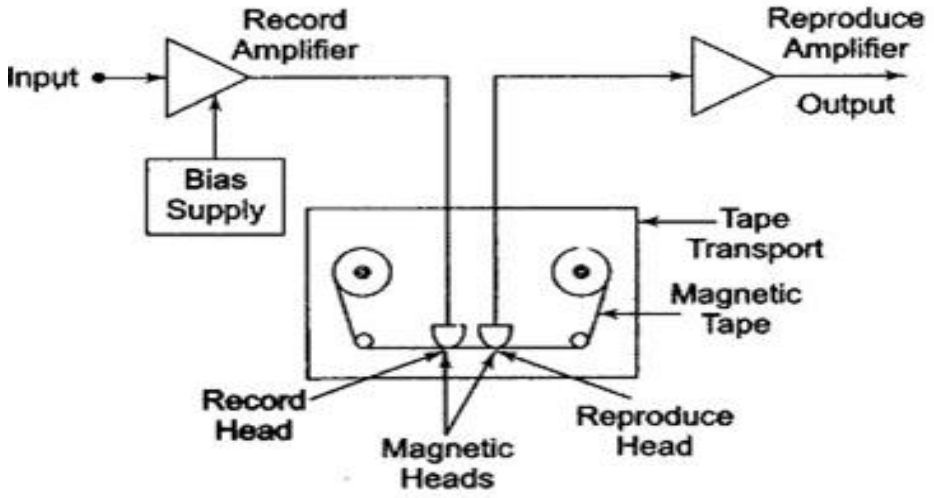


Fig 1.1 Elementary magnetic tape recorder

The Magnetic Tape Recorder Working Principle is made of a thin sheet of tough, dimensionally stable plastic, one side of which is coated with a magnetic material.

Some form of finely powdered iron oxide is usually cemented on the plastic tape with a suitable binder. As the tape is transferred from one reel, it passes across a magnetizing head that impresses a residual magnetic pattern upon it in response to an amplified input signal.

The methods employed in recording data on to the magnetic tape include direct recording, frequency modulation (FM) and pulse code modulation (PCM).

Modulation of the current in the recording head by the signal to be recorded linearly modulates the magnetic flux in the recording gap. As the tape moves under the recording head, the magnetic particles retain a state of permanent magnetization proportional to the flux in the gap. The input signal is thus converted to a spatial variation of the magnetization of the particles on the tape. The reproduce head detects these changes as changes in the reluctance of its magnetic circuit which induces a voltage in its winding. This voltage is proportional to the rate of change of flux. The reproduce head amplifier integrates the signal to provide flat frequency characteristics.

Since the reproduce head generates a signal which is proportional to the rate of change of flux, the direct recording method cannot be used down to dc. The lower limit is around 100 Hz and the upper limit for direct recording, around 2 MHz The upper frequency limit occurs when the induced variation in magnetization varies over a distance smaller than the gap in the reproduce head.

The signal on an exposed tape can be retrieved and played out at any time by pulling the tape across the magnetic head, in which a voltage is induced.

It is possible to magnetize the tape longitudinally or along either of the other two main axis, but longitudinal magnetization is the best choice.

Figure 12.10(b) shows simply how the tape is magnetized. If a magnetic field is applied to any one of the iron oxide particles in a tape and removed, a residual flux remains. The relationship between the residual flux and the recording field is determined by the previous state of magnetization and by the magnetization curves of the particular magnetic recording medium.

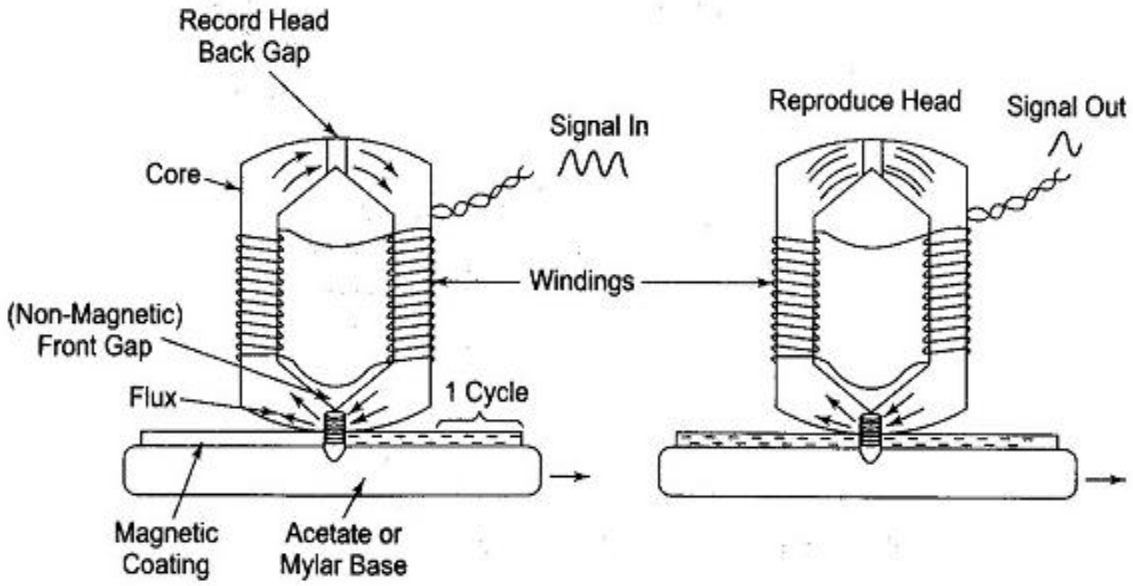


Fig 1.2 Magnetisation of Top

A simple magnetic particle on the tape might have the B H curve shown in Fig. 12.10(c) where H is the magnetizing force and B the flux density in the particle.

Consider the material with no flux at all, i.e. the condition at point 0. Now if the current in the coil of the recording head [Fig. 12.10(b)] is increased from 0 in a direction that gives positive values of H, the flux density increases along the path 0 — 1— 2, until the material is eventually saturated. If the operating point is brought from 0 only as far as 1, and H is brought back to 0, B follows a minor hysteresis loop back to point 6. A greater value of coil current would leave a higher residual flux, and a lower current a lower residual; a very simple recording process results.

However, the linearity between residual flux and recording current is very poor. Hence to obtain linearity in direct recording, FM is used. In all systems, the signal is reproduced by passing the magnetized tape over a magnetic head similar to the

recording head. The magnetization of the particles on the tape induces a varying flux in the reproducing head and a voltage is induced in the coil, proportional to the rate of change of flux.

1.3.6 Troubleshooting Audio Cassette Recorder/Player (ACR or ACP)

A troubleshooting Audio Cassette Recorder/Player described below.

1.3.7. Dead, no sound

- A dead ACP might be caused by a bad off/on or leaf switch. A bad or defectivecassette motor can cause a dead cassette player. A defective component in the channel can cause a dead channel. Substitute another permanent magnet(PM) speaker for the suspected open voice coil in the speaker. A bad tape head cancause no playback or recording within the cassette player.

1.3.7.1.Poor tape motion

- Notice if the motor belt is off when there is no tape motion. Replace with a flanged motor pulley if the belt keeps coming off as the motor starts up. Replace a loose belt or broken belt when it will not stay on the capstan flywheel or motor pulley. Does the motor rotate without any tape motion? Suspect an open motor winding or a flat shaft problem with no or poor motor rotation.
- A dead or defective motor can cause slow tape motion. The erratic motor rotation might result from worn brushes or tongs in a dc motor. Check the motor terminals with an ohmmeter continuity test. No continuity indicates that the motor winding is open. A defective speed circuit can cause poor or no tape motion.
- Check for a dry or frozen capstan or flywheel bearing for poor tape motion. Remove the flywheel, and clean out the bronze bearings. Clean off the capstan shaft with alcohol and a cloth. Apply light grease before replacing the capstan or flywheel. Make sure that the bottom keeper plate is not bent out of line, causing the flywheel to slow down.

1.3.7.2. No fast-forward or rewind

- Notice if the tape motor is rotating when the radio circuits are functioning with no tape motion. Check for a worn or loose belt. Check for a dirty tape or radio switch assembly with no tape movement. Excessive tightness in the gear train assembly can cause no fast-forward or rewind. Suspect a capstan motor for no fast-forward or rewind.

1.3.7.3. Tape everywhere

- Check to see if the capstan or pinch roller is dirty or the take-up reel is not operating. The cassette player can “eat” or spill out tape when the take-up reel is not taking up excess tape. If the take-up reel rotates erratically or slowly, the tape can pullout. An out-of-shape pinch roller can cause the tape to spill out. Clean up the idler pulley and all tape contact surfaces in play and record modes. Replace the idler assembly if necessary; a malfunctioning one can cause insufficient tape tension and thus cause the tape to spillout. Excess tape wrapped around the capstan drive can

cause slow speeds and warbleng sounds. Check for missing hub caps on the tops of the reels when there is pulling of tape. A sluggish take-up reel assembly can cause tape to pull out from the cassette. A gear-driven idler with missing teeth or dry bearings can cause the pulling of tape.

1.3.7. 4.Jammed tape

- Check for tape wrapped around the capstan when the cassette will not eject and must be pulled out of the cassette player. Try to rotate the tape backward with the capstan or flywheel. Reach in the back and locate the flywheel. Notice if the tape is loosening up as the flywheel is rotated backward. Often the cassette door will not open when there is a jammed tape in the player.

1.3.7.5 Poor erase

- The erase head is designed to erase any previous recording from a tape. A jumbled or distorted recording can be caused by a packed tape erase head with excessive tape oxide. The erase head may be out of place and may not touch the tape, and this can result in a messed-up recording.

1.3.7.6. Intermittent operation

- Intermittent tape rotation can be caused by a loose drive belt or pulley or a dry fly-wheel bearing or drive motor. A bad off and on switch can cause intermittent motor rotation. The motor might operate intermittently with a badly soldered connection on the pause control switch. A dirty or worn leaf switch can cause the cassette player to be intermittent. Suspect a dirty or worn function switch for intermittent cassette rotation. Look for a bad connection within the tape head to cause intermittent sound.

1.3.7.7. Recording problems

- Make sure that the cassette player is playing right before checking for recording conditions. Suspect a broken or dirty switch when the tape will play and not rewind. A worn tape head can prevent a recording in one or both channels. A jumbled recording and no erase can result from a ground wire off the erase head. The no record symptom may be caused by a defective switching IC. Clean the record/play switch if a loud cracking noise is heard when the player is switched to record mode.

1.3.7.8. Noisy recording and playback

- Suspect a broken wire on the tape head for a loud howl and rushing noise with no play or record mode. A bad internal connection of the tape head can cause the same intermittent loud and rushing noise. A warbling sound and lost recording at the beginning of a tape can indicate a defective cassette. Check for a dirty or worn play/record switch when there is a loud howling sound.

1.3.7.9. Will not eject

- Suspect the door latch, a defective plunger, or a loose pin when the cassette will not eject. Check for a defective eject button and no dc voltage to the solenoid plunger for no ejection of the cassette. The cassette player may not eject a tape when the door will not open because tape is wrapped around the capstan. Remove one end of a possible shorted diode across the solenoid winding, and check with the diode tester of the DMM. Poor switch contacts can cause the cassette to from the player.

1.3.7.10. Slow speeds

- Slow speed can result from a dry capstan bearing or pinch roller, tape wrapped around the pinch roller, a loose or oily belt, or a defective motor. Check for gummed-up or dry

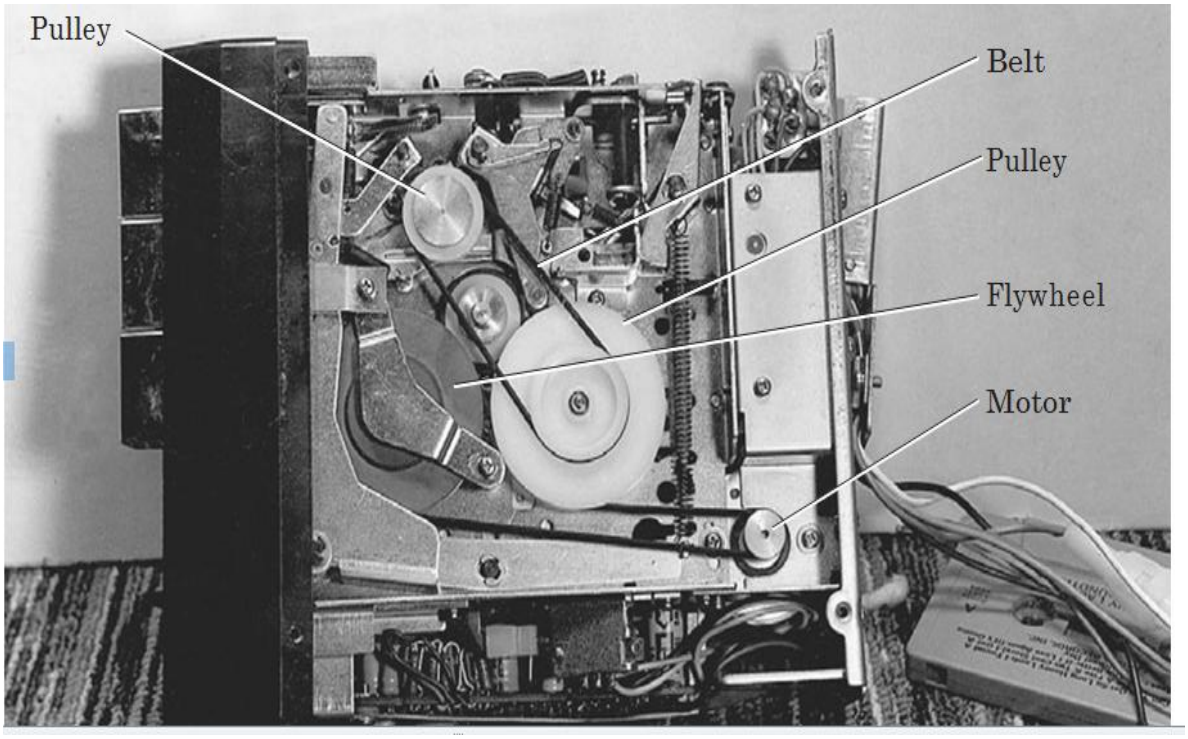


Figure.2-3.Clean up all drive belts, idlers, and pulleys for slow speeds.

Capstan and flywheel bearings. Simply remove the capstan, clean it with alcohol and arag, lightly oil it with phono lube or light oil, and replace it (Fig. 2-1). Replace all oily, cracked, loose, or shiny belts.

- Check the batteries when the tape slows down during battery operation. Try the machine using Ac operation to determine if weak batteries are causing the slow speed.

Table.2.1. Summary of Audio Tape player/recorder troubleshooting.

Symptom	Cause	Remedy
Cassette cannot be inserted		Check cassette for damage. Check for foreign material inside player. Check if play or record button is depressed.
Record button cannot be depressed	No cassette loaded.	Load cassette.
	Cassette tab removed.	Place tape over cutout if you want to record on this cassette.
Playback button cannot be locked in	Tape is completely wound toward arrow direction.	Rewind tape with rewind button.
Tape does not move	Batteries are in backward.	Fix batteries.
	Weak batteries.	Test, and replace below 1.2 V.
	No ac.	Connect ac power adapter.
	Motor doesn't work.	Check voltage across motor. Continuity test motor winding to see if it is open.
No sound from speakers	Headphones plugged in.	Remove headphones plug.
	Volume is turned down.	Adjust location of volume control.
Fast tape speed	Incorrect speed control setting.	Readjust speed control.
Weak or distorted sound	Weak batteries.	Test, and replace below 1.2 V.
	Dirty heads.	Clean heads with alcohol and cleaning stick.
Poor recording	Weak batteries.	Test, and replace below 1.2 V.
	Dirty R/PB tape heads.	Clean up with alcohol and cloth.
Poor erase	Improper connection.	Check all head connections.
	Dirty erase head.	Clean erase head.
	No dc voltage.	Check dc voltage on head.
	No oscillator waveform.	Take scope waveform on head terminals.

1.4. Television receiver

1.4.1. Introduction

Television means “to see from a distance”. The Television system extends the sight of the human eye throughout the world. Such television system includes both Transmission and Reception of T.V. signals. Transmission means sending of information through a network known as transmitter and reception means receiving of information through a circuit known as T.V. receiver.

T.V. Receiver is an electronic circuit which can reproduce the transmitted signal into corresponding light and sound either in mono chrome or in color. Thus a Television receiver is the combination of AM receiver for picture and FM receiver for the associated sound reproduction. Television receiver is a combination of an AM receiver for the picture signal and an FM receiver for the associated sound. In addition, the receiver also provides suitable scanning and synchronizing circuitry for reproduction of image on the screen of picture tube. We shall confine our discussion to monochrome (black and white) receivers. However, it may be noted that all the circuits for a black-and-white picture are also needed in a color receiver. The color television picture is just a monochrome picture with color added in the main areas of picture information.

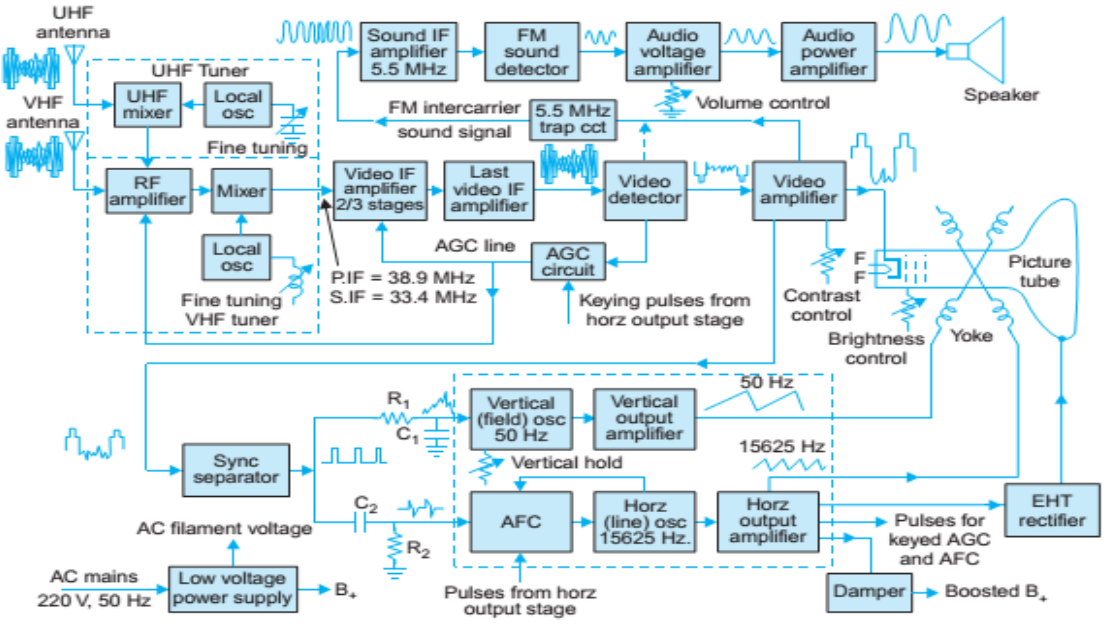


Fig. 4.1 Block Diagram of monochrome TV receiver

1.4.2 Antenna

Antenna converts electromagnetic waves in to corresponding electrical signals. Generally for VHF reception “Yagi Antenna is used. It consists of a dipole with one reflector and two or more directors are used. It is a compact high again directional array is often used in firings areas. In areas where signal strength is very low booster amplifiers with suitable matching networks are used. Strongest signal is induced in the antenna if it has same polarization as the transmitting antenna. All TV antennas are mounted in horizontal position for better reception and favorable signal to noise ratio.

1.4.3 RF Section:

This section consists of RF amplifier, mixer and local oscillator and is normally mounted on aseparate sub-chassis, called the ‘Front End’ or ‘RF Tuner’. According to frequency of reception these are 1. VHF tuner, 2. UHF tuner signals picked up by the antenna. Here the receiver uses the super heterodyning principle for conversion of the incoming signal into the common fixed carrier frequencies called Intermediate Frequencies. These are picture IF and sound IF. These values are 38.9 MHz for picture VIF and 33.4 MHz for sound SIF. Thus using RF section or channel selector or RF Tuner we can amplify the incoming composite video signal to the required level and then these are further converted into the VIF and SIF. Further these are fed the video IF amplifier.

The purpose of the tuner unit is to amplify both sound and picture signals picked up by the antenna and to convert the carrier frequencies and their associated bands into the intermediate frequencies and their sidebands. The receiver uses superhetrodyne principle as used in radio receivers. The signal voltage or information from various stations modulated over different carrier frequencies is hetrodyned in the mixer with the output from a local oscillator to transfer original information on a common fixed carrier frequency called the intermediate frequency (IF). The setting of the local oscillator frequency enables selection of desired station. The standard intermediate frequencies for the 625-B system are-PictureIF = 38.9 MHz, Sound IF = 33.4 MHz.

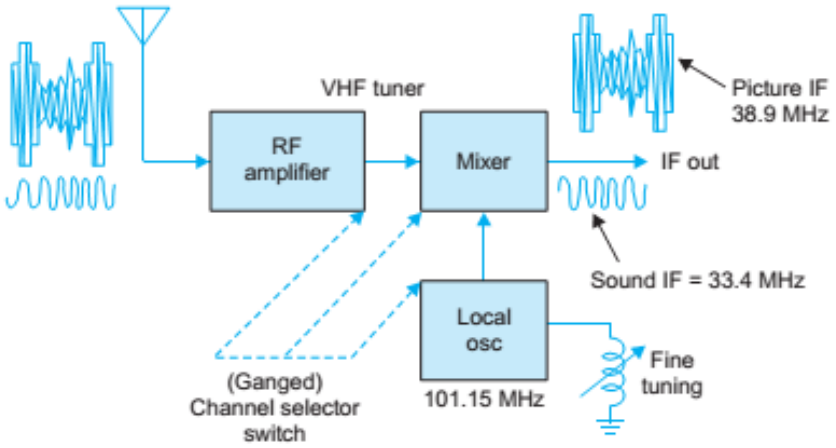


Fig. 4.2: Block diagram of a VHF tuner.

The main function of the turner is as follows.

1. To selected channel signal from the many signals up by the Antenna and reject others.

2. To amplify the received or selected signal.

3. To convent the incoming signal frequency to a common IF band.

4. To provide good S/N ratio.

5. It avoids adjacent channel frequency.

6. It provides image frequency rejection.

7. It acts as coupling device between antenna & receiver.

8. It prevents spurious picks ups from sources which operate in the IFband of receiver.

9. It has a fine control for accurate setting in the IF band.

4. 4 Video IF Amplifier

Since the composite video signals is the envelope of the modulated pictures IF signal practically all the gain and selectivity of the receiver is provided by the IF section. Generally 3 or 4 IF transistors amplifier stages are used for this purpose. In integral circuits one IC contains all the IF amplifier stages.

The main functions of the IF sections

1. To amplify the modulated IF signals over its entire bandwidths.

2. It also provides vestigial side band correction.

3. It provides again of above 800 to amplify the 0.5 mV input signal toabout 4 v.

4. It also provides adjacent channel signal rejection.

5. It also provides good selectivity.

1.4. 5 Video detectors:

Modulated IF selections after due amplification inthe IF selection are fed to the video detector. The video detector is essentially a rectifier cum high frequency filter circuit to recover video signal from the modulated carrier. Semiconductor diodes are used exclusively for detection and need about 2 volts or more of IF signal for linear detection without distortion. The signal to the detector is fed from the output of last IF amplifier

stage. Either polarity of this signal can be rectified by suitably connecting the diode, since both sides of the modulated envelope have the same amplitude variations. This choice depends on the number of video amplifier stages used and the manner in which the video signal is injected in the picture tube circuit. The detector is designed to receiverthe Composite video signals and to transform the sound signal to another lower carrier frequency.This is done by rectifying the input signals and filtering out unwanted frequency components. Thus the video signal which is demodulated with correct polarity isfed to the cathode of picture tube after one stage of video amplification.It should be noted, however, that polarity is not important in an audio system because the phase of ac audio signal for the loudspeaker does not matter in reproduction of sound, but a polarity inversion of video signal driving the picture tube would produce a negative picture. The detector may use either series circuit or shunt circuit, the basic forms of which are shown in Fig. 5 The series circuit arrangement is preferred because it is more suited for impedance match between the last IF amplifier output and input of the video amplifier.

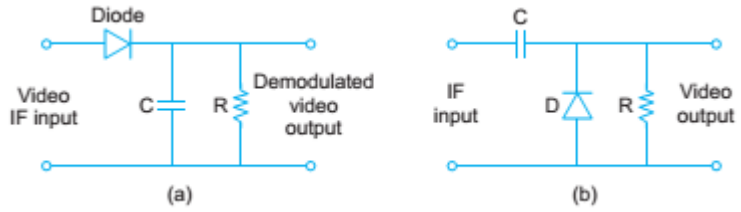


Fig. 4.3 Basic detector circuits (a) series (b) shunt

1.4.6 AGC

AGC means automatic gain control. AGC circuit control gain of RF and IF stages to deliver almost constant signal voltage to the video detector, despite changes in the signal picked up by the Antenna. Generally the signal available from the antenna to the television receiver may vary from fraction of am V to fraction of volt. It is clear that the television receivers' gain will vary with these variations in the signal strength. The result variation in gain is that a strong signal will produces excessive contrast, if the signal is very strong it over loads the video IF stage. This results in clipping is sync pulse tips. As a result sync pulse will be lost and the picture will appear turnout and will roll vertically. Overloading of the video stage produces negative picture. In order to prevent the above we require a circuit that control the output of the video detector to produce good picture is known as AGC.

The main advantages of AGC are as

1. Intensity and contrast of the picture once set remains constant irrespective of changes in the input signal strength.
2. Contrast in the reproduced picture does not change when the receiveris switched from one situation to another.
3. Amplitude cross modulation distortion on strong signals is avoided.
4. Further due to passing aero planes and fading effects will be reduced.
5. The sound signal being the part of CVS(composite video signal) also stays constants as it is also controlled by the AGC.
6. Separation of sync pulses becomes easy.
7. The gain on weak signals is improved using delayed AGC.

1.4.7 Video Amplifier

The picture tube needs video signal with peakamplitude of 80 to 100 V for producing picture with good contrast. This amplifierprovides necessary gain to achieve necessary amplification to the video signal todrive the picture tube. Here gain control is also provides in the stage to adjustthe contrast between black and white parts of the picture. That's why this gaincontrol is also known as contrast control. Thus the amplified video signals arefed to the cathode of the picture tube.

1.4.7.1 Sync separator:

The horizontal and vertical sync pulses from thepart of the composite video signal are separated in the sync separator. The Composite video signal (CVS) is either taken from the video detector output or after one stage of videoamplification. A sync separator is

clipper circuit that is suitably biased to produceoutput only during sync pulse amplitude of the video signal.

1.4.7.2 Sync processing and AFC circuit:

The output obtained from the sync separators is fed simultaniously to a differentiator and integrator circuits.The differentiator provide sharp pulse for triggering the horizontal Oscillator.Thus using integrator and differentiator vertical sync pulsed are separated fromthe sync separators.As the differentiator is a high pass filter it also developed output inresponse to noise pulses in addition to the spiked horizontal sync pulses. These results in occasional wrong triggering to the horizontal oscillator, which resultsin diagonal tearing of the reproduced picture. This problem can be solved byusing automatic frequency control circuit. The AFC circuit employs adiscrimination arrangement which compares the incoming horizontal sync pulsesand the voltage that develops across the output of the horizontal deflectionamplifier.Thus the AFC output is a dc control voltage that is free of noise pulses.This control voltage is used to synchronize the horizontal oscillator with thereceived horizontal sync pulses.

1.4.8 Vertical deflection Circuit:

Blocking oscillator are normally used as vertical deflection oscillators. This oscillators produces necessary saw tooth voltages required for vertical deflection. A potentiometer frequency known as vertical hold is used in this section to reset the vertical oscillator's frequency from it frequency drift. The output of the oscillators is fed to a power amplifier. After amplification the same output is coupled to vertical deflections coils to produce the vertical deflection of the beam on the picture tube screen.

1.4.9 Horizontal deflection circuit:

The horizontal oscillators is similar to vertical oscillators. It is used develop sweep derive voltage at 15625 Hz. This oscillators is controlled by the control voltage developed by the AFC circuit. The oscillator output is wave shaped to produce linear rise of current in the horizontal deflection coils. Since the deflection coils need about one amp of current to sweep the entire raster, for this purpose the output of the oscillator is given one stage to power amplification and then fed to the horizontal deflection coils.

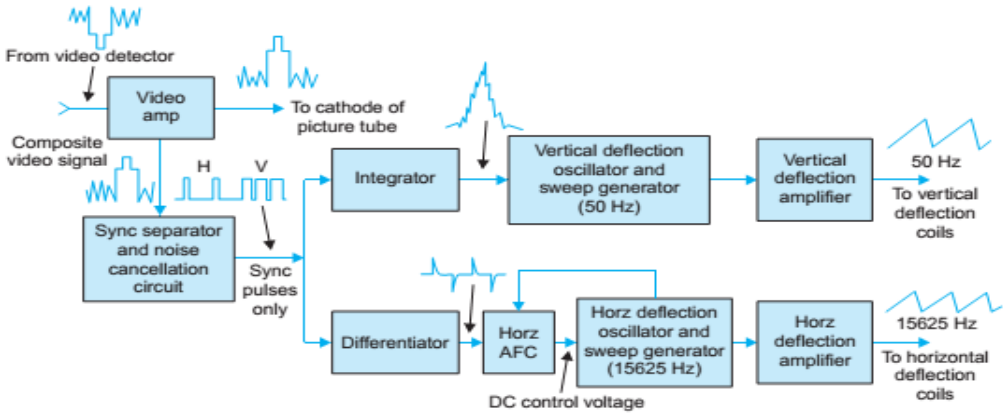


Fig.4.4 Block diagram of the sync separator and deflection circuits in a television receiver.

1.4.10 Interlaced scanning

In television pictures an effective rate of 50 vertical scans per second is utilized to reduce flicker. This is accomplished by increasing the downward rate of travel of the scanning electron beam, so that every alternate line gets scanned instead of every successive line. Then when the beam reaches the bottom of picture frame, It quickly returns to the top to scan those lines that were missed in the previous scanning. Thus the total numbers of lines are divided into two groups called 'fields'. Each field is scanned alternately. This method of scanning is known as 'interlaced scanning' and is illustrated in Fig5. It reduces flicker to an acceptable level since the area of screen is covered at twice the rate. This is like reading alternate lines of a page from top to bottom once and then going back to read the remaining lines down to the bottom.

In the 625 line TV system, for successful interlaced scanning, the 625 lines of each frame or picture are divided into sets of 312.5 lines and each set is scanned alternately to cover the entire picture area. To achieve this, the horizontal sweep oscillator Is made to work at a frequency of 15625 Hz (312.5 X 50 =15625) to scan the same number of lines per frame (15625/25 = 625 lines), but the vertical sweep circuit is run at a frequency of 50 instead of 25 Hz. Note that since the beam is now deflected from top to bottom in half the time and the horizontal oscillator is still operating at 15625Hz, only half the total lines. i.e. 312.5 (625/2 =312.5) get scanned during each vertical sweep. Since the first field ends in a half line and the second field commences at middle of the

line on top of the target plate or screen (see Fig.3.3), the beam is able to scan the remaining 312.5 alternate lines during its downward journey. In all then, the beam scans 625 lines (312.5 X 2 = 625) per frame at the same rate of 15625 lines (312.5 X 50 =15625) per second. Therefore, with interlaced scanning the flicker effect is eliminated without increasing the speed of scanning, which in turn does not need any increase in the channel bandwidth.

It may be noted that the frame repetition rate of 25 (rather than 24 as used in motion pictures was chosen to make the field frequency equal to the power line frequency of 50 Hz. This helps in reducing the undesired effects of hum due to any pick-up from the mains, because then such effects in the picture stay still, instead of drifting up or down on the screen. In the American 1V system, a field frequency of 60 was adopted because the supply frequency is 60 Hz in USA. This brings the total number of lines scanned per second equal to (525/2) X 60 =15750 lines which is practically the same as in the 6251ine system.

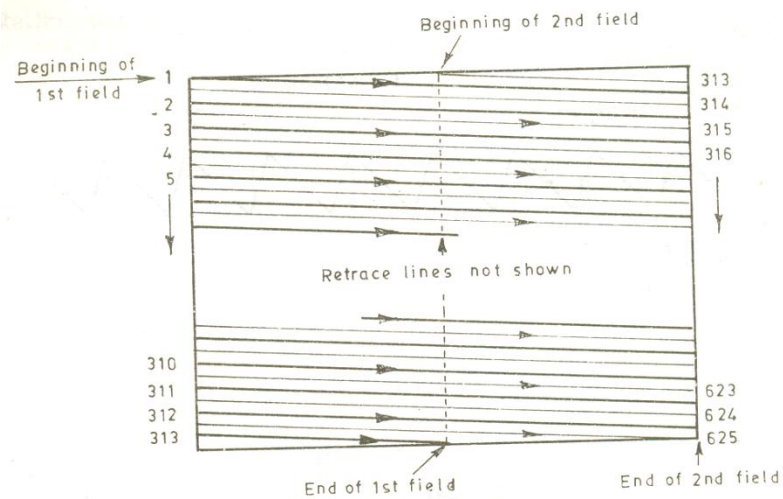


Fig.4.5 principle of interlaced scanning.

1.4.10.1 Scanning Periods

The wave shapes of both horizontal and vertical sweep currents are shown in Fig. 3.5.As shown there, the retrace lines involved (both horizontal and vertical) are due to physical limitations of practical scanning systems and are not utilized for transmitting or receiving any video signal. The nominal duration of one horizontal line as shown in Fig. 3.5 (a) is 64μs (l06 /15625 =64μs), out of which the active line period is 52μs and

remaining 12 μs is the line blanking period. The beam returns during this short interval to the extreme left side of the frame to start tracing the next line.

Similarly with field frequency set at 50 Hz, the nominal duration of one vertical trace (see Fig. 3.5(b)) is 20ms (1/50 =20ms.). Out of this period of 20ms, 18.720ms are spent in bringing the beam from top to bottom and the remaining 1.280ms is taken by the beam to return back to the top to commence the next cycle. Since horizontal and vertical sweep oscillators operate continuously to achieve the fast sequence of interlaced scanning, 20 horizontal lines (1280 μs/64μs =20 line) get traced during each vertical retrace interval. Thus 40 scanning lines are lost per frame as blanked lines during retrace interval of two fields. This leaves active number of lines, (Na) for scanning the picture details equal to 625 - 40 = 585; instead of the 625 lines actually scanned per frame.

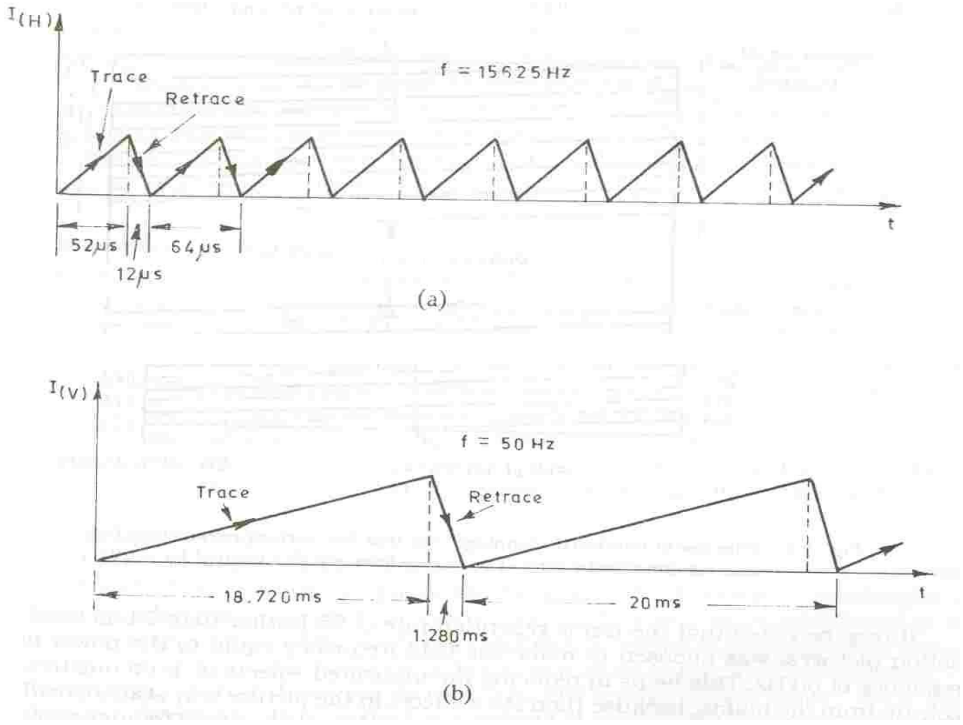


Fig.4.6 a) horizontal and b) vertical deflection current.

1.4.10.2 Scanning Sequence

The complete geometry of the standard interlaced scanning pattern is illustrated in Fig. 6. Note that the lines are numbered in the sequence in which these are actually scanned. During the first vertical trace actually 292.5 lines are scanned. The beam starts at A, and sweeps across the frame with uniform velocity to cover all the picture elements in one horizontal line. At the end of this trace the beam retraces rapidly to the left side of the frame, as shown by dashed line in the illustration, to begin the next horizontal line. Note that horizontal lines slope downwards in the direction of scanning because vertical deflecting current simultaneously produces a vertical scanning motion, which is very slow compared with horizontal scanning. The slope of horizontal trace from left to right is greater than during retrace from right to left. The reason is that the faster retrace does not allow the beam so much time to be deflected vertically. After line one, the, beam is at the left side ready to scan line 3, omitting the second line. However, as mentioned earlier it is convenient to number the lines as they are scanned and so the next scanned line skipping one line, is numbered two (2) and not three (3). This process continues till the last line gets scanned half when the vertical motion reaches the bottom of raster or frame. As explained earlier, skipping of lines is accomplished by doubling the vertical scanning frequency from the frame or picture repetition rate of 25 to the field frequency of 50 Hz. With the field frequency of 50 Hz the height of the raster is so set that 292.5 lines get scanned as the beam travels from top to bottom and reaches point 'B'. Now the retrace starts and takes a period equal to 20horizontal line periods to reach the top marked 'C'. These 20 lines are known as inactive lines, as the scanning beam is cut -off during this period. Thus the second field starts at the middle of the raster and the first line scanned is the 2nd half off-line number 313.The scanning of second field, starting at the middle of the raster automatically enables the beam to scan alternative lines left un scanned during the first field. The vertical scanning motion otherwise is exactly the same as in the previous field giving all the horizontal lines the same slope downwards in the direction of scanning. As a result 292.5 lines again get scanned and the beam reaches the bottom of frame when it has completed full scanning of line number 605. The inactive vertical retrace again begins and brings the beam back to the top at point

'A' in a period during which 20 blanked horizontal lines (605 to 625) get scanned. Back at point 'A', the scanning beam has just completed two fields or one frame and is ready to start the third field covering the same area (number of lines) as scanned during the first field. This process (of scanning fields) is continued at a fast rate of 50 times a second, which not only creates an illusion of continuity but also solves the problem of flicker satisfactorily.

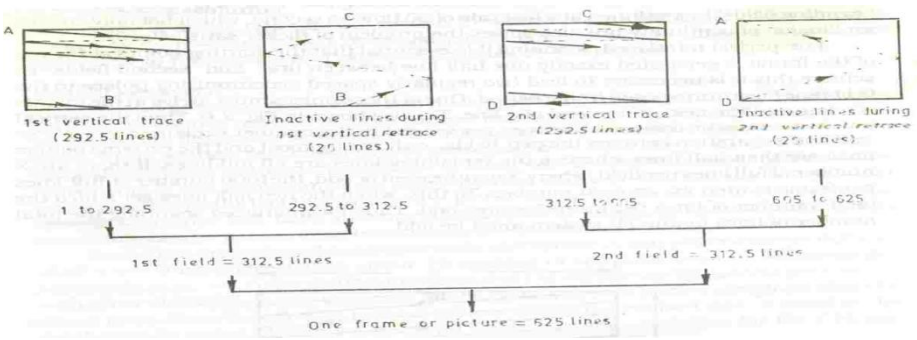


Fig.4.7 odd line interlaced scanning procedures

.For perfect interlaced scanning it is essential that the starting points at the top of the frame is separated exactly one half -line between first and second fields. To achieve this it is necessary to feed two regularly spaced synchronizing pulses to the field time base during each frame period. One of these pulses must arrive in the middle of a line and the next at the end of a line. This is shown in Fig.7. Thus the vertical time base must be triggered 50 times per second in the manner explained above. For half line separation between the two fields, only the topmost and the extreme bottom lines are then half lines whereas the remaining lines are all full lines. If there are X number of full lines per field, where X may be even or odd, the total number of full lines per frame is then 2x, an even number. To this, when the two half lines get added the total number of lines per frame become odd. Thus for interlaced scanning the total number of lines in any TV system must be odd.

Further for correct interlacing it becomes necessary that at the transmitter automatic frequency control must be utilized to maintain a horizontal scanning frequency that is exactly 312.5 times as great as the field frequency i.e. 50 Hz. this is accomplished by generating a stable frequency at 15625 Hz by crystal controlled oscillator circuits. A frequency doubling circuit produces a frequency of 31250Hz which is utilized to control the correct generation of equalizing and vertical sync pulses. Four frequency division

circuits each with a ratio of 5:1 are employed to drive 50 Hz. the vertical scanning frequency (31250 =5 X 5 X 5 X 5 X 50). Thus all the required frequencies are derived from a common stable source and they automatically remain interlocked in the correct ratios

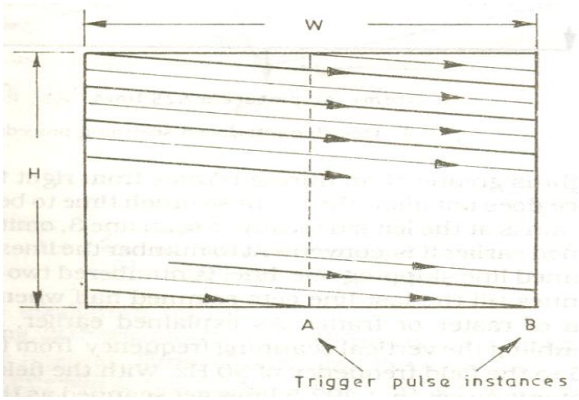


Fig. 7 vertical trigger pulse instants.

1. 4.11 Sound Section

The sound section consists sound IF amplifier, FM detector, Audio voltage amplifier, audio power amplifier and loud speaker. Theinter carrier sound IF signal directly cannot drive the FM detector. So at leastone stage of amplification is needed to drive the FM detector. This is achievedwith the sound IF amplifier. After amplification the sound IF signals is fed to FMdetectors. The FM detector is normally a ratio detector or discriminatorproceeded by a limiter. Here in this stage sound is demodulated and De-emphasisrestores the amplitudes of higher audio frequencies to their correct level. Thus demodulated sound signal is further amplified using voltage amplifiers in order todrive power amplifier. The power amplifier is either single ended or a push pull amplifier employing Transistors. These stages provide volume and tone controls. Thus amplified signals are fed to loud speaker. Finally loud speaker convertselectrical signal into corresponding sound signal. Sound is becoming increasingly important in television. The sound supports the image and adds another dimension to make the viewer feel more involved. TV sets come in mono, stereo and hi-fi. Properly installed loudspeakers send the sound forward. Higher quality sets have low-frequency speakers that send their signals sideways and also have much smaller high-frequency speakers placed somewhere in the lower parts or to the sides of the set. As low frequencies travel in all directions, low-frequency speakers do not need to point at the viewer.

1.4.11.1Sound Signal Separation:

The picture and sound signals on theirrespective carrier are amplified together in the IF section. In video detector VIFof 38.9 MHz acts as carrier and beats with the sound carrier 33.4 MHz producea difference of 5.5 MHz. This is called inter carrier signals. This retains all theFM modulated sound signals by providing a resonant tarp circuit in the videodetector the sound signals is separated from the video detector.

1.4.12 Degaussing Coils

A "degausser", is an *electronic tool* used for demagnetizing materials, thereby eliminating any magnetic fields they may have. It usually consists of a degaussing coil, which is a copper coil with an AC current passing through it. It is an extremely useful tool for demagnetising the the shadow mask of a colour television screen. A colour television usually has a shadow mask, which is extremely sensitive to magnetism. If it becomes magnetised, it may cause improper beam landing resulting in patches of colour on various parts of the screen. If the magnetism is minor, a television receiver set may correct it automatically as many sets have a built in degaussing coil. Usually situated around the edges of the screen, and held by a rope, it automatically activates when the television switches ON. However, on some televisions, this function activates when the television goes into standby mode.

The coil usually has a temperature sensitive resistor in series, which increases its resistance as the coil heats up. Consequently, the coil remains powered for a few seconds when the television starts. This is usually sufficient for removing weak magnetic fields, however if the magnetic fields are stronger, then an external demagnetizer is required.

1.4.13 High Voltage Supply (EHT):

In black and white tubes anode requires a voltage of 15KV for sufficient brightness. This is known as HV or EHT (Extra High Tension supply). This high voltage is produced during retrace intervals of horizontals scanning. A high voltage pulses of amplitude between 6to9 Kv are developed across the primary winding of the horizontal output transformer. Further these are stepped up by an auto transformer winding to about 10 to 15 KV andthen fed to high voltage rectifier. The output of the rectifier is filtered to provide required dc voltage. This is fed to final anode of the picture tube.

1.4.14 Low Voltage Power Supply:

The usual B+ or low voltage supply is obtained by rectifying and filtering the ac. mains supply. This given to various sections of the receivers. Thus a T.V Receiver can convert CVS signals in to corresponding picture and sound signal.

1.4.15 Working principle of Color TV

Colour television is based on the theory of additive colour mixing, where all colours including white can be created by mixing red, green, and blue lights. The colour camera provides video signals for the red, green, and blue information. These are combined and transmitted along with the brightness (monochrome) signal.

Each colour TV system is compatible with the corresponding monochrome system. Compatibility means that colour broadcasts can be received as black and white on monochrome receivers. Conversely colour receivers are able to receive black and white TV broadcasts. This is illustrated in Fig. 1.5 where the transmission paths from the colour and monochrome cameras are shown to both colour and monochrome receivers.

At the receiver, the three colour signals are separated and fed to the three electron guns of colour picture tube. The screen of the picture tube has red, green, and blue phosphors arranged in alternate dots. Each gun produces an electron beam to illuminate the three colour phosphors separately on the fluorescent screen. The eye then integrates the red, green and blue colour information and their luminance to perceive the actual colour and brightness of the picture being televised.

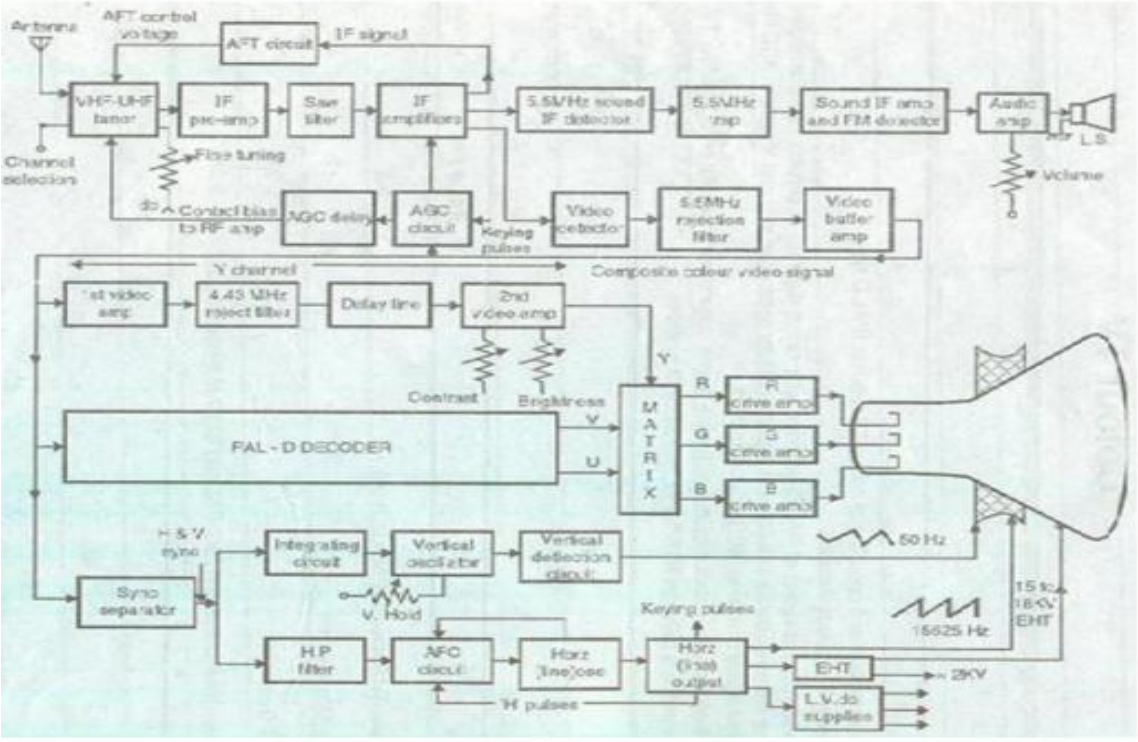


Fig. 4.8 Block Diagram of Color TV

A colour TV receiver contains all the necessary circuits of a monochrome receiver plus additional circuits required for the reproduction of a coloured picture.

Basically a colour TV receiver is a black-and-white receiver with a decoder for the colour signals and a colour picture tube. The figure is the functional block diagram shows that the circuits like the RF tuner, VIF amplifier, the video amplifier, the deflection sync, the sweep circuits and the EHT sections are virtually the same as in black-and-white receiver.

However there are some minor differences in design and details. For example the RF response in case of colour TV is kept more uniform than in monochrome receiver, this is to avoid any attenuation of the colour sub-carrier.

The colour TV uses the inter carrier sound system with one difference. The sound take-off point is at the last VIF stage immediately before the video detector. This is done to avoid interference between the sound IF and the chroma signal.

A separate diode detector is used to produce the sound IF but the rest of the audio circuits are the same as in a monochrome receiver. The two main circuits which distinguished a color TV from a monochrome TV are the colour picture tube and the chroma section containing the colour circuits.

According to Block Diagram of Color Television Sets In a color television receiver, additional circuits are provided to deal with the color.

The only difference between black and White Television set and color Television set is the IF circuit is the importance of bandwidth for colour receivers. Remember that video frequencies around 3.58 MHz just show details in monochrome, but these frequencies are essential for colour information. Without them, there is no colour. This is why the fine tuning control on colour television sets must be tuned exactly, or else the colour disappears, along with the higher resolution.

The sound is usually taken off before the video detector in colour sets, and a separate converter is used for it, instead of taking it from the video detector. The reason that this is done is to minimize a 920 KHz beat signal that can result between the 3.58 MHz colour subcarrier and the sound carrier signal. This signal would show up as interference in the television picture.

Color Receiver

A color receiver is similar to the black and white receiver as shown in Fig. below. The main difference between the two is the need of a color or Chroma- sub-system. It

accepts only the color signal and processes it to recover (B-Y) and (R-Y) signals. These are combined with the Y signal to obtain VR, VG and VB signals as developed by the camera at the transmitting end. VG becomes available as it is contained in the Y signal. The three color signals are fed after sufficient amplification to the color picture tube to produce a color picture on its screen.

As shown in Fig. below, the color picture tube has three guns corresponding to the three pick-up tubes in the color camera. The screen of this tube has red, green and blue phosphors arranged in alternate stripes. Each gun produces an electron beam to illuminate corresponding color phosphor separately on the fluorescent screen. The eye then integrates the red, green and blue color information and their luminance to perceive actual color and brightness of the picture being televised. The sound signal is decoded in the same way as in a monochrome receiver.

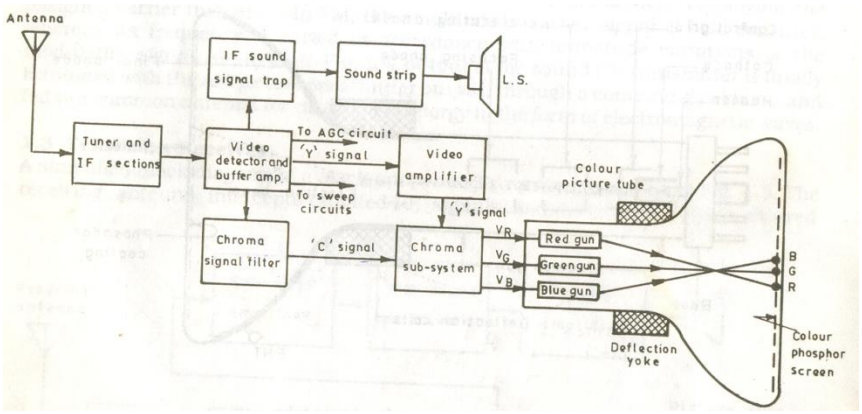


Fig.4.10 simplified block diagram of a color receiver.

COMPATIBILITY

Compatibility implies that (i) the color television signal must produce a normal black and white picture on a monochrome receiver without any modification of the receiver circuitry and (ii) a color receiver must be able to produce a black and white picture from a normal monochrome signal. This is referred to as reverse compatibility.

Mixing of Colors

Mixing of colors can take place in two ways—subtractive mixing and additive mixing. In subtractive mixing, reflecting properties of pigments are used, which absorb all wavelengths but for their characteristic color wavelengths. When pigments of two or more colors are mixed, they reflect wavelengths which are common to both.

The additive mixing of three primary colors—red, green and blue in adjustable intensities can create most of the colors encountered in everyday life. The impression of white light can also be created by choosing suitable intensities of these colors. Red, green and blue are called primary colors. These are used as basic colors in television. By pair wise additive mixing of the primary colors the following complementary colors are produced:

Red + Green = Yellow

Red + Blue = Magenta (purplish red shade)

Blue + Green = Cyan (greenish blue shade) Color plate 1 depicts the location of primary and complementary colors on the color circle.

If a complementary is added in appropriate proportion to the primary which it itself does not contain, white is produced.

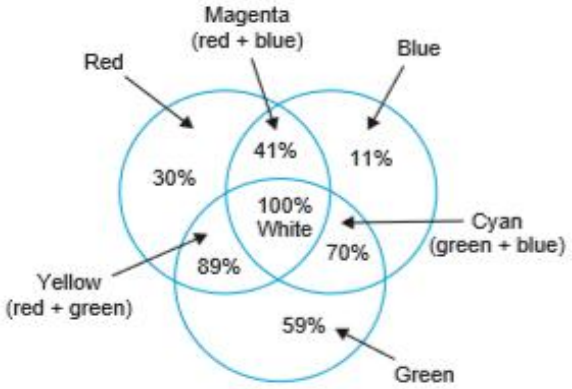


Fig 4.11. Additive color mixing

The typical arrangement in CTV Receivers is shown in block diagram. The circuits are roughly divided into the signal circuits obtaining the video and sound signals from the antenna input signal, the synchronizing and deflecting circuits for displaying the picture,

Chrominance Signal Circuits

It consists of the color reproduction circuits and the color synchronizing circuit, in which color signal to be applied to the picture tube for displaying the color picture is obtained.

Color Reproduction Circuits

a. Band-Pass Amplifier

This amplifier consists of 2 or 3 stages to separate the chrominance subcarrier from the composite video signal and amplify them.

b. ACC Circuit and Color Killer Circuit

The ACC circuit adjusts the gain of the band-pass amplifier so that the variation of the saturation of the color due to the change of the received signal is suppressed automatically. The color killer circuit operates to reject the color noise, which occurs in case of the monochrome signal reception, by inhibiting the operation of the band-pass amplifier.

c. Color Demodulator

Color-difference signal is obtained in this circuit from the chrominance subcarrier. There are some variations because of the difference in the demodulating systems.

d. Color Output Circuit

The luminance signal and the color-difference signals are mixed in this circuit so as to obtain the red, green and blue primary signals to reproduce the color picture.

(2) Color Synchronizing Circuit

To demodulate the chrominance signal correct, it is necessary to generate a 3.58 MHz signal whose frequency is same and phase is in the predetermined condition with that of the received chrominance sub carrier respectively. This signal is generated in this circuit with the aid of the burst signal and there are some methods in 3.58 MHz signal generation. This block consists of the burst amplifier, the chroma synchronizing (3.58 MHz generator) circuit and the others

a) Burst Amplifier

The burst signal superposed on the back porch of the horizontal sync signal is gated and amplified. The amplified burst signal is applied to the following Chroma synchronizing (3.58 MHz generator) circuit.

b) Chroma Synchronizing (3.58 MHz Generator) Circuit

To generate the 3.58 MHz signal the direct ringing and burst injection methods, and the indirect APC method are employed. The 3.58 MHz signal generated in this circuit is fed to the color demodulator as the chrominance subcarrier after the amplification and the phase control

Sound Reception

The path of sound signal is common with the picture signal from antenna to video detector section of the receiver. Here the two signals are separated and fed to their respective channels. The frequency modulated audio signal is demodulated after at least one stage of amplification. The audio output from the FM detector is given due amplification before feeding it to the loudspeaker.

Television Receiver Trouble Shooting tables

Table 1:Tuner / IF failures

No	Symptom	Cause
1	Picture noise, no sound/picture.	There is no +5V voltage coming to tuner
2	Screen is white, no sound/picture.	IF circuit is failed.
3	Sound is bad, there is picture noise	AGC circuit is failed
4	Channel is searched in OSD but can't be found.	SDA signal is not coming.

Table 2: **Color and RGB stages failures**

No	Symptom	Cause
1	Conversion lines on picture	Element with changed value on Video Amplifier Circuit
2	There is sound and picture but no red color	Color output stage (R) Red line or picture tube is failed
3	There is sound and picture but no Green color.	Color output stage (G) Green line or picture tube is failed.
4	There is sound and picture but no Blue color.	Color output stage (B) Blue line or picture tube is failed.
5	There is sound and white return lines on the screen.	RGB amplifier failure or no +155V.

Table 3: Sound failures

No	Symptom	Cause
1	There is picture but no sound, sound amplifier is in good condition.	Sound IF circuit is failed.
2	There is picture but no sound, speaker is in good condition.	Sound output circuit is failed.

Table 4:Horizontal stage failures

No.	Symptom	Cause
1	No Picture, no high voltage.	Horizontal driver transistor, BC639 or L502 driver coil is down
2	No Sound, no high voltage.	Horizontal output transistor D2586 is not working.

Table 5 Vertical stage failures

No	Symptom	Cause
1	There is sound, Vpos is slided downward, there is no picture up	No V drive A signal
2	There is sound, Vpos is slided upward.	No V drive B signal
3	There is sound and there is single horizontal line on the screen.	Vertical output is not working
4	There is sound, the picture is narrow	One of the vertical circuit elements is

	from upward and downward.	down or its value is changed
5	There is sound, the picture is long from upward and downward.	One of the vertical circuit elements is down or its value is changed.

Table 6 Feeder stage failures

No.	Symptom	Cause
1	Dead receiver, no Sound &Picture, Stand-By LED is not working.	"SMPS" primary side, IC601 and T603 keying mosfet is not working.
2	Dead receiver, no S.P.Stand-By mode cannot be "ON".	No SMPS output DC 6V and 3.3V
3	Dead receiver, Blowed fuses condition. Stand-by led is not working, no Stand-By.	The fuse is blowed or 220V is not coming.

1.5. Switch-mode power supply

The electronic power supply integrated with the switching regulator for converting the electrical power efficiently from one form to another form with desired characteristics is called as Switch-mode power supply. It is used to obtain regulated DC output voltage from unregulated AC or DC input voltage. The dc voltages required for various sections of a TV receiver range in magnitude from above l2V to 160V. The electronic power supply integrated with the switching regulator for converting the electrical power efficiently from one form to another form with desired characteristics is called as Switch-mode power supply. It is used to obtain regulated DC output voltage from unregulated AC or DC input voltage.

Fig. 5.1 Switch mode power supply

1.5.1 Advantages of SMPS are -

(i) Small physical size,

(ii) Greater efficiency because of lesser heat dissipation

(iii) Protection against excessive output voltage by quick-acting guard circuits,

(iv) Isolation from mains supply without the need for a large 50 Hz transformer,

(v) Reduced harmonic feedback into the mains supply and

(vi) Ease of simultaneous generation of both low and intermediate voltage supplies.

1.5.2 Disadvantages

Despite many advantages the SMPS has some drawbacks.These include: -

(I) The rapid switching of chopping current generates strong interfering signals.

(2) Higher harmonics or oscillatory currents due to trapped energy lie in the radio frequency range and can enter the tuner circuit to cause dot interference on the picture tube screen.

(3) Strong induced voltages get fed back to the mains thus polluting supply to other appliances in use nearby.

1.5.3 Essentials of SMPS

In any SMPS power supply, mains voltage is first rectified and filtered by high voltage rectifiers and capacitors. The unregulated dc voltage thus obtained is chopped at high frequency by switching transistor(s) operated by a control circuit. The chopping frequency is chosen to be 15.625 KHz for supplies to be used in television receivers. The chopped dc is applied to the primary of a transformer and voltage induced at its secondary is rectified using fast recovery power diodes and smoothed with a capacitor or inductor-capacitor filter. A fraction of dc output voltage is fed back via a sensing amplifier to the control circuit which adjusts duty cycle of the switching transistor (s) to keep the output voltage constant. The transformer used is very small in size as it works at a very high frequency. Its turns ratio is chosen to obtain desired output voltage. Several windings on the same transformer enable generation of different dc voltage sources simultaneously.

1.5.4. Use of SMPS

To reduce cost, size and weight, Monitors, TVs, Mobile charger, PCs, laptop and camcorder power packs, printers, fax machines, VCRs, portable CD players, DVD players microelectronics-based devices in automotive, computing, communications, consumer electronics and industrial applications use SMPS.

1. 5. 5 Block Diagram of a Typical SMPS and How It Works

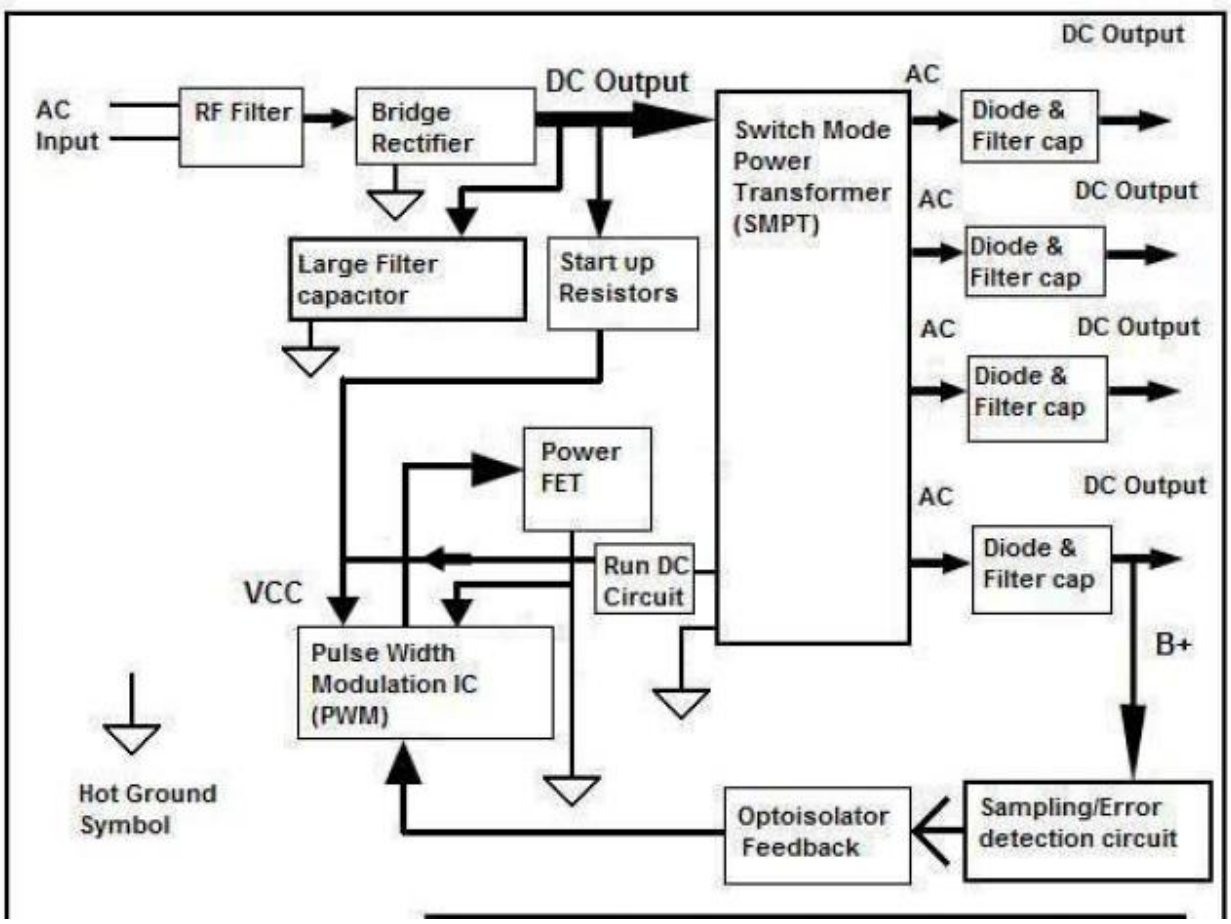


Fig.5.2 Block diagram of switch mode power supply

Generally SMPS consists of the following main circuits in order to form the complete set (circuit). Either one of the circuits malfunction could cause problems in SMPS. The main circuits are:

1. Input Protection and EMI Filtering Circuit
2. Bridge circuit
3. Start up and Run DC circuit
4. Oscillator circuit
5. Secondary Output Voltage circuit
6. Sampling circuit
7. Error Detection
8. Feedback circuit
9. Protection circuit and

1.5.5.1. Input Protection and EMI Filtering Circuit

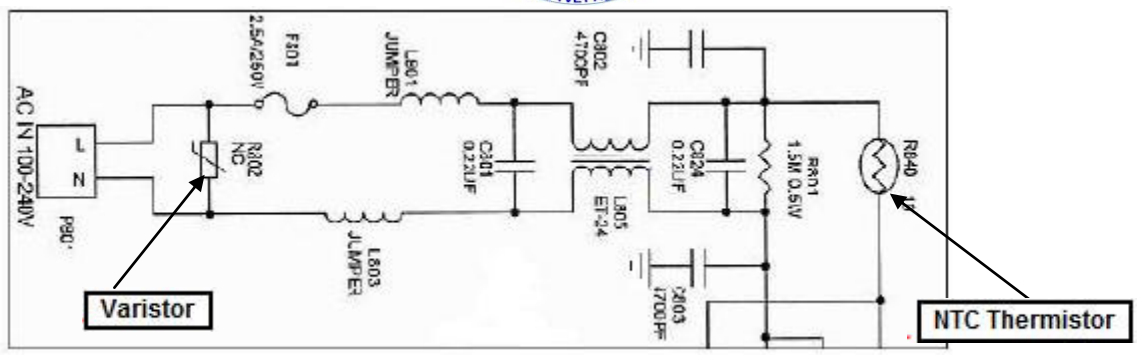


Fig.5.3 Input protection and EMI filtering

This is the first circuit where AC supply enters the SMPS. The Varistor R802 protects the power supply from transient voltages resulting from lightning strikes or power surge. The fuse F801 provides protection against circuit faults and effectively isolates the circuit from the AC supply source. Capacitor C801 and C824 are X capacitors and help to reduce the differential mode electromagnetic interference (EMI). Resistor R801 discharges C801 and C824 on AC removal, preventing potential user shock. Inductor L805 is a common mode inductor and helps in filtering common mode EMI from coupling back to the AC source. C802 and C803 are Y capacitors connected from the Line/Neutral to Earth to reduce common mode EMI. Thermistor R840 limits the **initial peak inrush current** drawn by the circuit at start up.

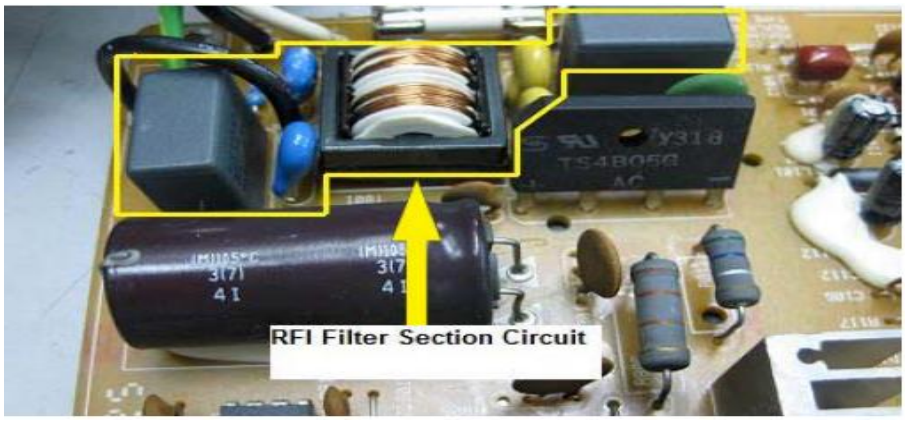


Fig.5.4 EMI filtering

1.5.6. Bridge circuit

The bridge circuit consists of a bridge rectifier (either 4 individual diodes or a single package rectifier) and a filter capacitor. The function of the bridge rectifier is to convert the incoming AC voltage into DC voltage and the filter capacitor (usually have the value of 220uf 400Volt) to remove the ripples and this will provide a nice DC voltage source to the primary winding of switch mode power transformer. For countries that use the 220 to 240 VAC, the DC voltage that you will get is about 300VDC and for countries that use 110-120VAC, the DC voltage that you will get is about 150 to 160 VDC. The DC voltage that you get is measured across the two pins of the filter capacitor using a multimeter.

In some power supply design, you could see that there are capacitors connected across each diode in the bridge rectifier .The function of the capacitors is to suppress the RFI signals generated by the rectifier diodes in the secondary side

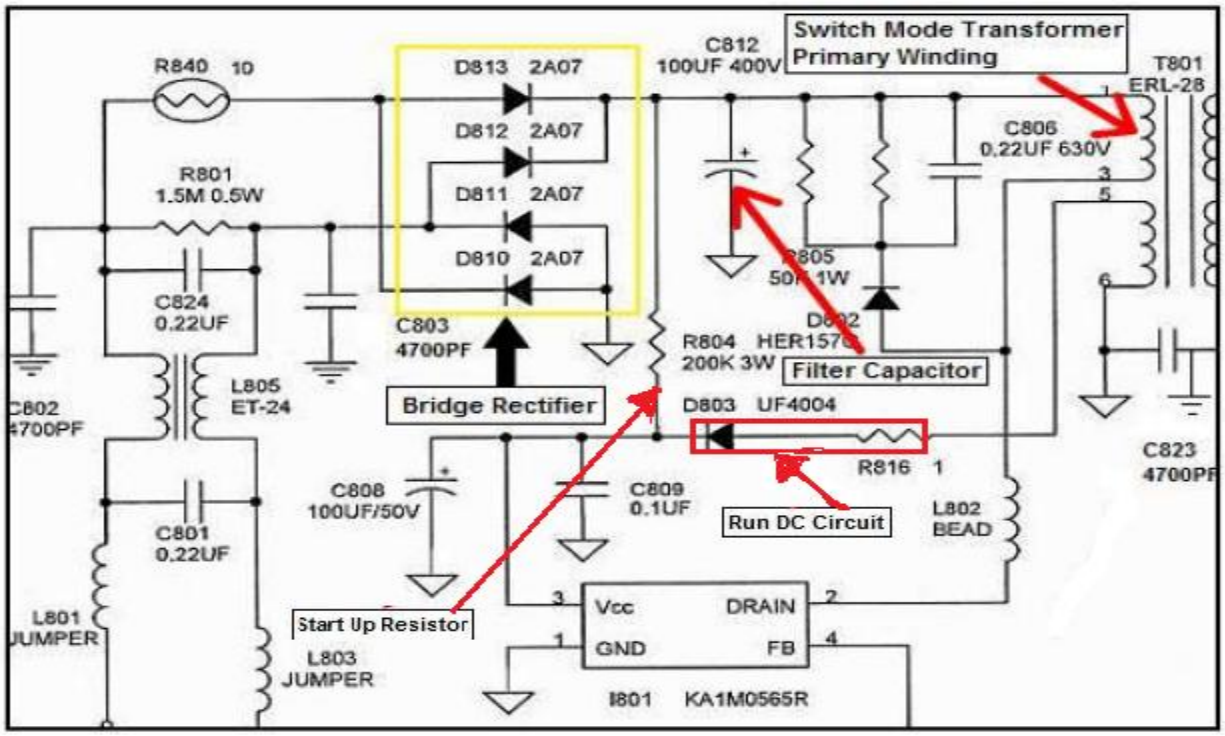


Fig. 5.5.bridge rectifier and filter capacitor

If the bridge rectifier is shorted, then the main fuse would surely blow. In some cases, it could also cause the power IC, power FET and corresponding components to blow as well. If the filter capacitor value drops, open circuit or the ESR value had gone high, it may cause no power symptom, power blink or unstable voltage in the secondary side.

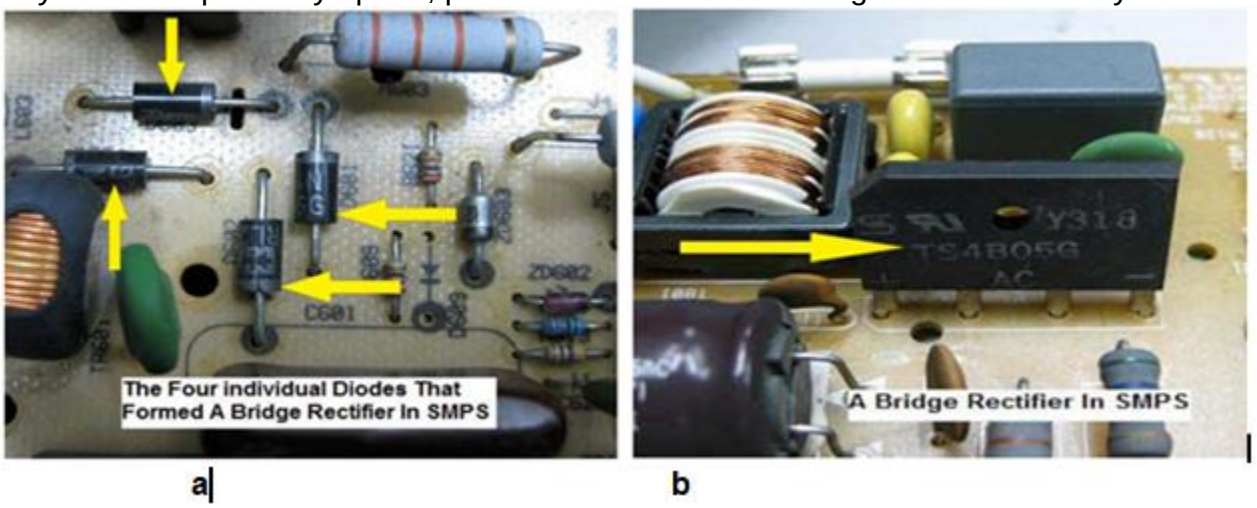


Fig.5 6.a).Discrete component b) IC bridge rectifier

1.5.7. Start Up and Run DC Circuit

The start up and run circuit for SMPS is shown in the above figure. This circuit usually consists of one to three high Ohms resistors (usually from 47K Ohm to several hundred K Ohm) and is connected between the 300VDC voltage line and the supply input of power IC. After the 300 VDC goes through the start up resistors, the voltage will drop to about 16 VDC (start up voltage depends on the type of SMPS design) and this voltage is used to kick on the oscillator in the power IC the first time.

After the kick starts, even if the starts up resistors have been removed, the supply will continue to operate because it now gets the supply from another source which is the secondary winding (in the primary side). This is called the **Run DC circuit**. As the large filter capacitor discharges the power IC requires additional voltage to maintain stable operation thus additional circuit, i.e. Run DC circuit is provided to the power IC from the secondary winding so that the circuit (voltage source) becomes stable.

If the start up resistors is opened circuit or turned into high ohms, it would cause no power symptoms. Sometimes it could also cause intermittent power problem. That means sometimes you can turn on the SMPS but after you have switched off the supply and turned it on again, it would not work. Wait for a while and try a few more times, the SMPS will then begin to start again. This is what is called as intermittent no power problem.

1.5.8. Oscillator Circuit

This circuit consists of power IC, power FET, the transformer primary winding and at least one secondary feedback either from secondary winding or from optoisolator IC. The power IC is the main source in controlling the output voltages at the secondary side of SMPS. The power IC generates output pulse waveform (drive signal) to the power FET through the gate pin and the power FET started to switch on. When the switch is turned .On., the transformer primary winding charges (energy stored) and when the switch is turned off, the energy in the primary winding will be transferred (discharges its stored energy) into the secondary. In other words, switching the primary winding of the transformer ''On'' and ''off'' will result in secondary voltage. This also shows that by controlling the switch's on/off time (from the power IC) we can obtain necessary secondary voltage. In other words, the output voltage can be varied by changing the frequency or duty cycle of the FET (or bipolar transistor) drive signal (waveform).

1.5.9 Secondary Output Voltage Circuit

The secondary output voltage circuit provides various positive or negative DC output voltages to other circuits like Vertical, Horizontal, CPU, Color, Fly back transformer, and etc. The secondary output voltage circuits usually consist of diodes (ultra fast recovery diodes-to convert AC to DC), filter capacitors (generally are electrolytic capacitors-to filter off the ripples) and inductors/coils (a coil allows DC to flow through it while restricting AC current flow). With these three components in each of the output line, the outputs generated are clean DC and suitable for various circuits (loads). The amount of voltage generated in each output depends on the total turns in each of the secondary

winding of switch mode transformer. The more turns it has, the higher output would be generated.

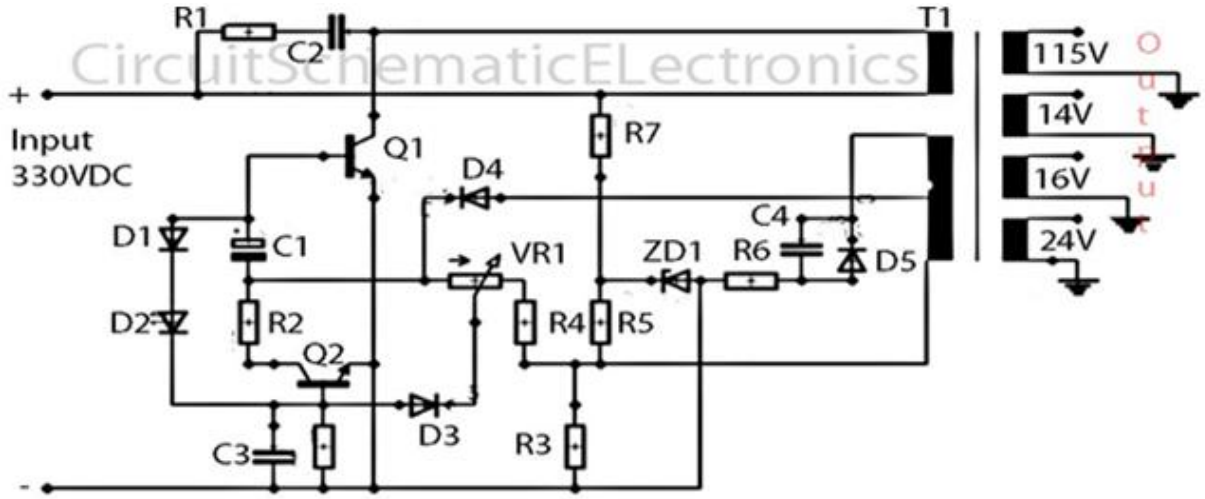


Fig.5.7 Universal SMPS secondary output voltage

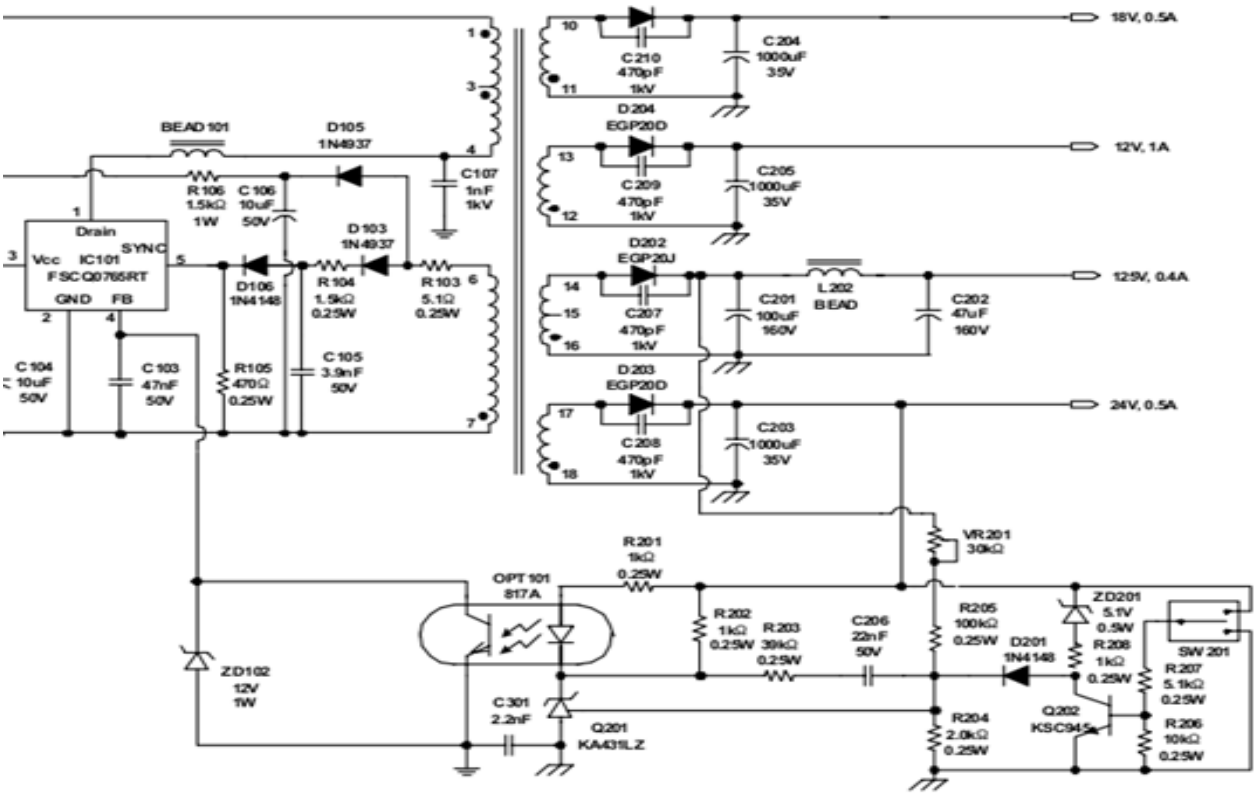


Fig. 5.8 SMPS secondary output Voltage

1.5.10. Sampling circuit

In order to maintain the output voltages delivered to the load (various circuits), a sample of at least one output voltage source developed by the supply is required. For a CRT Monitor power supply, the sample voltage normally derived from the B+ voltage line that goes to the primary winding of Fly back transformer. Some call this sampling circuit as sensing circuit. Normally only one output voltage source is required to be sampled, because if the particular output voltage source is too low or too high, generally all of the other output voltages may vary too. The reason for this sampling circuit in SMPS is to provide an input to the error detection/feedback circuit so that the duty cycle in the primary side can be controlled and effectively maintain the output power. The sampling circuit usually consists of only a few resistors and in some designs, a preset could be found. If this circuit has an open/resistor or resistor turned into high ohms or even open circuit in the preset/trimmer the power could blink and also there might be a power shutdown due to output voltages being too high.

Note: In some SMPS designs, the sample voltage was taken from the hot side (primary side) feedback winding to provide a signal to the power IC in order to control the power level delivered to the load as shown in the above figure.

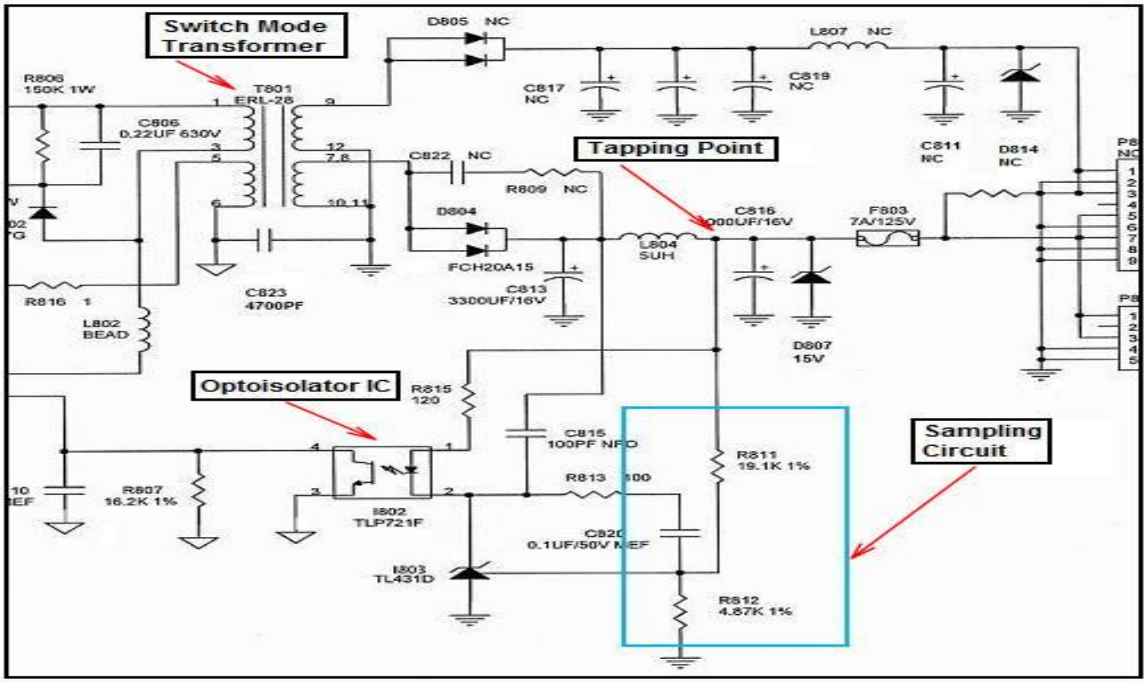


Fig.5.9 sampling circuit

1.5.11. Error Detection/Error Amp Circuit

The error detection circuit monitors the sampled voltage source (increases or decreases its level) derived from the sampling circuit and activates the Optoisolator IC feedback as needed to control the ‘’On’’ time of the switching supply so that it will not deliver more or less power to the secondary side. If this IC or corresponding components have problem, it will cause power shutdown, power blinking, low output power and even totally no power at all.

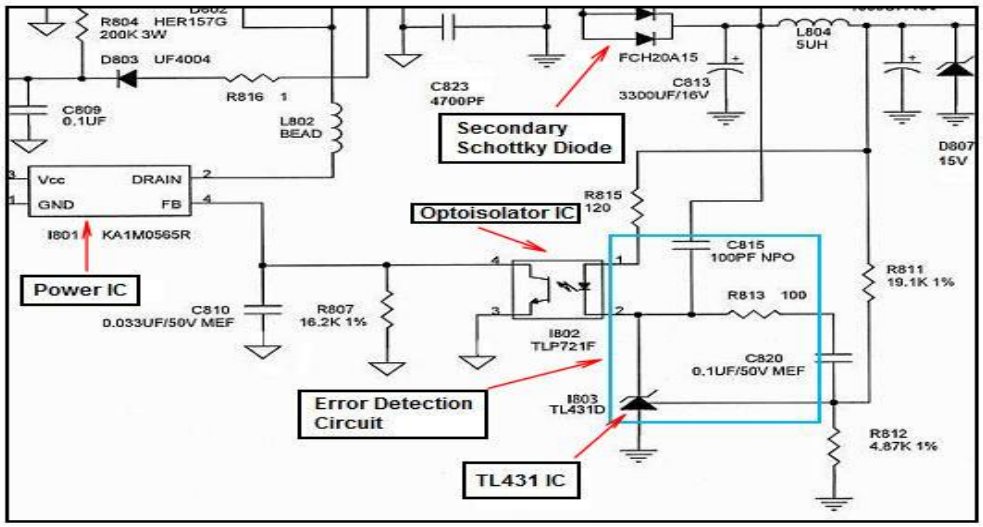


Fig. 5.10 Error detection circuit

1.5.12. Feedback Circuit

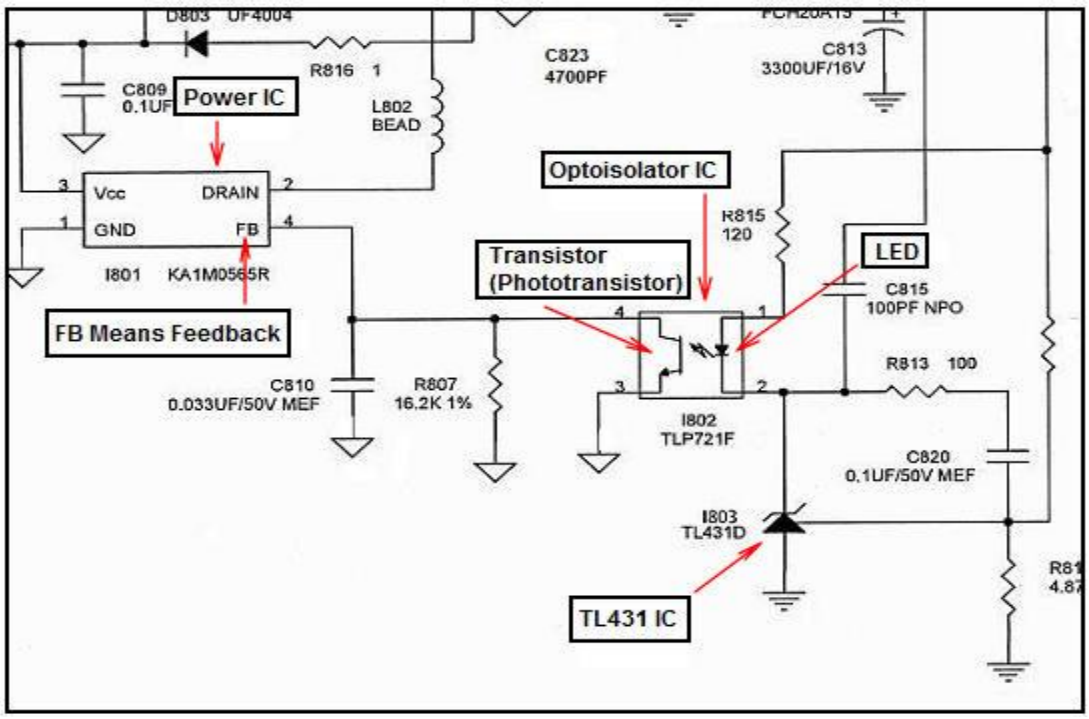


Fig.5.11 feedback circuit

This is generally an Optoisolator IC that uses the internal LED to emit lights to the phototransistor. The phototransistor acts as an output device while the LED acts as an input device. The light generated by the LED is determined by the level and potential of the DC error voltage applied to the LED's by the error detection circuit. When the LED is

emitting light (inside the Optoisolator IC), the phototransistor is conducting. That means if the LED light intensity is great, the phototransistor will conduct even more and vice versa (decreases and increases its resistance proportionally) thus controlling the input to the oscillator in Power IC (through feedback pin as seen from figure above). The end result causes the oscillator's frequency to change in response to the error signal feedback and alters the drive signal to compensate for the output voltage change. Remember, this comparison/compensation occurs continually and provides a closely regulated output voltage.

Note: The feedback circuit also provides isolation between the cold ground (LED) side and the hot ground (phototransistor) side of the power supply. In some designs, the error signal feedback is developed from the hot side secondary winding of the power supply and requires no isolation as shown from the above figure.

Note: The Sampling, Error Detection and Feedback circuits are called the regulation circuit.

1.5.13. The Protection Circuit

The protection circuit is designed to protect the components by shutting down either part or all of the power supply in the event problem occurs. There are four common types of protection circuits that can be used by SMPS. They are Surge Protection (SP), Over voltage protection (OVP), Over current protection (OCP) and Thermal Shut Down protection (TSDP).

A) Surge Protection (SP)

Basically the main surge protection components are the Fuse, Varistor and the NTC Thermistor.

B) Over Voltage Protection (OVP)

The function of the OVP circuit is to monitor the start up DC supplied to the power IC. It senses the over voltage conditions and shut down the power supply if they occur. Once it is shut down, you need to remove the AC main and replug to get it turn on again.

C) Over current protection (OCP)

There are many SMPS designs that have the Over current protection circuit in the primary side. This circuit usually samples the voltage drop across a resistor in series with the switching transistor (FET or Bipolar Transistor) if the transistor draws too much current. **If the current rises abnormally, the voltage will exceed a reference level and shut down the output waveform** of the power IC thus no output power produced from the secondary side.

Note: The over current sensing resistor can increase in resistance value and cause a false shutdown. The value may be increased slightly and cause an intermittent shutdown condition. The value is usually very small from 0.1 ohm to about 1 ohm.

D) Thermal Shut Down protection

Because of the amount of current flow through the Power FET, the Power FET generates heat. If the Power IC overheats (exceeding certain temperature, usually 125 to 150 degree Celsius), this circuit (inside power IC) turns off the IC and latches (to close or lock) it. Due to this, we need to unplug the AC supply and turn the power On again to restart the SMPS.

Note: This thermal shut down condition happens most probably due to three reasons:
a) The Power IC itself has overheating problem.
b) There is not enough heat compound apply to the IC heat sink causing difficulty in transferring heat.
c) The ventilation in the equipment itself is bad. For example, a faulty fan in the computer power supply could cause the power supply to shut itself off due to the hot air could not be sucked out.

1.5.14.Understand The Six Common Problems Found In SMPS

No matter what type of power supply you are repairing, It can say that the power supplies problems fall into the following categories:
1. No power
2. Low output voltage
3. High output voltage
4. Power Cycling/Blinking
5. Power Shutdown and
6. Intermittent Power Problem

Once you have understood the common problems in SMPS, you then can use the necessary steps to isolate, troubleshoot and repair the SMPS. For a successful repair you must first test the power supply with power .On Look at the problem carefully before you start any troubleshooting work. I don't want you to waste unnecessary time by repairing the SMPS when the actual fault is intermittent power problem and you treat it as no power problem! In other words-please don't misdiagnosed! Even if it takes you a longer time to inspect the faulty SMPS-the time will be well spent! Ask your customer what is the problem with the SMPS. Once you got the picture, you will easily diagnose the fault based on the tips that you get. Let's begin:

1. No power

No power in SMPS tends to fall into these two categories:
a) Dead and silent with fuse blown
b) Dead and silent with fuse good

It is very easy to identify the no power problem. Switch 'On' the equipment or SMPS (make sure that the AC power cord is properly connected) and look at the power LED light indicator in the front side of the equipmnt. If there is no light and does not have any rushing sound chances are high the equipment has a no power symptom.

Video system

Introduction to Video cassette recorder (VCR)

The main purpose of the video recorder is recording and replaying video and audio signals. Although built-in tuners and timers have become integral parts of the average video recorder, they are not prerequisites for reaching the main goal: audio and video registration and playback.

In this section we will take a look inside the VCR, at the various video systems, and at the most common features of video recorders. We will also take a close look at the carrier of the video signal:

How the VCR Works

The Helical Scan System

In an audio cassette deck, which only registers audio signals, the tape passes over a static recording/playback head at constant speed. The higher the speed of the tape, the more tape particles pass the head opening and the higher the frequencies that can be registered. Thanks to the extremely narrow head opening, it is possible to record and play back the entire tone range, up to 18,000 or 20,000 Hz, despite a slow tape speed of no more than 4.75 centimeters per second.

However, to register video signals, a range of 3.2 MHz is required and so a tape speed of approximately 5 meters per second is a prerequisite. This is over 100 times as fast as the tape speed for an audio cassette deck. The required high recording speed for video recorders is realized by the helical scan system without such high tape speeds. The system basically consists of a revolving head drum that has a minimum of two video heads.

The head drum has a diameter of approximately 5 cm and rotates at a speed of 1500 revolutions per minute. The 1/2" (12.65 mm) wide videotape is guided around half the surface of this drum, in a slightly oblique manner. This is achieved by positioning the head drum at a slight angle. The tape guidance mechanism then ensures that the tape is guided through the device at a speed of approximately 2 cm per second (half ofthe low tape speed that is used in audio cassette decks).

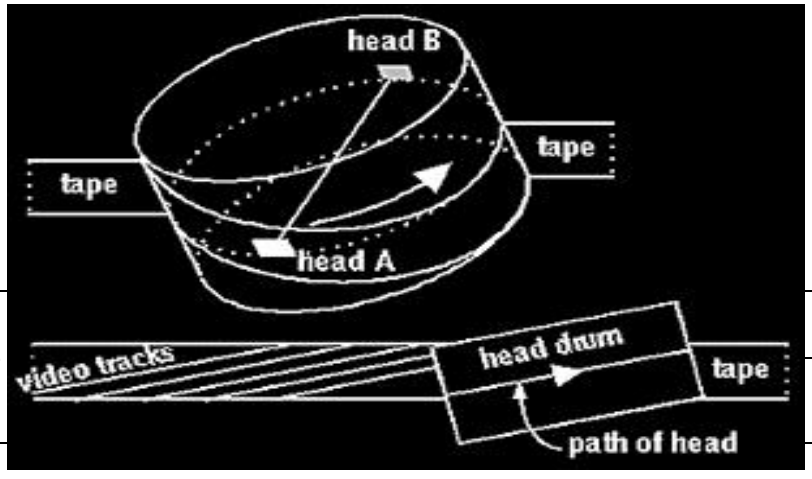


Fig 1.1 shows Tape guidance.

In the meantime, the rapidly revolving video heads write narrow tape tracks of no more than 0.020 to 0.050 mm wide on the tape, next to each other, diagonally. Every half revolution, each of the two heads writes one diagonal track which equals half an image. The first head writes one track, i.e., the first field (the odd numbered scanning lines). The second head writes a second track, i.e., the other half of the image (the second field: the even numbered scanning lines), which precisely fits in the first image. This corresponds to the interlacing principle, as applied in television (see Chapter 2: TV set). One full revolution of both heads results in two diagonal tracks right next to each other, together forming one entire image scan (a frame). This means that two apparently contradictory requirements can be realized simultaneously: low tape speed of only 2 cm per second and at the same time a high registration speed (relative tape speed) of no less than 5 meters per second. These two requirements make it possible to record the high video frequencies up to 3.2 MHz. At the same time, the low tape speed gives a time capacity up to three hours.

Azimuth Settings

Compared with early video recorders, modern day video recorders have their video tracks lying right next to each other. To avoid interference, the two video heads are angled slightly away from each other. As a result, the video head openings that transmit the magnetic tracks to the tape, create an angle between them. The heads are 15 degrees angled in opposite direction, making a total angle of 30 degrees. This diverted registration angle ensures no problems are caused if the heads slightly lose track when playing back and touch the next track. The heads only register tape information at an angle that precisely corresponds to the position of the head opening. This system is called the azimuth recording system. If the video heads stray too far from the track, which could lead to distorted images, tracking control can correct.

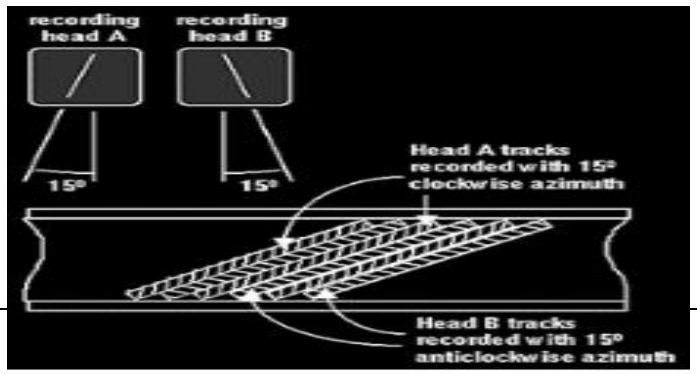


Fig 1.2 shows Azimuth settings. The head openings are cut with different azimuth angles, so that the tracks can be written next to each other.

Synchronization Track

The revolutionary speed of the head drum and the video heads needs to maintain constancy within strict parameters. Moreover, the tracks must be scanned during playback in precisely the same way as they were recorded. Each tape track is synchronized at the recording stage by means of field synchronization pulses. These pulses are generated in the video recorder by a separate head which are recorded on a separate narrow track at the side of the video tape. This is called the synchronization, servo or control track.

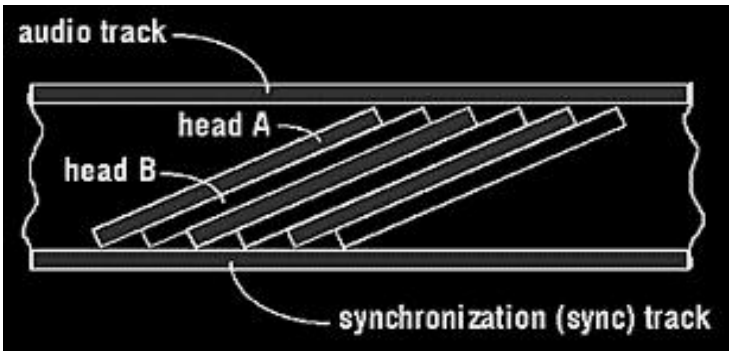


Fig 1.3 shows position of the video, audio and synchronization tracks on the tape

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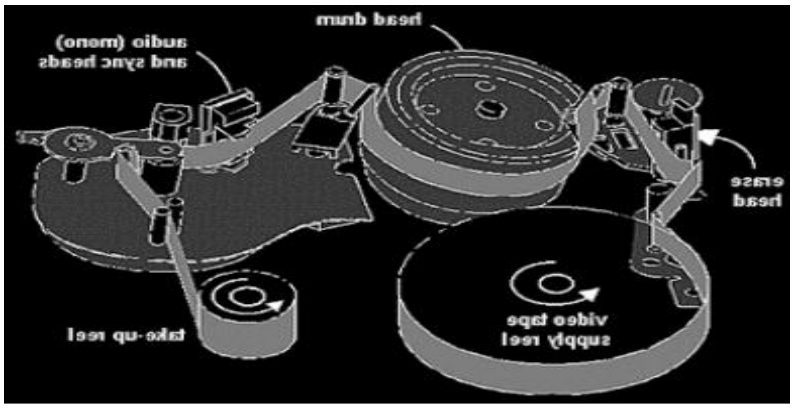


Fig 1.4 Position of the audio, sync and erase heads inside the VCR

Video Systems

There are three major video systems in use today:

- Video Home System (VHS)
- Betamax
- Video Hi8

When the video recorders were first introduced, Philips also developed a system called V2000. Despite the fact that is was a high quality system, it was not successful in the market. Although Betamax was reasonably successful at first, its popularity waned and VHS was adopted as the world standard.

Betamax

The Sony Betamax System, launched in 1975, was based on the pre-existing professional Sony U-matic-system. In the Betamax system, the video tape is guided along the head drum in a U-shape for all tape guidance functions, such as recording, playback and fast forward/backward. When the cassette is inserted, the tape is guided around the head drum (called threading). Threading the tape takes a few seconds, but once the tape is threaded, shifting from one tape function to another can be achieved rapidly and smoothly.

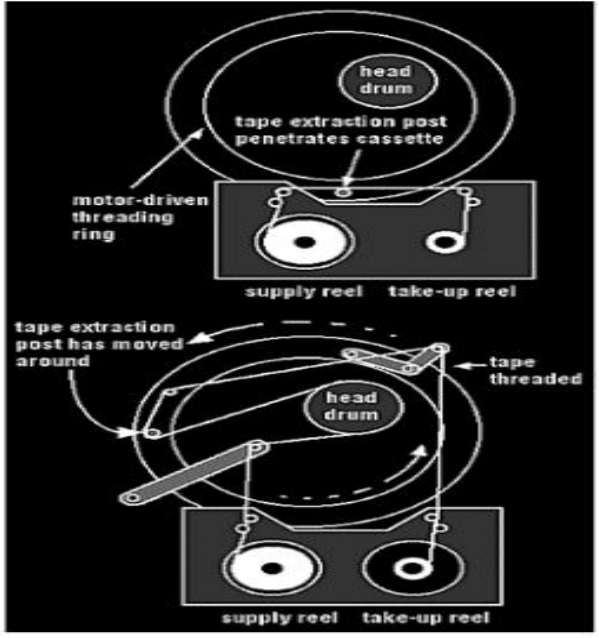


Fig 1.5 shows the Betamax U-system before (top) and after (bottom) threading.

VHS

JVC's VHS System was introduced one year after the launch of Betamax. In VHS, the tape is guided through in an M-shape; the so-called M-tape guidance system. It is considered simpler and more compact than the U-system. Threading is faster and is done every time the tape guidance function is changed. It is therefore somewhat slower and noisier than the U-system. This problem is being solved by "Quick-start" VHS video recorders, which allow fast and silent changes in tape guidance functions. To avoid excessive wear, M-tape guidance system recorders are provided with an automatic switch-off feature, activated some minutes after the recorder is put on hold, which automatically unthreads the tape. An improvement of the basic VHS system is HQ (High Quality) VHS.

In the VHS system different starting points were used than in Betamax, such as track size and relative speed. VHS has rather wide video tracks, but a slightly lower relative tape speed, and that also counts for the audio track. In general, the advantages of one aspect are tempered by the disadvantages of the other. The end result is that there is not too much difference between the sound and image qualities of both systems.

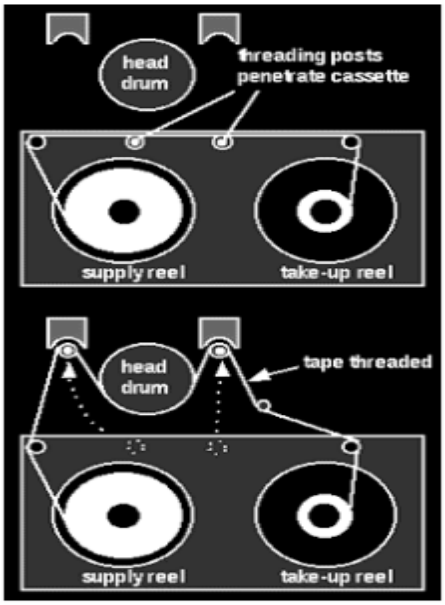


Fig 1.6 shows the VHS M-system before (top) and after (bottom) threading.

VideoHi8

As a direct addition to the Video-8 camcorders, there is a third system: Video Hi8, which uses a smaller cassette than VHS and Betamax. The sound recording takes place digitally, making its sound quality very good. When using the special Hi8 Metal Tape, the quality of both image and sound are equivalent to that of Super-VHS. The Video-Hi8-recorder can also be used to make audio recordings (digital stereo) only. Using a 90 minute cassette, one can record 6 x 90 minutes, making a total of 18 hours of continuous music. The video Hi8-system also allows manipulating digital images, such as picture-in-picture and editing. Video Hi8 uses a combination of the M- and U-tape guidance system.

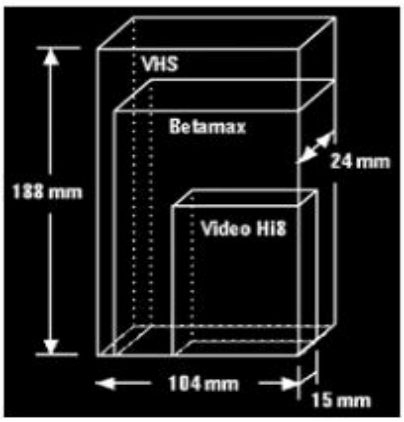


Fig 1.7 shows Cassette sizes compared.

Sound Recording

Mono

In case of a mono video recorder, the audio signal which corresponds with the image is transferred to a separate, fixed audio head. As in an audio cassette deck, this head writes an audio track in longitudinal direction of the tape. This is called linear or longitudinal track recording.

The video recorder has two erase heads. One is a wide erase head covering the whole tape width which automatically erases all existing image, synchronization and sound information when a new recording is made. The other erase head is smaller and positioned at the position of the audio track. With this erase head, the soundtrack can be erased separately, without affecting the video information. In this way, separate audio can be added to a video recording. This is called audio dubbing, and can be particularly useful when making your own camera recordings.

The linear audio track does have some restrictions. Due to its low tape speed, it is not suitable for hi-fi recordings. Moreover, the audio track is so narrow (0.7 mm for VHS and 1.04 mm for Betamax) that not even stereo sound can be recorded properly. The frequency range is limited as is the dynamic range (which relates to the amount of decibels), and the signal-to-noise ratio is not very high.(The signal-to-noise ratio relates to amount of noise compared to the total signal. The higher this ratio, the less noise and the better the signal will be). The sound quality of the mono track can be improved by a noise reduction system. There is a way to get superior hi-fi stereo sound quality on a videotape (used in hi-fi video recorders,) which will be discussed later.

Hi-fi Stereo Sound

Hi-fi video recorders were developed for improved sound quality. The most common quality of video images is HQ. (The recorder is labeled 'VHS High Quality Hi-fi Stereo'). Conventional mono video recorders use linear audio registration, which does not allow hi-fi recordings. A special method was therefore devised to record stereo sound with hi-fi quality.

In the case of hi-fi, the audio signal is also put on tape via revolving heads similar to the video signal, not on the linear track. As there is no space between the video tracks, as the video tracks lie right next to each other with no space in between, the audio tracks need to be recorded in the same place as the video tracks. The way this is realized is by recording the audio signal under (deeper than) the video signal.

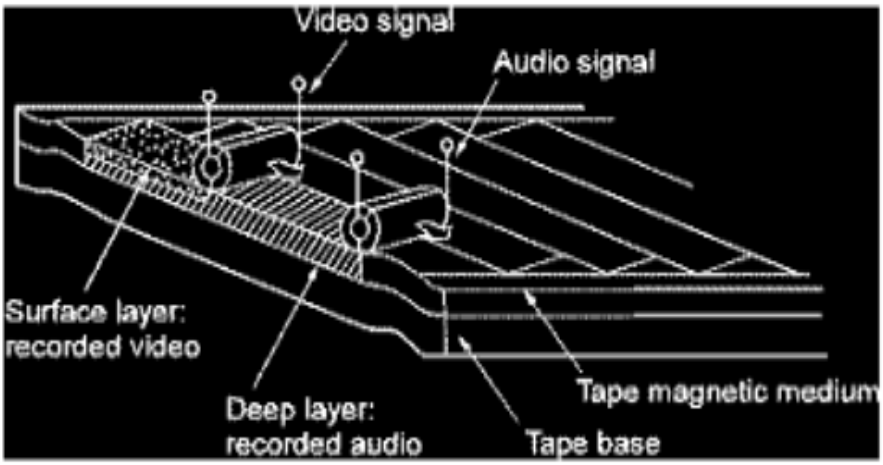


Fig1.8 shows Hi-fi video recording, where the audio signal is recorded at a deeper level, after which the video signal is recorded on top

In hi-fi video recorders, the audio signal is modulated to a high carrier frequency. This is realized via FM modulation, with the right channel stereo signal at a slightly higher frequency than the left channel. The corresponding video and audio signals are written to tape immediately after each other. First the FM audio signal is registered at a deep level in the tape's magnetic coating. Straight after the audio signal, the video signal is recorded. As the frequency of the video signal is higher than the audio signal, it will not register as deep in the tape coating as the audio signal. The video signal erases the audio signal in the top layer and records the video signal instead. Thus, the audio and video signal tracks are written in the same magnetic layer, separately, one on top of the other. The entire magnetic coating is only 0.004 mm thick. To ensure that the two do not interfere, the audio and video tracks are written on tape from a different angle, by means of a different head with a different azimuth setting.

To guarantee compatibility with cassettes not recorded in stereo hi-fi, the fixed audio recording/playback heads remain in place. So, a hi-fi video recorder always has two audio registration systems installed. This offers possibilities for amateur video makers to do audio dubbing using an audio mixer to combine the sound of the hi-fi track with other sounds and to write the mix to the linear audio track. In this way synchronized recordings will be left intact.

Quality Audio Recorders

A hi-fi video recorder is also suitable as a high-quality audio recorder, not only because of the professional recording quality, but also because of the long play possibilities and the low recording costs.

The specifications of hi-fi video sound registration systems equal those of professional tape decks and compact discs. The entire sound spectrum can be covered without any problems, and the dynamic range is 80 dB, close to the 90 dB that compact discs can cover. (As the video recorder is a recording medium, a couple of good microphones can actually cover the whole 80 dB range.) Recordings made on a hi-fi video recorder result in almost un measurable wow and flutter and very little harmonic distortion. The low tone quality of a hi-fi video recorder is remarkably good compared to tape recordings of cassette decks. A disadvantage is that sound editing is not possible via a VCR. Instead,

the required tape segments can be copied unto another tape without hardly any loss of sound quality.

A hi-fi-video recorder needs to be tuned very accurately. As the two rotating audio heads function alternately, the recorded sound consists of successive particles and need to fit together perfectly. If they do not, the result is rumble, which is a humming sound. In high quality, well-tuned hi-fi video recorders you will not hear this sound.

Super-VHS

Super-VHS or S-VHS (for Betamax: ED-Beta)is a major step forward in the field of video registration. It is a recording-playback system of such high quality that its recordings are equal to the quality of direct TV broadcast signals. S-VHS offers better image quality than normal VHS, fuller colors, more sharpness, clearer color separations and color fields, and eliminate more effects. Details not visible on normal VHS, become visible on S-VHS, such as fine fabric patterns and eyelashes. As in all video recording systems, recording image and sound on magnetic tape involves the actual image, the colors, the horizontal and vertical synchronization pulses for perfect image building, and finally the sound. S-VHS requires so much information that it takes a frequency band of 7 million Hz (7 MHz) to store all the information. As this would be too much, in S-VHS the 7 MHz bandwidth is reduced to 5 MHz, without seriously reducing the image quality.

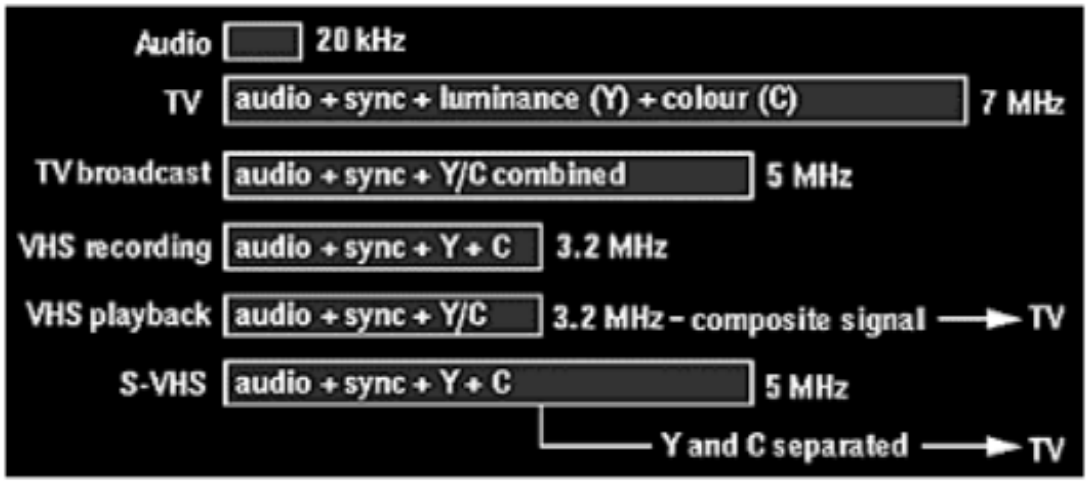


Fig 1.9 shows The frequency ranges of sound, TV and VCR. The original 7 MHz are reduced to 5 and 3.2 MHz. S-VHS can register the full TV bandwidth. The Y and C signals are put separately on tape and separately transferred to the TV when played back.

Signal Separation

However perfectly the helical scan system works, normal VHS video recorders cannot register the entire 5 MHz range that comes through via a television broadcast. The bandwidth is reduced to 3.2 MHz at the expense of quality, meaning reduced sharpness, detail, and clarity of color transitions and more noise. Taking away almost 2 MHz is not a matter of simply filtering the signal, as that would lead to the loss of essential information. The bandwidth is reduced by separating the interwoven Y and C signals and putting them on tape separately. When played back, both components are re-mixed to one signal and then transferred to the television set, together with the sound and synchronization signals. In S-VHS the reduced bandwidth is brought back to its original full 5 MHz. In order to achieve this, new video heads and a superior kind of tape were developed, with higher recording density and a smoother tape surface, for optimal head-tape contact.

Resolution

Due to the increased bandwidth and the increased dynamic range of the brightness (Y) signal, the resolution of the S-VHS recording is higher than VHS. Resolution relates to the number of distinguishable adjacent vertical picture lines. As the vertical picture lines are placed next to each other and virtually placed on a horizontal line, we also speak of horizontal resolution. Increased horizontal resolution means more detail is visible, resulting in a brighter image, clearer picture lines and smoother image fields. S-VHS has a resolution of 400 picture lines, compared to 240 picture lines in VHS, and 300 in the conventional TV signal. Moreover, a sub-emphasis-circuit suppresses image noise, particularly for weak video signals and also contributes to better image quality.

In S-VHS the brightness and color signals (Y and C) are not combined in the usual manner when played back, and are not sent to the TV as a composite signal, but are transmitted separately. This separated transmission takes place via a special cable and a connection socket: the S-connection (S = Separated Y/C). The result is that the cross color between these signals is largely decreased, which has a positive impact on the color separation.

VHS - S-VHS Compatibility

The S-VHS recorder is a two-in-one recorder: an S-VHS-recorder which can also be switched to VHS mode.

S-VHS recorders are backward compatible, meaning that S-VHS recorders and tapes can handle both VHS and S-VHS, whereas normal VHS recorders and tapes cannot. For S-VHS application, special S-VHS cassettes must be used, which reach the requirements of S-VHS and have an identification slot, that makes the recorder automatically switch to S-VHS mode when the cassette is inserted. When a normal VHS cassette is inserted, the video recorder will automatically switch to VHS. It is not possible to make S-VHS recordings on a VHS cassette but normal VHS recordings can be made on a S-VHS cassette. In these cases, the result is good image quality, but not S-VHS quality. When a pre-recorded VHS cassette is played back on a S-VHS recorder, it is without the S-VHS quality. The recorder will then automatically switch to normal VHS. An S-VHS recording cannot be played back on a conventional VHS recorder, because it cannot cope with the increased bandwidth and the other improvements. The result is a distorted black-and-white image. Recordings made in S-VHS can only be played back on an S-VHS recorder.

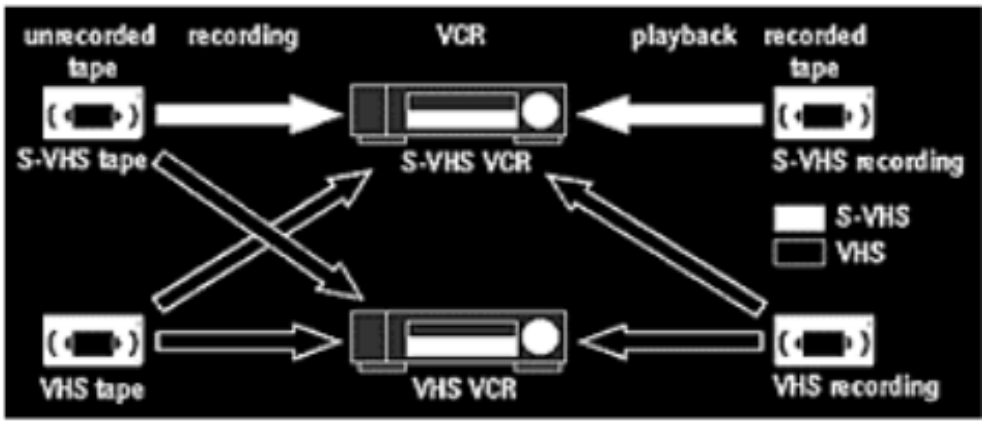


Fig 1.10 shows VHS - S-VHS compatibility. Only registration of S-VHS recordings via the VHS-system is not possible.

To gain maximum benefit, TV sets to which the S-VHS recorder is connected, must be provided with S-connections. The same applies to transmission via SCART-RGB sockets. If transmission takes place via normal SCART or HF connection, the image improvement would be less impressive, although still noticeable. The advantages of S-

VHS and ED-Beta become more obvious when making your own camera recordings, than in normal video and TV use. Especially when making copies of camcorder recordings, even a third generation copy suffers hardly any quality loss. This applies not only to S-VHS and Super-Beta-hi-fi, but also to the Hi8-system.

VCR Connections to TV Sets

A video recorder can be connected to a television set via antenna connection. The TV antenna is connected directly to the antenna input of the video recorder (ANTENNA, AERIAL IN, RF or HF IN. HF stands for High Frequency). The antenna output on the video recorder (AERIAL OUT or HF OUT) is connected to the antenna input of the TV via a coax cable. Both devices therefore receive a TV signal. When playing back a recorded videocassette, the video signal is sent to the antenna input of the TV via the same cable. This is possible as the video recorder has a built-in oscillator (or small sender), that generates a carrier frequency similar to the frequency of the channel reserved for VCR. The A/V-channel of the TV must be tuned to this frequency, so that the recording can be watched on the TV.

The SCART connection will give higher quality, provided there is a SCART bus on both the television set and the video recorder. Both the audio and video signals will then be sent directly to the audio/video amplifier in the TV set, instead of having to make the detour via the oscillator and demodulator, in which the audio/video signal has to be converted twice: first to the high transmission frequency and then back again. The SCART-connection also performs better when copying videotapes.

VCR Features

Heads

The minimum heads required for video and audio registration are two heads for video and one for audio (mono).

Three video heads on the head drum allow still picture without distortion and slow motion. With two heads, distortion lines might be visible on the screen, but in case of three heads, the image will be still and without stripes.

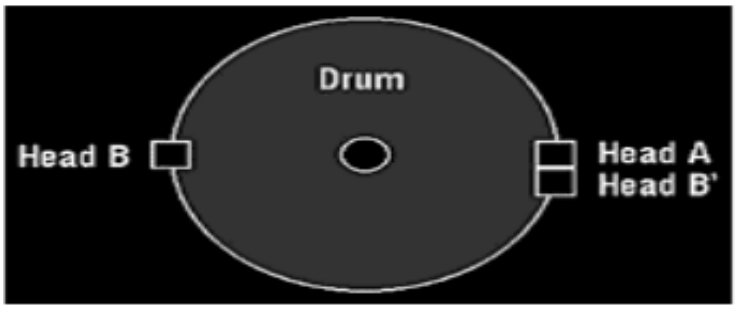


Fig 1.11 shows Placement of three video heads on the head drum. During recording and normal playback, heads A and B are used. For still picture heads B and B' scan the same video track for noise-free reproduction.

Besides still picture and slow motion, four video heads offers the choice between standard play and long play. Standard Play (SP) is the cassette's usual playing time. Long Play (LP) allows you to double the recording time. The video heads write tracks that are half as wide as in case of standard play. The narrower tracks mean that there is less information put on tape, which results in somewhat lower quality. In the UK there are VCRs on the market that can record in long play with only two video heads.
Hi-fi stereo audio recording via frequency modulation requires 2 additional audio heads on the head drum instead of one separate audio head for mono.

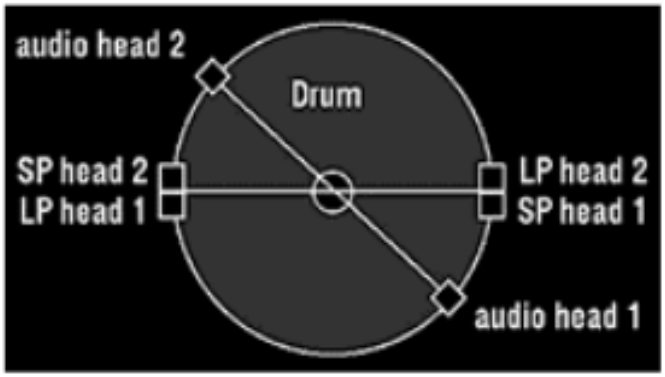


Fig 1.12 showing a 4-head drum plus 2 audio heads for hi-fi recordings.

Flying Erase Head

Besides the separate erase heads already present in the VCR, the flying erase head is an erase head that is placed on the head drum just like the video and hi-fi audio heads. The main benefit of the flying erase head is that it makes better editing compared to the other erase heads. The flying erase head follows the video tracks in the same diagonal direction, contrary to the regular erase heads which erase all information vertically.

Timer Programming

There are several ways to set the timer on the VCR to make your own recordings. In order to make sure that the VCR knows what and when to record, the following information must be entered: start time, stop time, date and channel/program. This information can be entered directly on the VCR or via remote control. However, many people have difficulties with programming, and so, other ways of programming have been developed, some of which are described here below. VPT (Video Programming by Teletext) is a way to set the VCR timer with the help of Teletext. There are two requirements: the first is that the VCR must have the VPT feature, and the second is that the channel, which broadcasts the program you want to record, must have Teletext.

By calling up the Teletext page with the program information, and pressing the VPT button, a cursor appears on the TV screen. Using the cursor, the program you want to record can be selected. By pressing the VPT button again, the program will be stored in the timer memory. With the Teletext decoder built into the VCR, it is also possible to use the VCR to display and record Teletext subtitles.

Sometimes programs start at a different time than listed in TV guides or on Teletext. VPS (Video Program System) is a system by which the broadcast station ensures that the VCR starts and stops the recording session at the proper moment, by transmitting signals which are received by the VCR. For this system to operate, the broadcast station has to use VPS, and the VCR must be equipped with the VPS feature. If the reception quality is poor, the VPS feature might not function properly. VPS comments may also appear in TV guides. Currently, this system is only operational in Germany, Switzerland and Austria.

ShowView is invented by US company Gemstar, and works by means of individual codes for every TV program. The VCR must have the ShowView feature. The numeric code, which can range from 3 to 9 numbers contains the channel, date, start and stop time information and is printed in the TV guide next to the program. By entering this code into the VCR, the timer will be set automatically.

Finally, "parallel programming" makes normal VCR timer use more simple, by continuously displaying the start time, stop time, program number and date. The user has direct access to all four settings and can adjust each as needed by remote control.

Digital Image Correction

One of the most effective picture improvements is realized by a digital image correction system. Here, every image that is transmitted by the video recorder is first sent to a memory and not directly to the screen. The memory compares the incoming image with the previous image. Any sudden irregularities, such as drop-outs or distorted lines, are immediately identified and corrected. The digital image memory offers still playback images and a perfect, stable picture-by-picture reproduction, with interval options ranging from one to many seconds.

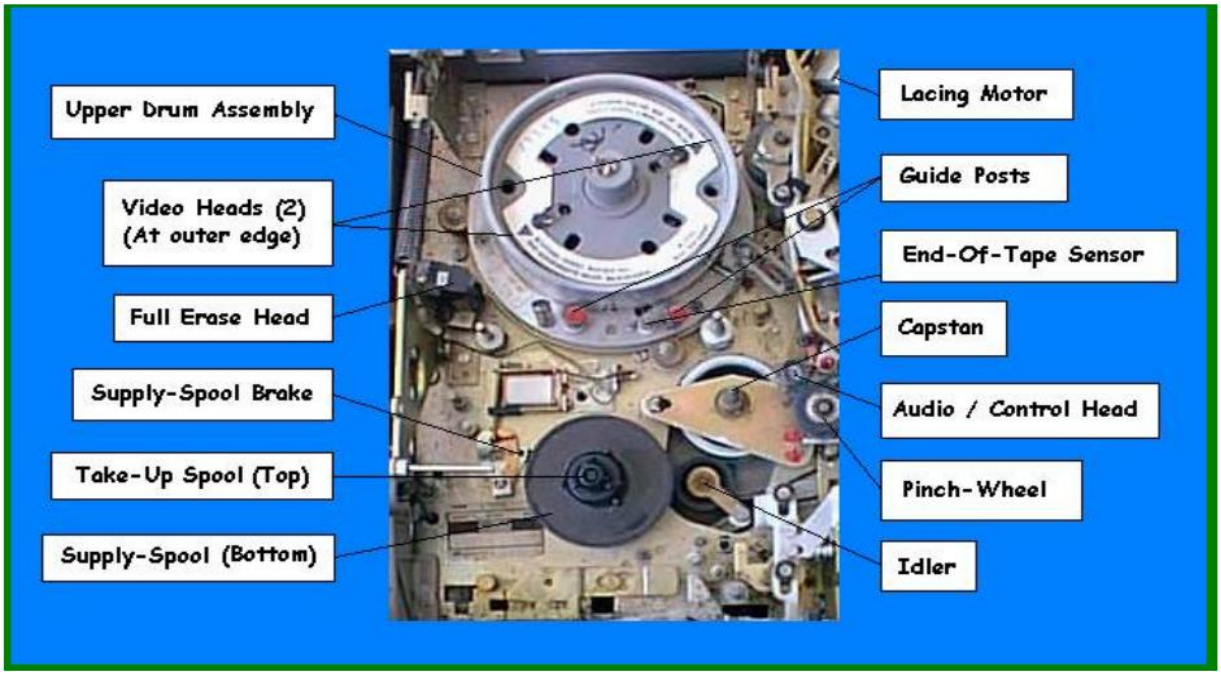
Video Cassette Recorder (VCR) Repair

Although DVDs have nearly replaced video-taped movies, many homes keep a video cassette recorder/player for occasional use. This Fix-It Guide on video cassette recorder (VCR) tells how a VCR works, what often goes wrong, how to identify a VCR problem, and what parts and tools you will need to fix it. It then gives simple step-by-step instructions for how to disassemble a VCR, how to clean the tape transport, how to service the idler assembly, and how to lubricate a VCR. This guide also refers to other

Fix-It Guides for specific repairs such as electrical cord repair, electrical receptacle repair, power switch repair, motor repair, and others.

The VCR is concerned with the physical mechanics of moving and scanning the tape.

The first item that should be mentioned in the figure below is the
Lacing motor: When a cassette is loaded into the VCR and the machine is switched



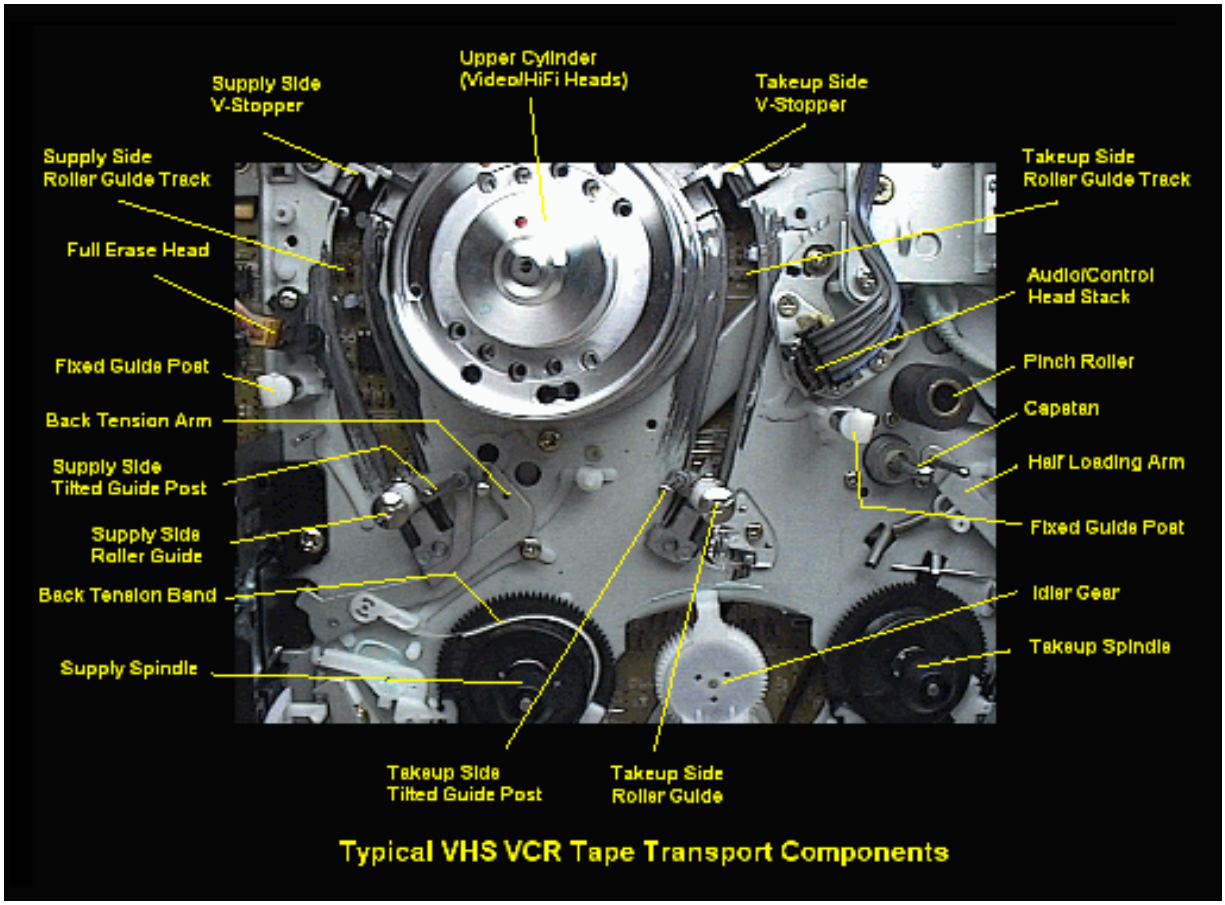
on, it is this motor and its associated mechanics which drag the tape out of the cassette housing and wrap it around the drum and guide posts by rotating the entire drum assembly 200 degrees clockwise rotation.
The guide posts: being on the inside of the tape, pull the tape out of the cassette as They themselves are pulled round the drum.

Fig 1.13 VCR mechanical parts of moving and scanning the tape.

The capstan and pinch-wheel: combine to pull the tape from the supply spool, past the video heads and audio / control heads and back onto the take-up spool. In the play and record modes, the take-up spool carrier has just enough torque to provide drive to take up the slack between the capstan and the take-up spool without actually dragging the tape through the mechanism itself.

Apart from the video heads, there are three more heads in the VCR.
The full erase head: on the left hand side erases the entire cross section of the tape before fresh audio and video are recorded. If this head is not working, then when a fresh recording has been made, vague images of the previously recorded program will be seen underneath the new recording.

The audio and control heads: are mounted on the same assembly on the right hand side of the VCR. The audio head records the sound on the bottom of tape and plays it back in the same way as an audio tape recorder. The control head records and picks up pulses to accurately control the position of the tape, and these are recorded on the top of the tape.VCR Tape Transport Fundamentals



Parts of the tape transport in a VCR

Fig 1.13 Parts of the tape transport in a VCR

- **Supply spindle** - left hand side platform on which the supply tape reel (inside the cassette) sits. The edge which contacts the idler tire, and associated brake pad, should be cleaned.

- **Take up spindle** - right hand side platform on which the takeup tape reel (inside the cassette) sits. The edge which contacts the idler tire, and associated brake pad, should be cleaned.

- **Idler** - assembly which swings between supply and takeup reels and transfers power to the appropriate reel to wind the tape up during play and record and often to drive FF and REW. This may use a rubber tire or a gear.

- **Idler tire** - the black rubber ring on the outside of one part of the idler which actually contacts the reel edges. This is single most likely part to need replacement after a few years of use. Some VCRs use a gear instead of a tire, but the tire is most common, especially in older units. Clean and inspect - replace if in doubt.

- **Roller guides** - there are two, one on each side. These assemblies move from their retracted position toward front of machine to their loaded position for play and record. The white rollers should spin freely and be clean. When retracted, the roller guide assemblies will be slightly loose. However, when the tape is wound around the video head drum, they must be snug against the V-Stoppers - the brackets at the end of the tracks. Also on the same assembly are tilted metal

- **guide posts** – again one for each side. These sometimes fall out with obvious consequences. Proper functioning and adjustment of the roller guides is the most critical requirement for proper tracking. (However, do not touch their setting s without being really sure that they are at fault and not until you have read the sections relating to tape path alignment.) Clean and inspect.

- **Roller guide tracks** - combination of plastic and metal slots in which the roller guide assemblies slide during tape loading and unloading. Check to make sure there is still some healthy grease on the surfaces. If gummed up or excessively dirty, clean and relube with a dab of plastic-safe grease on each sliding surface.

- **Video head drum or upper cylinder** - approximately 2.45 inches in diameter by 75 inches high. This rotating assembly contains the video heads (and HiFi audio and flying erase heads, if present). Stay away from this unit. as video heads are very delicate. If you must clean it, refer to the specific instructions on cleaning video heads elsewhere in this document. Video heads do not normally require cleaning despite what the cleaning tape people will have you believe. If you are not having video noise problems, they should be left alone.

- **Capstan** - right side after tape exits from roller guide. The capstan is a shaft about 3/16" diameter which during play and record (and search) modes control tape movement forward or reverse when the pinch roller is pressed against it. Should be cleaned thoroughly to assure proper tape movement during play, record, and search modes.

- **Pinch roller** - black rubber roller about 1/2" diameter, 3/4" high which spins freely and is pressed against the capstan during play, record, and search modes. It is constructed as a molded rubber sleeve fused to a metal roller on a small ball bearing. A hard, shiny, dried out pinch roller can lead to tape edge munching and erratic sound, speed, and tracking. Clean thoroughly. Inspect for cracked,

hard, shiny, or otherwise deteriorated rubber and free and smooth rotation. Even if you have no obvious record or playback symptoms, if the pinch roller appears concave or with a distinct worn ridge, replacement is recommended - erratic behavior will soon be the result. A tape which runs off center due to a bad pinch roller may result in tape edge damage and over time can also alter the wear pattern of the audio/control head and various guide posts.

- **Audio/control Head Stack** - between right roller guide (when tape is loaded around drum) and capstan. Includes magnetic heads for non-HiFi (linear) audio and synchronization control track. Should be cleaned since tracking and non-HiFi audio performance is critically dependent on its performance.

- **Back tension arm** - left side just as tape exits cassette - this is coupled to a felt Back Tension Band and serves to maintain a constant tension on the tape during play, record, and forward search. Retracts toward cassette when tape is unloaded. Back tension is somewhat critical and may need adjustment after long use.

- **Various other fixed guide posts** - vertical stationary metal posts which tape contacts. Should be cleaned but rarely need adjustment. The positions of these vary somewhat by manufacturer.

- **Full erase head** - left side towards rear which tape passes over just before going around roller guide, guide post, and drum. Rarely causes problems. Clean.

- **Impedance roller** - left side near full erase head. Freely rotating roller stabilizes tape movement. Some VCRs lack this component. Clean.

- **Half loading arm** - right side near capstan/pinch roller. On VCRs with 'rapid or instant access transports' this helps to position the tape in the intermediate (half loaded) position. A similar arm is usually present in other VCRs and helps to position the tape around the pinch roller. Check for free movement. Clean. Lubricate bearing if sluggish.

- **Belts - various size black rubber bands** - a typical VCR will have between 0 and 12 of these on top and bottom. Typical is 3 or 4. Most are of square cross section though an occasional belt may be flat or round. The belts will need replacement after a few years. Clean and inspect. Replace any belts that are hard, cracked, stretched, or flabby. A good belt will feel soft and rubbery without cracks or other signs of deterioration. It will return to its relaxed length instantly if stretched by hand about 25%. Belt kits are generally available by VCR model but individual belts can be ordered as well. In either case, this is very low cost maintenance which can make an absolutely huge difference in the happiness of your VCR. New belts can often restore a comatose VCR to perfect health

1.1.1.7 VCR troubleshooting

VCR repair can be quite difficult without a schematic; there are a lot of mechanical and electronic problems that can be solved without one. Mechanical problems can be seen, felt, and heard, whereas electronic symptoms may require added service time. Note the electronic problem, and isolate and locate the defective component. in Case histories may help to solve other VCR problems. Record each case history for future reference. Remember, several VCR brands may be the same inside.

Testing and repairing small motors

Aside from obvious mechanical problems and lubrication if needed, you usually cannot do much to repair defective motors. it is sometimes possible to disassemble, clean, and lubricate a motor to restore it to good health. However, without the circuit diagram, even knowing what the proper voltages and signals should be on (2) or (3) type motors would prove challenging.

The following are some of the possible problems that can occur with the basic permanent magnet motors:

- Open or shorted windings or windings shorted to case.
- Partial short caused by dirt/muck or carbon buildup on commutator.
- Burnt out armature due to defective driver, power supply, controller, or mechanical overload.
- Dry/worn bearings.

An open or shorted winding may result in a 'bad spot' - a position at which the motor may get stuck. Rotate the motor by hand a quarter turn and try it again. If it runs now either for a fraction of a turn or behaves normally, then replacement will probably be needed since it will get stuck at the same point at some point in the future. Check it with an ohmmeter. There should be a periodic variation in resistance as the rotor is turned having several cycles per revolution determined by the number of commutator segments used. Any extremely low reading may indicate a shorted winding.

An unusually high reading may indicate an open winding or dirty commutator. Cleaning may help a motor with an open or short or dead spot but most likely it will need to be replaced.

Capstan problems

Capstans are expensive especially if they are integral with the capstan motor, but unless it is bent (very unlikely), or the bearings are totally shot, or it is direct drive and the motor is bad, the capstan should not be a problem as long as you ”carefully” clean off all of the black tape oxide buildup with alcohol and a lint free cloth. Don't get impatient and use anything sharp! The black stuff will come off. A fingernail may help. A dry bearing may need a drop or two of light oil (electric motor or sewing machine oil).

Sometimes, there is a bearing cover washer that works its way up and interferes with the tape movement.

Some VCRs have had problems with defective capstan motors resulting in intermittent pausing or stopping of video playback when hot. The entire motor or just the bearing assembly needs to be replaced in this case

Capstan motor (bearing) problems

The bearing housing bends after a period of time from pinch roller pressure. The new one is much stronger. Quick but temporary cure is to grasp the top of the bearing housing with big pliers and bend slightly towards pinch roller.

The capstan motor is a direct drive unit with a large flywheel/magnet assembly mounted just below a set of flat coils. The bearing that the capstan turns through is also part of the bracket that supports the motor. With time, the bearing wears out, allowing the capstan to tilt ever so slightly. This tilt causes the capstan flywheel to come into contact with the coils, causing a scraping sound, intermittent pauses, and eventually causing the motor electronics to die. Stop using the VCR now to prevent damage to the motor's electronics. The capstan motor bearing can be replaced without having to replace the entire motor.

Check the winding on your motor. Many times when the bearing fails, it allows the magnet assembly to rise, which in turns starts to cut into the windings.

1. Remove top and bottom covers with machine unplugged
2. Unplug connector cable to capstan motor circuit board
3. Unscrew motor from chassis (3 screws accessed from top of chassis.
4. Remove capstan flywheel and shaft from motor (just pull to separate it from the rest of the motor)
5. Unscrew capstan bearing from motor assembly (3 screws)
6. Assembly is reverse of disassembly.
7. Play junk tape to see if there is any folding of the upper or lower edges of the tape, especially just past the capstan. You may need to make some adjustments to the metal guides to the right of the capstan.

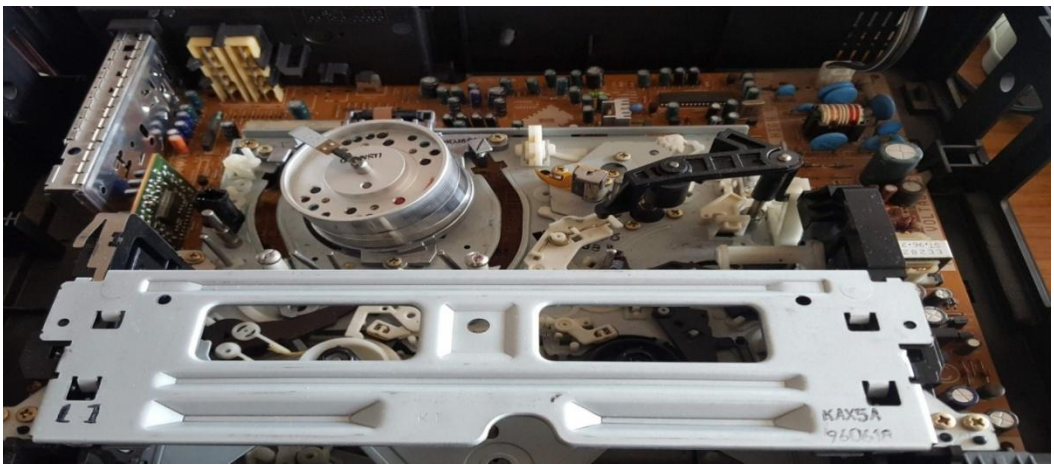


Fig 1.14 internal part of VCR

Power supply problems

Many VCRs, (and possibly other makes) use a DC to DC switching power supply built onto it's own separate, shielded PCB which plugs into the main circuit panel, and is secured in place by two or three screws. On this power supply, located right next to the switching regulator transistor (Q1) there is a 16 V, 22 uF, non-polarized electrolitic capacitor which frequently fails, probably due to constant exposure to the heat generated by Q1. (Refer to Samsung VCR Power Supply Parts Location.) When this capacitor is faulty, the VCR's flourescent display will usually flash about once per second when the set is first plugged in, and possibly after some time, the display will become steady and the unit will function normally. In extreme cases where the capacitor is completely open the display may never light up at all. If the power supply is removed from the VCR, and tested under a no-load condition, all voltages will likely appear normal, giving the false impression that the VCR is overloading it. When working on this panel, please bear in mind that it is directly connected to the 120 VAC power line, and therefore presents a significant danger of electrical shock - BE CAREFUL.

VCR power supplies

1. Troubleshooting is quite straightforward as the components are readily identified and it is easy to trace through from the power transformer, bridge or centertapped full wave rectifiers, regulators, caps, etc. The circuitry is not usually complex and the most common failures tend to be quite obvious. It should be possible to determine the correct output voltages from basic circuit principles.

2. Start at the line cord - if there is infinite resistance between the two prongs, there is a problem in the primary side of the transformer. A fuse may be blown, the transformer primary may be open (or a thermal fuse under the outer layers of insulation may be blown), or there may be bad connections between the line cord and the transformer. If this checks out, there may be a problem on the secondary side - bad rectifiers, transistors or IC regulators, or bad connections. It is unlikely that the secondary winding of the transformer itself is bad.

3. Failures of one or more of the outputs of these hybrid regulator blocks are very common. Use ECG/STK/NTE cross reference to identify the correct output voltages. Test with power switch in both positions. Any significant discrepancy indicates a likely problem. While an excessive load dragging down a voltage is possible, the regulator is the first suspect. See: "VCR Power Supply Regulators" for pinouts of some of the common ones. The correct output voltages will be specified by on the regulator pinout. If you find **no** voltages on the regulator at all, go back and check starting at the line cord as above.

4. Switching supply problems are tougher to diagnose but it is usually possible without service literature by tracing the circuit and checking for bad semiconductors with an ohmmeter. Common problems - dried up capacitors, shorted semiconductors, open startup resistors, and bad solder joints. For a sample circuit, see the document: Various Schematics and Diagrams which

includes an example of a switching power supply found (with minor differences) in many models of Panasonic (and clone) VCRs.

In a supply that is dead - has blown the main fuse - check all semiconductors, capacitors, and resistors as a failure in one may damage others and just replacing the first one you find that is bad may result in it just blowing immediately. Fusable (flameproof) resistors (blue or brown body or boxy ceramic power type) may open up if there was a shorted switching transistor. Power resistors supplying current for the startup circuit may open from age. See the document: Correct output voltages can be determined with some work - tracing the circuit. However, it is usually safe to assume that there should be at least one around 5 to 6 V output for the logic and one or more others at 12 V or higher for the motors and other electronics.

Note: The initial test in (1) for power transformer based supplies of checking between the prongs of the line cord cannot be used with a switcher - it will likely always read open even if the supply is perfectly good.

5. Problems in either the power transformer/rectifier/filter capacitor section (usually no regulator) or switching supply are possible. However, they can pretty much be dealt with independently. Note: the switching supplies used in these usually run off of a lower voltage input than the more common off-line non-isolated type making them somewhat less hazardous to your health to work on. See (1) to (3), above.
6. Problems can occur in either the battery charger or power supply section. Short running time on battery alone is usually caused by a bad battery. If possible, try a known good battery or battery eliminator first to determine which it is. The older style portable units were quite reliable and easy to service. However, modern camcorders are so jam packed with microminiature surface mounts unmarked circuitry that troubleshooting and repair is definitely not fun. Not to mention the joys of just getting inside with only a finite use of expletives.

How Can I Identify a Video Cassette Recorder Problem?

- If the VCR won't operate at all, make sure power is on at the electrical receptacle, test the electrical cord, and check your owner's manual for proper connections to other home entertainment components; test the power switch. Also check the internal fuse.
- If the VCR does not record or play back, clean or replace faulty belts (see below). Inspect and service the idler if faulty (see below).
- If the VCR plays back but does not record, check for a faulty record safety switch. Also try cleaning the heads (see below).
- If playback does not work or a cassette won't load, clean and replace the belts as necessary (see below). Test and replace a playback switch if it tests faulty (see below). Clean a dirty logic switch or have a faulty one serviced (see Appliance Controls).

- If the cassette is jammed or won't eject, remove and inspect the tape basket for jammed gears. Inspect and replace belts as needed. Remove and straighten a bent tape basket.
- If a cassette binds when ejecting, test the eject motor and have a faulty one serviced or replaced. Also clean or replace a dirty or faulty logic switch (see Appliance Controls).
- If the VCR mangles tapes, clean the transport (see below) and check the idler wheel (see below).
- If recordings are of poor quality, clean the video heads (see below).
- If the picture quality is poor, clean the transport and adjust tracking according to your owner's manual (many units have automatic tracking adjustment).
- If the picture is wiggly, adjust tracking, and clean the heads and transport (see below).
- If the picture is jumbled, clean the transport (see below).
- If there is excessive dropout, clean the transport and adjust tracking.
- If the picture bends at the top (flagging), have the unit serviced.
- If the picture jumps, clean the video heads.
- If there is no color, adjust tracking and clean the video heads.

Fig1.15 VCR power supply

Caution: If the cover is off when the VCR is plugged in for testing, be careful around the fuses and high-voltage power supply.

What tools Need for Video Cassette Recorder Repair?

Replacement parts are available from the manufacturer and after market suppliers as well as from local electronics stores. The tools you will need to fix a VCR include these:

- Screwdrivers
- Small pliers or a pick
- Head-cleaning materials
- Denatured alcohol
- Canned air or vacuum cleaner
- Cotton or foam swabs
- Clean cloth
- Light machine oil
- Lubricating grease

What Are the Steps to Videocassette Recorder Repair?

Disassemble a VCR:

1. Unplug the VCR and remove any screws securing the top and bottom cover. To remove the face, take out the face latch screws from the bottom; then turn the VCR over and release the latches while tilting off the face. Align the slide switches with buttons to reinstall the face.
2. Tilt a circuit board away to access or test parts beneath it. Remove any mounting screws and latches.
3. Remove the tape basket and disconnect the power plug and grounding screw.
4. Remove the tape basket.

Note Remember to reconnect any grounding wires that may have been disconnected when disassembling the VCR.

Clean a VCR tape transport:

1. Remove general dirt and dust with canned air.
2. Clean the capstan and other tape loop components with cotton or foam swabs and denatured alcohol. Clean the video heads last to avoid recontamination.
3. Clean the video head and drum with a swab. Without touching the drum, hold a clean cloth flat against the head and slowly rotate the drum.

Service the VCR idler assembly:

1. Remove the split ring holding the idler assembly on the shaft using small pliers or a pick.
2. Lift the idler assembly off the shaft. Remove the wheel to inspect and clean it as needed.
3. Clean the idler pulley and wheel with a foam-tipped swab dampened with denatured alcohol. Replace the pulley and wheel if they are damaged.

Lubricate a VCR (lubricate sparingly and only where original lubrication has failed or been cleaned off):

1. Lift up the capstan shaft washer and carefully add a drop of oil below it.
2. If the tape guide needs lubrication, first clean it with alcohol-soaked swabs. Apply a dab of lubricating grease on each track and turn on the VCR to spread the grease.

6. DVD/VCD/CD Player Repair

DVD /VCD/CD player is a complex set of equipment having mechanical, optical and

electronics systems.

6.1 Disc drive mechanism

The disc drive mechanism consists of a motor that will drive the disc in a circular motion. The mechanism will also have a disc feed – a loading tray that is used to accept the DVD from the user. Thus the entire disc drive is basically a spindle that holds the disc and a motor that is used to circle the disc. The spindle is held in its position with the help of small gears and belts that are attached internally. Some players have an automatic feed system in which, there will be no tray. Instead the disc will be automatically recognized after inserting a part of it.

Fig.6.1 disk drive mechanism

6.2. Optical system

The optical system mainly consists of the laser beam, lenses, prism, photo-detectors and also mirrors. The output of this mechanism will be the input for the disc-drive. The laser beam will be a red laser diode which works at a wavelength of 600 nanometers. The optical system also requires a motor to drive it. The laser system and photo-detector is placed together on a single platform. The laser diode as well as other diodes is made with the help of glass.

6.3. Printed Circuit Board

The PCB is similar to that of any other electronic circuits. The electronic outline must be drawn on the PCB with the correct placement of all the IC's resistors as well as capacitors. After the outline has been drawn, the components must be soldered to their respective places. All this must be done in a very clean environment so that the board does not become contaminated by dust. All the primary components of the electronic circuit should be made out of silicon.

6.3.1 Parts & Circuitry involved

6.3.1.1 Spindle Motor

In order to read the data present in the CD, the CD needs to be rotated at some specific speeds. Hence the rotary motor comes into play. It rotates the CD inserted by the user so that the lens could read out the data present in it and produce the output. If motor is burned then the disks inserted by the user will not be rotated and hence there will be no output. However you can test the motor using a multimeter .The reading of a good motor should be between 5Ω& 50Ω depending on the size of the motor. Lower resistance reading indicates short and infinite reading indicates open of the windings.
The spindle motor should be replaced with an identical unit though it doesn't have to be the exact manufacturer's part number - universal substitutes are often available at a much lower price. Most of the other spindle motors found in CD players and CDROM drives (as well as VCRs and other consumer electronics and small appliances) are basically similar. The important differences are mainly mechanical - size, mounting, shaft length, etc. There may be variations in nominal voltage and current usage but for non-critical applications like drawer loading or disc changing, if you can make a generic replacement fit the space and attach to the drive components, There is a good chance that it will work well enough.

6.3.1.2 Lens

The lens is the most import part of any Optical storage Disk Players. It reads the data present in the disk inserted by the user. It along the processor makes the output which may be audio/video/images of supporting format of the player.

6.3.1.3 Lens Tray

This is another important part, infect it's a moving part. It is the base of the lens. In order of reading of the CD (Compact Disk) the lens got to move to reach different part of the CD. So the lens tray in this way proves out to be one of the important parts.

6.3.1.4.Cooling Fan

Not all, but some of these Optical storage Disk Players has a cooling motor to dissipate the heat produced in the electronics circuitry, basically the audio amplifier section. Incase the cooling fan is out of order then, troubleshoot it as mentioned for the **Spindle motor**. However if the motor is good but it's not running due to dirt deposition then I recommend you to service it with the PHILIPS oil based spray

6.4 Power Supply

Switch-mode power supplies or **SMPS** convert the line ac voltage to low-voltage high-current dc. In most switching power supplies a 220-Vac input first passes through a fuse and a line filter. The ac input is then rectified by a full-wave bridge rectifier and filtered by a pair of high-voltage capacitors. This creates two high-voltage sources from either side of the full-wave bridge, one positive and the other negative. A pair of transistors is then used to switch these high voltage supplies across the primary winding of a transformer. This switching action is very fast and typically switches at speeds around 50–300 kHz. An integrated circuit such as the TL5001 or TL494 is commonly used to control the transistors at this switching rate. This IC not only controls the switching speed of the transistors, but also controls the conduction time of each transistor. This pulse-width modulation (PWM) sets the on and off duty cycle of the devices. The output voltage of the power supply is determined by this timing. Other features designed into the PWM controller help regulate, stabilize, and provide the requirements for higher load current and instantaneous current. These power transistors charge and discharge the transformer primary and thus induce power to the secondary winding. Isolation between the line and the dc supply voltage is implemented using this transformer mutual coupling. The output of the transformer (which is now a pulse-width-modulated voltage at the switching frequency) is then rectified by special high-speed diodes to change it back to dc. For the 5-Vdc output, there are usually two diodes housed in a single package. This package is usually a TO-220 or TO-218 three-leaded package. The 12-Vdc and –5-Vdc outputs each have their own pair of output diodes. These outputs are not pure dc, and require extensive filtering to remove the high-frequency component generated by the switching action of the transistors. Filtering is accomplished using a combination of inductors and capacitors in a low-pass configuration. The output voltage of the power supply is regulated by feeding some of the output back to the integrated circuit that controls the switching transistors Failure of the control IC can induce various power supply failure modes, from a reduction in regulation and/or response, to complete output failure. Protection within the IC invokes shutdown of all control signals, turning the module off. An optoisolator is used to decouple the feedback line from the dc regulated output.

6.5. Testing and Repair

All testing is done with the power off. Start by testing the pair of switching transistors. These transistors are typically mounted on a heat sink that helps them run cooler. Test them by using an ohmmeter or a digital multimeter set to the diode test range. Check

each transistor for shorts between emitter and collector. By the way, these transistors should always appear shorted between base and emitter when tested in circuit. It is not necessary to test the base-emitter junction of the transistors. When the switching transistors fail, they always short between emitter and collector. If you are in doubt, pull the transistors out of the circuit to test them. If the transistors are shorted, the fuse should have blown. Be sure to test the high-voltage diodes as well. The high-voltage diodes are usually part of a bridge rectifier, although they may be individual diodes. Next, test the output rectifiers. There are three pairs of diodes to test. One pair is for the –5V output. These are fairly small, approximately the same size as the ubiquitous 1N4004 with which we are all familiar. The 12V diodes are usually somewhat larger. The two 5V output diodes are housed together in a dual-diode package that looks very much like a transistor. Like the switching transistors, this diode package is mounted on a heat sink. It usually has the diode schematic symbols printed on it. This diode does not usually test properly in-circuit. Testing can be simplified by unsoldering it with a solder sucker instead of removing it completely from the printed-circuit board. Failures of the ±5V output diodes are rarely seen. All diodes must be replaced with high-speed diodes—otherwise the power supply generates excessive noise. Follow these tests by replacing any defective output capacitors will fire up the power supply. The supply should be tested under load. Use a 5W, 25W resistor or equivalent as a dummy load, connected between the 5V output and ground (DC COM). This should draw 1 A from the supply, which is adequate for test purposes. If the supply is still inoperative, the integrated circuit may be bad. Test the IC by removing it from the printed-circuit board and installing it in a power supply that is known to be good.

6.5.1 Negative Voltage Output Too High

Most switching-regulator power supplies have three dc outputs. One is the main 5Vdc output that powers the computer system. The others are the 12V and -5V outputs. These dc outputs are often used to power the sound generating system and the audio amplifier itself. When testing a power supply, it is important to check all three outputs. When a switching-regulator power supply fails; all three outputs usually drop to zero volts.

Sometimes, however, the output voltage may rise. If you find that the 5Vdc and 12Vdc outputs are normal, but the –5Vdc output is too high (more than –6 Vdc), try replacing the –5V output filter choke. It’s easy to locate the –5V filter choke, even without a schematic diagram. Just follow the trace on the printed-circuit board back from the –5 Vdc output of the power supply. You will eventually come to a component that may look something like a capacitor but is clearly labeled L on the board and is generally accompanied by the schematic symbol for a coil as well. The coil is wound on a ferrite coil and covered with a plastic sleeve that has been heat-shrunk over it. Examine the coil; if the covering is melted or missing entirely, the coil may be bad.

6.5.2 Output Capacitor Replacements

When replacing the output filter capacitors, it is a good idea to change them all, unless they can be tested and are good. Testing of the suspectcapacitor should be done with a capacitance meter. It is best to test the capacitance and leakage resistance at the operating voltage or maximum voltage the cap can withstand.

6.5.3 Output Diode Replacements

Output diodes are a common failure item in the switching-regulator power supply. Around twenty-five to thirty percent of them are found to have bad output diodes. There are three pairs of output diodes: one pair for each of the outputs: 5 Vdc, 12 Vdc, and -5 Vdc. These are not ordinary diodes—they are special, high-speed schottky fast-recovery diodes. These diodes are made to handle the very fast switching frequencies of 50 kHz (20 ms).The 5-V diode assembly rarely needs to be replaced in a switching-regulator power supply. The 12V and -5V output diodes are the most common failures. It is normal for these diodes to test bad when doing in-circuit checks. There is usually a low-ohm resistor (normally around 100 W) across the output of the power supply that causes a very low reading when checking the 12-V or–5V output diodes. When these diodes fail, they generally short completely. Instead of reading around 100 ohms, you will get a reading close to zero ohms: a dead short.

6.5.4 Substitute Diodes

The 12-V output diodes are usually rated at 3 amps. The –5V output diodes are often similar. Good engineering practice dictates that high speed, fast-recovery diodes be used in this circuit. Normal diodes have been found to fail prematurely due to their higher switching losses and subsequent thermal stress, and as such they are unacceptable as substitutions.

6.6 Logic Board

The logic board is the main circuit in any Optical Storage Disc player. This is the brain of the complete system. It controls and possesses every signal. The lens reads the data present in the CD inserted by the user and sends the data to the logic board. The logic board basically has video processing chip, Audio processing chip, and a main controller chip. The board also processes the IR signal received by the IR IC present in the front panel by the remote.

Fig.6.1 Logic board

Malfunctioning of the LOGIC BOARD can cause abnormal functioning of the system. But there is nothing except some of the discrete components in the board to replace. Incase if there is no audio output and everything is absolutely fine in the audio amplification circuit, then you got to end up with the conclusion as the audio chip is gone out. Then all you can do is that you can quit the repair work as you won't find the replacement of the audio chip in the market! Similarly if no video output then probably video IC is gone out. You won't find its replacement in the market.

6.7 Most common CD/DVD Player Problems

Here is a short list of common causes for a variety of tracking and audio or data readout symptoms:

- ✓ Dirty optics - lens, prism, or turning mirror.
- ✓ Drawer loading belts - worn, oily, flabby, or tired.
- ✓ Sticky mechanism - dirt, dried up/lack of lubrication, dog hair, sand, etc.
- ✓ Broken (plastic) parts - gear teeth, brackets, or mountings.
- ✓ Need for electronic servo adjustments - focus, tracking, or PLL.
- ✓ Intermittent limit or interlock switches - worn or dirty.
- ✓ Bad connections - solder joints, connectors, or cracked flex cable traces.
- ✓ Motors - electrical (shorted, dead spot) or mechanical (dry/worn bearings).
- ✓ Laser - dead or weak laser diode or laser drive (power) problems.
- ✓ Photodiode array - bad, weak, or shorted segments or no power.
- ✓ Bad/heat sensitive electronic components.
- ✓ Bad or missing optical pickup shield ground.

So,here is a list of some most common problems encountered by Optical storage Disk Players and their cause

6.7.1Most Common Problems and Likely Causes

Problem: CD player is totally dead.

Possible causes:

1. Power outlet, wall adapter, or batteries are dead (as appropriate).
2. Damage to line or wall adapter cord or plug.
3. Bad connections or faulty component in power supply (including blown fuse).
4. Defective microcontroller.

Problem: CD player is operational but there is no display or partial display.

Possible causes:

1. Burned out back-light bulb(s).
2. Bad connections to display panel (totally dead or erratic).
3. Bad solder connections on display panel (some segment work).
4. Bad power supply (EL panel filament, driver voltages).

Problem: CD player ignores you.

Possible causes:

1. Bad connections to one or more buttons or sets of buttons.
2. Microcontroller failed to reset properly.
3. Missing/bad voltages from power supply.
4. Defective microcontroller or other logic.

Problem: Drawer does not open or close.

Possible causes:

1. Worn, stretched, oily, flabby, belt.
2. Dirty mechanism or gummed up lubrication.
3. Stripped gear or other mechanical damage.
4. Defective motor or bad connections to motor.
5. Bad drawer/eject button.
6. Missing/bad voltages from power supply.
7. Defective microcontroller or other logic.
8. Dealer antitheft lock enabled.

Problem: Drawer operation is erratic.

Possible causes:

1. Dirty sense switch contracts or bad connections.
2. Worn, stretched, oily, flabby, belt.
3. Dirty mechanism or gummed up lubrication.
4. Defective motor or bad connections to motor.
5. Stripped gear or other mechanical damage.
6. Missing/bad voltages from power supply.
7. Defective microcontroller or other logic.

Problem: Drawer does not close (or open) completely.

Possible causes:

1. Worn, stretched, oily, flabby, belt.
2. Dirty mechanism or gummed up lubrication.
3. Foreign object like toy, rock, or runaway disc blocking drawer.
4. Stripped gear or other mechanical damage.

5. Gear timing is messed up.

Problem: CD changer jams when selecting or ejecting CDs.

Possible causes:

1. Bad belts, dirt or need for lubrication.
2. Foreign objects, chipped or broken gears, or other mechanical damage.
3. Messed up gear timing.
4. Defective sensor (micro switch or opto-interrupter).
5. Defective motor, driver, or power supply.
6. Logic or microcontroller problem.

Problem: CD player or CDROM drive damages CDs.

Possible causes:

1. Broken, bent, or missing part.
2. Messed up gear timing (mainly cartridge changers).
3. Other mechanical fault.
4. Lens hitting CD due to electronic fault or need to adjust focus servo.

Problem: Spindle table loose or sticks to clamper upon eject.

Possible causes:

1. Set screw loosened or glue failed holding spindle to motor shaft.
2. Parts of spindle table broke.

Problem: Intermittent or erratic operation.

Possible causes:

1. Dirty, scratched, or defective disc.
2. Dirty lens.
3. Extended length discs too long for player.
4. Loading (mechanical) not completed reliably.
5. Bad connections including missing/erratic optical deck shield.
6. Cracks in ribbon cable to optical pickup.
7. Dirty drawer or limit switches.
8. Power supply or logic problems.
9. External interference.
10. Internal damage (e.g., loose parts) in optical pick up.

Problem: CD player or CDROM drive overheats.

Possible causes:

1. Excessive ambient temperature - sauna or hot stereo components.
2. Failing/marginal part in power supply, logic, or optical pickup.

Problem: Operation is poor or erratic when cold:

Possible causes:

1. Gummed up grease or dirt inhibiting movement until warm.
2. Condensation on optical components due to temperature change.
3. Bad connections or dirty contacts affected by temperature.

Problem: Disc is not recognized displaying 'disc', 'error', etc.

Possible causes:

1. Disc loaded upside-down.
2. Transportation lock engaged.
3. Dirty, scratched, or defective disc.
4. Dirty or damaged objective lens.
5. Loading (mechanical) not completed reliably.
6. Damaged lens suspension or damaged lens cover preventing free movement.
7. Dirt, gummed up lubrication, or damage in sled drive mechanism.
8. Dirty/defective limit switch or sensor.
9. Defective spindle motor.
10. Spindle table height incorrectly set.
11. Bad component in optical pickup.
12. Cracks in ribbon cable to optical pickup.
13. Need to adjust servo (or less likely, optical) alignment.
14. Faulty power supply, electronics, or control logic.
15. Bad connections including missing/erratic optical deck shield.
16. External interference.

Problem: Disc spins in wrong direction or over speeds and is never recognized.

Possible causes:

1. Disc loaded upside-down.
2. Dirty, scratched, or defective disc.
3. Dirty or damaged objective lens.
4. Tracking or CLV servo out of adjustment or faulty.
5. Bad component in optical pickup.
6. Microcontroller or control logic problems.
7. Bad connections or defective ribbon cable to optical pickup.
8. Defective spindle motor including worn bearings.

Problem: Pickup attempts to reset past inner track.

Possible causes:

1. Dirty or defective limit switch, bad connections to it, or its electronics.
2. Broken parts preventing limit switch from being activated.
3. Tracking or CLV servo out of adjustment or faulty.
4. Microcontroller or logic problems.

Problem: Player won't let you go near it and/or use your favorite lamp.

Possible causes:

1. Missing optical deck shield, ground strap, or other connection.
2. Outside interference.

Problem: Seek operations take too long or fail to complete.

Possible causes:

1. Dirty, scratched, or defective disc.
2. Transportation lock engaged.
3. Dirty or damaged objective lens, suspension, obstruction, etc.
4. Tracking servo out of adjustment or faulty.

5. Mechanical problems with sled movement.
6. Faulty sled motor or drive IC.
7. Faulty control logic.
8. Bad flex cable to optical pickup.

Problem: Search, seek, or play starts correctly, then loses time or position.

Possible causes:

1. Dirty, scratched, or defective disc.
2. Dirty or damaged objective lens, suspension, obstruction, etc.
3. Tracking or PLL servo out of adjustment or faulty.
4. Stuck button.
5. Defective sled motor drive IC.
6. Faulty control logic.

Problem: Short distance skipping.

Possible causes:

1. Dirty, scratched, or defective disc.
2. Dirty or damaged objective lens, suspension, obstruction, etc.
3. Fine tracking servo out of adjustment or faulty.
4. Weak laser or other defective part in the optical pickup.

Problem: Playback gets stuck (rapid repeat).

Possible causes:

1. Dirty, scratched, or defective disc.
2. Dirty or damaged objective lens, suspension, obstruction, etc.
3. Dirt, gummed up lubrication, or damage in sled drive mechanism.
4. Transportation lock engaged.
5. Need for servo alignment.

Problem: Occasional long distance skipping or repeating.

Possible causes:

1. Dirty, scratched, or defective disc.
2. Dirty or damaged objective lens, suspension, obstruction, etc.
3. Dirt, gummed up lubrication, bad belt, or damage in sled drive mechanism.
4. Transportation lock engaged.
5. Need for servo alignment.

Problem: Player gets stuck at approximately same time on multiple discs.

Possible causes:

1. Dirt, gummed up lubrication, or damage in sled drive mechanism.
2. Sled reaching mechanical stop with extended length (>74 minute) disc.
3. Transportation lock engaged.
4. Need for servo alignment.
5. Defective spindle motor.

Problem: Various tracking problems on portions of discs:

Possible causes:

1. Dirty, scratched, or defective disc.

2. Faulty spindle motor.
3. Misalignment of spindle table and sled track.
4. Need for CLV adjustment (Constant Linear Velocity).

Problem: Repetitive noise at disc rotation rate.

Possible causes:

1. Dirty, scratched, or defective (possibly warped) disc.
2. Dirty or damaged objective lens, suspension, obstruction, etc.
3. Loose spindle or foreign material on spindle table.
4. Disc not firmly clamped.
5. Bent spindle.
6. Excessive spindle run out due to worn bearing.
7. Need for servo alignment.
8. Weak laser or other component in optical pickup.

Problem: Audio muting, noise, or distortion.

Possible causes:

1. Dirty contacts on RCA jacks on CD player or amp.
2. Bad connections to RCA jacks.
3. Dirty/defective muting relay contacts.
4. Defective components in the analog circuitry (final filter, muting, amp).
5. Faulty power supply (for audio circuits if used).
6. Dirty controls (probably on amp unless problem is with the headphones).

PC monitor Maintenance/Repair

The monitors typically used with PCs come in a wide variety of sizes and resolutions, and are typically based on one of two display technologies: liquid crystal display (LCD) or cathode-ray tube (CRT).

Display Specifications:

The following sections examine the features and specifications to look for when comparing or selecting displays.

Display Size

Display sizes are measured diagonally, which is an artifact from the round tubes used in the first televisions, where the diagonal measurement was equal to the physical diameter of the tube. Whereas the diagonal display size measures the physical size of the display, the *viewable image size* refers to the diagonal measurement of the usable area on the screen (for example, the operating system desktop).

On an LCD panel, the physical diagonal measurement and the viewable image size of the display are the same. With CRTs, however, the viewable image size is typically 1" smaller than the advertised diagonal display size. Therefore, when you're comparing LCDs and CRTs with the same diagonal size, the LCD will actually offer a larger viewable image.

Resolution

Resolution indicates the amount of detail a monitor can render. This quantity is expressed in the number of horizontal and vertical picture elements, or *pixels*, contained in the screen. The total is usually expressed in the millions of pixels, or *megapixels*. As the resolution increases, the image consists of a greater number of pixels. With more pixels, you can see more of a given image and/or the image can be viewed in greater detail.

Aspect Ratio

A given resolution has a horizontal and vertical component, with the horizontal component the larger of the two. The aspect ratio of a display is the ratio between the horizontal and vertical number of pixels. It is calculated as the width (in pixels) divided by the height.

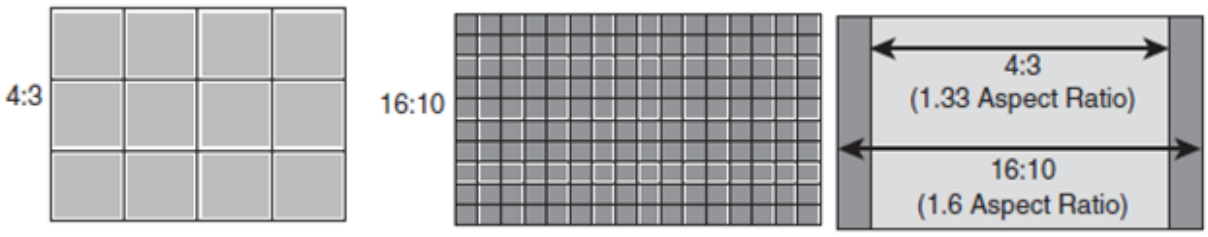


Figure 1.Standard (4:3 or 1.33) versus widescreen (16:10 or 1.60) display aspect ratios.

Pixels

In a color monitor, each picture element (pixel) consists of three red, green, and blue (RGB) subpixels. By varying the intensity of each of the subpixels, you can cause the overall color and brightness of the pixel to be anything from black (all off) to white (all on) and almost any color or level in between. The physical geometry of the RGB subpixels varies depending on the type of display, but the shape is normally either rectangular stripes or round dots. LCD monitors normally have the three subpixels arranged as rectangular vertical stripes in a linear repeating arrangement. CRTs may also use linear stripes, or they can have staggered stripes or dot triads.

When you're choosing a display, the most important considerations are the combination of size and resolution. The overall combination of size and resolution is normally expressed in pixels per inch (ppi), but it can also be expressed in pixel pitch, which is the distance between pixels in millimeters. A higher ppi number (or lower pixel pitch) means that fixed size images such as icons and text will be smaller and possibly harder to read. Pixel pitch is also sometimes called *dot pitch*, in reference to the dot shaped subpixels used on some displays. Figure 3 illustrates a dot-shaped subpixel arrangement most commonly found on shadow-mask base CRTs, where the pixel or dot pitch is the shortest distance between same color subpixels.

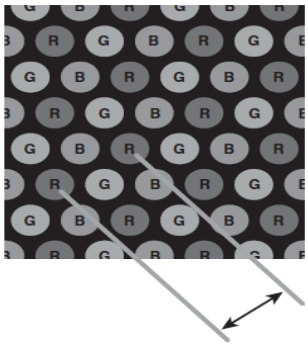


Figure 3.Dot-shaped subpixels, where pixel or dot pitch is the shortest distance between same color subpixels.

Figure 4 and 5 show striped subpixel arrangements in both linear and staggered forms. Of these, the linear form is the most common, used on virtually all LCDs and most

aperture grille–based CRTs. With striped subpixels, the pitch is measured as the horizontal or vertical distance between same color subpixels.

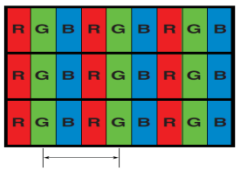


Figure 4.Stripe-shaped subpixels in alinear arrangement, where pixel pitch is the distance between same color subpixel stripes.

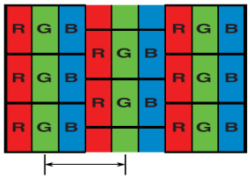


Figure 5.Stripe-shaped subpixels in a staggered arrangement, where pixel pitch is the distance between same color subpixel stripes.

Generally, the higher the resolution, the larger the display you will want. Why? Because operating system and application program icons and text normally use a constant number of pixels, higher display resolutions make these screen elements smaller onscreen. By using a larger display, you can use higher resolution settings and still have icons and text that are large enough to be readable. Although it is possible to change icon and text size, this often causes other problems with formatting in variouswindows and dialog boxes, such that in most cases it is best to stick with the default sizes.

At lower resolutions, text and onscreen icons are very large. Because the screen elements used for the Windows desktop and software menus are at a fixed pixel width and height, you'll notice that they shrink in size onscreen as you change to the higher resolutions. You'll be able to see more of your document or web page onscreen at the higher resolutions because each object requires less of the screen.Tables 3 and 4 show the sizes and resolutions for commonly available standard and widescreen LCD monitors.

Table 3.Sizes and Resolutions for Non-Widescreen (<1.50 Ratio) Monitors.

Display Size	Designation	Native Resolution	Megapixels	Pixels Aspect Ratio	Pixel per Inch	Pitch (mm)
15.0"	XGA	1024×768	0.79	1.33	85	0.298
17.0"	SXGA	1280×1024	1.31	1.25	96	0.263
19.0"	SXGA	1280×1024	1.31	1.25	86	0.294
20.0"	UXGA	1600×1200	1.92	1.33	100	0.254

Table 4. Sizes and Resolutions for Widescreen (>1.50 Ratio) Monitors.

Display Size	Designation	Native Resolution	Megapixels	Pixels Aspect Ratio	Pixel per Inch	Pitch (mm)
16.0"	WXGA	1366×768	1.05	1.78	98	0.259
17.0"	WXGA+	1440×900	1.30	1.60	100	0.254
19.0"	WXGA+	1440×900	1.30	1.60	89	0.284
19.0"	WSXGA+	1680×1050	1.76	1.60	104	0.244
20.0"	WXGA+	1440×900	1.30	1.60	85	0.299
20.0"	WSXGA-	1600×900	1.44	1.78	92	0.277
20.0"	WSXGA+	1680×1050	1.76	1.60	99	0.256

A LCD Monitor

LCD or flat panel computer displays are the latest and greatest offerings in the desktop computer industry. They have been used for years in the portable and notebook computing markets, but recent developments have increase performance and size while reducing costs making them viable in the desktop environment. LCD displays are lightweight, extremely thin and use much less power than CRT based monitors.

What is Liquid Crystal and How It Works?

Liquid crystal was discovered by the Austrian botanist named Fredreich Rheinizer in 1888. Liquid crystal is an unusual organic material and it is neither solid nor liquid. That means although it is liquid in form and appearance, Liquid Crystal exhibits a crystalline molecular structure that resembles a solid. Liquid crystals are rod-shaped molecules whose molecules can be aligned precisely when subjected to electrical fields. As a liquid they are able to flow over and around small grooves and can change their position

depending on applied voltage. When properly aligned, the liquid crystals allow light to pass through makes the desired images appear.

An LCD monitor consists of six layers: a backlight, a sheet of polarized glass (polarizer), TFT glass, a layer of liquid crystal solution, colorfilter/glass and a second polarized sheet of glass.

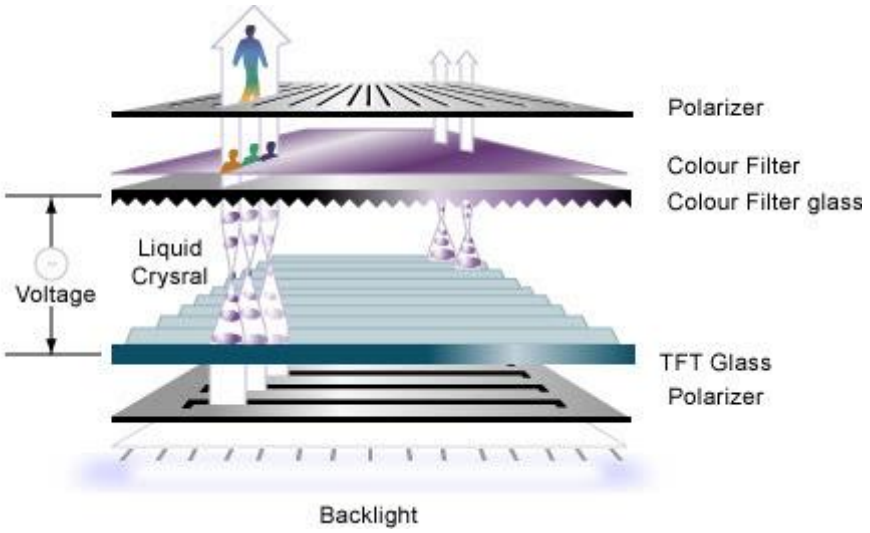
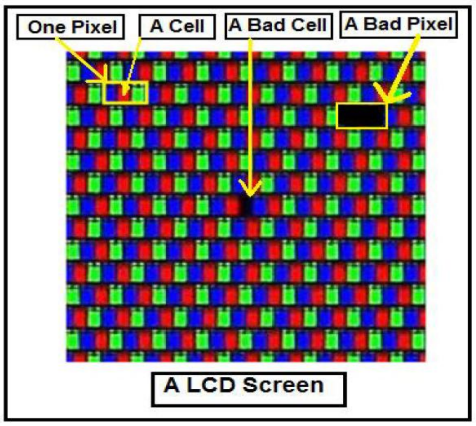


Figure 6. LCD monitor layers.

A fluorescent light source, known as the backlight, makes up the rearmost slice of bread. Light is shined from behind the panels. This light passes through the first of two polarizing filters. The polarized light then passes through a layer that contains thousands of liquid crystal blobs arrayed in tiny containers called cells. The cells are, in turn, arrayed in rows across the screen; one or more cells make up one pixel (the smallest discernible dot on a display). Electric leads around the edge of the LCD create an electric field that twists the crystal molecule, which lines the light up with the second polarizing filter and allows it to pass through. Each crystal either allows light to pass through or blocks the light. The configuration of the crystals forms the image.

Types of LCD's

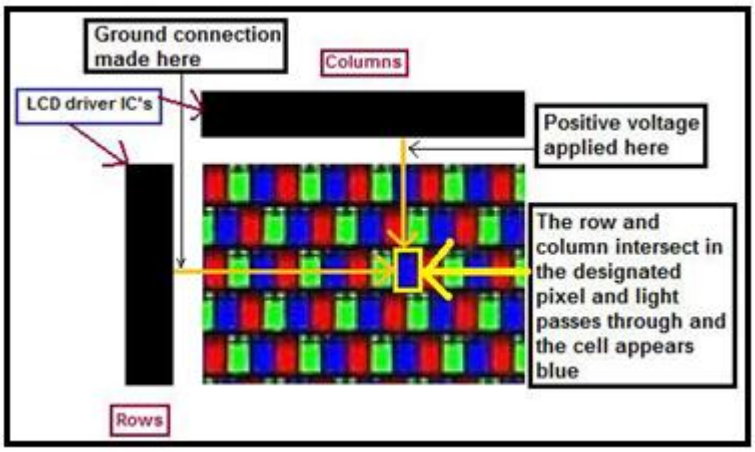
There are two basic kinds of LCD color displays: passive-matrix and active matrix.



In a color LCD panel, each pixel is made up of **three liquid crystal cells**. Pixels do not actually generate the colors that you see. It is thewhite light (backlight) passing through each pixel, which filtered to formthe intended color. The front glass is coated with color filter material infront of each red, green and blue dot (cell). Light passing through thefiltered cells creates the colors you see on the LCD.

Each cell or subpixel can be individually addressed with a control voltage. This means, for example, that a 15” LCD Monitor screen that have the resolution of 1024 x768 contains 2,359296 subpixels (1024 x 768 x 3). Occasionally the mechanism that sends the electrical current to one or more pixels fails; in those instances you'll see a completely dark cell (bad cell) or a "bad" pixel.

Passive Matrix LCD

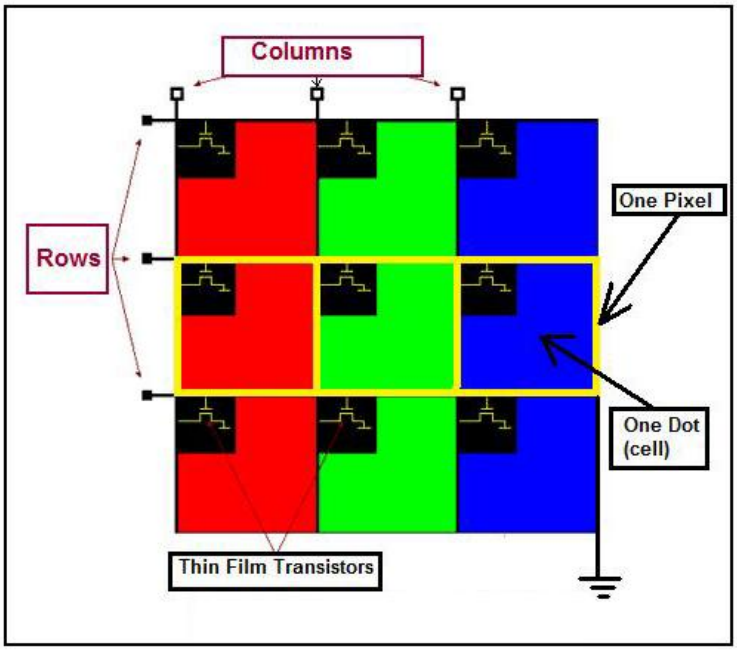


Passive-matrix LCD Monitors use a simple grid to supply the voltage to a particular pixel on the display. Creating the grid is quite a process! It starts with two glass layers called substrates. One substrate is given columns and the other is given rows made from a transparent conductive material. The rows or columns are connected to integrated circuits thatcontrol when a charge is sent down a particular column or row. The liquid crystal (LC) material is sandwiched between the two glass substrates, and a polarizing film is added to the outer side of each substrate. To turn on a pixel, the integrated circuit sends a charge down the correct column of one substrate and a ground activated on the correct row of the other. The row and column intersect at the designated pixel, and that delivers the voltage to untwist the liquid crystals at that pixel.

For example, if the dot at row 0, column 0 is supposed to be red, the green and blue dots turn “On” at that point to block white light through all but the red filter. White light travels through the red filter on the front glass where it emerges as red. When the red, green and blue dots are all on, all light is blocked and the pixel appears black. If all three dots are off, all light passes through and the pixel appears white.

There are disadvantages although the simplicity of the passive-matrix system is beautiful. First, the response time is slow. Response time refers to the LCD's ability to refresh the image displayed. The easiest way to observe slow response time in a passive-matrix LCD is to move themouse pointer quickly from one side of the screen to the other. You willnotice a series of "ghosts" following the pointer. Such slow update times make passive displays poor choices for fast graphic operations (like games), animation and motion video. Second, their contrast ratio is poor which generally results in washed out or hazy pictures. Third, the viewing angles for color passive matrix LCD’s also are poor at around 45 degrees. That means your clearest view of the display will be to look at it straight on.

Active-matrix or TFT (thin film transistor) technology



TFT stand for thin film transistor (or active-matrix) produces colorimages that are as sharp as traditional CRT displays. Basically, TFTs are tiny switching transistors and capacitors. The three elements provide the red, green and blue light source for each pixel that your eye perceives. They are arranged in a matrix on a glass substrate. To address a particular pixel, the proper row is switched on, and then a charge is sent down the correct column. Since all of the other rows that the column intersects are turned off, only the capacitor at the designated pixel receives a charge.

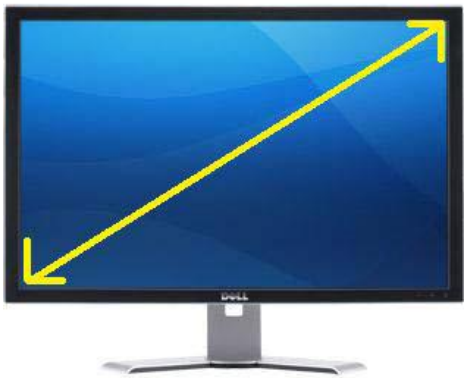
The capacitor is able to hold the charge until the next refresh cycle. Andif we carefully control the amount of voltage supplied to a crystal, we can make it untwist only enough to allow some light through. This means that the switching occurs right at the cell turning the white light on or off and the result is faster response times, and less crosstalk between cells. When the red, green and blue elements are all off, white light shines through the three elements, and the pixel appears white. If the red, green and blue elements are all on, all light is blocked, and the pixel appears black.

Active-matrix LCD'S response time is very fast-approximately 16ms andbetter. Such fast response time provides excellent performance for graphics or animation applications. The active matrix screen also provides a comfortable viewing angle of 90 degrees and above.
Additionally, higher drive signals can be used which creates much brighter and higher contrast images. The disadvantage of active matrix LCD'S is that the price is still high due to the high cost of building TFT factories and expensive technology used to fabricate all the tiny transistors (FET) onto the glass plate.
Nearly all modern color LCDs--both in notebooks and for desktop monitors is using the active matrix LCD (TFT).

Screen Size

When you purchase a 17-inch CRT monitor, you usually get 16.1 inches or a bit more of actual viewing area, depending on the brand andmanufacturer of a specific CRT. The difference between the "monitor size" and the "view area" is due to the large bulky frame of a CRT. Unlike CRT monitors, LCD displays are marketed by the actual screendimensions.That means if you purchase a 17" LCD monitor, you actually get a full 17" viewable area, or very close to a 17". This is the measurement of the displayable area of the screen from the lower corner to the opposite upper corner of the display. Below is the rough guide for the screen size:

17" CRT = 15" TFT
19" CRT = 17"-18.4" TFT
21" CRT = 19"-20" TFT



Obviously these are not always exact, but it is a good rough guide to the sizes. For instance a 21" CRT may offer a viewable area of more like 20".

Response Time

Response Time is the specification which many people, especially gamers, have come to regard as the most important. It translates to the amount of time it takes for a liquid crystal cell (pixel) to go from active (black) to inactive (white) and back to active (black) again. In practical terms, it refers to the speed of the pixels and how fast they can change from one color to another, and therefore how fast the picture can be redrawn. The faster this transition can change the better. This helps reduce the effects of ghosting/ blurring in games and movies which can result if the response time is too slow.

The response time is measured in milliseconds or (ms). Lower numbers mean faster is the transitions time (e.g. 16 ms is faster than 25 ms.). If you visit any computer dealers and get the brochure from them you could see a small word (ms) printed besides the LCD Monitor price list. This is to tell you that the particular LCD Monitor is running on what milliseconds. Generally the lower the milliseconds (response time) the more expensive is the LCD Monitor price.

Contrast Ratio

Contrast ratio is a big marketing tool by the manufacturers and one that is not easy for consumers to grasp. Contrast ratio relates to the display's comparative difference between its brightest white values and its darkest black values. As a rule of thumb, the higher the contrast ratio, the better.

A higher contrast ratio will have truer colors with less "wash out." The standard offering for lower end models is commonly 700:1. Many experts recommend a contrast ratio of 1000:1 or better.

Brightness

Brightness is a measure of the brightest white the LCD Monitor can display. Typically LCD Monitors are far too bright for comfortable use, and the On Screen Display (OSD) is used to adjust the brightness setting down. Higher brightness is good as it leads to a better contrast ratio and can be useful for dark scenes in games / movies where it might be difficult to distinguish between shades of grey.

Viewing Angles

A CRT monitor can be viewed from almost any angle, but with an LCD this is often a problem. The viewing angle is an especially important consideration if you plan to have multiple people viewing the LCD monitor at any given time. When you use an LCD, your view changes as you move different angles and distances away from the monitor. At some odd angles, you may notice the picture fade (wash out), and possibly look as if it will disappear from view. The reason for this is because LCD'sproduce their image by having a film that when a current runs through thepixel, it turns on that shade of color.

The problem with the LCD film is that this color can only be accurately represented when viewed straighton.

Digital and analogue connections

LCD Monitors are digital devices and thus have to convert analogue (VGA) signals before they can be displayed. A graphics card with a digital video interface (DVI) can send the signal straight to the display in digital format and **no conversion required**. Many LCD Monitors come with an analogue input (featuring a D-shaped connector that has 15 pins arranged in three rows, sometimes labeled D-Sub), some come with both, and only a very few come with just a digital input.

Portrait/Landscape modes

Some LCD Monitors pivot so that the longer edge can go horizontal (Landscape mode) or vertical (Portrait mode). This feature can be very useful for desktop publishing, Web surfing, and viewing large spreadsheets, but don't pay extra for it if you won't use it.


LCD Monitor Life span

Life span, this is typically the time taken (viewing hours) for the average backlight to dim to 50% of their original brightness. Generally, LCD monitors last longer than CRTs. A typical LCD lifespan is 50,000 hours of use compared to 15,000 to 25,000 for a CRT. A longer monitor lifespan can provide a better return on investment.

Overview of LCD Monitor Circuits

Most LCD Monitors can be broken down into 6 major circuits, each circuit have its own function.

Power Supply Circuit

The role of the power supply is to provide power to the rest of the circuits in the LCD Monitor. Normally the output voltages are 12V and 5 Volts and the 5 Volts were brought it down again to 3.3 V and 2.5 Volts through voltage regulator. However in some LCD Monitor designs, the output voltages may not be the values mentioned above. You have to test it with your digital multimeter.

Inverter Circuit

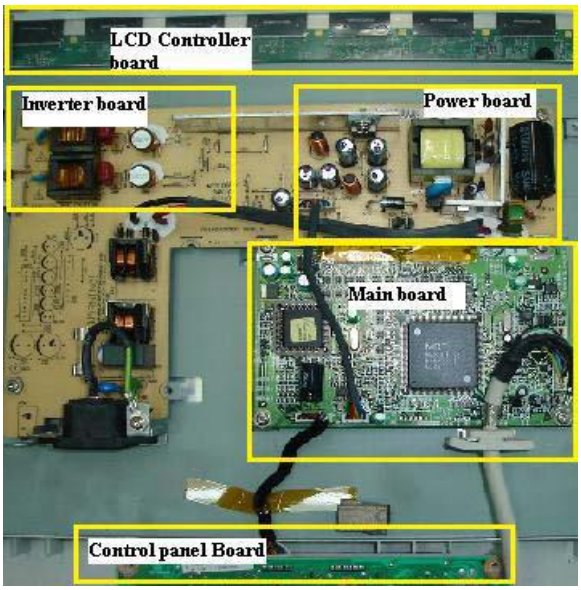
Provide high voltages and current required by the backlight (lamps). Inverter generates from 600 up to 1000 plus VAC from one, two or even four high voltage transformer depending on how many backlights were used.

Main board/AD board

Convert the RGB analogue signal into digital signal and channel it to the LCD driver/controller board.

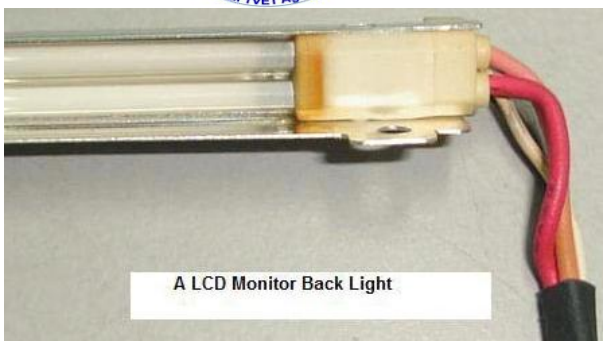
LCD Driver/Controller board

Accepts additional display information from the Main Board and drive the transistors in the LCD panel.



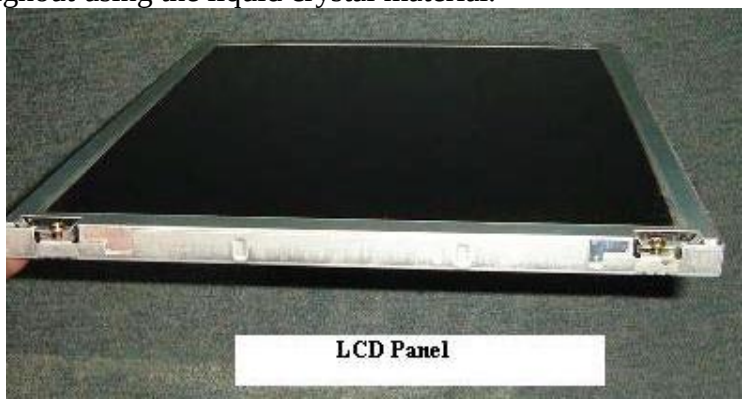
Backlight (lamps)

Generate a consistent, uniform light source. The light generated from the backlight focused through the LCD.

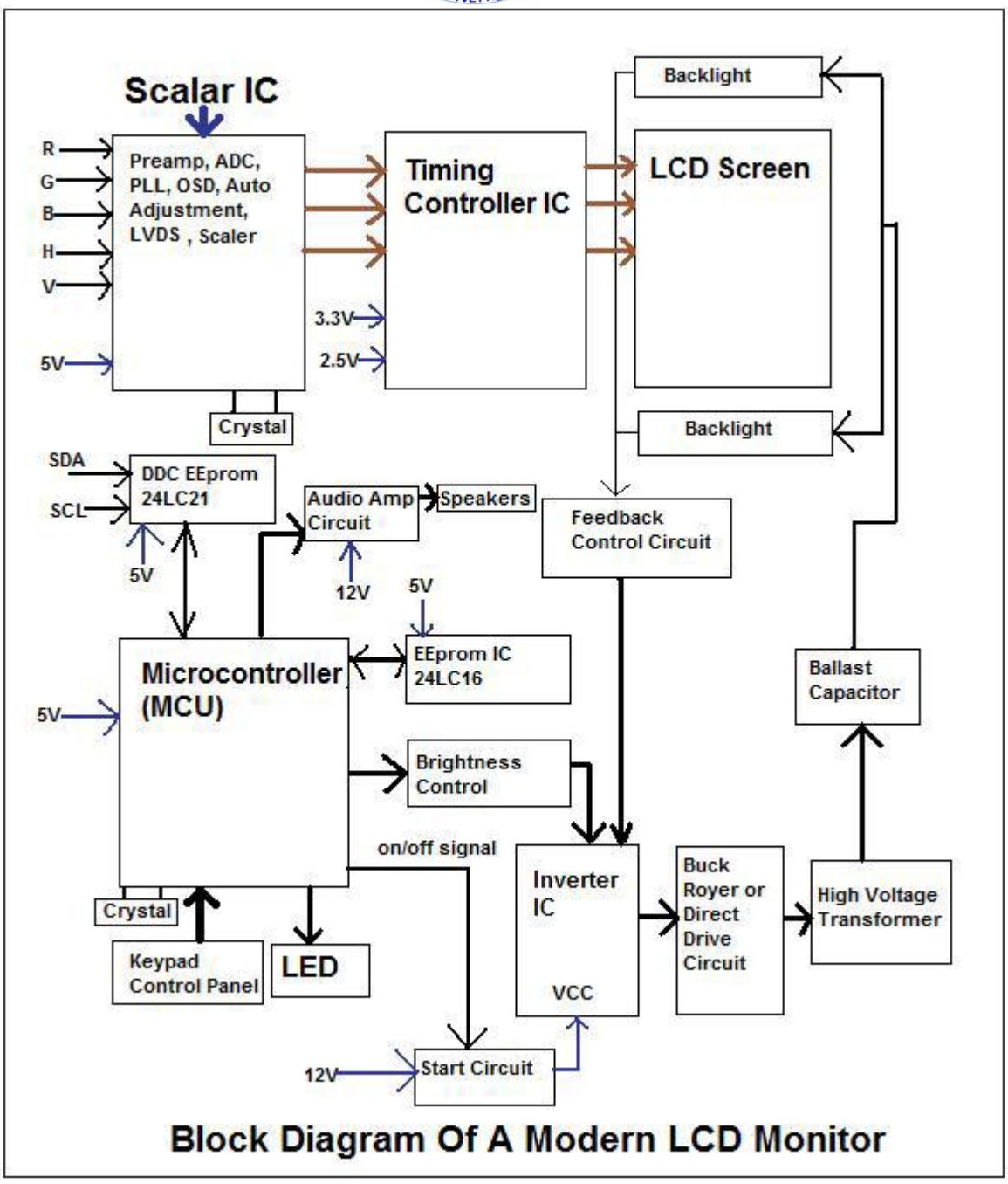


LCD Panel

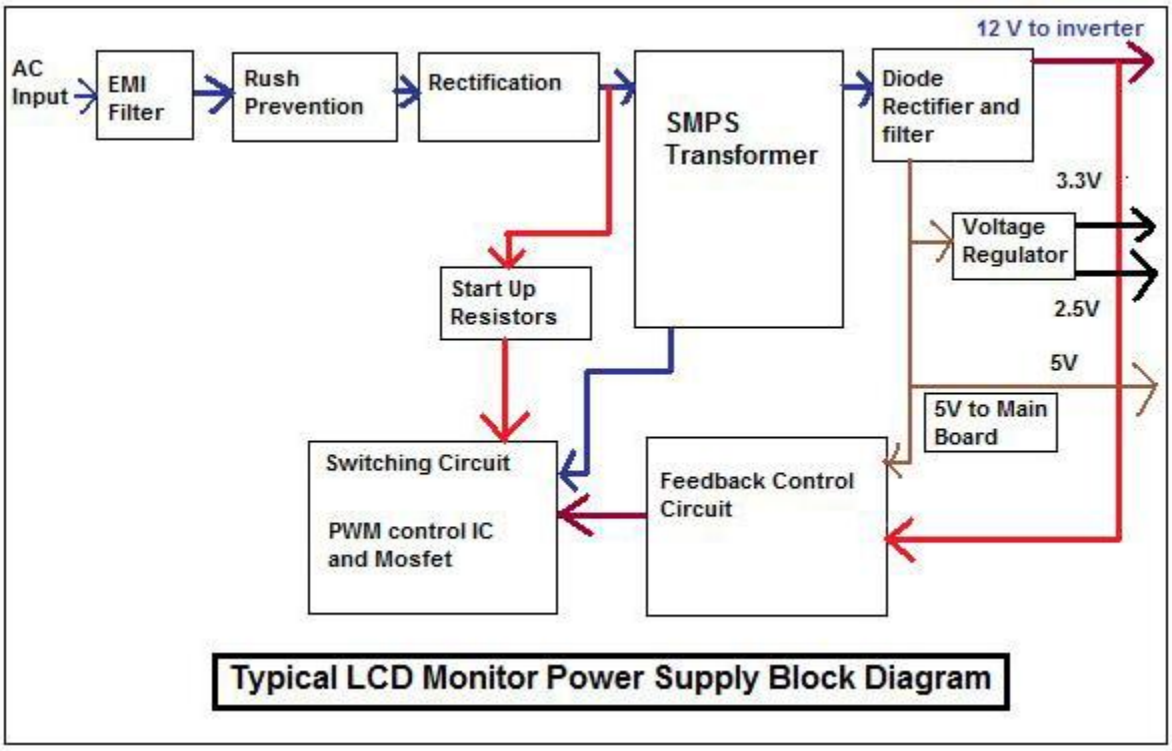
Controls light throughout using the liquid crystal material.



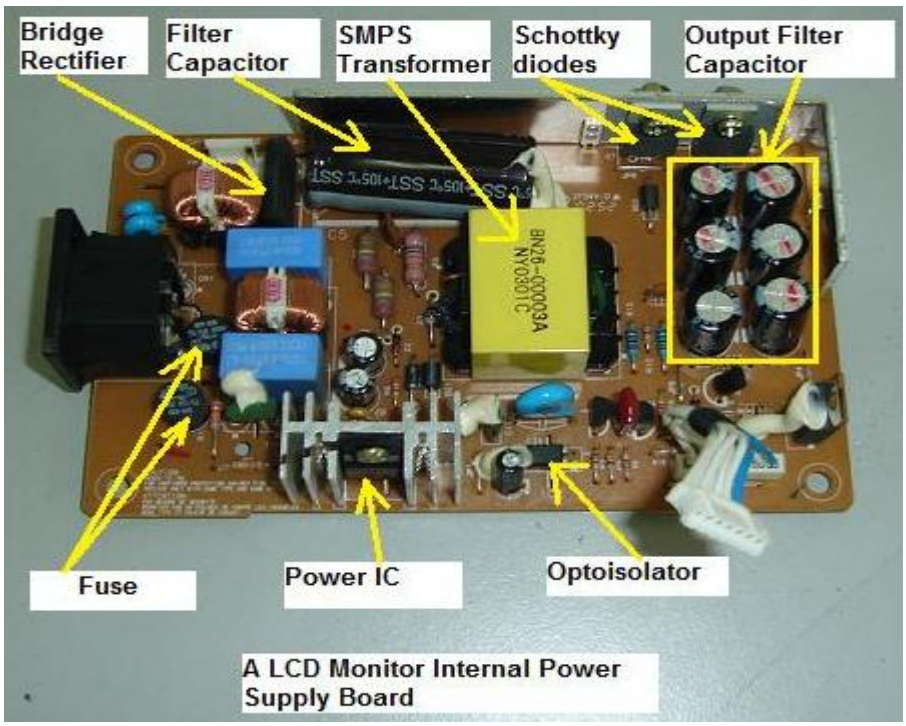
LCD Monitor Block Diagram



Understanding Power Supply Board

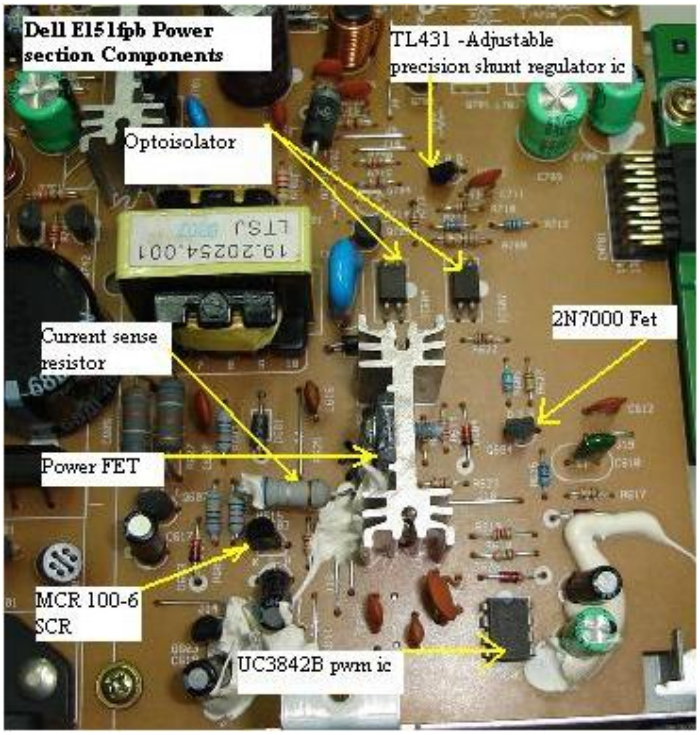


The switch mode power supply used to power up LCD Monitor can be either the external or internal type. The function of the power supply is to convert the main supply AC 220 volts into DC output voltages to supply to the necessary boards in LCD Monitor.



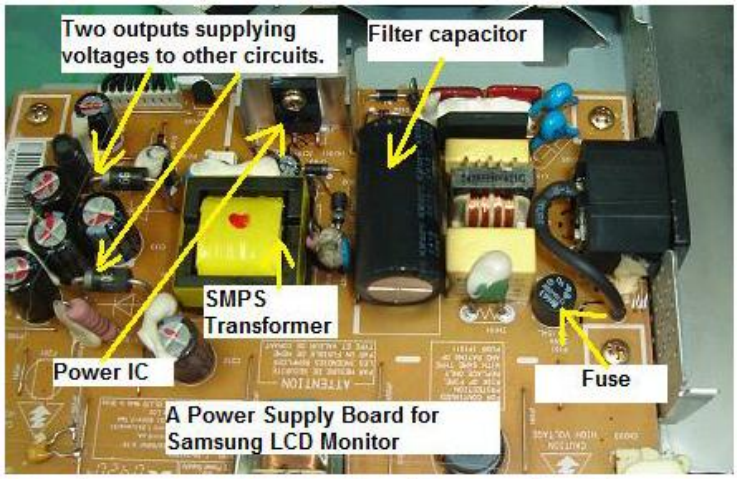
The internal type power supply

220 Volts AC supply enters the power supply and to the bridge rectifier ac pins (normally pin 2 and 3). The AC supply is then converted into DC output voltage (about 300 VDC) where the big filter capacitor filtered off the ripple so that the power supply will have a nice constant of DC voltage. This high voltage DC supply is then given to a switching power FET Transistor. This switching FET transistor circuit is switched on and off at a very high speed by a control circuit (power IC) which generates very high frequency square wave pulses.



The switching FET transistor circuit switches the given high voltage DC, on and off at the same high frequency and gives square wave pulses as the output. These square wave pulses are then given to the primary winding of Switch Mode Power Transformer. These pulses induce a voltage at the primary winding of the transformer which will generate voltage at the secondary winding. This voltage at the secondary winding is then rectified and filtered to produce the required output.

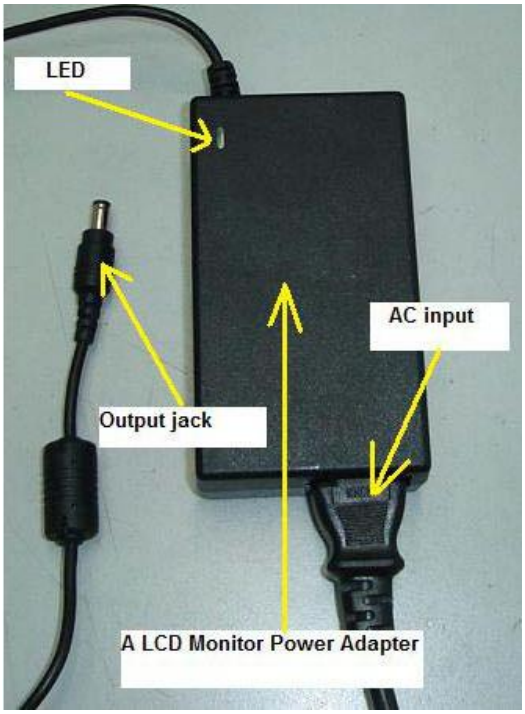
The build in power supply have output of usually 12 volts and 5 volts where the 12 volts enters the inverter IC and also audio power amp IC.The 5 volts will go through one or two voltage regulators to get the 3.3 and 2.5 volts to power the Scalar IC, MCU, EEprom and even the LCD driver/controller board.

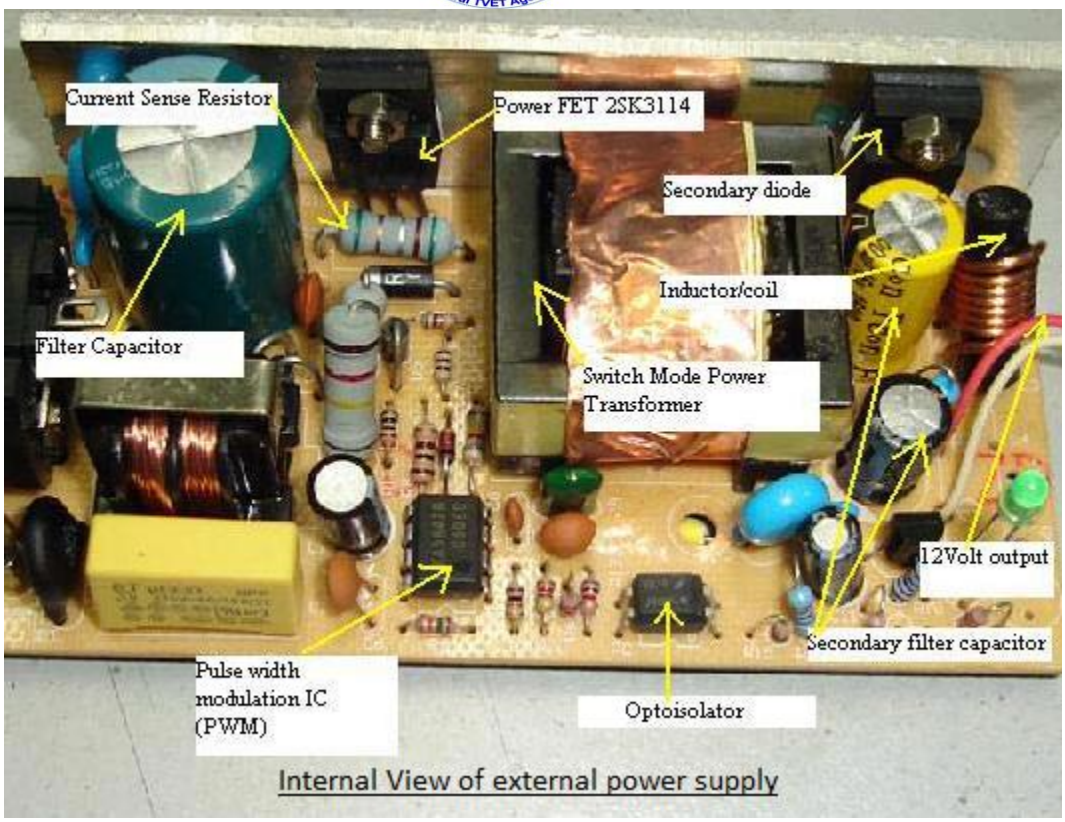


Note: The Power FET transistor already integrated in to the Power IC

Please take note that many latest designs of LCD Monitor power supply designs have the switching power FET transistor already integrated into the power IC thus you will not find the power FET in the power supply board.

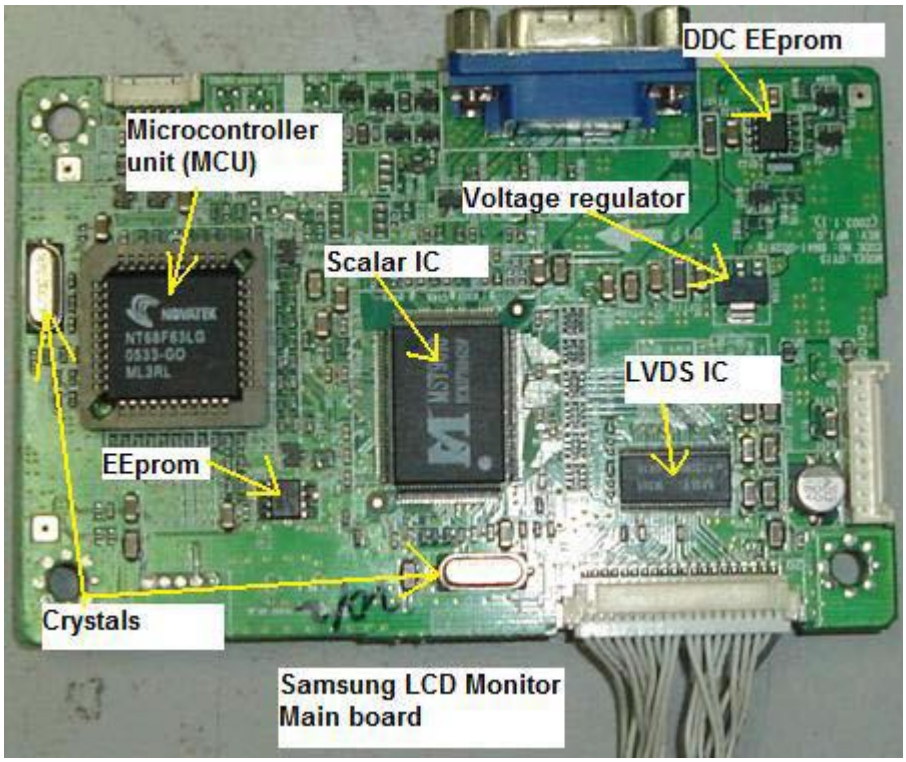
The External type power supply





Internal View of external power supply

Understanding Main board/AD board

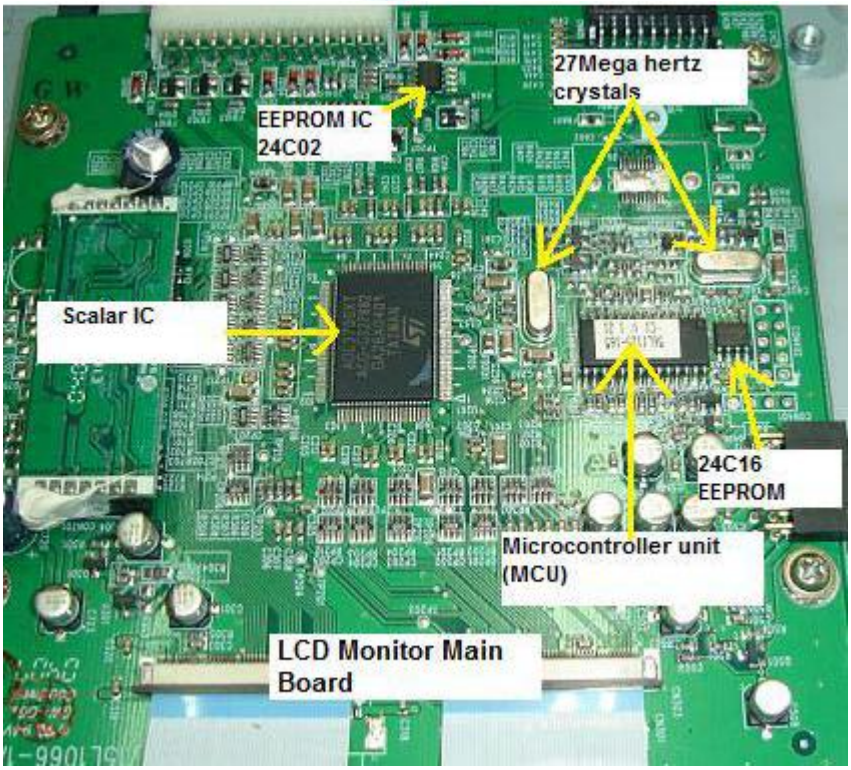


Some technicians called it as Main board; to some is AD board and also some referred to it as Logic board or Scalar board. The purpose of this board is to convert the RGB analogue signal into digital signal and send it to the LCD controller and driver circuit and finally to the LCD screen.

This board contains of a Scalar IC, MCU (microcontroller unit), EEprom's , Crystal, Voltage regulator and other surrounding SMD components. This board normally powered by 2.5 v, 3.3 v and 5 Volts. In some designs like Samsung, the Main board have lots of problem like no display, intermittent no display, optimum mode error OSD display and etc. while to some designs like DELL, it was very robust.Here are the functions of each IC in the Main board:

Scalar IC- It consists of Pre-Amp, ADC (Analogue to Digital Converter), Auto-Adjustment, PLL (Phase Locked Loop), On Screen Display (OSD),Dual LVDS (Low Voltage Differential Signaling) transmitter and the Scaling IC in it. The scaling IC inside the Scalar IC will convert analogue input signals of Red, Green and Blue to 8 or 16 bits (depends on the MCU used) digital signals of Red, Green and Blue that the controller IC in the LCD panel can acknowledge. The auto adjustment function provides automatic frequency, phase, H/V position and white balancetuning at any screen condition. For older LCD Monitor the ADC, OSD and the LVDS transmitter are not integrated into the Scalar IC.

MCU (Microcontroller) – A Microcontroller is a small computer which is contained in one IC and is programmed for one group of specific tasks. The microcontroller includes a CPU, SRAM, DAC, A/D Converter and a 64K-byte internal program Flash ROM. It improved write / erase and data retention performance for Flash (allowing the user to define their own preferred programs), faster programming and erase times of the Flash memory and Flash can be used to emulate EEPROM.



EEprom IC's- EEPROM stands for Electrical Erasable Programmable Read Only Memory and also referred to as E²PROM. As the name suggest, an EEPROM can be both erased and programmed with electrical pulses. Since it can be both electrically written into and electrically erased, the EEPROM can be rapidly programmed and erased in circuit for reprogramming without removing them from the circuit board.

EEPROM is also called a non-volatile memory because when power is turned off the stored data in the EEPROM will not be erased or intact. New EEPROM have no data in it and usually have to program with a programmer before it can be used. Information stored in this type of memory can be retained for many years without a steady power supply.

What is the function of EEPROM?

EEPROMs are used to store user programmable information. EEPROM in LCD Monitor performs two functions:

- When a LCD Monitor is switch on it will copies all data or informationfrom the EEPROM to the microcontroller (MCU). For example, theEEPROM will let the microcontroller know the frequencies at which themonitor is going to operate.
- It is used to store the current settings of the LCD Monitor. The settings of the monitor will not be erased even when the monitor is turned off. Anytime a change is made in the monitor settings, the microcontroller updates the setting in the EEPROM. When the monitor isturn on again, the stored settings are used to set up the monitor for operation.

What are the symptoms if LCD Monitor EEPROM data is corrupted or damaged?

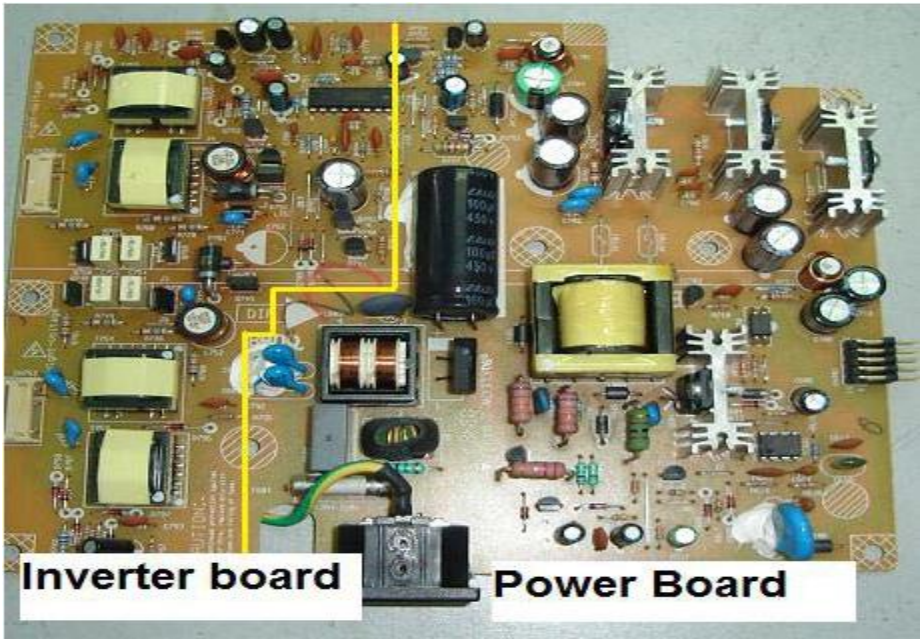
- No Display
- Horizontal or vertical frequencies run.
- Cannot save (store) current setting.

- Certain control functions like sound, brightness and contrast control does not functioning.
- On Screen Display (OSD) does not function or the OSD will have a corrupted display.

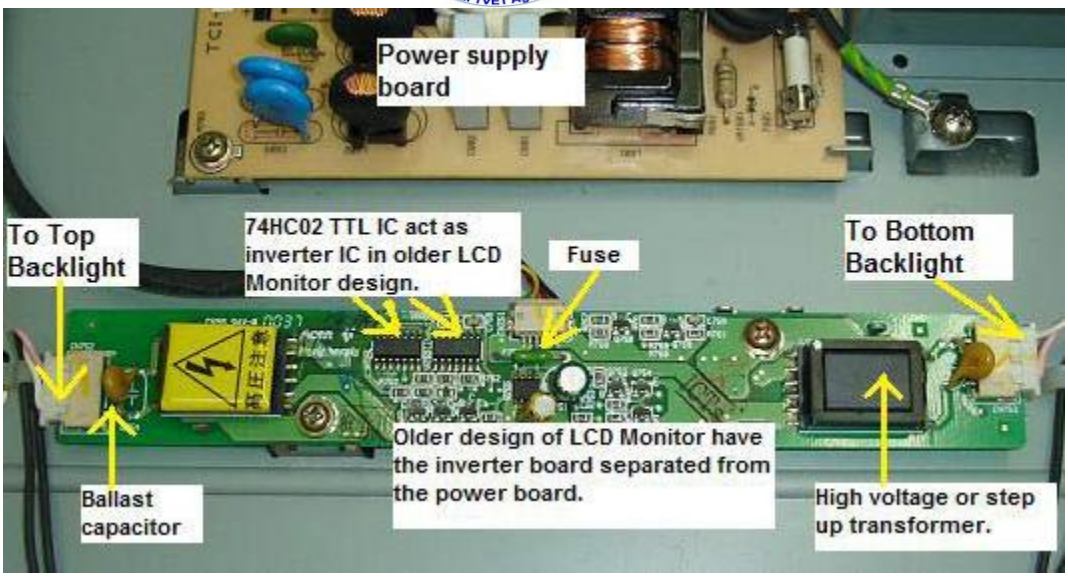
Crystal- The function is to keep the frequency of the clock from drifting. If the signal from this clock stops producing frequency, or is weak, or thepulses begin to vary or change, the LCD Monitor might show intermittent problems or might stop altogether. Make sure there are sine waveform when check with an oscilloscope.

Voltage regulator- Providing a constant supply of 2.5 V, 3.3 V and 5 Volts to all the IC's in the Main board and Controller board. A low or missing one of the supply voltages could cause no display and the power LED wouldn't light up too.

Understanding Inverter Board



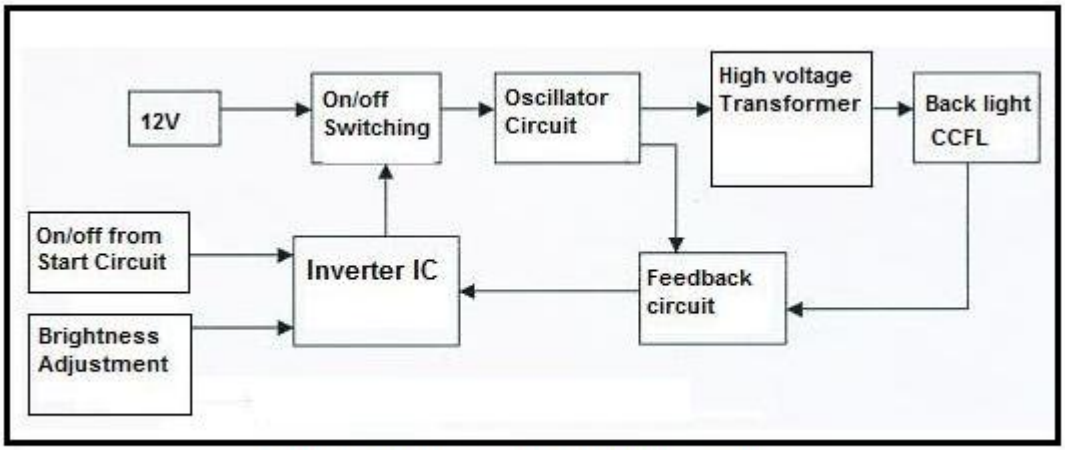
For a newer LCD Monitor design, the inverter board is joining together with the power board as shown in the above photo. Older LCD Monitor has the inverter board separated from the power board as shown below



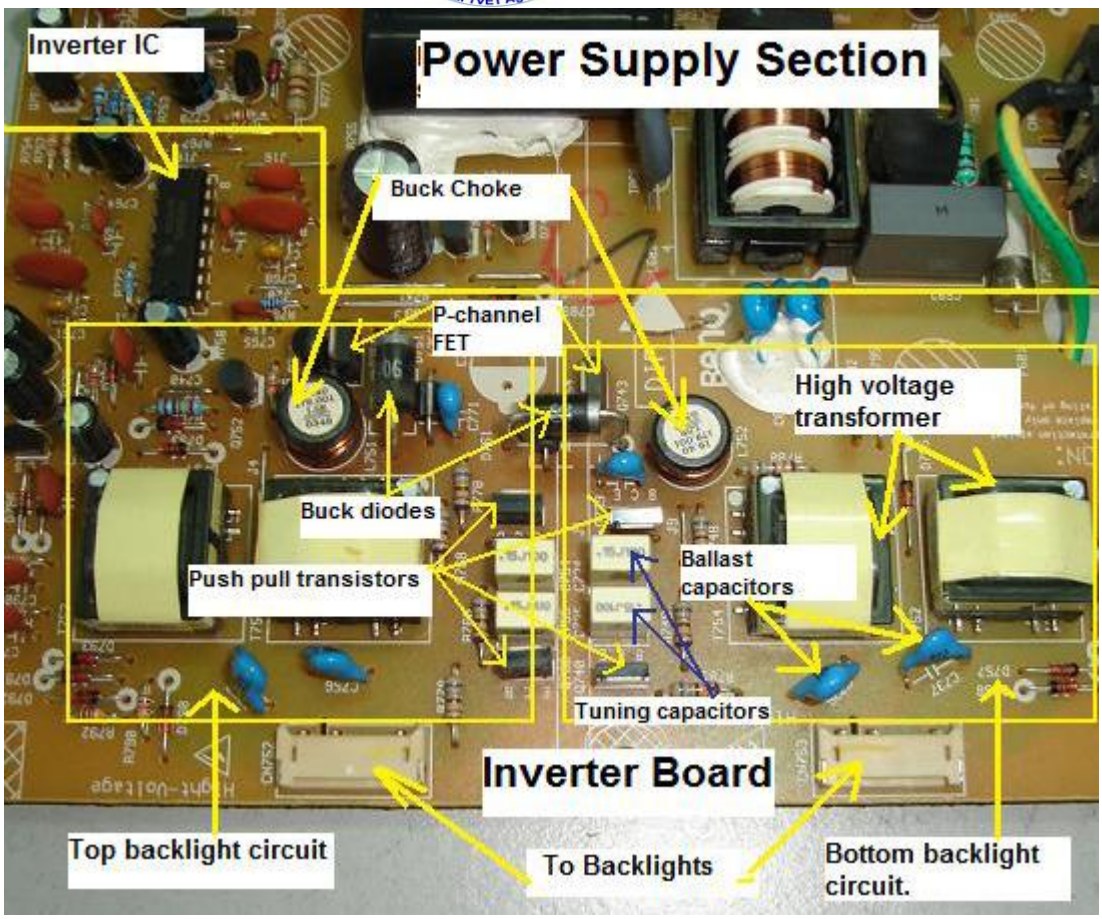
There are four types of inverter designs (topologies) used in the LCD Monitors.
1) Buck Royer inverter
2) Push pull inverter (Direct Drive)
3) Half bridge inverter and (Direct Drive)
4) Full bridge inverter (Direct Drive)

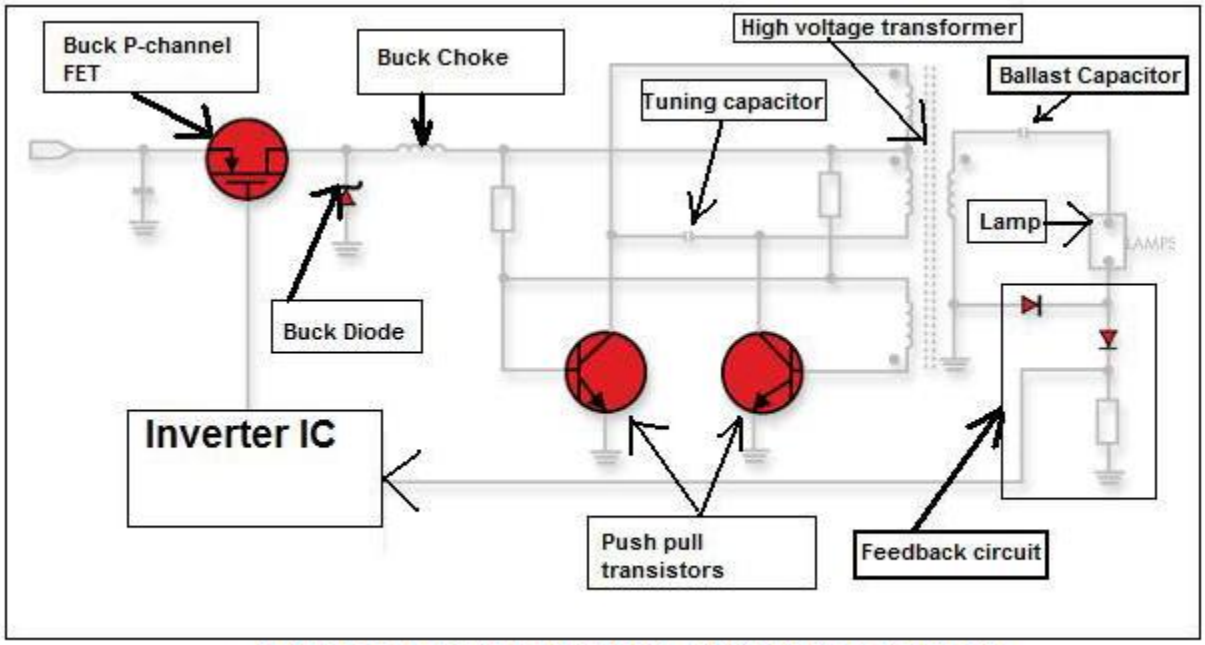
Number 2, 3 and 4 are called **Direct Drive** because it eliminates the need for the inductor (buck choke) and resonant capacitors found in a conventional Royer Oscillator. In other words, Direct Drive architecture reduces component count, lower production cost and most importantly improved transformer designs that optimize performance.

1) Buck Royer Inverter



Block diagram of Inverter circuit



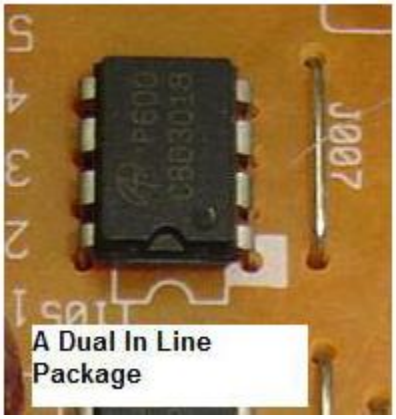


A basic schematic diagram of Buck Royer circuit

In order to drive the Backlights (CCFL lamps) embedded in the panelmodule, an inverter circuit is required to convert the 12 volt DC up to hundreds or even a thousand plus AC voltage output. The inverter is formed by symmetric circuitry, in order to drive

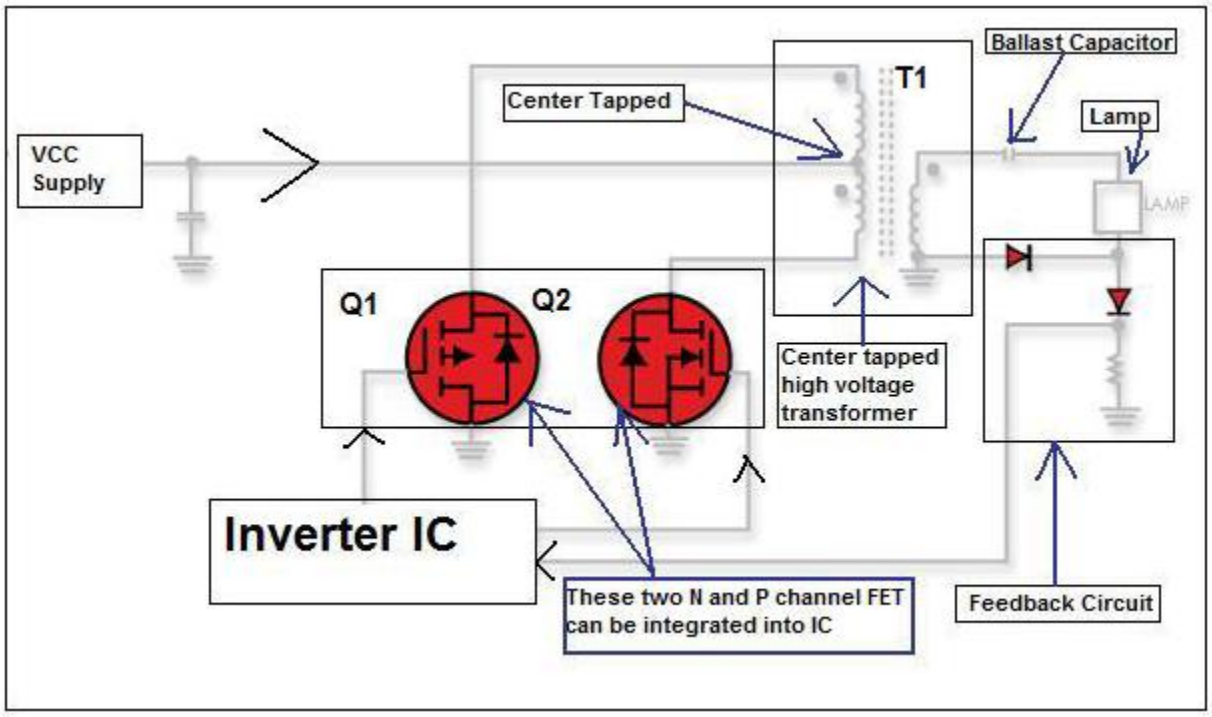
the separate lamp modules. The input stage (buck converter circuit) consists of Inverter IC (PWM IC), Buck P-channel FET, Buck Choke and Buck Diode. The Buck converter circuit converts a DC voltage to a lower DC voltage.
The other stage consists of a tuning capacitors, high voltage transformer,and push-pull transistor pair to boost ac output to hundreds of voltage. The ballast capacitor controls current amplitude through the lamp negative impedance by dropping an approximately equal voltage across its positive impedance. The feedback circuit is for protection purposes and will shut down the inverter IC just in case if the high voltage produced by the high voltage transformer exceeded the normal value and also it can detect bad or a flicker backlights. The inverter IC also used to control the brightness of the CCFL lamps. The AC frequency of the high voltage transformer is typically run at 30 to 70 KHz. The higher the frequency, the greater is the light output.

Note: Some LCD Monitor design has the Buck type P-channel FETintegrated into an IC thus in order to successfully testing them you can use the comparison method with another known good FET (comparing the ohms value between pins). The IC can be in Dual in Line package or SMD type.



The common Buck P-channel FET is FU9024N, J598 and etc. The SMDFET IC's are 4431, BE3V1J and etc. The common push pull transistors part numbers are C5706, C5707 and etc.

2) Push Pull Inverter (Direct Drive)

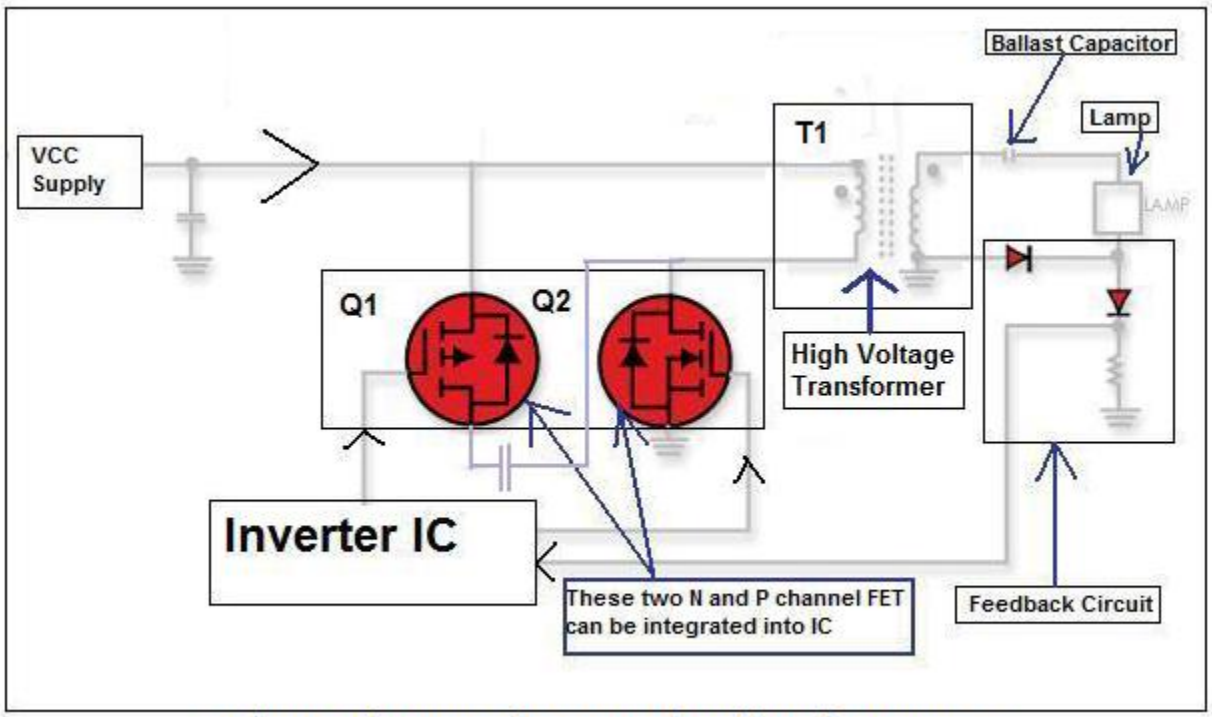


The push pull inverter shown above when Q1 switches on, current flows through the 'upper' half of T1's primary and the magnetic field in T1 expands. The expanding magnetic field in T1 induces a voltage across T1secondary. When Q1 turns off, the magnetic field in T1 collapses and after a period of dead time (dependent on the duty cycle of the PWM drive signal), Q2 conducts, current flows through the 'lower' half of T1's primary and the magnetic field in T1 expand. Now the direction of the magnetic flux is opposite to that produced when Q1 conducted. The expanding magnetic field induces a voltage across T1 secondary. After a period of dead time, Q1 conducts and the cycle repeats.

Note: the above diagram only showing a single channel IC that is driving the Q1 and Q2. Some inverter IC can have two channels in order to *drivetwo high voltage transformers. Each output from the transformercan drive more than one lamp.*

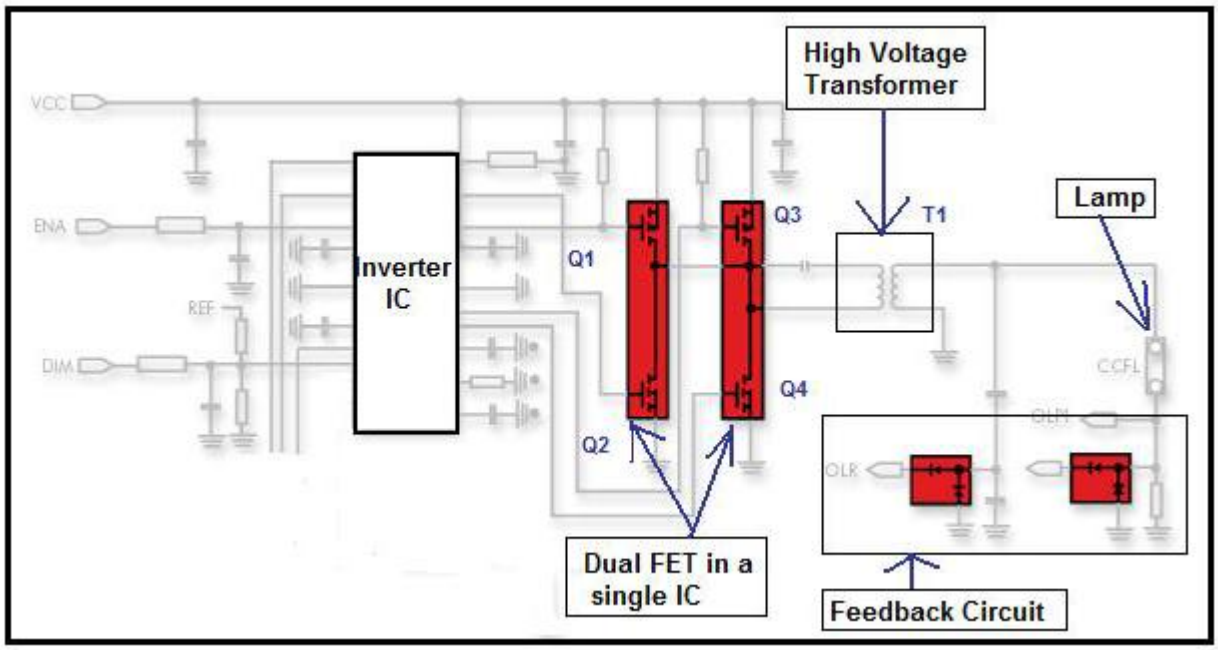
3) Half Bridge Inverter (Direct Drive)

The half bridge inverter is similar to the push pull inverter, but a Centre tapped primary is not required. The reversal of the magnetic field is achieved by reversing the direction of the primary winding current flow. This type of inverter is found in many LCD Monitor too. The control circuit of a half bridge inverter is similar to that of a push-pull inverter. This design has optimal utilization of transformer core and primary winding (one vs. two for push pull). The above diagram only showing a single channel IC that is driving the Q1 and Q2. Some inverter IC can have two channels in order to drive two high voltage transformers.



A basic schematic diagram of Half Bridge Inverter

4) Full Bridge Inverter (Direct Drive)

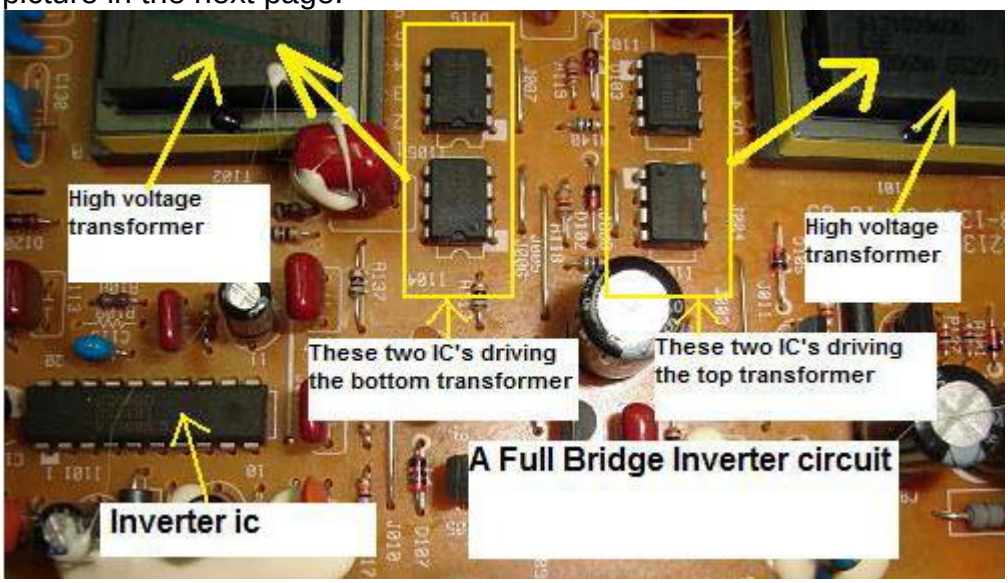


The full bridge inverter is similar to the push pull inverter, but a Centretapped primary is not required. The reversal of the magnetic field is achieved by reversing the direction of the primary winding current flow. This type of inverter is found in many latest LCD Monitors.

Diagonal pairs of transistors will alternately conduct, thus achieving current reversal in the transformer primary. This can be illustrated as follows - with Q1 and Q4 conducting,

current flow will be 'downwards' through the transformer primary and with Q2 and Q3 conducting, and current flow will be 'upwards' through the transformer primary. The control circuit monitors V out and controls the duty cycle of the drive waveform to Q1, Q2, Q3 and Q4. The control circuit operates in the same manner as for the push-pull inverter and half-bridge inverter, except that four transistors (FET) are being driven rather than two.

In some LCD Monitor like the HP1703 that uses the OZ960 inverter IC, the output from inverter IC can parallel out to drive another high voltage transformer as seen from the picture in the next page.



The full bridge inverter design has 4 IC's (each IC have two FET (N andP channel)) in it. Two IC's were used to drive each high voltage transformer.

Remember that the dual N and P channel Mosfet IC can bein SMD type or Dual in Line package.

Common faults found in inverter board

1. Dry Joints (Very common in the buck choke and high voltagetransformer pins)
2. Shorted or burnt high voltage transformers
3. Shorted or leaky push pull transistors
4. Capacitance value open (out) in tuning capacitors
5. Shorted buck P-channel FET
6. Inverter Pico fuse open circuit or turned high ohm
7. Ballast capacitors value out causing shutdown and brightnessfluctuate
8. Burnt pins or loose connection in the backlights connector

Surprisingly the inverter IC's are very robust and seldom fail. Somecommon part numbers for inverter IC's are TL1451ACN, 0Z960, 0Z962, 0Z965, BIT3105, BIT3106, TL5001 and etc.

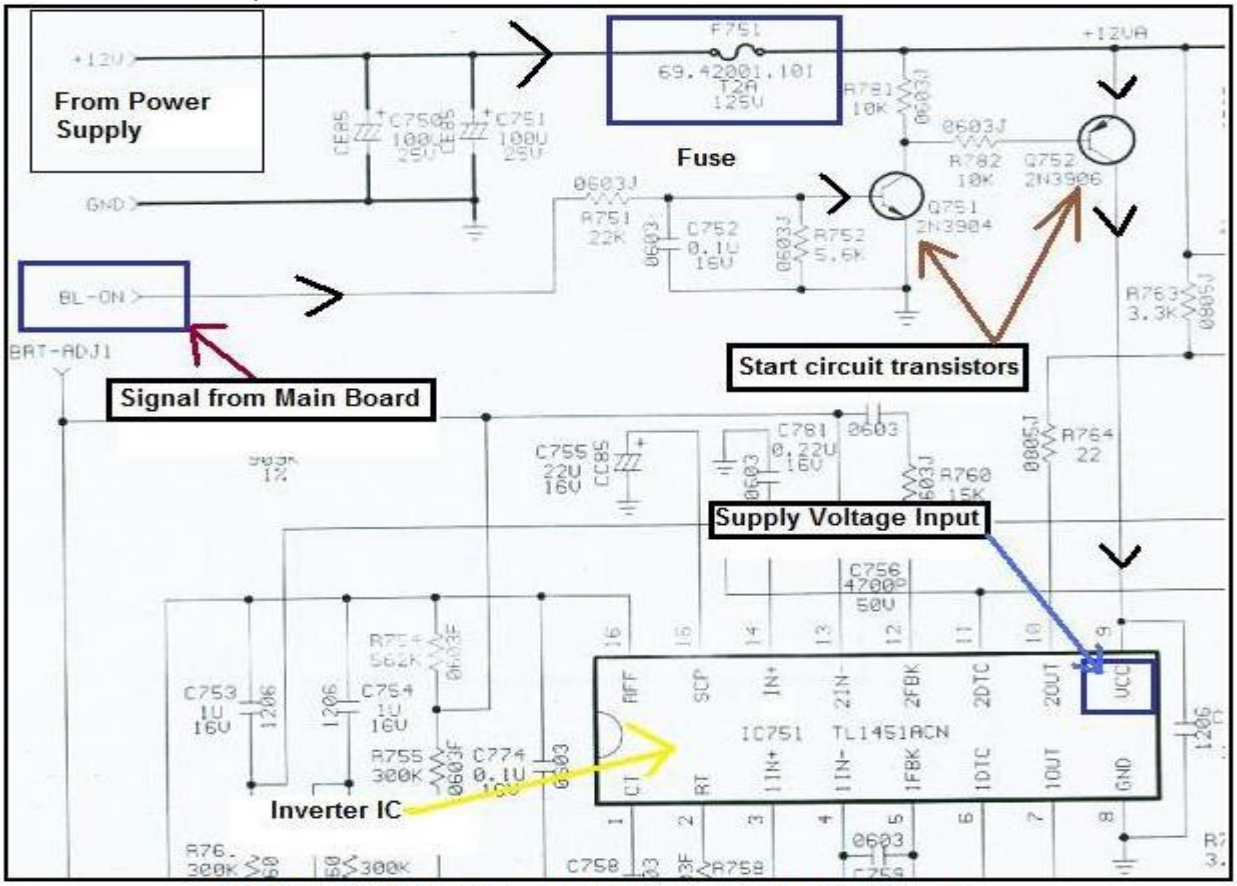
Understanding the Start Circuit

Most of the LCD Monitor has a Start Circuit to control the voltage fromthe power supply to the supply pin of Inverter IC. The main control signal comes from the Main board and the voltage is from 0 and few Volts (2- 5 Volts).

If the signal is Zero Volts, then the inverter IC would not receive any supply voltage from the power supply and if the signal is 2 Volts (On) then the inverter IC would be “On” and the high voltage transformer would energized and the backlights will light up.

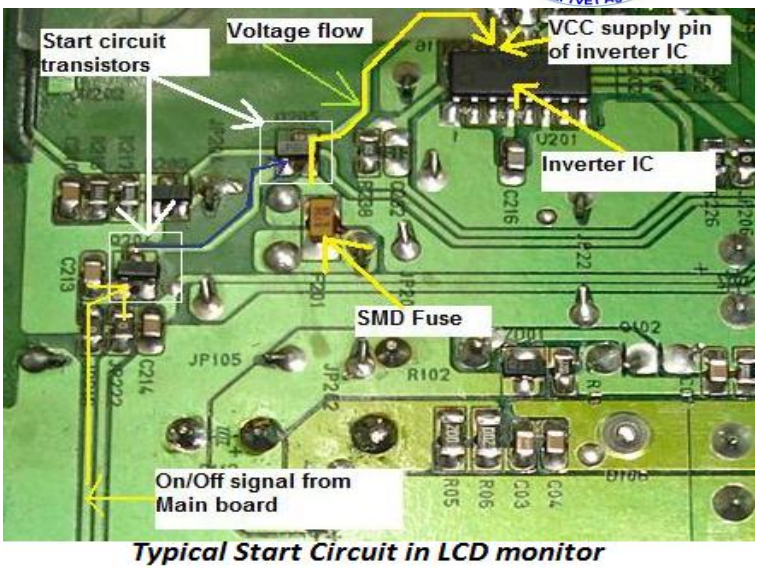
The Start Circuit is a good starting point to diagnose why the LCD Monitor has no display, display shutdown and intermittent no display problem.

Let’s take a look from the schematic diagram below how this Start Circuitworks. Whenever a good LCD Monitor is turn “ON” (assuming the VGA connector is already plugged into the Computer system CPU) the Main board would first send out an “On” (BL-ON) signal (about 2 to 5 Volts depending on the LCD Monitor designs) to the base of Q751. The ON signal caused the Q751 to turn ON and this lead to Q752 also ON. Thus the 12 Volts could flow from the emitter and out at the collector pin andreach the VCC (supply) pin of TL1451ACN (Inverter IC). F751 is a Pico fuse (some is SMD fuse) and rated at 2 Amp 125 Volt.



A Start circuit schematic diagram in LCD monitor

If the Main board didn’t send the “ON” signal (due to problems in Mainboard) to the base of Q751, the transistor Q752 would not turn “On” thus no voltage will flow to the VCC (supply) pin of the inverter IC causing no display in LCD Monitor.

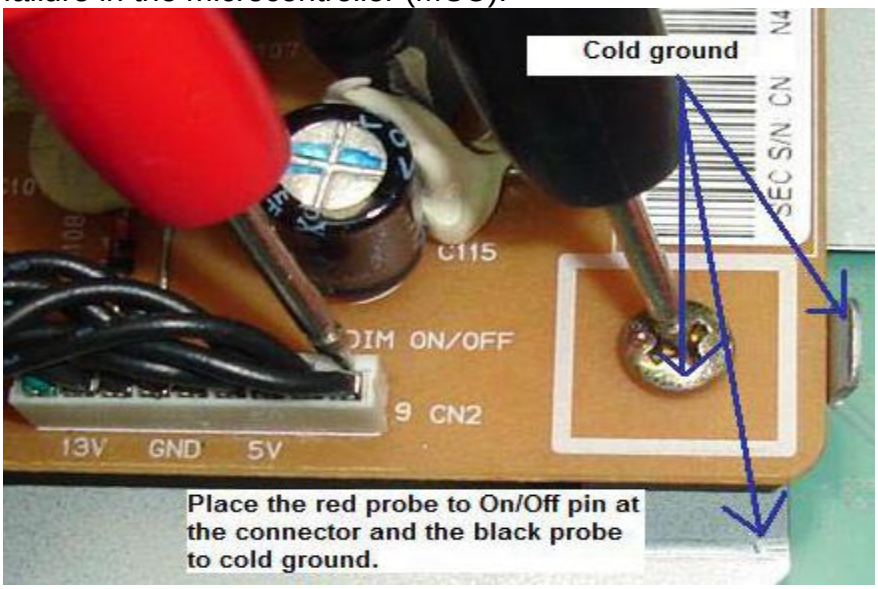


Typical Start Circuit in LCD monitor

Other designs may use the C945 and A733 as the combination pair inStart Circuit while some design like the Samsung 153V used the A6J (PNP digital transistor) and the A8J (NPN digital transistor) as shown in the picture below. Both transistors are digital transistors and it have resistors (4k7 + 4k7) built into the transistor.

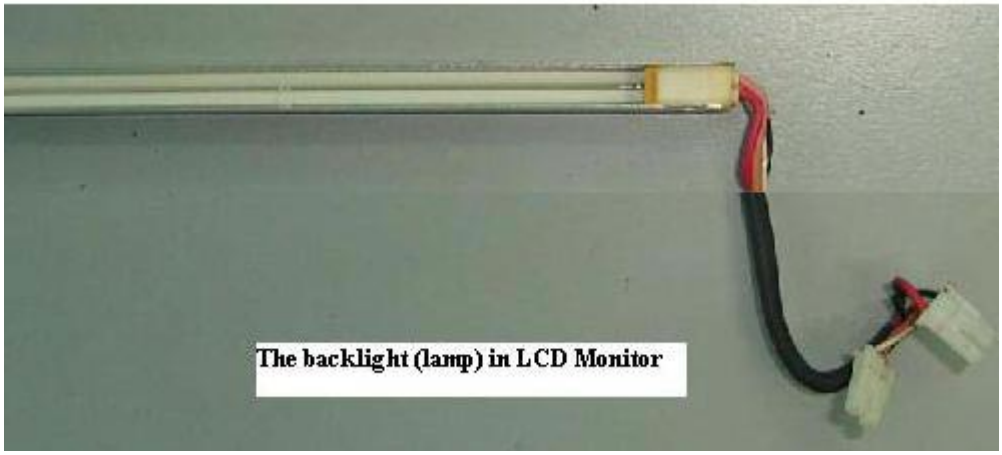
You may ask how to diagnose LCD Monitorproblem that have power but with no display symptom? Actually it is very easy to check if the problem is in the Main board, Start Circuit or even in the inverter IC itself.

Place the red probe of your digital meter to the On/off pin as shown in thephoto below then the black probe to any cold ground. Now switch “ON”the LCD Monitor and look at the voltage. If there is a voltage (say 2 to 5 Volts) you can confirm that the Main board is working and sending a right signal. If no voltage measured by the meter then this indicates the Main board is having problem. Samsung LCD Monitor with the models of 153V, 173V, 510N, 710N, 713N and 910N are very famous for no display problem (not sending the “On” signal) and intermittent no display problem and was caused by a failure in the microcontroller (MCU).



Next if there is an “ON” signal then expects about 9 to 12 Volts at theVCC supply pin of inverter IC. If there are input signal to the base of the Start Circuit transistor and no output to the inverter supply pin, suspect defective components in the Start Circuit area or even a faulty Pico fuse preventing the supply voltage from flowing to the inverter IC.
Do not overlook that a shorted inverter IC may pulling down the supplyvoltage to a very low value if the fuse did not open circuit. If possible, direct replace the inverter IC and retest the LCD Monitor again. For an intermittent no display problem you could actually see from your meter that the On/off signal voltage is rising and falling and this is a clear sign of the microcontroller (MCU) fault. Do more practical testing on a good LCD Monitors and it would not take you long to find out if the fault is in the Main board, Start circuit or in the inverter circuit area.

Understanding the Backlight (Lamps)

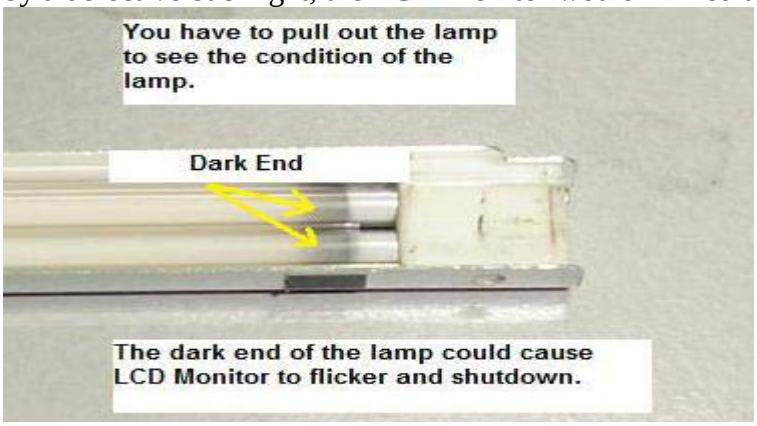


The LCD panel itself cannot emit light. Therefore, a backlight system thatsupplies the light from behind is normally required. The backlight system consists of a light emitting device that produces light, a conductor panel that distributes the light to the entire LCD surface uniformly, and a power supply that drives the light emitting device. Backlights can comes in many types of lengths and shapes too.
Currently, the most commonly used light emitting device is a fluorescenttube called a cold cathode tube or CCFL. The CCFL is called a cold cathode tube because even though the principle of illumination is the same as that of the hot cathode tubes used by indoor lamps, this lampdoes not require preheating of the filament.
Also, the electrodes at the end of the bulb stay at a low temperature whileemitting light. CCFL also enjoy a long life (approximately 50,000 hours) without serious degradation. A special power supply, inverter, which generates approximately 600 to 1000 AC is required to drive a CCFL. This inverter is a small power supply used to make this CCFL illuminate, and is one of the important functional parts of a complete LCD display.

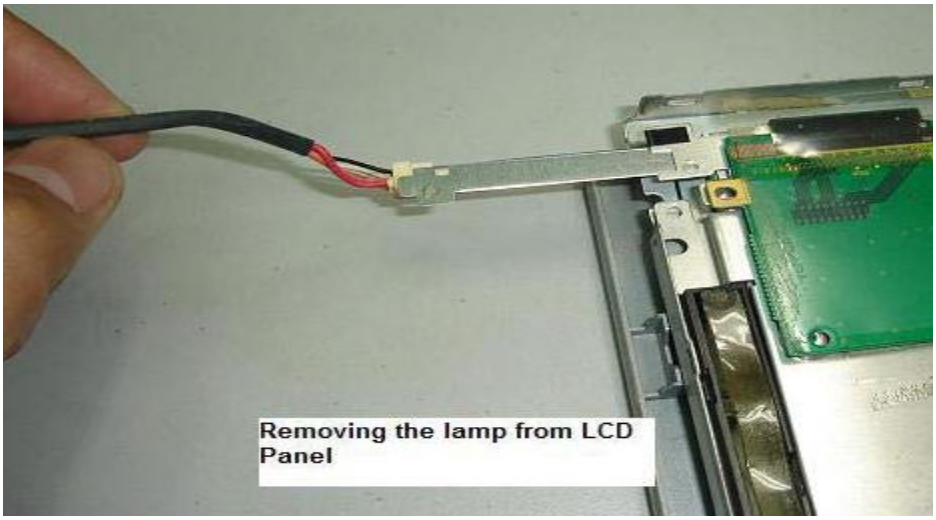
Display Flicker and Reddish

Normally a reddish display and display flicker in LCD Monitor were caused by one of the defective backlight (either top or bottom backlight). For those LCD Monitors that do not have the feedback circuit in the inverter board, even though the backlight have problem the LCD Monitor continue to work and never shutdown. This is totally different in LCD Monitors that

have the feedback circuit in the inverter board because even a slight flicker in the display caused by a defective backlight, the LCD Monitor would immediately shutdown.

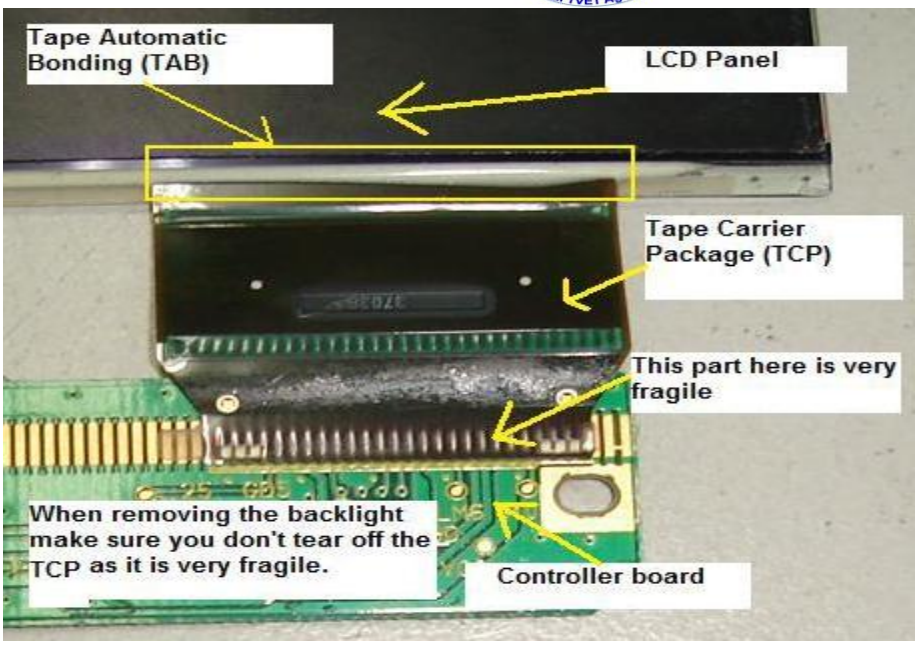


Replacing Backlight



In order to successfully replace the backlight you must gently pull out thebacklight together with its casing as shown in the photo above. Some backlight can be easily removed while some were tough. For those backlight that had been totally sealed up, you must be careful when retrieving the back light.

Note: don’tdamage the tape carrier package (TCP) when removing a backlight. If TCP damagedthen the LCD panel can’t be use anymore because the display has a thick black bar at the side of the display. The TCP is very fragile and you should put more attention to it when you try to disassemble the LCD panel in order to check or replace the backlight.Once the TCP broken there is no way to repair it.



Questions related to the backlight

1. ***How do we know if a backlight is good or bad?***

By using another known good backlight either from a new backlight you bought as a spare or from another working LCD Monitor. If the backlight connector is compatible, just connect it and test. If the display is reddish or have flicker chances are high is the backlight fault. Again you have to remove the backlight and see if there is any dark end or not.

2. ***Can I install a 15" backlight into a 17" LCD Monitor?***

Yes you can, but the top and bottom display would not properly covered up (due to the 15" backlight is shorter than a 17" backlight) and you could see some darker area at the edge of the display.

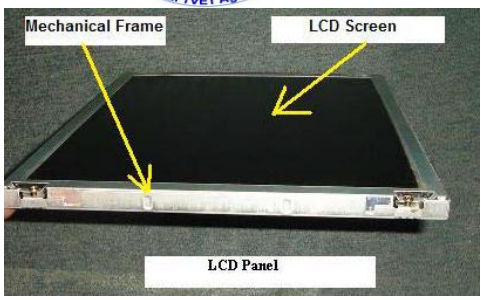
3. **Can I replace a backlight from other brands of same size LCD Monitors (assuming from a 15" to 15" LCD Monitor)?**

Yes, you can but again you have to check the **intensity** of the backlight from other LCD Monitor even though it is the same size of Monitor. If the replacement looks a little bit darker compare to the original backlight (assuming you have replaced the top backlight) then you may have to replace the bottom backlight too (even though the bottom backlight is good) for balance of light intensity purposes. You can keep the bottom backlight (the good backlight) for future use.

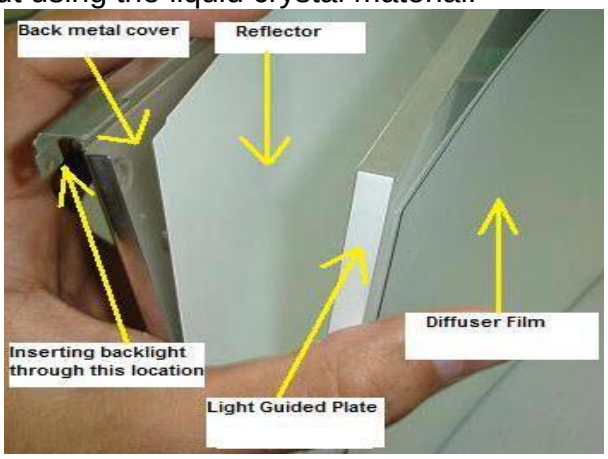
Warning!

Please do not touch on a broken lamp with bare hands as it contains mercury. Mercury is known to be very poisonous to our human body!

Understanding LCD Monitor Panel



The LCD panel consists of Mechanical frame, Controller board, Tapecarrier package (TCP), Tape Automatic Bonding, LCD Driver IC's, Backlights (lamps), Polarizer, Diffuser film, Light Guide Plate and Reflector film. The whole purpose of the LCD panel is to controls light throughout using the liquid crystal material.

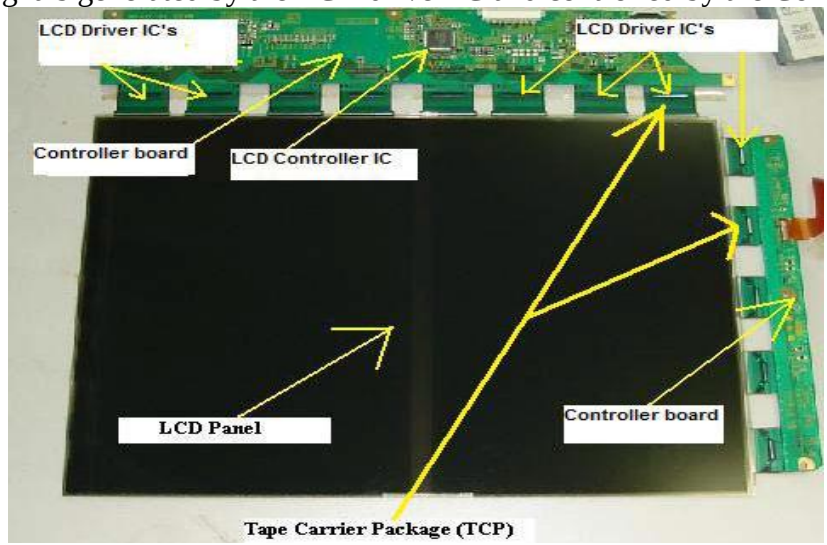


Mechanical frame

Provides mechanical housing to hold LCD panel and to help in reducing the electromagnetic interference (EMI).

Controller Board

The purpose of the Controller board is to accept additional display information from the MAIN Board and then drive the column driver transistors and row driver transistors as to which pixel in the LCD panel should light or off. These driver transistors in the LCD panel are operated by digital control signals generated by the LCD driver IC and controlled by the Controller IC.

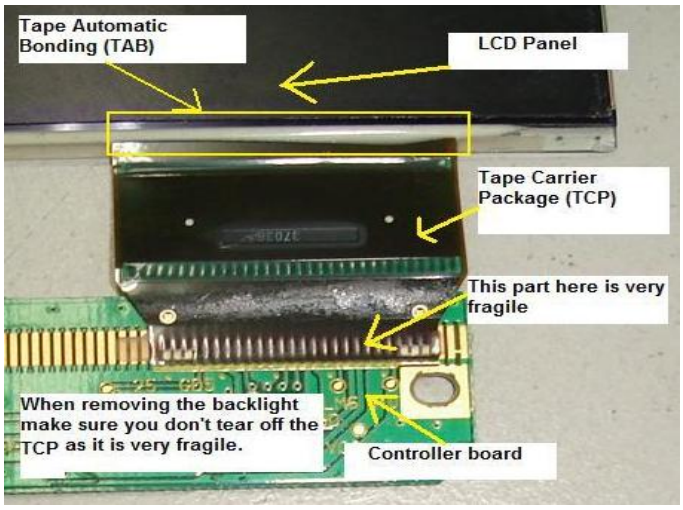


Tape Carrier Package

Tape Carrier Package (TCP) package provides both mechanical and electrical support to the LCD driver semiconductors (IC's) between the LCD panel and the driving module for the application in flat panel displays.

Tape Automatic Bonding (TAB)

Tape Automated Bonding is an interconnect technology between the substrate (In LCD Screen) and the IC (in TCP); using a prefabricated carrier with copper leads adapted to the IC pads instead of single wires.



Backlight

Generate a consistent, uniform light source. The light generated from the backlight focused through the LCD.

Polarizer

A polarizer is a thin film that allows light to pass in only one orientation. In between the polarizer films contains the Colour filter, Colour filter glass, Liquid Crystal and TFT glass.

Diffuser film

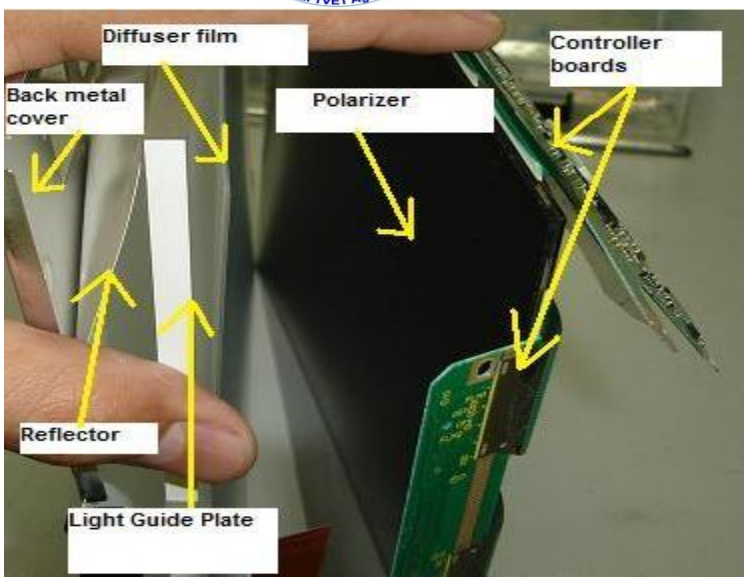
Diffusion films are used in the manufacture of LCD panels to ensure that the display illumination is uniform, with as much light as possible reaching the viewer.

Light Guide Plate (LGP)

Light guide plates uniformly distribute light from the backlights, which are installed at the top and bottom of displays, over the entire screen.

Reflector Film

Receive light from Backlights to redirect the light into the light guide plate



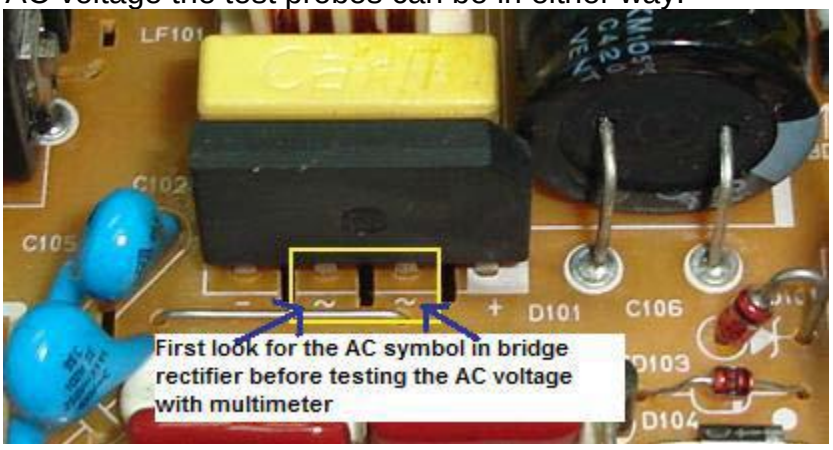
Replacement of LCD Panel

If the LCD panel has problems such as cracked, white display, rainbow colours, bad controller board, one or few vertical lines, big horizontal black bar across screen, broken TCP and etc, the only way to solve it is to replace with a similar type of LCD panel. You can't replace with a different type of LCD panel because the specification is different in terms of connectors, signal flows, voltage and etc.

LCD Monitor Critical Voltage Test Points

Critical voltage test points are the fastest way to determine at where the faulty section or even faulty components located.

First locate the bridge rectifier and then place the test probes across the AC pins. Hold the test probes tight so that it won't slip away and touch on other pins. Since you are measuring the AC voltage the test probes can be in either way.



If you get a reading of about 230 Volts AC thenthis proved the presence of AC voltage from the AC outlet and the fuse is working. If it is zero volts then you have to check the circuit before the bridge rectifier. It could be a bad fuse; the AC outlet was not turned "On", loose connection, broken AC cable and etc.

Testing the filter capacitor voltage

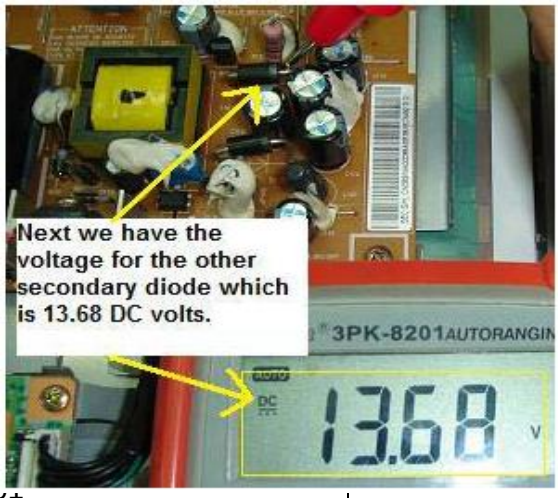
Once you have confirmed that the bridge rectifier has AC supply input, you should now expect about 300 Volts DC present at the pin of the filter capacitor. Please make sure you hold tight to your test probes and carefully touch on the capacitor pins. If you accidentally touch the pins while doing the test, it might generate a great spark and blow the power section. If you don't have the confident to do the job get a repair friend to help you out.

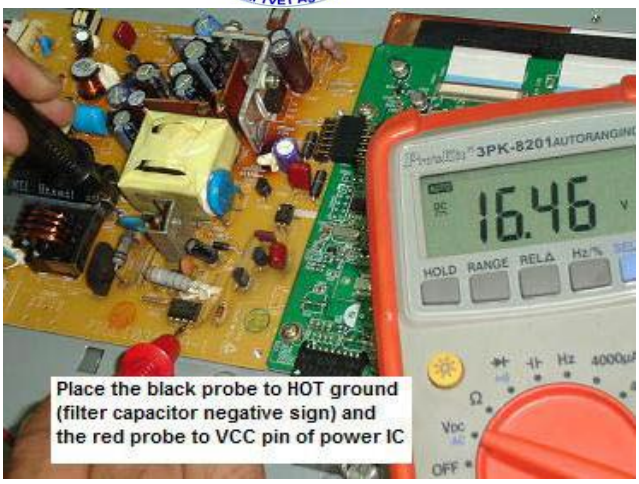
*The black probe has to be at the negative pin side and the red probeto positive side*as shown from the photo. You get DC voltage becausethe bridge rectifier already converted it from AC supply. If you get theexpected DC voltage then move on to test the supply voltage of the power IC, if not troubleshoot the area to locate if there is any problem with the circuit like dry joints, broken track and etc.

Testing the supply voltage (VCC) of power IC

First locate the VCC pin of the power IC from the data book or from the internet. Once you have found the VCC pin, now place the red probe to the VCC pin and the black probe to HOT ground (primary filter capacitor negative pin) and switch "On" the power. Youshould get a DC volt reading from 16 to about 20 volts (depending onLCD Monitor designs). In the below photo, we got 16.46 DC volts.

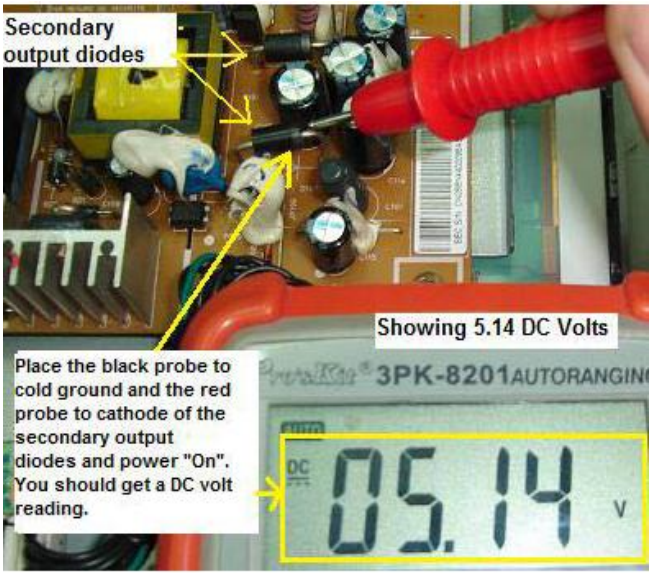
If you get the right voltage this mean that the bridge rectifier, filter capacitor and the startup resistors is doing its job and you should now perform the next test. Don't waste unnecessary time changing the bridge rectifier, filter capacitor or even checking the resistance value of startup resistor.





Testing the secondary output voltages

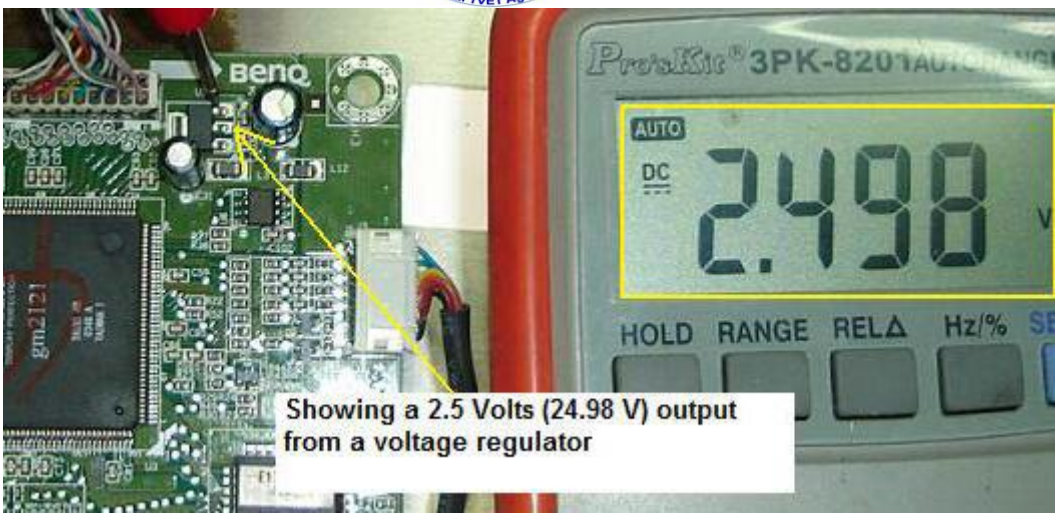
Just place the red probe at the diode cathode side and the black probe to cold ground (the chassis ground) and power "On". You should get a DC volts reading from all the secondary output diodes.



Using our common sense we can conclude that since we got the rightoutput voltages at the secondary side, this clearly indicates that allthe components or the primary side of the power supply is functioning. If you spend your time testing the components in the power side, you are justwasting your time.That's why there is a good advantage of performing the voltage testing to confirm which parts in the LCD Monitor is having problem.

Since there is correct voltages presence at the secondary outputs, yournext step would be finding faults that are located after the secondary output diodes.

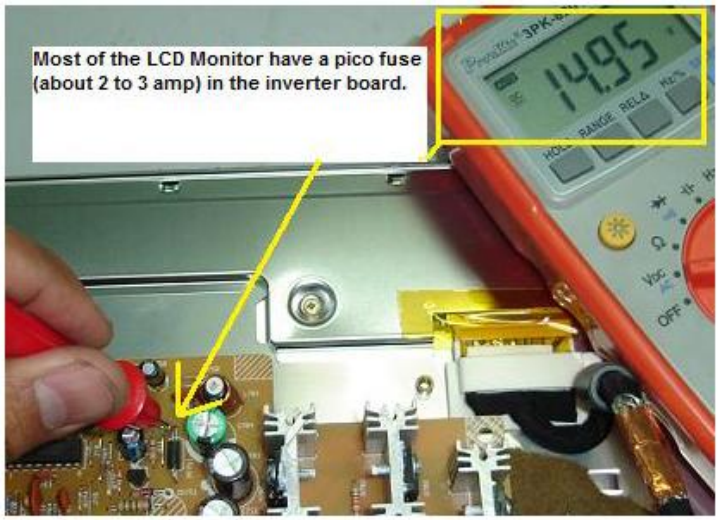
Testing the voltage regulator



If the output voltages are good, next you have to test the supply voltage tothe Main board. Look out for a 3 pin IC and most probably it is the voltage regulator that supplying voltage to the Main IC's. Just place the red probe to the output of the voltage regulator (normally pin 3 is the output pin) and read from the meter. If it show 2.5 V or 3.3 Volt then the voltage regulator is good. If not you have to start troubleshoot backward from the input pin (pin 1) and sometimes the voltage regulator itself can be defective too!

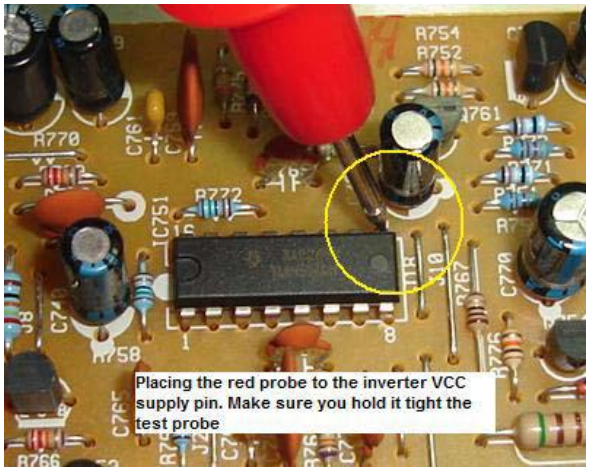
Testing the Inverter Board

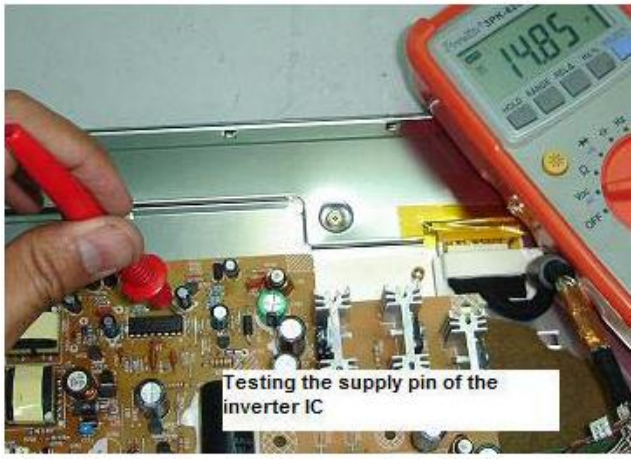
In order for the inverter board to function, the inverter IC must first receive a supply voltage (VCC) from the power supply. The voltage is somewhere from 12 to 16 Volts DC (depending on the design of the LCD Monitor) and also supplying to the Buck Royer circuit and the transformer. If the voltage is not present or too low for the inverter IC, the LCD Monitor would not have display (dark display) or even intermittent shut down. Thus it is important to make sure that the inverter IC must receive a steady voltage from the power supply.



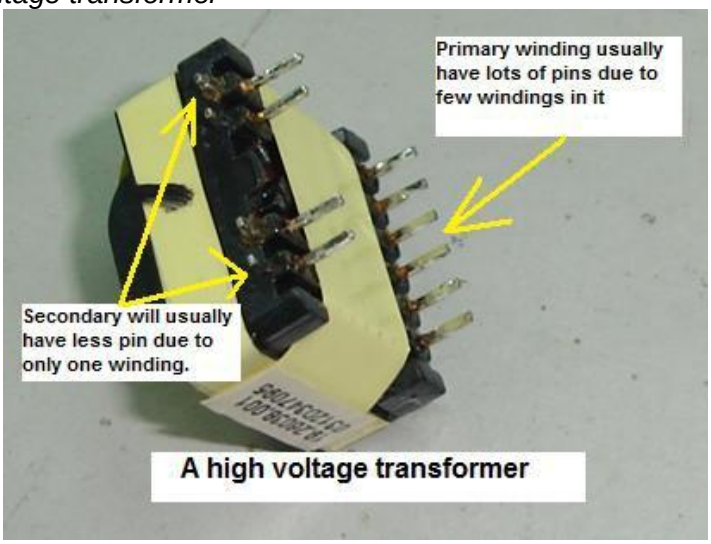
Place the red probe to the Pico fuse and black probe to cold ground. Read from your meter and it should have a DC volt. If there is low or no voltage, suspects the defective Pico fuse and the secondary diode or even the power supply. Sometimes a shorted component upstream (further down the electronic circuit) may have dragged down the voltage. Lift up one leg of the fuse and retest again. If you got a normal voltage then this proved that the upstream circuits or components have problem.

Now, assuming if you get the right voltage at the supply pin of inverter IC then this proved that the Start Circuit and the Main board are working fine.If you get zero volt and the Pico fuse haveabout 12 to 16 volts then suspect a faulty Main board (not sending the“On” signal to Start Circuit) or even the Start Circuit itself have problem.

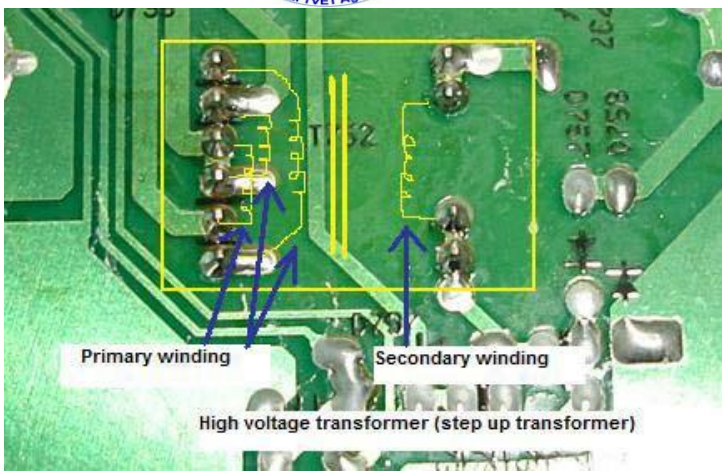




Testing the high voltage transformer



Testing LCD Monitor high voltage transformer is like checking powersupply SMPS transformer. Why it is called high voltage transformer? It is because the transformer is a step up transformer that mean it step up AC input voltage from 10 to 20 over volts to several hundred AC output voltage! There are 3 ways to test the transformer, you can use the resistance test or with the help of a flyback tester which is more accurate in finding shorts between winding or even you can perform the voltage test.

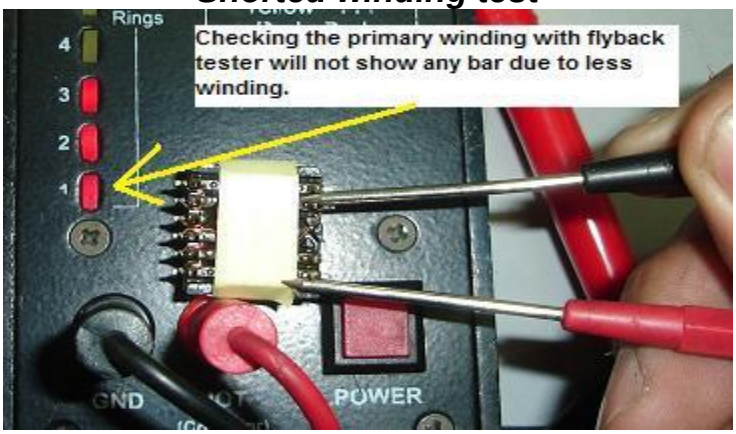


Resistance test

The primary winding have less winding thus the resistance is very low(most meters will show zero ohms). The secondary have more winding thus the resistance is higher than the primary side. Ohmmeter only showing whether is there any broken winding in it or not and it is not agood meter to test shorted between windings turn. You need the flyback tester to test shorted between winding turns.

Make sure also that you set your analogue meter to X10 Kilo Ohms to measure between the primary and the secondary winding. It has to be no reading; if you got any reading that's mean there is an internal short circuit between the primary and the secondary winding. *For a burnt orshorted transformer, the only way to solve it is to replace with a newtransformer.*

Shorted winding test

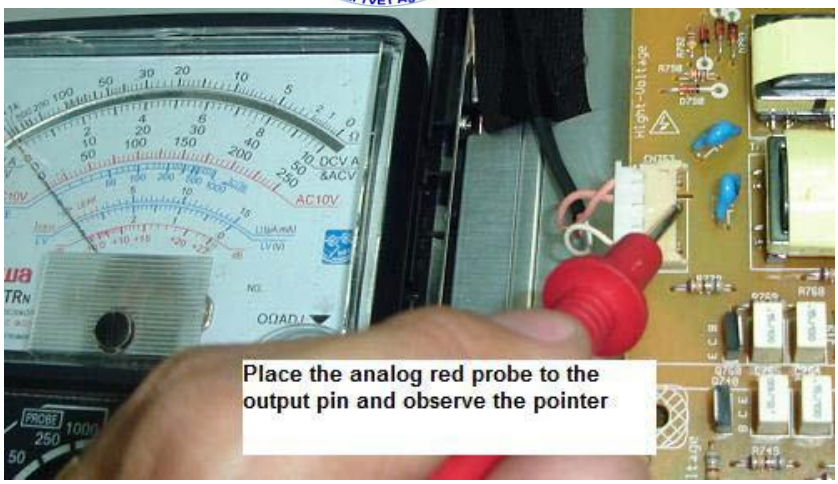


Getting a good resistance measurement does not mean that thetransformer is good. You need to perform the shorted winding (turn) test with a flyback tester in order to confirm that the winding is indeed good.Primary winding seldom shorted but secondary winding have the higherchance due to more turns in it. Simply place the flyback tester across thesecondary winding and read from the LED bars.

Depends on transformer windings some good one will light up the 1st LED and the second LED will blink. Some will light up the 2nd LED and the third LED will blink and to some it will light up the 3RD LED and the fourth LED will blink. These are the good measurement of high voltage transformer. If you get no reading at all, then most probably the transformer winding has gone shorted.

Voltage test

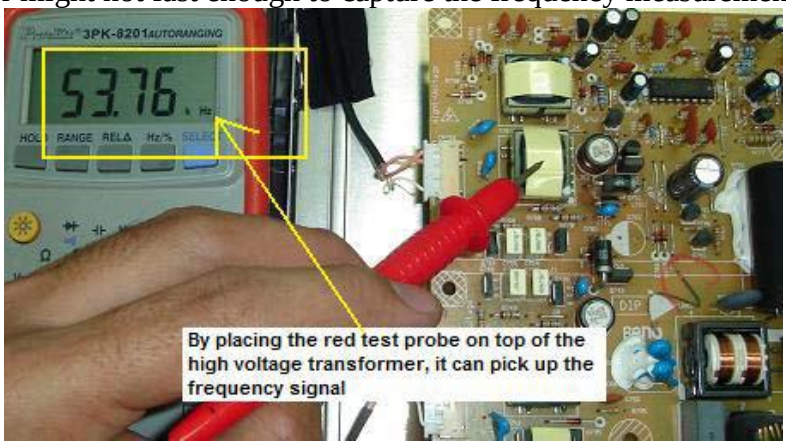
The third test is to perform voltage measurement on the output pin of the transformer. Switch "On" the LCD Monitor and set your analogue meter to 1000AC range. Hold the red test probe and quickly touch on the pin of the backlight connector as shown from the photo in the next page. The moment the probe touch on the pin, you could clearly see that the meter's pointer kick up very fast. You have to release the probe fast otherwise the LCD Monitor will go into shutdown mode due to the feedback circuit had detected unusual changes in the output voltage. For the black probe just leave it and no need to connect to cold ground.



If you could see the pointer moved up very fast, this is a good sign thatthe transformer is working fine. Again if the inverter IC have problem, the transformer would not be energized and you cannot use this method totest it. After few LCD Monitors has come across your repair bench, I'm sure you will know which methods to use to test the transformer.

The Frequency Test

There is another unique way to test if the inverter board or the transformer is working or not. Just place your digital meter red probe on top of the transformer and select the frequency test (make sure your meter have the capability to measure higher range of frequency) and the meter will pick up the frequency. This again proved that the transformer is working and the best is still doing the voltage test. The disadvantage of this way is that if the LCD Monitor have shutdown problem, the meter might not fast enough to capture the frequency measurement.



Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. The basic components of Public adders system:

A, Microphone, FM Transmitter and speaker B, Microphone, AM receiver and speaker

C, Microphone, FM receiver and speaker D, Microphone, Amplifier and Speaker

2. Which one of the following device is used for converting acoustics sound energy to electrical energy is?

A, speaker B, transmitter C, microphone D, amplifier

3.Tuner section of TV set comprises of :

A Rf amplifier B Local oscillator C. Mixer D. All of the above

4. What is the reason tuner is mounted on a separate sub-chassis?

A. To avoid signal interference B. To increase signal interference

C. A&B D. None of these

5.which mechanism is used to drive the disc in a circular motion?

A, Optical drive B, Loading and unloading C, disc drive mechanism D, All of these

6. If a multimeterreading of spindle motor is Lower resistance this indicates

A, open B short C both short and open D None of these

Answer Sheet

Note: **Satisfactory rating - 3 and 5 points** **Unsatisfactory - below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Answer sheet

Name: _____ Date: _____

Information Sheet- 2	Verifying repair/ maintenance history in line with the company procedures

- Verifying repair/ maintenance history in line with the company procedures

A **repair history** is a **record** of the work repair or maintenance work that has been carried out on audio video product and system. A full **service history** denotes the complete collection of these repair and maintenance documents, with every **service** carried out as per the manufacturer's requirements

Repair history is a chronological list of all maintenance performed on an asset. Synonymous with equipment repair history and maintenance record. Keeping

equipment at optimum working condition minimizes the risk of having unscheduled downtime. If maintenance is needed, it's important to keep a comprehensive record - whether scheduled or unscheduled - to help you understand the importance of your equipment's upkeep works. Maintenance records of work equipment are a key part of health and safety management, requiring efficient storage and management. Paperwork is often kept for extended periods of time for health and safety or compliance purposes.

Customers are the richest potential source of information about what is wrong and where the trouble is. Competent troubleshooters always talk to the customers when available. customers are with the equipment when the trouble occurs, and they generally know what the customers and the equipment were doing when it happened. The client can provide indications of the problem by describing what happened that was different from normal operation. This information may tell the competent troubleshooter a great deal about what is wrong and where.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. A repair history is a record of the work repair or maintenance work that has been carried out on audio video product and system.

a)true b) false

2. Customers are the richest potential source of information about what is wrong and where the trouble is.

a)true b) false

3. Maintenance records of work equipment are a key part of health and safety management, requiring efficient storage and management.

a) false b) true

Answer Sheet

Note: **Satisfactory rating - 3 and 5 points** **Unsatisfactory - below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Answer sheet

Name: _____ Date: _____

1)a2)a 3)b

Information Sheet- 3	Acquiring **service manuals** and ***service information*** required for repair/maintain as per standard procedure

- Acquiring **service manuals** and ***service information*** required for repair/maintain as per standard procedure

Service manuals are the manuals provided by manufacturers which cover the servicing, maintenance and repair of their products. They were not originally offered to the public as they were developed for the dealerships so that their mechanics were able to fix their own products.

If you have a maintenance manual, using it to make repairs or do maintenance on equipment can make the job much easier and more efficient. Most manuals are self-explanatory, but here are some tips on getting more out of yours.

When we use the service manual the following steps will be followed:

Step1 Make sure you have the right manual in front of you.

Step2 Look for specific sections detailing the type of service or repair you are going to perform**.**

Step3 Read the section which describes the task you are undertaking before you actually start. This will help you understand what is involved and what tools you'll need to have on hand.

Step4 Follow instructions carefully when performing any maintenance until you are familiar with the procedure**.**

Step5 Look for specific warnings.

Step6 Look for references to specific tools, gauges, or other specialized equipment required to perform your maintenance or repair.

Schematic diagram: is a **drawing** showing all significant components, parts, or tasks (and their interconnections) of a circuit, device, flow, process, or project by **means** of standard symbols. **Schematic diagrams** for a project may also be used for preparing preliminary cost estimates. Schematic diagrams may also be used to explain the general way that an electronic functions without detailing the hardware or software used in the actual electronic.

Parts list:

Parts list is known as a bill of materials (BOM) is a tabular list of the items used to make an assembly. Parts list is usually combined with the assembly drawing, but it is a separate and individual document and can be and provides a complete list of all parts needed to build the complete project.

The four elements listed below is the most common items and placed in the assembly drawing. The information associated with the parts list generally includes:

1. Item number: are based on the assembly structure, that is, the order in which parts are displayed in assembly.

2. Part number: is a reference back to the detail drawing.

3. Description: is usually a part name or a complete description of purchase part or stock specification, including size and dimensions.

4. Quantity: The number of that particular part used on this assembly.

Operating instructions/User's/Owner's manual

User documentation, be it called a **user manual**, **user** guide, or other, is usually provided to customers once they buy a product or services. The User Manual contains all essential information for the user to make full use of the information system. This manual includes a description of the system functions and capabilities, contingencies and alternate modes of operation, and step-by-step procedures for system access and use. An owner's manual is an instructional book or booklet that is supplied with almost all technologically advanced consumers.

Information contained in the owner's manual typically includes:

- Safety instructions; for liability reasons these can be extensive, often including
- Assembly instructions; for products that arrive in pieces for easier shipping.
- Installation instructions; for products that need to be installed in a home or workplace.
- Setup instructions; for devices that keep track of time or which maintain user accessible state.
- Instructions for normal or intended operations.
- Programming instructions; for microprocessor controlled products such as VCRs, programmable calculators, and synthesizers.
- Maintenance instructions.
- Troubleshooting instructions; for when the product does not work as expected.
- Service locations; for when the product requires repair by a factory authorized technician.

- Regulatory code compliance information; for example with respect to safety or electromagnetic interference.
- Product technical specifications.
- Warranty information; sometimes provided as a separate sheet.

Service Information was a regular programme used to gave out technical information for the technician. Service information include the following basic points:

Job report sheets: **is** blank quantity for the worker to fill up during or after performing the **job**.

A **bill of materials** (BOM) provides a list of all the raw materials or components, sub-components, assemblies, and sub-assemblies required to build or repair a product or service. It is a comprehensive list of parts, items, assemblies and other materials required to create a product, as well as instructions required for gathering and using the required materials. The bill of materials explains what, how, and where to buy required materials, and includes instructions for how to assemble the product from the various parts ordered.

Customer index is a measure of how products and services supplied by a company meet or surpass customer expectation. Customer satisfaction is defined as "the number of customers, or percentage of total customers, whose reported experience with a firm, its products, or its services (ratings) exceeds specified satisfaction goals."
Customer Index is an economic indicator that measures the satisfaction of consumers across the country. The **four** crucial things a **customer needs** are: Fair price. Good service. Good product.

Service Flowchart is a kind of diagram showing how steps in a process fit together, through which you can build a step-by-step picture of the process for analysis, discussion, or communication. A flowchart is a formalized graphic representation of a logic sequence, work or manufacturing process, organization chart, or similar formalized structure. The purpose of a flow chart is to provide people with a common language or reference point when dealing with a project or process.

Stock deals with products that are sold **as** part of the business's daily operation, **inventory** includes sale products and the goods and materials used to produce them. Manual or computer-based record of the quantity and kind of inventory (1) at hand, (2) committed (allocated) to firm-orders or to work-in-process, and (3) on order. It often also includes history of the recent transactions in each inventory item.

A material requisition form lists the items to be picked from inventory and used in the production process or in the provision of a service to a customer, usually for a specific job. The form usually has three purposes: To pick items from stock. To relieve the

inventory records in the amount of the items picked. Requisition slip is a form for ordering material to be used for certain purpose.

Supplier Index is a leading indicator and predictor of future growth or contraction. A rising Supplier Deliveries Index over time usually signals future supply problems. A decreasing Supplier Deliveries Index usually signals increased supply availability — and possibly decreased economic activity.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Operational manuals are the manuals provided by manufacturers which cover the servicing, maintenance and repair of their products.

a) true b) false

2. Which one is included in the service information of maintenance :

a) Material requisition form b) Supplier Index c) bill of materials d) all of these

3. The information associated with the parts list is

a) Item number. b)Part number c) Description dimensions. d) all of these

4. Schematic diagrams may also be used to explain the general way that an electronic functions without detailing the hardware or software used in the actual electronic.

a) true b) false

Answer Sheet

Note: **Satisfactory rating - 3 and 5 points** **Unsatisfactory - below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Answer sheet

Name: _____ Date: _____

Information Sheet- 4	Preparing workstation for repair job in line with the company requirements and work specifications

- Preparing workstation for repair job in line with the company requirements and work specifications

A workstation an area where work of a particular nature is carried out, such as a specific location on an assembly line. It is an area having the necessary repair tools for the job that will be accomplished according the company requirement and specification. Get your electronics assembly, testing, or repair facility running efficiently with workstation

Self - check 4	Write test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1.A workstation an area where work of a particular nature is carried out

a) true b) false

2..workstation is an area having the necessary repair tools for the job that will be accomplished

a) false b) true

Answer Sheet

Note: **Satisfactory rating - 3 and 5 points** **Unsatisfactory - below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Answer sheet

Name: _____ Date: _____

Information Sheet- 5	Preparing the necessary *tools*, *test instruments and personal protective equipment* in line with job requirements

- Preparing the necessary ***tools***, ***test instruments and personal protective equipment*** in line with job requirements

A tool is any instrument or simple piece of equipment that you hold in your hands and use to do a particular kind of work. It's hard to do a good job of electronics construction unless proper electronic tools and knowledge of using them are adequate. Some of the basic tools that should prove useful are discussed here.

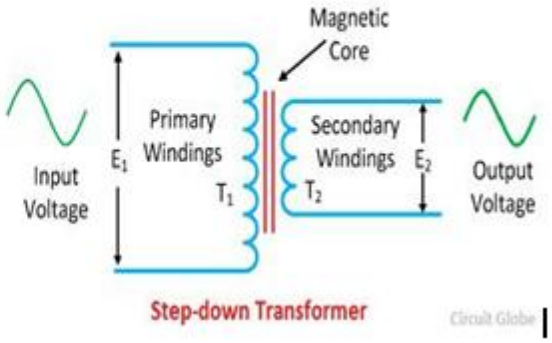
Variable Power Supply: A variable power supply is one which includes some means for the user to easily adjust the output voltage and sometimes the current. Adjustment is most often accomplished with a potentiometer, but may also be done with an analog control voltage, a digital input, an autotransformer, etc

A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters.

Fig. Variable Power Supply

Step-down Transformer

Step down Transformer is a type of transformer, which converts a high voltage at the primary side to a low voltage at the secondary side. A transformer in which the output (secondary) voltage is less than its input (primary) voltage is called a step-down transformer. A step-down transformer acts as a voltage-decreasing device. The amount by which it decreases the input voltage depends on the ratio of the number of turns in the primary coil to the number of turns in the secondary coil. If, for example, the primary coil has double the amount of turns as the secondary coil, the ratio will be 2:1 and the output voltage will be half the input voltage.



A **soldering iron** is a hand tool used in soldering. It supplies heat to melt solder so that it can flow into the joint between two work pieces. A **soldering iron** is composed of a heated metal tip and an insulated handle. Conveniently operated with a trigger using one hand, a **soldering gun** is shaped like a pistol and is used for joining metal surfaces. A soldering iron, which is also used for joining two pieces of metal, is wand-shaped and utilizes a heated metal tip.

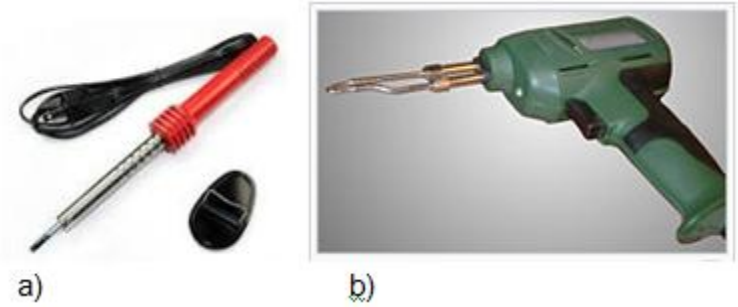
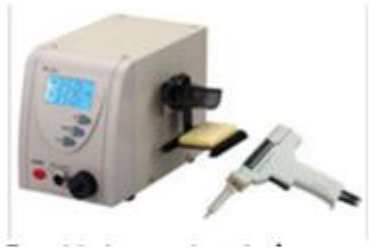


Fig. a)soldering iron and b)soldering gun

- **De-soldering tools**

Apply heat to the connection to be de-soldered. When the solder melt. A variety of models: Station types that ensure high safety for components by using built-in transformers to provide low voltage and high isolation. Portable types that is easy to take along. The FM series has excellent thermal recovery, and optional soldering irons can also be connected for soldering. Simple suction-type de-soldering tools that do not need batteries are also available.

De-soldering iron



De-soldering workstation

De-soldering pump

De-soldering sucker

- screwdriver (assorted)

- wrenches (assorted)



- Allen wrench/key

- signal generator - AF/RF

Signal generator is an electronic device that generates repeating or non-repeating electronic signals in either the analog or the digital domain. **Radio frequency** (RF) and microwave signal generators are used for testing components, receivers and test systems in a wide variety of applications including cellular communications, audio and video broadcasting, satellite communications, radar and electronic warfare. The signal generator, which produces the periodic signal having a frequency of Audio Frequency (AF) range is called AF signal generator.

Fig. signal generator

- multi-testers (analog/digital)

A multimeter (multitester) also known as a VOM (volt-ohm-milliammeter), is an electronic measuring instrument that combines several measurement functions in one unit. A typical multimeter can measure voltage, current, and resistance. Analog multimeters uses a microammeter with a moving pointer to display readings. The

primary difference between the two is the display, an analog multimeter uses a needle to show the value, while a digital multimeter will show the results as numbers on a screen.

fig. multi-testers

- utility knife/stripper

Utility knife is a knife used for general or utility purposes. The utility knife was originally a fixed blade knife with a cutting edge suitable for general work such as cutting hides and scraping hides, butchering animals, cleaning fish, and other tasks.

Wire stripper is a small, hand-held device used to strip the electrical insulation from electric wires.

Fig. utility knife/stripper

fig. wire stripper

- **Pliers (assorted)**

Pliers are a hand tool used to hold objects firmly, possibly developed from tongs used to handle hot metal. They are also useful for bending and compressing a wide range of materials. Generally, pliers consist of a pair of metal first-class levers joined at a fulcrum positioned closer to one end of the levers, creating short *jaws* on one side of the fulcrum, and longer *handles* on the other side. This arrangement creates a mechanical advantage, allowing the force of the hand's grip to be amplified and focused on an object with precision.

fig. Pliers

- **Test jig**

T**est jig** facilitates the probe of defined test points to help determine the expected inputs and outputs of the PCB. A test fixture, on the other hand, secures the PCB in a firm grip for the execution of the probe. PCB test jigs are customized devices used to test a PCB.

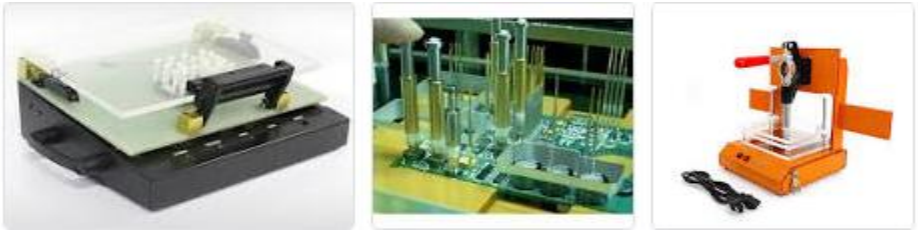
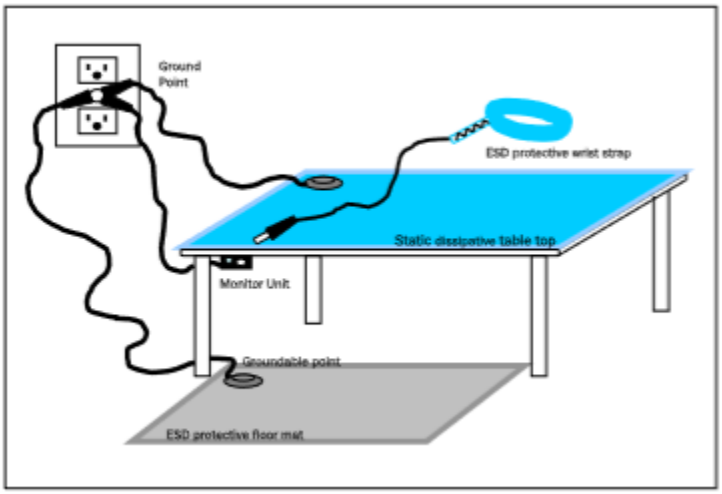


Fig. test jig

- **ESD-free work bench with mirror**

A workbench is the key area for many ESD protected areas. ESD workbench provides many of the elements for the basis of an ESD protected area. Although many other elements are needed, having a good ESD workbench is key. Not only does a typical ESD workbench provide a static dissipative surface on which to work, but it also provides suitable connection points for other elements of the static protected environment.

Static-safe work bench. The diagram below shows a typical static-safe work bench. The table top is covered by a static dissipative mat which is grounded through a 1 Meg-ohm resistor. This resistor is required in order to protect the users of the static-safe work bench – in the event that the ground becomes electrically live, the resistor will prevent electrical shock at the work bench. The same safety requirement holds true for the antistatic wrist-strap as well.



- **Degaussing**

Degaussing is the process of reducing or eliminating an unwanted(remnant) magnetic field (or data) stored on tape and disk media such as computer and laptop hard drives, diskettes, reels, cassettes and cartridge tapes. Degaussing is the process of significantly reducing the magnetic field produced by a large ferrous object.

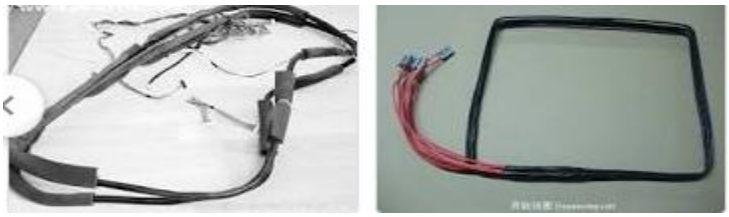
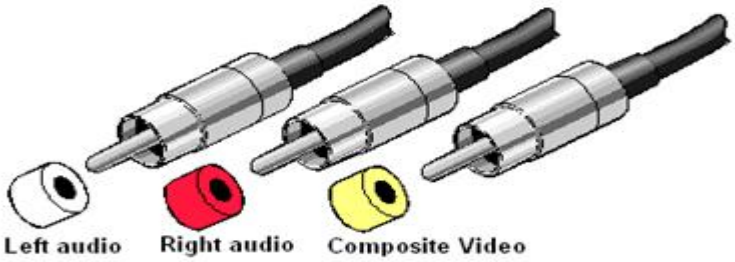


Fig. Degaussing coil

- RCA Cables/connectors

An RCA connector is a type of electrical connector commonly used to carry audio and video signals. An RCA connector is a plug and a jack designed for use with coaxial cable for frequencies ranging from the very lowest up to several megahertz.



a) RCA sockets, or jacks, video output b)Composite video cable

- **Oscilloscope**

An oscilloscope is a laboratory instrument commonly used to display and analyze the waveform of electronic signals. In effect, the device draws a graph of the instantaneous signal voltage as a function of time. An oscilloscope measures two things: Voltage and Time (and with time, often, frequency).Most oscilloscopes can only directly measure voltage not current. One way to measure AC current with an oscilloscope is to measure the voltage dropped across a shunt resistor. In view of the advantages which they posses, oscilloscopes are an essential piece of electronics test equipment for any electronics laboratory or area testing electronics hardware.

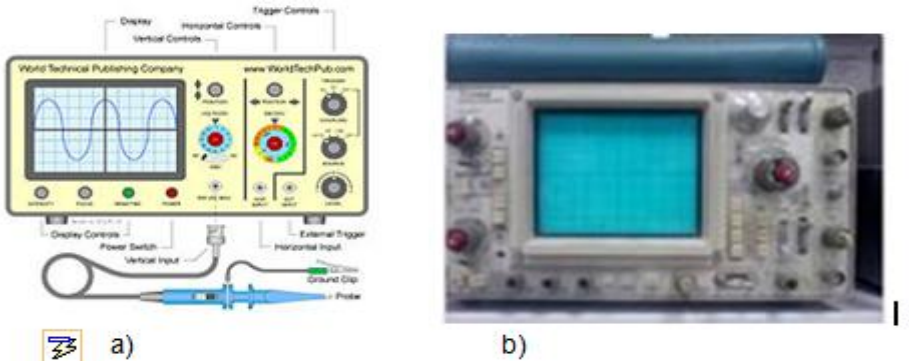


Fig. a) analog and b) digital oscilloscope

- TV pattern generator

TV pattern generator produces audio / video signals, direct and with the RF modulation, on the allocated T.V. Channel frequencies for alignment, testing and servicing of T.V. receivers.

- high-grade magnifying glass with lamp

A high-grade magnifying glass with lamp is an essential tool for anyone working with precision assembly, inspection or design. Because users can effortlessly view smaller details, lighted magnifying lamps are tremendously helpful in reducing eye strain and preventing vision fatigue.

fig. high-grade magnifying glass with lamp

- **Flashlights**

Flashlights are portable light sources that use battery, electrical, or mechanical power to illuminate an area or item for inspection. They are made of aluminum, plastic or other lightweight materials and **used in** emergency, military, and maintenance applications.


- cleaning brush

  Cleaning brushes use bristles, wire, or other filaments to dust, scrub, and remove deposits from objects and surfaces. They are commonly used to scrub and **clean** kitchens and bathrooms, spot dust and **clean**, and remove metal, paint, and residue from equipment.


Fig. cleaning brush

- high voltage probe

  High voltage and Voltmeters for oscilloscopes,DVMs, recorders. HV DC, AC & Wide band DC-10MHz. Safety probes for any scope, digital display or recorder.

Fig. high voltage probe

- **Ball peen hammer**

  The ball peen hammer is a kind of peening hammer that has 2 ends. 1 end is shaped like an ordinary hammerhead while the other is ball shaped. It has a handle

that is like that of a regular hammer and the material can vary, which includes wood, metal or fiberglass. Ball peen hammers are commonly used to drive cold chisels, set rivets, and bend and shape metal.

Fig. ball peen hammer

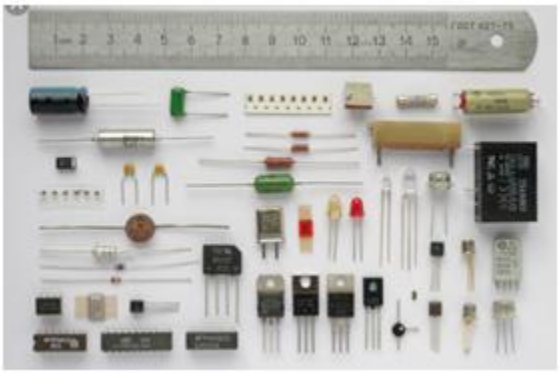
- soldering lead

Soldering lead have about 60% tin and 40% lead in them. They are toxic because they have lead in them. It is frequently used to join wires to leads of components such as switches or to join components of all kinds to a printed circuit board. The primary tool used for applying solder is a soldering iron, a device whose metal tip heats to temperatures well above the melting point of solder.

- De-soldering Wires

De-soldering wires are generally used for gathering the excess solder in circuits and for dismounting integrated circuits.

- assorted electronic components



- **Contact Cleaner**

Contact cleaner is a chemical, or a mixture of chemicals, intended to remove or prevent the build-up of oxides or other unwanted substances on the conductive surfaces of connectors, switches and other electronic components with moving surface contacts, and thus reduce the contact resistance encountered. Electrical contact cleaner is simply compressed air with a cleaning agent that evaporates, such as isopropyl alcohol. It is useful for cleaning electric components that have food, grease, or oils on them. It can dislodge foreign elements and clean components

- **Tweezers**

Small tweezer is used to hold small components especially when doing soldering and de-soldering of surface mount components. A small instrument like a pair of pincers for plucking out hairs and picking up small objects.

fig. Small tweezer

- **Silicon Grease**

Silicone grease is commonly used for lubricating and preserving rubber parts, such as O-rings. Additionally, silicone grease does not swell or soften the rubber, which can be a problem with hydrocarbon based greases. It functions well as a corrosion-inhibitor and lubricant for purposes that require a thicker lubricant

- **Insulation tester w/ stand**

The insulation resistance (IR) test (also commonly known as a Megger) is a spot insulation test which uses an applied DC voltage (typically either 250Vdc, 500Vdc or 1,000Vdc for low voltage equipment.

- Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) - Specialized clothing or equipment worn by employees for protection against health and safety hazards. Personal protective equipment is designed to protect many parts of the body, i.e., eyes, head, face, hands, feet, and ears. Personal protective equipment (PPE) is protective clothing, goggles, or helmets other garments or equipment designed to protect the wearer's body from injury or infection. The hazards addressed by protective equipment include physical, electrical, heat, chemicals, biohazards, and airborne particulate matter. Protective equipment may be worn for job-related occupational safety and health purposes, as well as for sports and other recreational activities. "Protective clothing" is applied to traditional categories of clothing, and "protective gear" applies to items such as pads, guards, shields, or masks, and others

- **Working clothes/Apron**

The apron(close) prevents your clothes from coming in contact with the food, hence any germs, dust, hair etc, stay within the apron and off your plate. We hear of many incidents of our clothes catching fire, minor burns are also a part of daily cooking.



- **Hand gloves**

A glove is a garment covering the whole hand. Gloves usually have separate sheaths or openings for each finger and the thumb. Work gloves are personal protective equipment worn during work projects that cover and protect the hands from the wrist to the fingers. Work gloves are meant to save the user's hands and fingers from unnecessary wounds such as cuts, blisters, splinters, skin punctures or heat and chemical burns.



- **Face/Dust Mask**

The main purpose of a dust mask is to protect the wearer and prevent illness, more specifically preventing the development of respiratory illnesses. These types of problems can reduce the quality of life as well as its length. **Dust masks** just don't

provide a good face seal and they protect about as well as nose hair, which is to say not that well.

Fig. Face/Dust Mask

Goggles:

special glasses that fit close tothe face to protect the eyes from chemicals, wind, water, etc. Goggles are basically glasses that strap on to your head and cover your whole eye area. Swim *goggles* and safety *goggles* protect your eyes, There are goggles you wear when riding a motorcycle, working in a lab with chemicals, or playing sports, for example. Some goggles do more than protect your eyes — night vision goggles help you see in the dark, and virtual reality goggles make it look like you're in another world.

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1.What is the use of RCA connector?

a) audio signals c) a&b

b) video signals d) none of these

2.The use of degaussing coil is

a) reducing or eliminating a magnetic field stored on tape and disk media

b) audio and video signals

c) a&b d) none of these

3.Pliers are a hand tools used to hold objects firmly?

A false b)true

Answer Sheet

Note: **Satisfactory rating - 3 and 5 points** **Unsatisfactory - below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer sheet

Name: _____ Date: _____

Short Answer Questions

Operation Sheet 1	Method of repairing Horizontal section of Television receiver

1. Method of repairing radio receiver power supply section -:

Step1. Follows OHS and safety procedure.
Step2. Unplug the receiver and open the housing.
Step3. Prepare the right tools for the work
Step4.Inspect the receiver for obvious problems identification
Step5.Check the receiver using 3S (sound, smell and sight) and T (touch) technique to identify the defects
Step6.Signal tracing and Signal injection method is used to identify the defective stage
Step7.Isolate and Replace the defective component of power supply section of the receiver
Step8.Check for the normal operation of the radio receiver

2. Method of repairing Horizontal section of Television receiver -:

Step1. Follows OHS and safety procedure.
Step2. Prepare the right tools for the work
Step3. Unplug the receiver and open the housing.
Step4. Discharge the filter cap if there is a voltage in it
Step5.Inspect the receiver for obvious problems identification using 3S (sound, smell and sight) and T (touch) technique to identify the defects
Step6.Use signal tracing and Signal injection method to identify the defective stage
Step7.Isolate and Replace the defective component of horizontal section of the receiver
Step8.Check for the normal operation of the television receiver

Note: the trainer will develop the other procedure according to the above sample method of repairing TV receiver section.

3. **Method of repairing bridge rectifier of SMPS for Television receiver -**:

Step1. Follows OHS and safety procedure.
Step2. Prepare the right tools for the work
Step3. Unplug the receiver and open the housing.
Step4. Discharge the filter cap if there is a voltage in it
Step5.Inspect the SMPS for obvious problems identification
using 3S (sound, smell and sight) and T (touch) technique to identify the defects
Step6.Use signal tracing and Signal injection method to identify the defective stage
Step7.Isolate and Replace the defective component of horizontal section of the receiver
Step8.Check for the normal operation of the radio receiver

4.Method of repairing output power of SMPS for VCD/DVD player -:

Step1. Follows OHS and safety procedure.
Step2. Prepare the right tools for the work
Step3. Unplug the player and open the housing.
Step4. Discharge the filter cap if there is a voltage in it
Step5.Inspect the SMPS for obvious problems identification
using 3S (sound, smell and sight) and T (touch) technique to identify the defects
Step6.Use signal tracing method to identify the defective stage
Step7.Isolate and Replace the defective component of SMPS **VCD**
Step8.Check the normal operation of the player.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 8-12 hours.

Task 1: If the capstan motor of a VCR is failed what are the symptoms and resolve the problem according to the procedure.

Task 2: If the TV set is dead but the power supply section is working what are the probable cause of failure and resolve the problem of the receiver according to the procedure.

Task3: If the TV set is totally dead what are the probable cause of failure and resolve the problem of the receiver according to the procedure.

Instruction Sheet	LG19: Diagnose faults

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Observing systematic pre-testing procedure in accordance with manufacturer's instructions
- Using appropriate tools and equipment Identify system defects/fault symptoms
- Using test instruments for the job in accordance with user manuals
- using specific testing procedures check and isolate circuits
- Identifying defects and faults explain to the responsible person in accordance with company policy and procedures
- Checking the control settings/adjustments in conformity with service-manual specifications
- Documenting results of diagnosis and testing accurately and completely within the specified time
- Advising or informing customers regarding the status and serviceability of the unit according to company procedures

This guide will also assist you to attain the learning outcome stated in the cover page.
Specifically, upon completion of this Learning Guide, **you will be able to –**

- Observe systematic pre-testing procedure in accordance with manufacturer's instructions
- Use appropriate tools and equipment Identify system defects/fault symptoms
- Use test instruments for the job in accordance with user manuals
- use specific testing procedures check and isolate circuits
- Identify defects and faults explain to the responsible person in accordance with company policy and procedures
- Check the control settings/adjustments in conformity with service-manual specifications

- Document results of diagnosis and testing accurately and completely within the specified time
- Advise or informe customers regarding the status and serviceability of the unit according to company procedures

Learning Instructions:

7. Read the specific objectives of this Learning Guide.
8. Follow the instructions described below 3 to 6.
9. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 and Sheet
10. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 Self-check 4, Self-check 5, Self-check 6, Self-check 7 and Self-check 8” **in page -165, 169, 171,173,175,177,175 and 181** respectively.
11. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1, Operation Sheet 2 , Operation Sheet 3, Operation Sheet 4, Operation Sheet 5 , Operation Sheet 6, Operation Sheet 7 and Operation Sheet 9 ” **in page -182.**
12. Do the “LAP test” **in page – 183** (if you are ready).

Information Sheet-1	Observing systematic ***pre-testing procedure*** in accordance with manufacturer's instructions

- Observing systematic ***pre-testing procedure*** in accordance with manufacturer's instructions

Pretesting is one of the most important step before undergoing troubleshooting procedures with the defective equipment. Pre-testing is done to ensure that the equipment owner's statement matches with the one the technician found during technical pre-testing.

During the pre-testing period, trainees should somehow ask some important questions to gather additional information on how the equipment's prior conditions before the fault occurred. In addition, in pre-testing procedure, trainees should inspect the physical conditions of the equipment such as scratches within the chassis, lost knots and bolts, broken handles and glass covers, etc. During the pre-testing procedure, a manufacturer's manual or a service manual is also needed, most especially when the equipment has a new functions in which the technician is not well oriented with the controls and other functions.

The following three idea is used as pretesting procedure for the technician:

a) Interview of customer re history of unit

Customers are the richest potential source of information about what is wrong and where the trouble is. Competent troubleshooters always talk to the customers when available. Customers are with the equipment when the trouble occurs, and they generally know what the customers and the equipment were doing when it happened. The client can provide indications of the problem by describing what happened that was different from normal operation. This information may tell the competent troubleshooter a great deal about what is wrong and where.

b) Visual inspection of the unit with power off

Visual inspection is very important in diagnosing faults; many defects can be diagnosed simply by carefully observing the operation of the circuit. Observation is all of the senses, that you have such as you can see but you can also smell, and you can also hear, and often times in a diagnostic system it is not always what you see, sometimes it's what you smell that tells a lot. Never open the casing of the equipment before switch off the power and unplug the equipment and inspect the fault inside the casing.

c) Operate the unit according to manual to confirm defects

By providing power the unit will be operated according to the manual weather the device is working or not

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. what is the use of pretesting

a) To get information from customer b)to inspect the defect visually

c) operating the unit d) all of the above

2.Pretesting is one of the most important step before undergoing troubleshooting procedures with the defective equipment.

a) false b) true

3 What are the procedure of pretesting

a) Interview of customer re history of unit
b) Visual inspection of the unit with power off
c) Operate the unit according to manual to confirm defects
d) All of the above

4. Customers are the richest potential source of information about what is wrong and where the trouble is

a) true b) false

Answer Sheet

Note: **Satisfactory rating - 3 and 5 points** **Unsatisfactory - below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Answer sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet- 2	Identifying system defects/fault symptoms using appropriate tools and equipment

- Identifying system defects/fault symptoms using appropriate tools and equipment

There are tools use to identify the defects of electronics equipment such as digital and analog mulitimeter, CRO, signal generator and pattern generator. Measurement of voltage, current or resistance can therefore serve as a reference to locate the actual fault. When you are searching for those effects of faults the various measured values are compared with the values expected (or given in the data sheet). We call the methods: Voltage analyzing, current analyzing and resistance analyzing

The voltage analyzing is the most often used one, because it can be carried out without any mechanical change of the device (voltage can be measured in parallel)

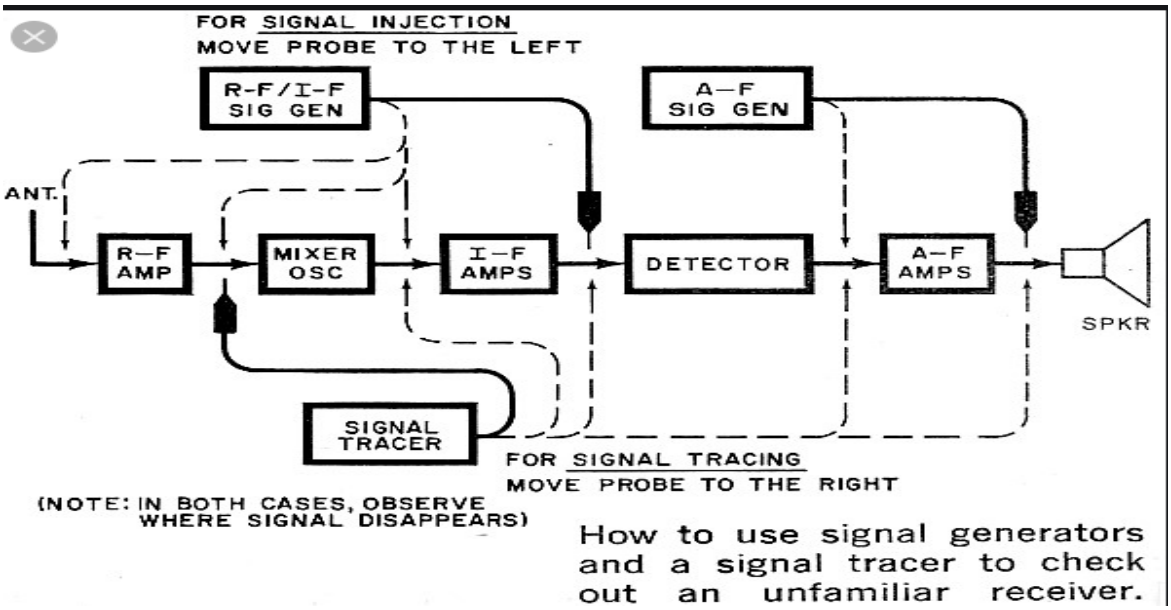
Signal tracing and signal injection are useful techniques when used with the split half troubleshooting method that was from the previous slide. Instead of tracing or injecting the signal from the beginning point of a circuit, the signal is introduced and traced from midpoints within the circuit.
Split-half is a technique for systematically isolating the source of an issue. You start by eliminating roughly half of the items you are checking, then trying to re-create the issue

The technician injects a test signal into the device under test. Then, by using the signal tracer, the tech can follow the signal through the various circuits of the device. The purpose of signal tracing is to locate the defective stage of a malfunctioning electronic system such as a radio or audio amplifier/guitar amplifier as efficiently as possible. Once the defective stage is determined, methods of checking individual voltages and components within that stage can be employed to isolate the failure to an individual component or wiring connection for repair.

Using both a signal generator and tracer together is often desirable or required to detect a signal in the "front end" of a receiver—the RF amplifier (if present) and convertor stage— due to the low signal levels there.

Signal substitution is another way of tracing a signal, but only a signal generator is required. The generator must have the capability to produce a variable strength radio frequency of the proper band that can be either amplitude modulated or un-modulated by the user.

Signal tracing and signal injection are useful techniques when used with the split half troubleshooting method that was from the previous slide. Instead of tracing or injecting the signal from the beginning point of a circuit, the signal is introduced and traced from midpoints within the circuit. If the output is good when a good signal is injected at the midpoint, then the second half of the circuit can be ruled out.



What are the six key steps to approach to electrical fault finding?

1. Collect the Evidence

All the evidence collected must be relevant to the problem in hand. If one is in doubt as to whether anything is relevant, then include it. Reject it afterwards at the first opportunity if it clearly is not relevant. The quantity of information collected is unimportant, what matters is that all information collected is relevant. Observe the system running, if you consider it safe to do so. Use all your senses: smell (burning), hearing (vibration), touch (temperature), sight (for unusual conditions). Refer to any relevant documentation.

2. Analyse the Evidence

Consider all the evidence collected and, if possible, reject any which after further careful consideration is not relevant. Study the hard core of relevant evidence and – through the process of careful, logical thinking –diagnose the likely fault or at least the area or region of the fault.

3. Locate the Fault

In a sense this is a continuation of the process of ‘analysis’. The areas or regions are systematically reduced in size until a specific part can be identified as being faulty. For example, if a door bell does not ring when it should, it is only by means of a systematic approach that one determines that the bell itself is faulty.

4. Determination and Removal of the Cause

If the cause of a fault is not removed, the fault will recur even though the fault has been rectified. For instance, a flat bicycle tyre might be the result of a puncture (the fault) in

the inner tube. If the puncture is repaired (i.e. the fault is removed) this will not be of much use if the cause of the puncture in the first place is not determined and appropriate action taken. The cause of the puncture may be a nail which has penetrated the outer cover. This must be removed.

5. Rectification of the Fault

This may be a simple task, as in the case referred to above, or it may be a much bigger one. Whatever is the case, it is a specific task based on earlier findings.

6. Check the System

It is important to ensure that the machine, equipment or system is functioning normally after the cause of the fault and the fault itself has been dealt with. In the case of the puncture, it is easy to confirm that the cause of the fault – and the fault itself – has indeed been dealt with satisfactorily, assuming that the tyre remains inflated. With more sophisticated equipment or systems it may necessary to 'fine-tune' the system in order to return it to optimum working conditions

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Signal tracing and signal injection are useful techniques when we used the split half troubleshooting method that was from the previous slide.

a)false b)true

2. Measurement of voltage, current or resistance cannot serve as a reference to locate the actual fault.

a)false b)true

3. The commonly used tools used to identify defects are :

a) pattern generator b)CRO c) signal generator d) all of the above

4. Which device is used to inject signal is ?

a) pattern generator b)CRO c) signal generator d) a&c

5. System defect will be identify by injection of known signal through pattern generator?

a) true b) false

Answer Sheet

Note: **Satisfactory rating - 3 and 5 points** **Unsatisfactory - below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Answer sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet- 3	Using test instruments for the job in accordance with user manuals

- Using test instruments for the job in accordance with user manuals

Continuity is the presence of a complete path for current flow. A circuit is complete when its switch is closed. A digital multimeter's Continuity Test mode can be used to test switches, fuses, electrical connections, conductors and other components. Signal generator is device used to inject a signal to the point under test pattern generator is device used for testing tv set signal flow line in accordance with the service manual.

A multimeter is an electronic instrument used to measure the three basic electrical characteristics: voltage, current and resistance. It has multiple functions and acts like ohmmeter, voltmeter and ammeter and also used for household wiring, electric motors, testing batteries and power supplies

A signal generator is also named as pitch generator, function generator or frequency generator is an electronic device used for generating electronic signals either in the analog or digital domains (repeating or non-repeating signals). Signal generators are used in testing, designing and repairing electro acoustic or electronic devices.
The oscilloscope is an electronic test instrument that constantly obverses varying voltage signals as a two dimensional plot of one or more signals as a function of time. The other names for oscilloscope are oscillograph, cathode ray oscilloscope or digital storage oscilloscope.
Some essential tools to set up electronics lab.

- Multimeter.
- Soldering Station.
- Soldering Accessories
- Bench Power Supply
- Wire Stripper
- Needle-nose Pliers and Wire Cutter
- Hot Glue Gun
- Precision Screwdriver Set.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Which device is used to inject signal is ?

a) Digital multimeter b)CRO c) signal generator d) a&c

2. Measurement of voltage, current or resistance can serve as a reference to locate the actual fault.

a)false b)true

3. The continuity test done to identify defects through the use of:

a) pattern generator b)CRO c) signal generator d) Digital multimeter

4. Signal tracing and signal injection are useful techniques when we used the split half troubleshooting method that was from the previous slide.

a)false b)true

Answer Sheet

Note: **Satisfactory rating - 3 and 5 points** **Unsatisfactory - below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Answer sheet

Score = _____

Rating: _____

Name: _____ Date: _____

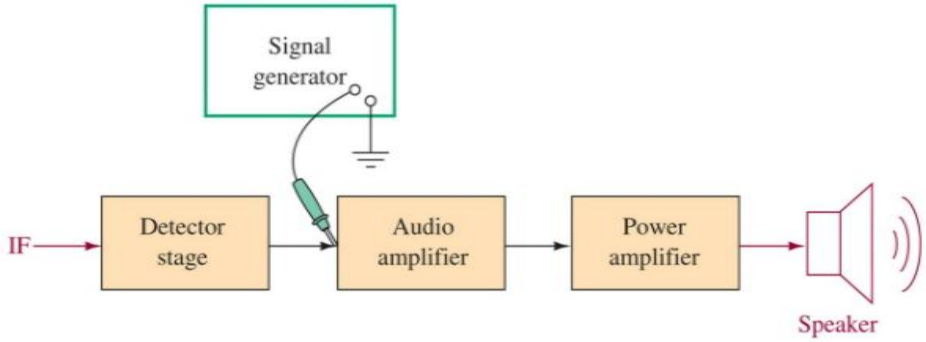
Short Answer Questions

Information Sheet- 4	using specified testing procedures check and isolate circuits defective parts

- using specified testing procedures check and isolate circuits defective parts

Following the OHS and safety procedure isolate the defective stage by using signal tracing and signal injection first then the defective component at the end according to the current industry standard and specification.

Signal injection.



Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. The use of signal generator is ?

   a)trace the continuity b)inject signal c)a&b d) none of these

2. Signal generator is used to isolate the defective parts of circuit

   a) true b) false

Answer Sheet

Note: **Satisfactory rating - 3 and 5 points** **Unsatisfactory - below 3 and 5 points**

You can ask you teacher for the copy of the correct answers.

Answer sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet- 5	Identifying defects and faults are explained to the ***responsible person***

- Identifying defects and faults are explained to the ***responsible person*** in accordance with enterprise or company policy and procedures

The ***responsible person*** for maintenance work can be
a)immediate supervisor and b) service supervisor / manager

a) **Immediate Supervisor(Line manager):** means the employee or officer on the next higher level of authority above the employee in the department wherein the grievance exists and who normally assigns and supervises the employee's work and approves his/her time records and evaluates his/her work performance. Line manager is a specific term referring to someone who is the immediate (i.e. nearest) to the employee

b) **Service supervisor / manager**

A Customer Service Supervisor oversees, leads and trains a company's service staff. Customer Service Supervisors investigate and solve product and service complaints.

The Customer Service Supervisor is responsible for the complete operations of the store when a more senior level manager is not present.

- ✓ Helping to build good customer relations.
- ✓ Recruiting staff and doing appraisals.
- ✓ Arranging staff meetings.
- ✓ Training and development.
- ✓ Handling complaints and queries (from customers and staff)
- ✓ Sorting security issues.
- ✓ Financial responsibilities.
- ✓ Arranging promotional even

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. The responsible person for maintenance are:

a)immediate supervisor b) service supervisor c) a&b

2. Line manager and immediate supervisor perform the same task

a)false b)true

3 The Customer Service Supervisor is responsible for:

a) the complete operations
b) a level of authority above the employee
c) a&b
d) none of the above

Note: **Satisfactory rating - 3 points** **Unsatisfactory -2 below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information sheet-6	Checking control settings/adjustments in conformity with service-manual specifications

- Checking control settings/adjustments in conformity with service-manual specifications

If a failure condition is checked during a testing , pressing rest button will reset the system, shut off the alarm and clear the failure condition. The Reset button must be pressed before performing another test or changing any of the setup parameters. This button also serves as an abort signal to stop any test in progress.

Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Before maintenance and after maintenance control setting will be checked
   a)true b) false

2. service manual must not be consulted during the checking of control setting

   a)true b) false

Note: **Satisfactory rating - 3 points** **Unsatisfactory -2 below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information sheet-7	Documenting results of diagnosis and testing accurately and completely within the specified time

- Documenting results of diagnosis and testing accurately and completely within the specified time

The formal description of a technical process is known as its documentation. Documentation takes the form of technical and user manuals that accompany various technological objects, materials, and processes. Electronic hardware, computers, chemicals, automobiles all are accompanied by descriptive documentation in the form of manuals. The aim of documentation is to give those carrying out the works the information they need. Documents are also used to prepare cost estimates and to obtain tenders from potential contractors. Documentation should be prepared by qualified specialists.

The documentation is a physical description of a system, device, material, or process. This technical description is used by expert users and designers as guidelines to maintain and modify various elements of the system.

- Technical documentations are very essential parts of maintenance because it can help:
  - ✓ To communicate with the concerned body through it
  - ✓ Used to know the history of the device.
  - ✓ Used to solve the same defect in future

Documentation is very essentials material for future use and to communicate with the responsible personnel regarding the equipment that should be maintained. A log book is a way to record and keep track of events in your classroom. Log books are important classroom management tools that can be used in a variety of ways such as recording tardy students entering the classroom, communication with students' parents, and student-teacher conferences.

The diagnostic process is a complex transition process that begins with the history and culminates in a result that can be categorized.

Self-Check -7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1.The formal description of a technical process is known as documentation.

A .true B.false

2.The use of documentations:

a)To communicate with the concerned body through it
b)Used to know the history of the device.
c)Used to solve the same defect in future
d) All of the above

3. Documentation is used for future

A true b false

Note: **Satisfactory rating - 3 points** **Unsatisfactory -2 below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information sheet 8	Advise or inform customers regarding the status and

	serviceability of the unit according to company procedures

2.8 Advise or inform customers regarding the status and serviceability of the unit according to company procedures

The service technician will inform the customer the status and serviceability of the unit with a short time the weather the equipment is serviceable or not by checking the condition of the device according to the service manual.

Self-Check -8	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Serviceability is informed to the immediate supervisor

   a) true b)false

2. The service technician will inform the customer

   a) true b) false

Note: **Satisfactory rating - 2 points** **Unsatisfactory -1 below 2 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Operation Sheet 1	Method of Diagnose faults

Diagnose faults

Step1 Observe systematic pre-testing procedure

Step2. Use appropriate tools and equipment Identify system defects

Step3 Using test instruments for the job in accordance to the manuals

step4 using specific testing procedures check and isolate circuits

step5 Identified defects and faults explain to the responsible person

step6 Check the control settings/adjustments in conformity with service-manual specifications

step7. Documenting results of diagnosis and testing accurately and completely

step8 Advise customers regarding the status and serviceability of the unit

LAP Test	Diagnosis fault

Name: _____ Date: _____

Time started: _____ Time finished: _____

Task 1: using fault diagnosis method identify and isolate defective stage and component of TV set which is completely dead.

Instruction Sheet	LG20: Maintain/repair product

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Using personal protective equipment in accordance with ***Occupational Health and Safety*** practices
- Following electro-static discharge (ESD) protection procedure is followed in accordance with current industry standard
- Replacing defective parts/components replaced with identical or recommended appropriate equivalent ratings
- Replacing/repairing parts or components are Soldered in accordance with the current industry standards
- Performing control settings/adjustments in conformity with service-manual specifications
- Performing repair activity within the required timeframe
- Observing care and extreme precaution in handling the unit/product as per procedures
- Performing cleaning of unit in accordance with standard procedures

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, **you will be able to –**

- Use personal protective equipment in accordance with ***Occupational Health and Safety*** practices
- Follow electro-static discharge (ESD) protection procedure is followed in accordance with current industry standard
- Maintain /repair Audio-Video products and Systems
- Replace defective parts/components replaced with identical or recommended appropriate equivalent ratings
- Replace/repair parts or components are soldered in accordance with the current industry standards
- Perform control settings/adjustments in conformity with service-manual specifications
- Perform repair activity within the required timeframe
- Observe care and extreme precaution in handling the unit/product as per procedures
- Perform cleaning of unit in accordance with standard procedures

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1, Sheet 2, Sheet 3 , Sheet 4, Sheet 5, Sheet 6, Sheet 7 and Sheet 8.

4. Accomplish the “Self-check 1, Self-check t 2, Self-check 3 and Self-check 4, Self-check 5, Self-check 6, Self-check 7 and Self-check 8” **in page -189, 191, 193,195,197,199,201 and 203** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1” **in page -204.**
6. Do the “LAP test” **in page – 205** (if you are ready).

Information sheet 1	Using personal protective equipment in accordance with ***Occupational Health and Safety*** practices

- Using personal protective equipment in accordance with ***Occupational Health and Safety*** practices

Occupational Health and Safety practices

The purpose of the Health and Safety policies and procedures is to guide and direct all trainees to work safely and prevent injury, to themselves and others. All employees are encouraged to participate in developing, implementing, and enforcing Health and Safety policies and procedures.

- **Use of proper tools and equipment**

The importance of using the right tool for the job. Each tool is precisely designed for a specific purpose, so choosing the correct tool will also decrease the amount of effort required to get a job done right without causing damage to either the equipment or the surface being worked on.

Basic Safety Rules for Hand Tools

- ✓ Always wear eye protection.
- ✓ Wear the RIGHT SAFETY EQUIPMENT for the job.
- ✓ Use tools that are the RIGHT SIZE & RIGHT TYPE for your job.
- ✓ Follow the correct procedure for using EVERY tool.
- ✓ Keep your cutting tools SHARP and in good condition.
- ✓ DON'T work with OILY or GREASY hands.

- **Observe workplace environment and safety**

A healthy work environment is about more than being safe. A Healthy workplace is one where employees in addition to feeling secure and enjoying a safe physical work environment; feel recognized for the work they do. Enjoy a positive social environment that encourages respect, fosters a sense of belonging and purpose.

- **Adherence to safety requirements in handling the unit**

Using the following personal protective equipment prevents needless injuries when manually moving **materials**: Hand and forearm protection, such as gloves, for loads with sharp or rough edges. Eye protection. Steel-toed **safety** shoes or boots.
Extreme care should be taken when operating equipment. Before you attempt to operate any tool or piece of equipment, you must be fully trained by an experienced operator. Make sure that all guards are in place and function properly and that all electrical connections are properly made.

Self-Check -1	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. The purpose of the Health and Safety policies and procedures is to guide and direct

   A true b false

2. Which one is used to follow during work :

a) Use of proper tools and equipment
b) Observe workplace environment and safety
c) Adherence to safety requirements in handling the unit
d) All of the above

Note: **Satisfactory rating - 2 points** **Unsatisfactory -1 below 2 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

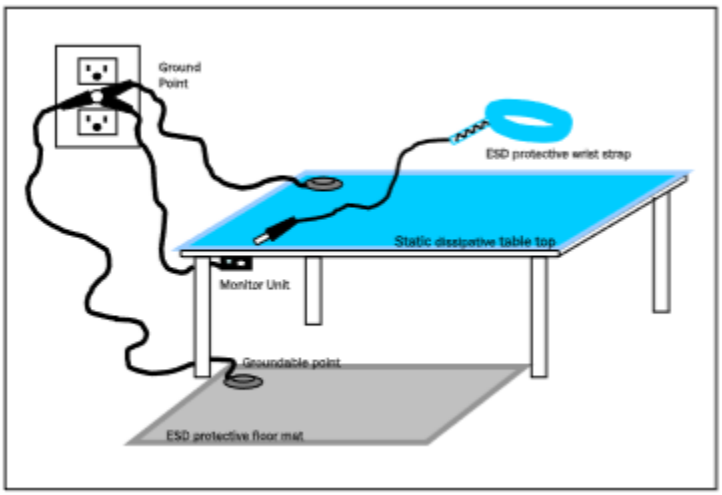
Name: _____ Date: _____

Short Answer Questions

Information sheet -2	Following Electro-static discharge (ESD) protection procedure in accordance with current industry standards

- Following Electro-static discharge (ESD) protection procedure in accordance with current industry standards

Static-safe work bench. The diagram below shows a typical static-safe work bench. The table top is covered by a static dissipative mat which is grounded through a 1 Meg-ohm resistor. This resistor is required in order to protect the users of the static-safe work bench – in the event that the ground becomes electrically live, the resistor will prevent electrical shock at the work bench. The same safety requirement holds true for the antistatic wrist-strap as well.



ESD protection method

1. Workstations should have conductive tabletops and be properly grounded
2. Grounded wrist straps for static control should be worn when handling the device
3. Use antistatic floors and floor mats where appropriate
4. Shoe straps should be used by personnel working in areas where wrist straps may be restrictive
5. Relative humidity should be kept between 45 to 60% since static generation increases exponentially as humidity decreases
6 Use antistatic envelope for storage of paper documentation accompanying product
7. Soldering irons must have grounded tips
8. Ionization devices should be used where appropriate for neutralizing static charge
9. Avoid high dielectric materials
10. Avoid hot socket insertions

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Static-safe work bench is used to :

a)static dissipative mat c) a&b

b) 1 Meg-ohm resistor. d) none of these

2. Which one of the following used as ESD protection method

a) Avoid high dielectric materials c) Soldering irons must have grounded tips

b). Avoid hot socket insertions d) all of these

3. Which one of the following is not used as ESD protection method

a).Workstations should have conductive tabletops and be properly grounded

b. Workstations should not have conductive tabletops and be properly grounded

c) Use antistatic envelope

d) none of these

Note: **Satisfactory rating - 3 points** **Unsatisfactory -2 below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information sheet 3	Replacing defective parts/components with identical or recommended equivalent ratings

- Replacing defective parts/components with identical or recommended equivalent ratings

Replace the part that has been disconnected from the circuit board. Solder the new part into position, ensuring that each terminal is making contact with the correct port in the circuit. Repair is mainly setting the device back to the condition of normal operation,. Replacement or repair should be accomplished as a part of routine maintenance. Defective damaged, worn out parts/components are replaced with identical or recommended appropriate equivalent ratings.

Replace the part that has been disconnected from the circuit board. The old part should come out of the board easily. If it does not, make sure that all of the solder has been removed. Solder the new part into position, ensuring that each terminal is making contact with the correct port in the circuit.

Many problems that circuit boards have may be repaired by replacing defective parts.. Parts that commonly need to be replaced include capacitors, transistors and various electronic chips. If, through visual inspection or through circuit analysis, you can identify which part is defective, you can usually repair a circuit board. Identify which part you want to replace on your circuit board. On the other side of the circuit board, there are solder points that connect the parts to the circuit. Identify the soldering points of the part you intend to replace.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1 Repair is mainly setting the device back to of the normal operation condition

a) false b)true

2. Replacement is considered as part of routine maintenance.

a) false b)true

3. Defective damaged, worn out parts/components are replaced with identical or recommended appropriate equivalent ratings

a) false b)true

Note: **Satisfactory rating - 2 points** **Unsatisfactory -1 below 2 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information sheet 4	Soldering repaired or replaced parts/components in accordance with the current industry Standards

- Soldering repaired or replaced parts/components in accordance with the current industry Standards

Soldering is a technique of melting a soft metal to join two pieces of harder metal. Tinning is a process of coating the two surfaces to be joined with a thin layer of solder to help the main mass of solder flow and melt into the joint.

Heat your soldering iron to operational temperature. Place the circuit board, with the solder side up, on a flat and well-lit surface.

Press the tip of your soldering iron against the solder point that is supporting the part you want to remove.

Suck up the liquid solder using a de-soldering device. There are several types of de-soldering devices, but they all generally work with suction.

Replace the part that has been disconnected from the circuit board.

Solder the new part into position, ensuring that each terminal is making contact with the correct port in the circuit.

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Soldering is a technique used as

   a) to join two pieces of harder metal.
   b) to tinning two pieces of harder metal.
   c) tinning is a process of coating the two surfaces to be joined
   d) all of the above

2. Sucker is used as to suck up the liquid solder from a de-soldering device.

   a)true b false

Note: **Satisfactory rating - 2 points** **Unsatisfactory -1 below 2 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information sheet 5	Performing control settings/adjustments in conformity with service-manual specifications

3.5 Performing control settings/adjustments in conformity with service-manual specifications

Incorrect control settings can indicate a trouble that does exist , particularly in equipment that have large number of control in the front panel. If the repaired equipment has the control setting after the repair action is completed the reset button will make on then check the system as whole.. The Reset button must be pressed before performing another test or changing any of the setup parameters. This button also serves as an abort signal to stop any test in progress.

Set up: Use this key to enter the setup menu and view or change the display contrast, alarm volume, and PLC remote settings.

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1.Before maintenance and after maintenance control setting will be checked

a)true b) false

2.service manual must not be consulted during the checking of control setting

a)true b) false

Note: **Satisfactory rating - 2 points** **Unsatisfactory -1 below 2 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information sheet 6	Performing repair activity within the required timeframe

- Performing repair activity within the required timeframe

Everything has its own time frame to perform the maintenance activity is one that need time frame therefore the action will be performed accordingly.

Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. time frame is used for customer as well as repair technician

a) true b) false

Note: **Satisfactory rating - 2 points** **Unsatisfactory -1 below 2 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information sheet 7	Observing care and extreme precaution in handling the unit/product as per procedures

- Observing care and extreme precaution in handling the unit/product as per procedures

Trainers can reduce injuries resulting from handling and storing materials by using some basic safety procedures such as adopting sound ergonomics practices, taking general fire safety precautions, and keeping aisles and passageways clear.

Self-Check -7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in proper handling of units are one of the important point in repairing?

a) True b) false

Note: **Satisfactory rating - 1 points** **Unsatisfactory -1 below 1 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information sheet 8	Cleaning of unit is performed in accordance with standard procedures

- Cleaning of unit is performed in accordance with standard procedures

Electrical contacts may get dirty with normal use, which can affect an item's performance. You can't clean an electrical contact with water, but there are some products that are safe and effective.

iisopropyl alcohol is the best compound, to use on computers, laptops or any other electronic devices. On the other hand, since isopropyl alcohol dries quickly, it is selected as the preferred method of cleaning electronics.
To clean the contacts, carefully spray them with tuner or electronic cleaner, turning the channel selector to distribute the cleaner over the contacts.

Electrical contact cleaner is simply compressed air with a cleaning agent that evaporates, such as isopropyl alcohol. It is useful for cleaning electric components that have food, grease, or oils on them. It can dislodge foreign elements and clean components

Isopropy: Alcohol 99% is the best substance to use for this purpose. Isopropyl Rubbing Alcohol 91% may also be effective, but it is best to use the purest IPA available. Be very careful when cleaning a computer or electronic device
Dip a cotton swab into white vinegar. Brush vinegar directly onto the corroded contacts. Vinegar is a weak acid that will dissolve and loosen corrosion.

Self-Check -8	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in

1. What is the effect of using contact clearer?
   a) which can affect an item's performance.
   b) iisopropyl alcohol is used for cleaning
   c) Electrical contact cleaner is simply compressed air
   d) all of the above are the effect of contact clearer

2. Electrical contact cleaner is useful for cleaning electric components that have food, grease, or oils on them. It can dislodge foreign elements and clean components
   a)false b)true

Note: **Satisfactory rating - 2 points** **Unsatisfactory -2 below 1 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Operation Sheet 1	**Method of** Maintaining/repairing product

Method of Maintaining/repairing product

Step1 Use personal protective equipment
Step2. Follow electro-static discharge (ESD) protection procedure
Step3 Replace defective parts/components replaced with equivalent ratings
step4 Replace parts or components are Soldered in conformity with the current industry standards
step5 Perform control settings/adjustments in conformity with service-manual
step6 Perform repair activity within the required timeframe
step7. Observe care and extreme precaution in handling the unit/product as per procedures
step8 Perform cleaning of unit in accordance with standard procedures

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Task 1: How to Maintain/repair units of audio video system.

Instruction Sheet	LG21: Test repaired product

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Reassembling units Repaired according to manufacturer's specifications
- Reassembling units are subjected to final testing and cleaning in conformity with manufacturer's specifications
- Compiling documentations of Service procedures and based on workplace requirements
- Disposing waste materials in accordance with ***environmental requirements***

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, **you will be able to –**

- Reassemble units Repaired according to manufacturer's specifications
- Reassemble units are subjected to final testing and cleaning in conformity with manufacturer's specifications
- Compile documentations of Service procedures and based on workplace requirements
- Dispose waste materials in accordance with ***environmental requirements***

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information "Sheet 1, Sheet 2, Sheet 3 and Sheet
4. Accomplish the "Self-check 1, Self-check t 2, Self-check 3 and Self-check 4" **in page -210, 212, 214 and 216** respectively.
5. If you earned a satisfactory evaluation from the "Self-check" proceed to "Operation Sheet 1, Operation Sheet 2 and Operation Sheet 3 " **in page -217.**
6. Do the "LAP test" **in page – 218** (if you are ready).

Information sheet 1	Repairing units reassembled according to manufacturer's specifications

- Repairing units reassembled according to manufacturer's specifications

Following the OHS and safety requirement of the repair units, after the repair action is completed the parts are reassembled according to the service manual of the unit

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Reassembling need the use of service manual and manufacturer specification

a) false b) true

Note: **Satisfactory rating - 2 points** **Unsatisfactory -1 below 2 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information sheet 2	Reassembling units are subjected to final testing and cleaning in conformity with manufacturer's specifications

- Reassembling units are subjected to final testing and cleaning in conformity with manufacturer's specifications

The reassemble units are subjected to final test in conformity with manufacturer's specifications before submit to the customer by providing power to the system the operation of the reassembled units according to the specification.

Now that the equipment is operational, check all the functions that have been affected by the failure. Although the equipment has been repaired and is now functioning, all operations must be checked and verified.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Reassembling is done after the repair action is performed.
   a)true b) false
2. The Reassembled units are subjected to final testing for the normal operation of the unit
   a) false b) true

3. Final Checking is done according to the manufacturer's specifications
   a)true b) false

Note: **Satisfactory rating - 2 points** **Unsatisfactory -1 below 2 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information sheet 3	Compiling documentations of Service procedures and based on workplace requirements

- Compiling documentations of Service procedures and based on workplace requirements

The formal description of a technical process is known as its documentation. Documentation takes the form of technical and user manuals that accompany various technological objects, materials, and processes. Electronic hardware, computers, chemicals, automobiles all are accompanied by descriptive documentation in the form of manuals. The aim of documentation is to give those carrying out the works the information they need. Documents are also used to prepare cost estimates and to obtain tenders from potential contractors. Documentation should be prepared by qualified specialists. The key to good documentation is to correctly identify the problem to be solved, and hence to specify an appropriate solution. The nature and extent of the work must then be clearly conveyed to those who will do it.

Two kinds of documentation are required when products are sold: Technical documentation and

- User documentation.

Technical documentation is a physical description of a system, device, material, or process. This technical description is used by expert users and designers as guidelines to maintain and modify various elements of the system.

- Technical documentations are very essential parts of maintenance because it can help:
  - ✓ To communicate with the concerned body through it
  - ✓ Used to know the history of the device.
  - ✓ Used to solve the same defect in future

User documentation includes the product guidelines addressed to the general user who needs to know basic requirements for getting the best use out of the technology. User documentation includes the manuals for product use, assembly, maintenance, operations, and repair.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Technical documentations are very essential parts of maintenance because it can help to:
   a)communicate with the concerned body through it
   b)Used to know the history of the device.
   c)Used to solve the same defect in the future
   d)all of the above
2. The use of User documentation includes:
   a) the product guidelines addressed to the general user
   b) the user can get the best out of technology
   c) a & b d) none of the above
3. User documentation includes the manuals for product use, assembly, maintenance, operations, and repair
   a) false b) true

Note: **Satisfactory rating - 2 points** **Unsatisfactory -1 below 2 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information sheet 4	Disposing waste materials in accordance with ***environmental requirements***

- Disposing waste materials in accordance with ***environmental requirements***

Environmental Requirements

- Proper disposal of chemicals and components
- Proper disposal of Non-biodegradable materials

Proper disposal of chemicals and components

Proper waste disposal is critical due to the fact that certain types of wastes can be hazardous and can contaminate the environment if not handled properly. These types of waste also have the potential to cause disease.

Chemicals, like other types of waste, can be harmful to human health or to the environment, either immediately or over an extended period of time. Chemical waste, like other hazardous waste need to be treated, disposed of, or recycled, safely. Some chemicals might also be fire hazards; these include petrol and paint thinners.

It is used to dispose of solid, liquid and gaseous waste. It is recognized as a practical method of disposing of certain hazardous waste materials (such as biological medical waste). Incineration is a controversial method of waste disposal, due to issues such as emission of gaseous pollutants.

Electronic waste or e-waste are those electrical and electronic items that are no longer usable or have been replaced by the new generation version. Disposal of computers and cell phones is the major segment of electronic waste.

- **Proper disposal of Non-biodegradable materials**

Non-biodegradable waste, which cannot be decomposed by biological processes, is called non-biodegradable waste. These are of two types-Recyclable: waste having economic values but destined for disposal can be recovered and reused along with their energy value. e g. Plastic, paper, old cloth etc.

Waste management is collection, transportation, and disposal of garbage, sewage and other waste products. The most important reason for waste collection is the protection of the environment and the health of the population. Rubbish and waste can cause air and water pollution

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the Environmental Requirements of waste disposal

a)Proper disposal of chemicals and components
b)Proper disposal of Non-biodegradable materials
c) a&b d) none of the above

2. Chemical waste have the potential to cause disease.

a) False b) True

3. Chemical waste can be harmful to human health or to the environment:

a) either immediately c) a&b
b) over an extended period of time

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Operation Sheet 1	Method of testing repaired unit

Method of testing repaired unit -:

Step1 Reassemble units Repaired according to manufacturer's specifications

Step2. Reassemble units are subjected to final testing and cleaning

Step3 Compile documentations of Service procedures

step4 Dispose waste materials in accordance with environmental requirements

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Task 1: How to test the repaired and reassembled units of audio video system.

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