

UNIT-3

TROUBLESHOOTING FUNDAMENTALS

INTRODUCTION TO TROUBLESHOOTING:

Troubleshooting is a process of detecting , analyzing and solving a problem. Hardware troubleshooting is the process of reviewing, diagnosing and identifying operational or technical problems within a hardware device or equipment. It aims to resolve physical and/or logical problems and issues within a computing hardware.

Troubleshooting procedure can be broken down into four steps:

1. Define symptoms
2. Identify and isolate the potential source of the problem
3. Repair or replace the suspected components.
4. Retest the system thoroughly to be sure that you have solved the problem.

The following precautions you must observe to prevent damage to yourself or to the PC:

- Keep out of the display chassis.
- Be careful when troubleshooting the power supply, if you are not experienced in high voltage circuitry.
- Handle diskettes carefully
- Don't cycle the power quickly
- Keep liquid away from the computer
- Handle components with care.

3.1: Trouble shooting tools: Bootable rescue disk, diagnostic software, virus detection software,

Antistatic tools:

Troubleshooting Tools:

Tools that are essential for PC troubleshooting are listed below:

- Phillips-head screw driver: A couple of sizes here are a good idea.
- Extractor, a spring: Loaded device that looks a bit like a hypodermic syringe
- Tweezers: For picking pieces of paper out of printers or dropped screws
From tight places.
- Flathead screw driver: A wide blade and a narrow blade are useful.
- Chip Extractor to remove chips: This is not done very often. It would put it in the second list.
- Socket drivers for hex nuts and hex screws.
- Bootable rescue disk
- Torn screw drivers.

Handy Equipment that it would be good to have:

- Multi Meter to check the power supply output
- Needle nose pliers for holding objects in place
- Flashlight to see inside the PC case
- AC outlet ground tester
- Small cups or bags to keep screws
- Antistatic bags to store unused parts
- Pen and paper for taking notes
- Diagnostic software
- Utility software and virus detection software on disks.

BOOTABLE RESCUE DISK

A Rescue Disk is useful in restoring a computer if it becomes non-bootable. The rescue disk is a bootable disk, which contains system critical information. This disk can restore corrupt boot sectors and partition table. As rescue disk can replace corrupt boot sectors and partitions table with a clean copy. It is a generic solution to all kinds of boot sector viruses. It is always advisable to keep track of the rescue drive for systems.

To create rescue disk in windows 9X follow the steps:

1. Click on start then settings and then click on control panel.
2. In the control panel window double click the add/remove programs icon.
3. Click the start-up disk tab, and then click the create disk button. The disk will then be created.

DIAGNOSTIC SOFTWARE:

Diagnostic software plays an important role in computer hardware servicing. Generally, these software's are used to identify the installed computer parts. Analyse Disk drives and test the working conditions of the devices and parts. Some of the diagnostic software's are used to perform some machine level tasks like low level formatting sector reading, FAT and partition table analysing.

LIST OF DIAGNOSTIC SOFTWARE'S:

The following are the most commonly used diagnostic software's:

- Microsoft Diagnostics-DOS MSD Command
- Norton utilities
- Check IT
- Quick Analysis(QA+) and
- ATDIAGS.
- These utility programs are available for both DOS and Windows Environment.

VIRUS DETECTION SOFTWARE:

A computer virus is a [computer program](#) that can replicate itself and spread from one computer to another. The term "virus" is also commonly, but erroneously, used to refer to other types of [malware](#), including but not limited to [adware](#) and [spyware](#) programs that do not have a reproductive ability.

Virus Detection software sometimes called virus scanners. Virus scanners are programs which search the system areas as well as program files for known virus infections. These scanner programs search for a specific virus code sequence called signature within a normal program to check for any virus infection.

They are two common methods that an anti-virus software application used to detect viruses.

- The first and by far the most common method of virus detection are using a list of virus signature definitions. The advantage of this detection method is that users are only protected from viruses.
- The second method is to use a heuristic algorithm to find virus based on common behaviours. This method has the ability to detect that anti-virus security firms have yet to create a signature for.

Some popular Virus Detection Software's:

- Norton antivirus software
- MacAfee antivirus software
- Quick heal antivirus software

SYMPTOMS/WARNING SIGNAL ABOUT VIRUS:

- The computer runs more slowly than normal
- The computer stops responding or looks up
- The system frequently restarts automatically
- Although the computer restarts on its own. It fails to run normally.
- Applications on the computer does not work correctly
- Disk drives are inaccessible.

ANTI-STATIC TOOLS:

Static electricity is a very high voltage stored in an insulated body. Although, the voltage is high, the amount of electrostatic discharge current that it can sustain is very low and so static electricity is not that harmful.

An electronic component such as memory or logic chip composed of fine, conductive, metal oxides deposited on a small piece of silicon. Its dimensions are measured in fractions of micron any static electricity discharged into this structure will spark between conductive tracks damaging them.

To protect components and components from ESD damage make sure that your body and clothing are drained of static electricity before starting work.

FOLLOWING TOOLS ARE DIRECTLY WIDELY USED TO HANDLE ESD PROBLEMS:

- Anti ESD work Bench
- Anti-static strip
- Anti-static MAT
- Anti-static slipper
- Anti-static bag



Fig:4.1.4.1: Anti ESD Work Bench

It is one that is grounded so that static electricity and electrostatic discharge (ESD) does not affect the products being working on



Fig:4.1.4.2 Anti Static Strip

An Anti static strip,ESD wrist strip or ground bracelet is an antistatic device used to prevent ESD by safely grounding a person working on electronic equipment.

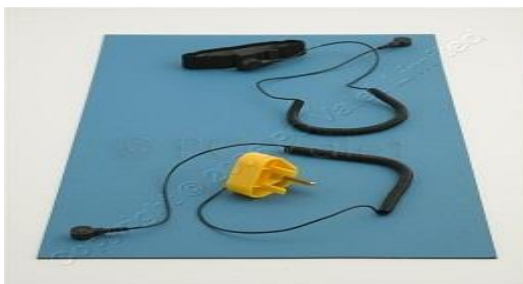


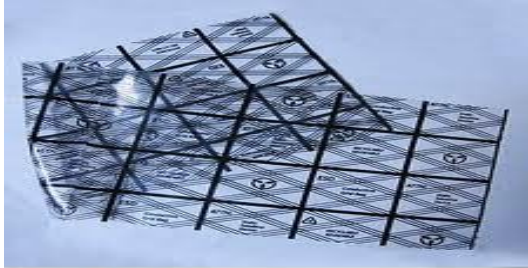
Fig:4.1.4.3:Anti Static Mat

Anti static mats are layered on work place area to control the static electricity.



Anti Static Slippers are used in electronic industry etc., to drain the static electricity safely while working.

Fig:4.1.4.4:Anti Static Slippers



It is a bag used for shipping or storing electronic components, which are prone to damage caused by electrostatic discharge

Fig:4.1.4.5 Anti Static Bag

3.2 HOW TO ISOLATE COMPUTER PROBLEMS:

The following are the fundamental rules in isolating computer:

- **Approach the problem systematically:** Start at the beginning and walk through the situation in a careful way. Remember it and apply every time.
- **Divide and Conquer:** This rule is the most powerful and it isolates the problem. In the overall system, remove software or hardware components one after another. Until the problem is isolate a small part of the whole system.
- **Don't overlook the obvious:** Ask simple question: Is the computer plugged in? Is it turned on? Is the monitor plugged in? Most problems are so simple that we overlook them because we accept the problem to be difficult . It is more efficient to first check the components that are easiest to replace.
- Make No Assumptions
- **Write things down:** Keep nothing down the symptoms. They will help you think more clearly.
- Reboot and start over
- Keep your cool
- Don't assume worst
- Know the starting point
- Careful visual inspection should catch the following types of faults.
 - Loose wires
 - Loose connections
 - Broken wires
 - Blown fuses
 - Wrong Switching settings
 - Missing jumpers
 - Burn PCB track
 - PCB track out
 - PCB track short
 - Cold solder joints.

When solving a computer problem, apply above rules and prepare course of action. As it involves the following:

- Interact with the user
- Isolate the problem by elimination the unnecessary
- Then follow establishes guidelines towards a solution

3.3 TROUBLE SHOOTING GUIDELINES:

Systematic trouble shooting means logical approach; it is a scientific and analytical process. The systematic troubleshooting approach can be divided into following steps:

- 1. Symptom observation:** one should be very careful in observing the fault symptoms while troubleshooting. It is common that while trouble shooting the system; one will notice one or two symptoms and ignores the remaining symptoms. But in case of multiple faults, it will be impossible to locate the exact fault or it will take more time.
- 2. Symptom Analysis:** The most important step in troubleshooting is the systematic analysis of the symptoms. A careful analysis of the symptoms will give a clue to the fault location process and how it is happened.
- 3. Fault Diagnosis:** It is highly sophisticated scientific process. It needs intelligence presence of mind and detective skill on the part of the engineer. The most important point here is the multiple dimensional views to be applied by the hardware engineer to know the cost and parts to be troubleshoot.
- 4. Fault rectification:** In the last guideline, rectify the identified fault.

3.3.1: POWER SUPPLY TROUBLESHOOTING:

Typical symptoms associated with power supply failures include the following:

- No indicator lights are visible. With no disk drive action and no display on the screen, nothing works and system is dead.
- ON/OFF indication lights are visible, but there is no disk drive action and no display the system fan might or might not run.
- The system produces a continuous beep tone.

CHECKING DEAD SYSTEMS:

Special consideration must be taken when a system is in operable system. There are no symptoms to give clues where to begin the isolation process. In addition, it is impossible to isolate the problem by using any software.

The absence of any lights workings usually indicates that no power is being supplied to the system by the power supply.

- Check the external connections of the power supply. This is the first step in checking any electrical equipment that shows no signs of life.
- Verify the position of the ON/OFF switch
- Examine the power card for good connection at the rear of the unit.
- Checking the setting of the 110/220 switch setting on the outside of the power supply.
- Check the power at the commercial receptacle using a voltmeter or by plugging in a lamp into the outlet.

3.3.2: TROUBLESHOOTING THE SYSTEM BOARD:

- The microprocessor RAM modules ROM BIOS and CMOS battery are typically replaceable units on the system board.
- Both the microprocessor and the ROM BIOS can be sources of such problems.

SYSTEM BOARD SYMPTOMS:

- The ON/OFF indicator lights are visible and the display is visible on the monitor screen, but there is no disk drive action and no boots up.
- The ON/OFF indicator lights are visible and the hard drive spins up but the system appears dead and there is no boot up.
- The system locks up during normal operation
- The system produces a beep code with one ,two ,three ,five ,seven or none beeps(NIOS dependent)
- The system produces a beep code of one long and 3short beeps

- The system does not hold the current date and time
- CMOS battery low message displays indicating failure of the CMOS battery.
- A 201 error code displays ,indicating a RAM failure
- A CMOS in operational message displays indicating a system configuration and setup failure.
- A CMOS Time and date not set message displays indicating a system configuration and set up failure.
- The speaker does not function after being replaced with a known good unit.
- The keyboard does not function after being replaced with a known good unit.

CONFIGURATION PROBLEMS:

Configuration problems typically occur when the system is being set up for the first time or when a new option has been installed.

MICROPROCESSORS:

In the event of a microprocessor failure, the system might issue a slow single beep from the speaker along with no display. This indicates that an internal error has disabled a portion of the processors internal circuitry. Such a problem results in the system continuously counting RAM during the boot up process. Only way to isolate the problem is to replace the microprocessor.

RAM:

RAM failures basically fall into two major categories and create different types of failures.

Soft Memory errors:

Errors caused by infrequent and random glitches in the operation of applications and the system. You can clear these events just by restarting the system.

Hard Memory errors:

Permanent physical failures that generate errors in the system and require that the memory units be checked by substitution.

ROM:

A Bad or damaged ROM BIOS typically stops the system completely when you encountered a dead system board examine the BIOS chip for physical damage. If these devices over heat it pointing toward damaged BIOS involves the boot up sequence. In any case, you can replace the defective BIOS with a version that matches the chipset used by the system.

CMOS BATTERIES:

If a system refuses to maintain time and date information, the CMOS backup battery or its recharging circuitry normally faulty after the back-up battery has been replaced to check the contacts of the battery holder for corrosion.

If the batteries fail or if it has been changed, the contents of the CMOS configuration are lost. After replacing the battery it is always necessary to access the CMOS setup utility to reconfigure the system.

3.3.3 TROUBLESHOOTING HARD DISK DRIVES

Typical symptoms associated with hard disk drive failures include the following:

- The front panel indicator lights are visible and the display is present, but there is no disk drive action and no boot up.
- The computer boots up to a system disk in the A drive but not hard drive indicating that the system files on the hard disk drive are missing.
- The computer does not boot up when turned on.
- An IBM-Compatible 17XX error code is produced on the display.
- No motor sounds are produced by the HDD while the computer is running
- A HDD controller failure message appears, indicating a failure to verify hard disk setup by system configuration file error.

- A C: or D: fixed disk drive error message appears, indicating a hard disk CMOS (Complementary Metal-Oxide Semiconductor Technology) set up failure.
- A No Boot Record Found, a Non-system Disk or Disk error, or an invalid system disk message appears.
- The video displays are active, but the HDD's activity light remains on and no boot up occurs, indicating that the CMOS HDD is incorrect.
- An out of disk space message appears, indicating that the amount of space on the disk is insufficient.
- Missing OS indicating that the master boot record is missing
- A Current Drive no longer valid message indicating HDD's CMOS configuration information is incorrect.

3.3.4 TROUBLESHOOTING OPTICAL DRIVE:

Optical drive troubleshooting issues can be hardware and software related .The affected components are the following.

1. OPTICAL DRIVE 2.OPTICAL MEDIA 3.SOFTWARE

CD-ROM AND DVD-ROM COMMON ISSUES:

- Drive cannot read an audio CD or any discs
- The BIOS does not recognize the drive
- The drive is not recognized or seen in windows.
- "Not ready reading drive" error.
- Data error reading drive X: while trying to read a CD.
- The driver may be corrupted or missing (code 19, 32, 31, 39, 41) in device manager error on CD/DVD drive.
- CD-Drive cannot open
- CD-Drive has no power

Troubleshooting CD-ROM and DVD-ROM Read issues:

- Ensure that the disk is not dirty or scratched.
- Try another CD or DVD
- Try another disk reading software.

Check if the drive is properly detected in my computer and in the device manager.

- If there is an error code in the device manager.
- If the driver is not detected in Device Manager and in My computer have the customer check if it is properly detected in BIOS as the secondary master and then reset the cables
- If detected, test the drive in DOS mode by booting to bootable disc to see if the CD is recognized.
- If the drive sees the bootable disc, it means that this is an OS issue. Remove the optical drive in safe mode.
- After reloading optical drive in safe mode and if the drive is properly detected in my computer and in Device Manager.

Here are some basic troubleshooting steps for write issues:

- Verify if the customer have a preinstalled burner drive
- Double check that the CD is not dirty or scratched
- Try another blank CD, preferable other hand
- See to it that disks comply with the drive specifications
- Use a CD lens cleaner before burning a file.
- Check if the customer is getting an error code when burning a file
- Try burning software.

3.3.5 TROUBLESHOOTING KEYBOARD

Most of the circuitry associated with the computer's keyboard located on the keyboard itself.

KEYBOARD SYMPTOMS:

- No characters appear on screen when entered from the keyboard
- Keyboard error-KB Test failure error appears
- Some keys work, whereas others do not work.
- Wrong characters are displayed
- An error code of six short beeps is produced during boot up
- An IBM-compatible 301 error code appears
- An unplugged KB error appears
- A key is struck.

BASIC KB CHECKS:

The keys of the KB can wear out over time. This might result in keys that don't make good contact. The struck key produces an error message when the system detects it.

An unplugged KB, or one with a bad signal cable, also produced kb error message during start-up. Ironically, this condition might produce a configuration error message that says "press F 1 to continue".

If the KB produces odd characters on the display, check the windows keyboard settings in Device Manager. If the Keyboard is not installed or is incorrect. Install the correct keyboard type and also correct language settings.

KEYBOARD HARDWARE CHECKS:

If you suspect a KB hardware problem isolate the KB as the definite source of the problem, because the keyboard is external to the system unit. Detachable and in expensive, simply exchange it with a known good KB

If the new KB works correctly, remove the back cover from the faulty KB and check for the presence of a fuse in the +5V DC supply and check it for continuity. Disconnecting or plugging in a KB has this type fuse while power is on can cause the KB to fail.

In replacing, the KB does not correct the problem and no configuration or software reason is apparent, the next step is to troubleshoot KB receiver section of system board. On most system boards, this ultimately involves replacing the system board.

3.3.6 TROUBLESHOOTING MONITOR

The Monitor is the difficult peripheral to troubleshoot due to presence of analog components as well as high voltage presence inside the monitor. Many display related problems are caused by incorrect configuration and cable fault.

Fault	Troubleshoot	Suggested Action
Monitor Dead	Monitor fuse blown, Monitors power supply section faulty	Check and replace fuse Check Power Supply Circuit.
Beeps at start up but no display	Display adapter not seated properly in expansion slot	See that display adapter place properly in the expansion slot
Power on LED glows but no connection	Power supply voltage abnormal some loose connection in power supply circuit. Brightness	Check power supply circuit. Check CRT tube socket for loose problem turn brightness control on
Abnormal brightness in display	Power supply voltage abnormal screen voltage high	Check power supply circuit. Check transistors, diodes and capacitors
Only one horizontal line appears	Deflection yoke's vertical winding is loose are open	Check deflection yoke vertical coil and replace
Only one vertical line appears	Deflection yoke's horizontal winding is loose or open	Check deflection yoke horizontal coil and replace
Bright spot/line on screen display	Monitor cable or loose connected. Display adapter fault	Check the cable connection and quality it is damaged replace it. Check display adapter. Replace picture tube and confirm
Display Shaking	Open diode in power supply.	Check the power supply for ripples replace

	Bridge rectifier circuit.	the capacitor
Display rolling in horizontal direction	Horizontal hold control misadjusted. Cable loose contact	Adjust the horizontal hold control present connect the cable properly
Display rolling in vertical direction	Vertical hold not adjusted cable loose contact	Adjust the vertical hold control pre-set connect
No Display	Problem in grounding video cable loose contact	Check contact problem in ground wire, check video and check power supply grounding connection
No Cursor	Software fault adapter not fully IBM Compatible	Replace adapter with fully compatible one
Spot seen when switching off	CRT Wreaking CRT ageing	Replace Picture tube and confirm

3.3.7 PRINTER PROBLEMS

The following are the steps one should take when something goes write with the printer. When a printer is not working or printing, or printing with character the problem could be in computer or in the software.

It could be also being that the printer interface or the cable or the printer itself is the reason behind this problem.

- Check if the printer is on-line, plugged to the mains, has paper and is in power on position.
- Switch off the printer and the system. Switch on the printer and then switch on the system and try printing once again.
- If the problem continues, disconnected the printer and do a self-test.
- If the self-test is OK then instead of using some software to test the printer.
- If the directory listing appears on the printer then the fault is with the software being used.
- If nothing works the n replace the printer interface board and try again.

DIAGNOSING PROBLEMS:

The following are some common problems you may encounter and suggested actions.

1. PRINTER DOES NOT PRINT: If your printer does not print, check the following

- Make sure that the printer is turned on; the power light should be on.
- Make sure that the printer is on-line, ONLIGHT should be on.
- If the printer is connected to a printer sharer, check that the sharer switch is on.
- Check that the software you are using has selected proper printer.

2. PRINTER DOES NOT WORK; DEAD PRINTER:

- AC input voltage improper, check AC input voltage
- Power supply fuse may have blown, check the fuse provided on printer.

3. AFTER PRINTING SOME CHARACTERS, PRINTER STOPS:

- This problem mostly happens if you are using serial communication. If computer and printer are using different protocol then this problem could happen.
- This is most likely due to old ribbon. This could also be due to mis-adjustment of the plate gap, check and adjust the gap between the platen and the print head.

4. Black/White horizontal line along each line/missing dots during printing:

This problem could also be due to

- Tip of the print dot pin being worn out, replace head to correct
- Dust around the print head connector, clean the connector

- Loose connections of the head data ribbon, check and connect firmly.

5. READY LIGHT ON THE CONTROL PANEL, NOTHING IS PRINTED:

- This shows that the data sent to the printer is reaching the printer but not printed. This is due to bad printer cable or printer not being setup proper.

6. SELF-TEST PATTERN IS NOT PROPER:

- If the self-test printed by the printer is not as it should be then there is some problem with the printer. Check power, print head, print head data ribbon etc.

7. END OF PAPER IS NOT SENSED AND PRINTING CONTINUES WITHOUT PAPER:

- Check for defective paper and end sensor, micro switch in the paper end sensor could be defective. This could also be due to the paper end sensing being disabled by given control command to the printer.

3.3.8 TROUBLESHOOT OS PROBLEMS:

Here we will consider the windows OS let us see frequently appeared problem and solutions for them.

1. Error Messages encountered during boot before windows loads:

Ensure that your computer BIOS settings are correctly configured to the hardware that is installed in your computer. Improper settings in the BIOS may cause various errors and these errors may stop the load process of the computer.

2. Error Messages while windows is loading:

Errors that occur while windows XP is loading and/or prevent window XP from loading are likely being caused by a configuration error in the registry.

- If you have recently changed or installed something that could have caused normal windows to stop loading. Try loading good configuration.
- If you are unable to get into normal windows and believe that removing or uninstalling a program or changing a setting may help enable you to get into windows.

3. Other error mgs that occur while a window are loading or after windows is loading:-

Error that have occurred while windows is loading and /or after windows has completed loading are offer caused by a program that is automatically loading each time window is loading problem or misconfiguration of a h/w device or computer virus.

- If error occur but Microsoft windows still loads verify no issues or conflicts exist in device manager
- Ensure that if program are loading automatically the error are not associated with these pgms
- Make sure windows xp is up to date by checking Microsoft windows update page
- If your computer has a virus protection program installed make sure it is up to date

Other error mages:- if you are experiencing other error msgs it is likely these error are being caused by the s/w program you are running and or a h/w device you are attempting to utilize

COMPUTER RUNNING SLOWLY:

- Make sure your computer has at least 500mb of free hard disk drive space if it is less it causes the computer to operate more slowly
- Run Microsoft scandisk and defrag on the computer and found our scandisk page and our defrag page.
- Close any program that are running in the background and/or disable back ground pgms from automatically loading each time your computer boots
- Click state search and click file and folders in search window search for files name * temp and make search in any drive and delete any files found

- Ensure that no error or conflicts exists in the device manager
- Make sure windows xp is to date by checking Microsoft windows update page.
- Delete all files in your windows prefect directory.
- Ensure your computer has the latest drivers for the h/w devices installed in your computer

3.4 SURGE PROTECTION AND BATTERY BACKUP

Surge Protection and battery backup is one of the important equipment you need for your computer, is a surge protector. They allow you to plug multiple components into one power outlet. The other function of the surge protector is to protect the devices from electric surges.

HOW SURGE PROTECTOR WORKS

- A Standard surge protector passes the electrical current along from the outlet to a number of electrical and electronic devices plugged into the power strip.
- If the voltages from the outlet surges or spikes rises above the accepted level.
- The surge protector diverts the extra electricity into the outlet's grounding wire.
- In the most common type of surge protector, a component called MOV (Metal Oxide Varistor) diverts the extra voltage. MOV forms a connection between power line and ground line.

AN MOV HAS THREE PARTS.

A piece of Metal Oxide Material in the middle, joined to the power and groundling line by two semiconductors.

These semiconductors have a variable resistance that is dependent on voltage. When voltage is below a certain level, the electrons in the semiconductors flow is in such a way as to create a very high resistance. When the voltage exceeds that level, the electrons behave differently by creating much lower resistance .As soon as the extra current is diverted into the MOV and to ground, the voltage in the hot line returns to a normal.

BATTERY BACKUP

A device which provides power to equipment during the absence of commercial AC with the help of a battery is known battery backup device Ups is the popular battery backup device.

UPS (Uninterruptable Power Supply):

A device that provides battery backup, when the electrical power fails or drops to an unacceptable voltage level. Small UPS system provide power for a few minutes enough to power down the computer in an orderly manner, while larger systems have enough battery for several hours.

UPS generally protect a computer against four different power problems:

- Voltage surges and spikes: Times when the voltage on the line is greater that it should be.
- Voltage sags: Time when the voltage on the line is less than it be
- Total Power Failure: Times when a line goes down or a fuse blows somewhere on the grid or in the building.
- Frequency Differences: Times when the power is oscillating at something other than specified.

THE MAIN PARTS OF ANY UPS ARE:

- A Voltage Regulator: It is consisting of a surge suppressor and a filter.
- An Inverter: This is powered by a battery.
- A Transfer switch: This initiates the shift from the mains to the battery in a case of a power failure.

THE SURGE SUPPRESSOR AND THE FILTER ensures that when the power is drawn from the mains there are no undue fluctuations or spikes passed to the computer, which can harm it. In the event of power failure, computer is moved to battery supplied power by the transfer switch.

The inverter converts the DC voltage supplied by battery into AC voltage.

3.5 STAND BY UPS, INLINE UPS, LINE INTERACTIVE UPS, INTELLIGENT UPS

UPs are available in different types. They are

1. Stand by UPs
2. Inline UPs
3. Line Interactive UPs
4. Intelligent UPs

A STANDBY UPS:

It switches circuits from the AC circuit to the battery powered circuit. The following figure shows the standby UPS. The solid line in the picture represents the primary circuit by which electricity flows. The dashed line represents the secondary circuit that is used when the AC current fails.

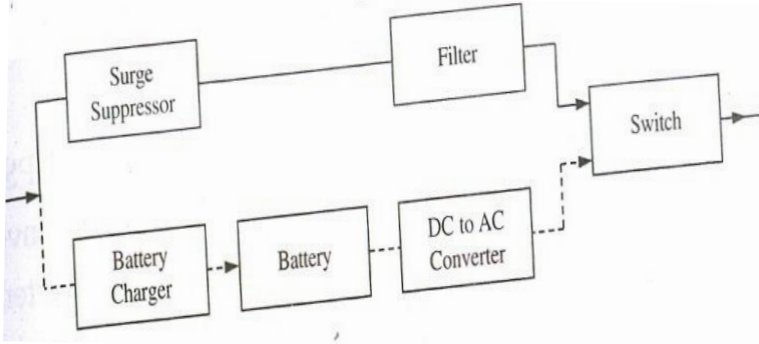


Fig: 4.5 (a) standby ups

The primary circuit will have surge suppressor and filter. During normal operation small amount of current flows to the secondary circuit to keep battery charged. When AC power fails the UPS switches from the primary to the secondary circuit and battery provides the power, which is converted from DC to AC before it leaves the UPS.

THE INLINE UPS:

As shown in the following figure, Inline UPS use battery powered circuit as the primary circuit instead of AC circuit.

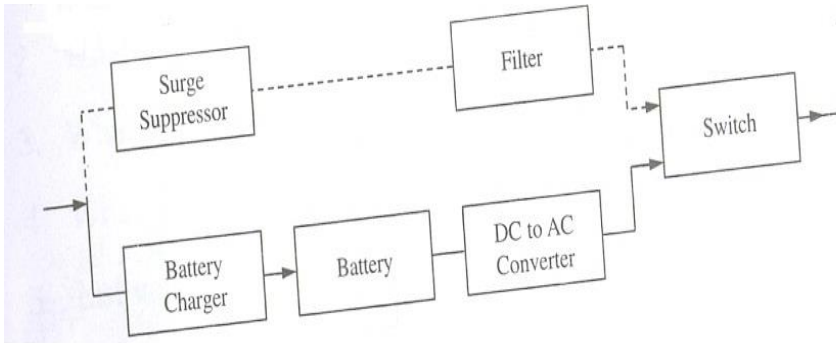


Figure: 4.5(b): Inline Ups

With the inline UPS, when the AC current fails no switching is needed because the primary circuit continues to be the battery powered circuit. The only thing that is lost is the battery recharging. These UPS are sometimes called the true UPS because they truly provide uninterrupted power supply, because the inline UPS converts the AC power to battery power in DC and then back to AC power.

Comparison of Standby and Inline UPS:

ITEM	Stand By UPS	Inline UPS
Line Noise	Medium to High	Almost Perfect
Surges	High	Almost Perfect
Switching Time	High	Almost Negligible
Cost	Inexpensive	Expensive
Suitable	Not Suitable	Suitable

LINE INTERACTIVE UPS:

The line interactive Ups is a variation of the stand by Ups that shortens the switching time by always keeping the inverter working. So there is no charging uptime for the inverter. An inverter is a device that converts DC to AC. However during regular operation the inverter filters electricity and charges the battery by converting AC to DC. If the power fails, the switch breaks the normal circuit and inverter switches roles and begins to convert the battery's DC to AC. The delay for the inverter to switch role is shorter that the delay for a standby UPSs that must start up the inverter.

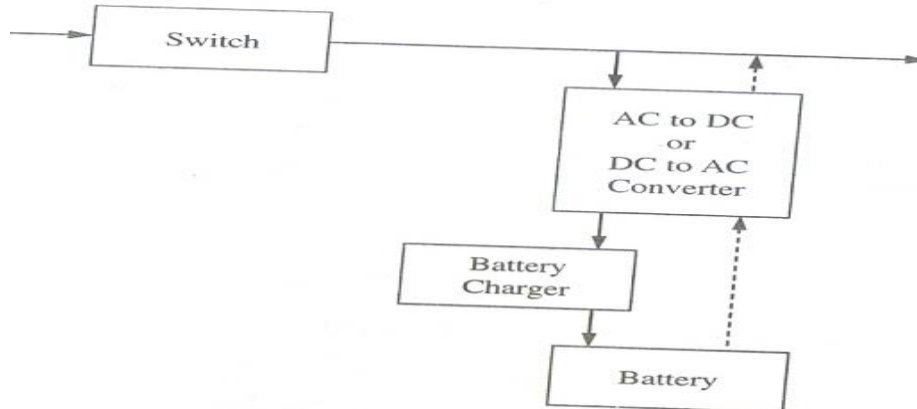


Figure: 3.5(c): line interactive Ups

INTELLIGENT UPS:

Some UPSs can be controlled by software from a computer for additional functionality. This type of UPSs will have serial port connection to the PC and microprocessor on board.

This type of UPSs can perform the following:

1. Diagnose the UPSs
2. Check for a weak battery
3. Monitor the quality of electricity received
4. Monitors the load
5. Automatically Schedule the weak battery test
6. Protect the servers during the back out of UPSs.

Windows NT and Windows 2000 offer support for Intelligent UPSs.