

# TEJ – Computer Technology

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## Computer Assembly

### Scope

It is not suggested that this activity be done as a standalone unit, but as part of a progression in student learning that includes the following preliminary units:

1. **Hardware Orientation:** In this unit, students are individually given buckets of computer hardware components found in most desktop units today (or, even, slightly older models). Students are instructed on each component at a time, and have the opportunity to closely inspect and handle the component. Safety considerations specific to each component are discussed at this time. The students are then instructed on proper hookup of components. On a subsequent day, students are allowed time to make the appropriate hookups and tested on their knowledge. This activity does not introduce electricity in any way, which reduces the safety concern at this point. In addition, students are working with scrap components, so breakage is a minor concern, allowing the students maximum ease to focus on learning.
2. **Computer Disassembly:** In this unit, students (working in pairs) test that a system unit is functioning, and then have the opportunity to disassemble the unit. All connections are dismantled, components are removed, and the motherboard is removed intact, with only the RAM sticks taken off. Students must take particular note of LED connections within the system unit, auxiliary power connections to the motherboard, etc. Students should NOT remove case structure that is meant to hold the internal drives in place, but rather, just remove the drives themselves and disconnect all cabling.

At this point in time, students are ready to tackle Computer Assembly (this unit). Students now have some familiarity with hardware components and connections from the previous two activities, students are now comfortable reassembling the hardware components and making the appropriate connections.

### Safety Considerations

There are a number of safety considerations to note while assembling a computer:

1. Always ground yourself before touching the inside of the computer. This may involve using an antistatic wrist strap or touching the painted chassis (outside case) of the computer first.
2. Long hair should be pulled back and secured, jewellery should be removed, ties or similar clothing should not hang into an open unit.
3. Your work surface should be clean, well-lit, free of dust or items that may build static electricity, including a carpeted floor. The floor should be tiled.
4. Before working inside the system unit, power off the unit and unplug. Laptop units should also have the battery removed, to prevent any source of power.

5. Computer connections should fit snugly and firm, without applying excessive force that will lead to breakage.
6. Keep sensitive computer parts in antistatic bags until ready to use, and avoid exposing them to static electricity.
7. Screws used to affix hardware components should neither be over-tightened (causing stripping) nor under-tightened so that the component is loose.

Working in pairs, on system units destined for scrap by the School Board, prepare the work space. Students should have a large space with adequate lighting, good ventilation, and a non carpeted floor. The workbench or table should be accessible from all sides. Remove clutter and have necessary screwdrivers available. An antistatic mat on the table will help prevent physical and ESD damage to equipment. Small containers can be used to hold small screws and other parts as they are being removed. Have compressed air available, to be dispensed by the teacher ONLY, due to the extreme danger of students inhaling compressed air.

## Steps

### Case Orientation and Power Supply installation

Computer cases vary by manufacturer. Typically, the cover is removed as one piece or the top is removed before the side panels can be removed. Next, the power supply is oriented to fit properly into the case (holes in power supply aligned to fit holes in case), and affixed with screws. Ensure that all necessary screws are installed and that the power supply is stable within the case.

### MotherBoard preparation and Installation

All components of the motherboard are installed BEFORE installing the motherboard itself into the case. The CPU, heatsink and fan assembly should not have been removed during computer disassembly. If removed, reinsert the CPU, apply thermal compound to the CPU chip, and reinstall the heatsink and fan assembly, ensuring that the CPU fan connection to the motherboard is made. If you are unsure of the connection, consult the motherboard manual available on the manufacturer's website.

Note: When handling the CPU, ensure that you do not touch the contacts at any time.

Install the RAM on the motherboard. Inspect the RAM and the RAM slot before attempting to insert. Align the notches of the RAM with the slot, and fully seat (press down fully) until the RAM tabs at the sides click.

If the motherboard is older (from a computer destined for scrap), it may be necessary to clean the motherboard from dust and dirt built up over years of use. Cleaning is done via compressed air administered directly by the teacher, or under the teacher's immediate supervision. Componentry connections that have built up grease or dust may be cleaned with isopropyl alcohol.

Visually inspect the appearance of the motherboard to ensure that all connections are secure, snug and clean.

The motherboard may now be installed in the computer case. It will be elevated slightly from the bottom of the case by plastic standoffs, preventing it from touching the case directly. Carefully align the motherboard to the screw holes, and affix it to the unit by inserting and tightening all screws.

### Internal Drive Installation

The computer will have two sizes of internal drives: 3.5 inch internal drives (hard drives or maybe even old 3.5" floppy drives), or 5.25" internal drives (CD/DVD drives).

The first step in drive installation is to first install the actual drive into the bay and affix with screws. Once again, screws should be soundly tightened. If additional drives are necessary, the student may need to pop out the cover on the drive bay, so that the external media can be loaded.

### Adapter Card Installation

Networking cards (wired and/or wireless), sound cards, and/or audio cards may need to be installed at this point. All cards will follow the same installation procedure:

- Locate the proper expansion board slot on the motherboard.
- Ensure that the contacts on the card and the slot are clean and free of dust and debris. If necessary, use isopropyl alcohol for cleaning.
- Align the card with the slot, and gently but firmly insert. Press down on the card until it is fully seated
- Secure the card to the case with the appropriate screw.

### Internal Cable Connection

There are several types of cabling connections that must be made.

Data Cables – Flat ribbon cables used to transfer data between the internal device and the motherboard must be connected. Depending on the type of drive (PATA or SATA), locate the appropriate cable, attach securely to the drive and then to the appropriate controller on the motherboard. The motherboard may have multiple controllers, labelled primary and secondary. Hard drives should be connected to the primary controller, whereas CD/DVD drives can be connected to the Secondary Controller. SATA drives should be connected to the appropriate 7 pin controller.

Data cables have a red stripe on one end indicating Pin 1. It is important to make the connections on both the drive and the controller to match Pin 1.

Power cables – Round colored cables from the power supply will be connected to each internal device, to provide the necessary power for the device to spin. Molex power connectors are the standard power connection, with berg connectors being used for floppy drives when necessary. The motherboard also requires a 20 pin power connection coming from the power supply. There may be an auxiliary 4 pin power connection required by the motherboard. This should have been noted by the students during computer disassembly.

Once again, all power connections should be firmly snug.

Finally, LED connections coming from the case must be inserted into the motherboard. these connections are difficult to remember, and should have been noted by the students prior to disassembly, or, the students may consult a working and assembled unit to reference for proper arrangement of these connections.

### Case Closure

Reattach the sides and/or cover of the case, and connect external cables to the computer. This will include a power cable to the power supply in the system unit, a video cable from the monitor, a keyboard and/or mouse cable, and possibly a networking cable.

### Booting Up the Computer

When the computer is turned on, you have the opportunity to test your skills in reassembly. There may be basic errors that the computer detects before the video display is available. These will be indicated by beep codes. When the computer is booted, the BIOS chip first tests RAM and other internal components using a POST. A beep code is used to indicate that there is a hardware problem. Beep codes are designed to be counted and then researched (by BIOS manufacturer) to determine the specific of the hardware problem. Many beep codes are related to RAM problems or CPU problems.

During the boot process, you may enter the BIOS setup program by pressing the correct key PRIOR to the computer finishing bootup. This key is specific to the BIOS program, but is usually F10, DEL, or occasionally F8. Pressing one or each of these keys in succession will permit entrance into the BIOS setup utility. Using this basic interface, you can review the existing hardware settings, as well as changing the boot order if you wish to install a new OS from CD.

### In Conclusion

Repetitive student experiences in computer disassembly and assembly will significantly improve student confidence in dealing with computer hardware and troubleshooting. Ample scrap system units provide plenty of opportunity for student experience. Students can add additional hard drives and/or optical drives for more practice. Even the process of scrapping a broken computer for the purposes of harvesting individual computer components assists significantly in building student confidence. In general, comfort level is directly tied to the amount of time spent dealing with the hardware in a hands-on approach.