IBM Mobile Systems

ThinkPad - X20 Series computer

Hardware Maintenance Manual

June 2000

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First Edition (June 2000)

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Introduction

Important service information

FRU replacement strategy

━━ Before replacing parts ━━

Ensure that all diskette fixes are installed before
replacing any FRUs listed in this manual.

Use the following strategy to prevent unnecessary FRU
replacement and service expense:

- **If you are instructed to replace a FRU, but the
  replacement does not correct the problem,
  reinstall the original FRU before you continue.**

- Some computers have both a processor board and a
  system board. If you are instructed to replace either
  the processor board or the system board, and the first
  board that you replace does not correct the problem,
  reinstall the original board, and then replace the other
  (processor or system) board.

- If an adapter or device consists of more than one
  FRU, any of the FRUs may be the cause of the error.
  Before replacing the adapter or device, remove the
  FRUs, one by one, to see if the symptoms change.
  Replace only the FRU that changed the symptoms.

━━ Attention ━━

A customized setup configuration (other than default
settings) may exist on the computer you are servicing.
Running Automatic Configuration may alter those set-
tings. Note the current configuration settings (using the
View Configuration option); then, when service has
been completed, verify that the settings are in place.

Hard disk drive replacement strategy:

Always try to run a low-level format before replacing a hard disk drive.

```
┌─ Attention ─────────────────────────────────┐
│                                              │
│  The drive startup sequence in the computer  │
│  you are servicing might have been changed.  │
│  Be extremely careful during write           │
│  operations such as copying, saving, or      │
│  formatting. If you select an incorrect      │
│  drive, data or programs can be overwritten. │
│                                              │
└──────────────────────────────────────────────┘
```

How to use error messages

Use the error codes displayed on the screen to diagnose failures. If more than one error code is displayed, begin the diagnosis with the first error code. Whatever causes the first error code may also cause false error codes. If no error code is displayed, see if the error symptom is listed in the Symptom-to-FRU Index for the computer you are servicing.

How to read POST error messages

POST error messages are displayed on the screen as three, four, five, or eight digits. The error messages that can be displayed as shorter POST messages are high-lighted in this index. Some digits have one meaning for SCSI errors and a different meaning for non-SCSI errors.

The following example shows which digits display the shorter POST error messages and also defines the SCSI information in each digit of an eight-digit error message.
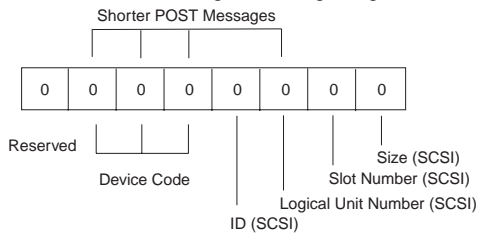
Each SCSI device is assigned a unique SCSI ID. Duplicate SCSI ID settings can generate a false error message. Use the SCSI ID to determine whether an error message is coming from an internal or an external device.

Safety notices: multilingual translations

In this manual, safety notices appear in English with a page number reference to the appropriate multi-lingual, translated safety notice found in this section.

The following safety notices are provided in English, French, German, Italian, and Spanish languages.

> **Safety Notice 1**
>
> Before the computer is powered-on after FRU replacement, make sure all screws, springs, or other small parts are in place and are not left loose inside the computer. Verify this by shaking the computer and listening for rattling sounds. Metallic parts or metal flakes can cause electrical shorts.
>
> Avant de remettre l'ordinateur sous tension après remplacement d'une unité en clientèle, vérifiez que tous les ressorts, vis et autres pièces sont bien en place et bien fixées. Pour ce faire, secouez l'unité et assurez-vous qu'aucun bruit suspect ne se produit. Des pièces métalliques ou des copeaux de métal pourraient causer un court-circuit.
>
> Bevor nach einem FRU-Austausch der Computer wieder angeschlossen wird, muß sichergestellt werden, daß keine Schrauben, Federn oder andere Kleinteile fehlen oder im Gehäuse vergessen wurden. Der Computer muß geschüttelt und auf Klappergeräusche geprüft werden. Metallteile oder -splitter können Kurzschlüsse erzeugen.
>
> Prima di accendere l'elaboratore dopo che é stata effettuata la sostituzione di una FRU, accertarsi che tutte le viti, le molle e tutte le altri parti di piccole dimensioni siano nella corretta posizione e non siano sparse all'interno dell'elaboratore. Verificare ciò scuotendo l'elaboratore e prestando attenzione ad eventuali rumori; eventuali parti o pezzetti metallici possono provocare cortocircuiti pericolosi.
>
> Antes de encender el sistema despues de sustituir una FRU, compruebe que todos los tornillos, muelles y demás piezas pequeñas se encuentran en su sitio y no se encuentran sueltas dentro del sistema. Compruébelo agitando el sistema y escuchando los posibles ruidos que provocarían. Las piezas metálicas pueden causar cortocircuitos eléctricos.

> **Safety Notice 3**
>
> The battery pack contains small amounts of nickel. Do not disassemble it, throw it into fire or water, or short-circuit it. Dispose of the battery pack as required by local ordinances or regulations. Use only the battery in the appropriate parts listing when replacing the battery pack. Use of an incorrect battery can result in ignition or explosion of the battery.
>
> La batterie contient du nickel. Ne la démontez pas, ne l'exposez ni au feu ni à l'eau. Ne la mettez pas en court-circuit. Pour la mettre au rebut, conformez-vous à la réglementation en vigueur. Lorsque vous remplacez la batterie, veillez à n'utiliser que les modèles cités dans la liste de pièces détachées adéquate. En effet, une batterie inappropriée risque de prendre feu ou d'exploser.
>
> Akkus enthalten geringe Mengen von Nickel. Sie dürfen nicht zerlegt, wiederaufgeladen, kurzgeschlossen, oder Feuer oder Wasser ausgesetzt werden. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Beim Ersetzen der Batterie nur Batterien des Typs verwenden, der in der Ersatzteilliste aufgeführt ist. Der Einsatz falscher Batterien kann zu Entzündung oder Explosion führen.
>
> La batteria contiene piccole quantità di nichel. Non smontarla, gettarla nel fuoco o nell'acqua né cortocircuitarla. Smaltirla secondo la normativa in vigore (DPR 915/82, successive disposizioni e disposizioni locali). Quando si sostituisce la batteria, utilizzare soltanto i tipi inseriti nell'appropriato Catalogo parti. L'impiego di una batteria non adatta potrebbe determinare l'incendio o l'esplosione della batteria stessa.
>
> Las baterías contienen pequeñas cantidades de níquel. No las desmonte, ni recargue, ni las eche al fuego o al agua ni las cortocircuite. Deséchelas tal como dispone la normativa local. Utilice sólo baterías que se encuentren en la lista de piezas al sustituir la batería. La utilización de una batería no apropiada puede provocar la ignición o explosión de la misma.

Safety Notice 4

The lithium battery can cause a fire, explosion, or severe burn. Do not recharge it, remove its polarized connector, disassemble it, heat it above 100°C (212°F), incinerate it, or expose its cell contents to water. Dispose of the battery as required by local ordinances or regulations. Use only the battery in the appropriate parts listing. Use of an incorrect battery can result in ignition or explosion of the battery.

La pile de sauvegarde contient du lithium. Elle présente des risques d'incendie, d'explosion ou de brûlures graves. Ne la rechargez pas, ne retirez pas son connecteur polarisé et ne la démontez pas. Ne l'exposez pas à une temperature supérieure à 100°C, ne la faites pas brûler et n'en exposez pas le contenu à l'eau. Mettez la pile au rebut conformément à la réglementation en vigueur. Une pile inappropriée risque de prendre feu ou d'exploser.

Die Systembatterie ist eine Lithiumbatterie. Sie kann sich entzünden, explodieren oder schwere Verbrennungen hervorrufen. Batterien dieses Typs dürfen nicht aufgeladen, zerlegt, über 100 C erhitzt oder verbrannt werden. Auch darf ihr Inhalt nicht mit Wasser in Verbindung gebracht oder der zur richtigen Polung angebrachte Verbindungsstecker entfernt werden. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Beim Ersetzen der Batterie nur Batterien des Typs verwenden, der in der Ersatzteilliste aufgeführt ist. Der Einsatz falscher Batterien kann zu Entzündung oder Explosion führen.

La batteria di supporto e una batteria al litio e puo incendiarsi, esplodere o procurare gravi ustioni. Evitare di ricaricarla, smontarne il connettore polarizzato, smontarla, riscaldarla ad una temperatura superiore ai 100 gradi centigradi, incendiarla o gettarla in acqua. Smaltirla secondo la normativa in vigore (DPR 915/82, successive disposizioni e disposizioni locali). L'impiego di una batteria non adatta potrebbe determinare l'incendio o l'esplosione della batteria stessa.

La bateria de repuesto es una bateria de litio y puede provocar incendios, explosiones o quemaduras graves. No la recargue, ni quite el conector polarizado, ni la desmonte, ni caliente por encima de los 100°C (212°F), ni la incinere ni exponga el contenido de sus celdas al agua. Deséchela tal como dispone la normativa local.

Safety Notice 6

To avoid shock, do not remove the plastic cover that surrounds the lower portion of the inverter card.

Afin d'éviter tout risque de choc électrique, ne retirez pas le cache en plastique protégeant la partie inférieure de la carte d'alimentation.

Aus Sicherheitsgründen die Kunststoffabdeckung, die den unteren Teil der Spannungswandlerplatine umgibt, nicht entfernen.

Per evitare scosse elettriche, non rimuovere la copertura in plastica che avvolge la parte inferiore della scheda invertitore.

Para evitar descargas, no quite la cubierta de plástico que rodea la parte baja de la tarjeta invertida.

Safety Notice 7

Though main batteries have low voltage, a shorted or grounded battery can produce enough current to burn combustible materials or personnel.

Bien que le voltage des batteries principales soit peu élevé, le court-circuit ou la mise à la masse d'une batterie peut produire suffisamment de courant pour brûler des matériaux combustibles ou causer des brûlures corporelles graves.

Obwohl Hauptbatterien eine niedrige Spannung haben, können sie doch bei Kurzschluβ oder Erdung genug Strom abgeben, um brennbare Materialien zu entzünden oder Verletzungen bei Personen hervorzurufen.

Sebbene le batterie di alimentazione siano a basso voltaggio, una batteria in corto circuito o a massa può fornire corrente sufficiente da bruciare materiali combustibili o provocare ustioni ai tecnici di manutenzione.

Aunque las baterías principales tienen un voltaje bajo, una batería cortocircuitada o con contacto a tierra puede producir la corriente suficiente como para quemar material combustible o provocar quemaduras en el personal.

Safety Notice 8

Before removing any FRU, power-off the computer, unplug all power cords from electrical outlets, remove the battery pack, then disconnect any interconnecting cables.

Avant de retirer une unité remplaçable en clientèle, mettez le système hors tension, débranchez tous les cordons d'alimentation des socles de prise de courant, retirez la batterie et déconnectez tous les cordons d'interface.

Die Stromzufuhr muβ abgeschaltet, alle Stromkabel aus der Steckdose gezogen, der Akku entfernt und alle Verbindungskabel abgenommen sein, bevor eine FRU entfernt wird.

Prima di rimuovere qualsiasi FRU, spegnere il sistema, scollegare dalle prese elettriche tutti i cavi di alimentazione, rimuovere la batteria e poi scollegare i cavi di interconnessione.

Antes de quitar una FRU, apague el sistema, desenchufe todos los cables de las tomas de corriente eléctrica, quite la batería y, a continuación, desconecte cualquier cable de conexión entre dispositivos.

Safety information

The following section contains the safety information that you need to be familiar with before servicing an IBM mobile computer.

General safety

Follow these rules to ensure general safety:

- Observe good housekeeping in the area of the machines during and after maintenance.

- When lifting any heavy object:

  1. Ensure you can stand safely without slipping.

  2. Distribute the weight of the object equally between your feet.

  3. Use a slow lifting force. Never move suddenly or twist when you attempt to lift.

  4. Lift by standing or by pushing up with your leg muscles; this action removes the strain from the muscles in your back. *Do not attempt to lift any objects that weigh more than 16 kg (35 lb) or objects that you think are too heavy for you.*

- Do not perform any action that causes hazards, or that makes the equipment unsafe.

- Before you start the machine, ensure that other service representatives and the customer's personnel are not in a hazardous position.

- Place removed covers and other parts in a safe place, away from all personnel, while you are servicing the machine.

- Keep your toolcase away from walk areas so that other people will not trip over it.

- Do not wear loose clothing that can be trapped in the moving parts of a machine. Ensure that your sleeves are fastened or rolled up above your elbows. If your hair is long, fasten it.

- Insert the ends of your necktie or scarf inside clothing or fasten it with a nonconductive clip, approximately 8 centimeters (3 inches) from the end.

- Do not wear jewelry, chains, metal-frame eyeglasses, or metal fasteners for your clothing.

  Attention: Metal objects are good electrical conductors.

- Wear safety glasses when you are hammering, drilling, soldering, cutting wire, attaching springs, using solvents, or working in any other conditions that might be hazardous to your eyes.

- After service, reinstall all safety shields, guards, labels, and ground wires. Replace any safety device that is worn or defective.

- Reinstall all covers correctly before returning the machine to the customer.

Electrical safety

Observe the following rules when working on electrical equipment.

> **Important**
>
> Use only approved tools and test equipment. Some hand tools have handles covered with a soft material that does not insulate you when working with live electrical currents.
>
> Many customers have, near their equipment, rubber floor mats that contain small conductive fibers to decrease electrostatic discharges. Do not use this type of mat to protect yourself from electrical shock.

- Find the room emergency power-off (EPO) switch, disconnecting switch, or electrical outlet. If an electrical accident occurs, you can then operate the switch or unplug the power cord quickly.
- Do not work alone under hazardous conditions or near equipment that has hazardous voltages.
- Disconnect all power before:
    - Performing a mechanical inspection
    - Working near power supplies
    - Removing or installing main units
- Before you start to work on the machine, unplug the power cord. If you cannot unplug it, ask the customer to power-off the wall box that supplies power to the machine and to lock the wall box in the off position.
- If you need to work on a machine that has *exposed* electrical circuits, observe the following precautions:
    - Ensure that another person, familiar with the power-off controls, is near you.

        Attention: Another person must be there to switch off the power, if necessary.
    - Use only one hand when working with powered-on electrical equipment; keep the other hand in your pocket or behind your back.

        Attention: An electrical shock can occur only when there is a complete circuit. By observing the above rule, you may prevent a current from passing through your body.
    - When using testers, set the controls correctly and use the approved probe leads and accessories for that tester.

- Stand on suitable rubber mats (obtained locally, if necessary) to insulate you from grounds such as metal floor strips and machine frames.

  Observe the special safety precautions when you work with very high voltages; these instructions are in the safety sections of maintenance information. Use extreme care when measuring high voltages.

- Regularly inspect and maintain your electrical hand tools for safe operational condition.
- Do not use worn or broken tools and testers.
- Never assume that power has been disconnected from a circuit. First, check that it has been powered off.
- Always look carefully for possible hazards in your work area. Examples of these hazards are moist floors, nongrounded power extension cables, power surges, and missing safety grounds.
- Do not touch live electrical circuits with the reflective surface of a plastic dental mirror. The surface is conductive; such touching can cause personal injury and machine damage.
- Do not service the following parts with the power on when they are removed from their normal operating places in a machine:
  - Power supply units
  - Pumps
  - Blowers and fans
  - Motor generators

  and similar units. (This practice ensures correct grounding of the units.)
- If an electrical accident occurs:
  - Use caution; do not become a victim yourself.
  - Switch off power.
  - Send another person to get medical aid.

Safety inspection guide

The purpose of this inspection guide is to assist you in identifying potentially unsafe conditions. As each machine was designed and built, required safety items were installed to protect users and service personnel from injury. This guide addresses only those items. You should use good judgment to identify potential safety hazards due to attachment of non-IBM features or options not covered by this inspection guide.

If any unsafe conditions are present, you must determine how serious the apparent hazard could be and whether you can continue without first correcting the problem.

Consider these conditions and the safety hazards they present:

- Electrical hazards, especially primary power (primary voltage on the frame can cause serious or fatal electrical shock)
- Explosive hazards, such as a damaged CRT face or a bulging capacitor
- Mechanical hazards, such as loose or missing hardware

The guide consists of a series of steps presented in a checklist. Begin the checks with the power off, and the power cord disconnected.

Checklist:

1. Check exterior covers for damage (loose, broken, or sharp edges).
2. Power-off the computer. Disconnect the power cord.
3. Check the power cord for:
   a. A third-wire ground connector in good condition. Use a meter to measure third-wire ground continuity for 0.1 ohm or less between the external ground pin and frame ground.
   b. The power cord should be the type specified in the parts list.
   c. Insulation must not be frayed or worn.
4. Remove the cover.
5. Check for any obvious non-IBM alterations. Use good judgment as to the safety of any non-IBM alterations.
6. Check inside the unit for any obvious unsafe conditions, such as metal filings, contamination, water or other liquids, or signs of fire or smoke damage.
7. Check for worn, frayed, or pinched cables.
8. Check that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

Handling electrostatic discharge-sensitive devices

Any computer part containing transistors or integrated circuits (ICs) should be considered sensitive to electrostatic discharge (ESD). ESD damage can occur when there is a difference in charge between objects. Protect against ESD damage by equalizing the charge so that the machine, the part, the work mat, and the person handling the part are all at the same charge.

When handling ESD-sensitive parts:

- Keep the parts in protective packages until they are inserted into the product. . Avoid contact with other people.
- Wear a grounded wrist strap against your skin to eliminate static on your body.
- Prevent the part from touching your clothing. Most clothing is insulative and retains a charge even when you are wearing a wrist strap.
- Use the black side of a grounded work mat to provide a static-free work surface. The mat is especially useful when handling ESD-sensitive devices.
- Select a grounding system, such as those listed below, to provide protection that meets the specific service requirement.

note

The use of a grounding system is desirable but not required to protect against ESD damage.

  - Attach the ESD ground clip to any frame ground, ground braid, or green-wire ground.
  - Use an ESD common ground or reference point when working on a double-insulated or battery-operated system. You can use coax or connector-outside shells on these systems.
  - Use the round ground-prong of the AC plug on AC-operated computers.

Grounding requirements

Electrical grounding of the computer is required for operator safety and correct system function. Proper grounding of the electrical outlet can be verified by a certified electrician.

Laser compliance statement

Some IBM Personal Computer models are equipped from the factory with a CD-ROM drive. CD-ROM drives are also sold separately as options. The CD-ROM drive is a laser product. The CD-ROM drive is certified in the U.S. to conform to the requirements of the Department of Health and Human Services 21 Code of Federal Regulations (DHHS 21 CFR) Subchapter J for Class 1 laser products. Elsewhere, the drive is certified to conform to the requirements of the International Electrotechnical Commission (IEC) 825 and CENELEC EN 60 825 for Class 1 laser products.

When a CD-ROM drive is installed, note the following:

CAUTION:

Use of controls or adjustments or performance of procedures other than those specified herein might result in hazardous radiation exposure.

O uso de controles, ajustes ou desempenho de procedimentos diferentes daqueles aqui especificados pode resultar em perigosa exposição à radiação.

凡未在这里指明的任何控制用法、调整、行为，

都会导致严重后果。

Pour éviter tout risque d'exposition au rayon laser, respectez les consignes de réglage et d'utilisation des commandes, ainsi que les procédures décrites.

Werden Steuer- und Einstellelemente anders als hier festgesetzt verwendet, kann gefährliche Laserstrahlung auftreten.

Az itt előírt eljárásoktól, beállításoktól és vezérlésektől eltérni a lézersugárzás veszélye miatt kockázatos !

L'utilizzo di controlli, regolazioni o l'esecuzione di procedure diverse da quelle specificate possono provocare l'esposizione a

Использование элементов настройки и выполнение процедур иных, чем указано здесь, может привести к опасному радиационному облучению.

Použitie kontrôl, úprav alebo iných vykonaní od iných výrobcov, ako je v tomto špecifikované, mohlo by mať za následok nebezpečenstvo vystavenia sa vyžiarovaniu.

El uso de controles o ajustes o la ejecución de procedimientos distintos de los aquí especificados puede provocar la exposición a radiaciones peligrosas.

Opening the CD-ROM drive could result in exposure to hazardous laser radiation. There are no serviceable parts inside the CD-ROM drive. Do not open.

Some CD-ROM drives contain an embedded Class 3A or Class 3B laser diode. Note the following.

DANGER:

Radiação por raio laser ao abrir. Não olhe fixo no feixe de luz, não olhe diretamente por meio de instrumentos óticos e evite exposição direta com o feixe de luz.

开启时会有激光发射时，请勿盯视激光光束，请勿直接查看视觉仪器，并且避免直接接触在激光光束之中。

Rayonnement laser si carter ouvert. Évitez de fixer le faisceau, de le regarder directement avec des instruments optiques, ou de vous exposer au rayon.

Laserstrahlung bei geöffnetem Gerät. Nicht direkt oder über optische Instrumente in den Laserstrahl sehen und den Strahlungsbereich meiden.

Kinyitáskor lézersugár ! Ne nézzen bele se szabad szemmel, se optikai eszközökkel. Kerülje a sugárnyalábbal való érintkezést !

Aprendo l'unità vengono emesse radiazioni laser. Non fissare il fascio, non guardarlo direttamente con strumenti ottici e evitare l'esposizione diretta al fascio.

Открывая, берегитесь лазерного излучения. Не смотрите на луч, не разглядывайте его с помощью оптических инструментов, а также избегайте прямого воздействия лазерного луча.

Keď je laserová jednotka otvorená. Vyhnite sa priamemu pohľadu a nehľadte priamo s optickými nástrojmi do lúča a vyhnite sa priamemu vystaveniu lúčov.

Radiación láser al abrir. No mire fijamente ni examine con instrumental óptico el haz de luz. Evite la exposición directa al haz.

Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

General descriptions

This chapter includes descriptions for any ThinkPad model that has the PC-Doctor DOS diagnostics program. Some descriptions might not apply to your particular computer.

Read this first

Before you go to the checkout guide, be sure to read this section.

Important notes

- **Only certified trained personnel should service the computer.**
- **Read the entire FRU removal and replacement page before replacing any FRU.**
- **Use new nylon-coated screws when you replace FRUs.**
- **Be extremely careful during such write operations as copying, saving, or formatting.** Drives in the computer that you are serving may have had their start sequence altered. If you select an incorrect drive, data or programs might be overwritten.
- **Replace FRUs only for the correct model.** When you replace a FRU, make sure the model of the machine and the FRU part number are correct by referring to the FRU parts list.
- **A FRU should not be replaced because of a single, unreproducible failure.** Single failures can occur for a variety of reasons that have nothing to do with a hardware defect, such as cosmic radiation, electrostatic discharge, or software errors. Consider replacing a FRU only when a problem reoccurs. If you suspect that a FRU is defective, clear the error log and run the test again. If the error does not recur, do not replace the FRU.
- **Be careful not to replace a nondefective FRU.**
- Service applied by an unauthorized/trained Thinkpad technician may potentially void your warranty

What to do first: When you do return a FRU, you must include the following information in the parts exchange form or parts return form that you attach to it:

1. Name and phone number of service
2. Date of service
3. Date on which the machine failed
4. Date of purchase
5. Failure symptoms, error codes appearing on the display, and beep symptoms

6. Procedure index and page number in which the failing FRU was detected

7. Failing FRU name and part number

8. Machine type, model number, and serial number

9. Customer's name and address

Note for warranty: During the warranty period, the customer may be responsible for repair costs if the computer damage was caused by misuse, accident, modification, unsuitable physical or operating environment, or improper maintenance by the customer. The following list provides some common items that are not covered under warranty and some symptoms that might indicate that the system was subjected to stress beyond normal use.

Before checking problems with the computer, determine whether the damage is covered under the warranty by referring to the following:

The following are not covered under warranty:

- LCD panel cracked from the application of excessive force or from being dropped . Scratched (cosmetic) parts

- Cracked or broken plastic parts, broken latches, broken pins, or broken connectors caused by excessive force

- Damage caused by liquid spilled into the system

- Damage caused by the improper insertion of a PC Card or the installation of an incompatible card

- Damage caused by foreign material in the diskette drive

- Diskette drive damage caused by pressure on the diskette drive cover or by the insertion of a diskette with multiple labels . Damaged or bent diskette eject button

- Fuses blown by attachment of a nonsupported device

- Forgotten computer password (making the computer unusable)

The following symptoms might indicate damage caused by nonwarranted activities:

- Missing parts might be a symptom of unauthorized service or modification.

- If the spindle of a hard disk drive becomes noisy it may have been subjected to excessive force or from being dropped.

- I9990303 errors can be caused by exposure to strong magnetic fields.

Related service information

This section provides information about the following:

- "Service Website"
- "Passwords"
- Power management

Service Web site

The latest maintenance diskette and the system program service diskette are available on
http://www.pc.ibm.com/us/files.html or
http://www.pc.ibm.com/us/support/thinkpad/tpopsys.html

Passwords

As many as three passwords may be needed for any ThinkPad computers: the power-on password (POP), the hard disk password (HDP), and the supervisor password (PAP).

When the power-on password, the hard disk password, or the supervisor password is used, a password prompt appears on the screen whenever the computer is turned on. The computer does not start until the password is entered.

Power-on password: A power-on password (POP) protects the system from being powered on by an unauthorized person. Without knowing the password, nobody can start the system.

Hard disk password: There are two hard disk passwords (HDPs):

- User hard disk password—for the user
- Master hard disk password—for the system administrator, who can use it to get access to the hard disk even if the user hard disk password has been changed by the user

Attention

If the master HDP has been forgotten, there is no way to reset it and recover the data from the hard disk.

This would require the hard disk to be replaced at the customer's expense.

Supervisor password: A supervisor password (PAP) protects the system information stored in the IBM BIOS Setup Utility so that without knowing the password, nobody can change the configuration of the computer.

Attention

If the PAP has been forgotten, there is no way to reset it and recover the data from the hard disk.

This would require the system board and the hard disk to be replaced at the customer's expense.

How to remove the power-on password: To remove the POP, do the following:

1. Power on the computer by pressing and holding **F1**.
2. Enter the supervisor password. The IBM BIOS Setup Utility menu appears.
3. Select **Password**, using the cursor keys to move down the menu.
4. Select **Power-on password**. A pop-up window opens.
5. Enter the password. When the Enter New Password field opens, leave it blank and press **Enter** twice.
6. Press **F10**; then click **Exit**.
7. Select **Yes** in the Setup Configuration window. The POP has been removed.

If you want to remove the POP but don't know what it is, do the following:

1. Turn off the computer.
2. Remove the DIMM cover from the bottom of the computer.
3. Remove the backup battery. For how to remove the backup battery, see "1030 Backup battery" on page 48
4. Turn on the computer and wait until the POST ends. After the POST ends, the password prompt does not appear. The POP has been removed.
5. Reinstall the DIMM cover.

How to remove the hard disk password: To remove the HDP, do the following:

1. Power on the computer by pressing and holding **F1**.
2. Enter the supervisor password. The IBM BIOS Setup Utility menu appears.
3. Select **Password**, using the cursor keys to move down the menu.
4. Select **Hard disk** x **password**, where x is the letter of the hard disk drive. A pop-up window opens.
5. Select either **User only** or **Master + User**.
6. Enter the password. When the Enter New Password field opens, leave it blank and press **Enter** twice.
7. Press **F10**; then click **Exit**.
8. Select **Yes** in the Setup Configuration window. The HDP has been removed.

How to remove the supervisor password: To remove the PAP, do the following:

1. Power on the computer by pressing and holding **F1**.

2. Enter the supervisor password. The IBM BIOS Setup Utility menu appears.

3. Select **Password**, using the cursor keys to move down the menu.

4. Select **Supervisor password**. A pop-up window opens.

5. Select either **User only** or **Master + User**.

6. Enter the password. When the Enter New Password field opens, leave it blank and press Enter twice.

7. Press F10; then click Exit.

8. Select Yes in the Setup Configuration window. The PAP has been removed.

Power management

To reduce power consumption, the computer has three power management modes: screen blank, standby, and hibernation.

Screen blank mode: In screen blank mode, the following occurs:

- The LCD backlight turns off.

- The hard disk drive motor stops.

- The speaker is muted.

Note: Screen blank mode in Windows 98 is called standby mode in Windows 95.

To enter screen blank mode, press **Fn** + **F3**. To end screen blank mode and resume normal operation, press any key.

Standby mode: When the computer enters standby mode, the following events occur in addition to what occurs in screen blank mode:

- The LCD is powered off.

- The hard disk drive is powered off.

- The CPU stops.

Note: Screen blank mode in Windows 98 and Windows 2000 is called standby mode in Windows 95.

To enter standby mode, do any of the following:

- Press **Fn** + **F4**.

- Close the LCD cover. (To prevent the computer from entering standby mode when the LCD is closed, click **Will not suspend even if LCD is closed** in the Power Management Properties window. Then only the LCD turns off.)

In certain circumstances, the computer goes into standby mode automatically:

- If a "suspend time" has been set on the timer, and the user does not do any operation with the keyboard,

the TrackPoint, the hard disk, the parallel connector, or the diskette drive within the time set.

- If the AC adapter is plugged in.
- If the battery indicator blinks orange, indicating that the battery power is low. (Alternatively, if **Hibernate when battery becomes low** has been selected in the "Power Management Properties" window, the computer goes into hibernation mode.)

Note: Even if you don't set the low-battery alarm, the charge indicator lets you know that the battery is low, and then the computer enters the power-saving mode automatically. This default low-battery behavior is independent of the operating system: so if you have set the low-battery alarm, the computer may not do what you specified. It chooses either your setting or the default setting, whichever is appropriate.

Any one of the following events causes the computer to resume operation from standby mode:

- The **Fn** key is pressed.
- The LCD cover is opened.
- The ring indicator (RI) is signaled by a serial device or a PC Card device. . The power switch is turned on.
- The resume timer is set. In Windows 98, the **Scheduled Tasks** setting has priority over the **Resume on timer** selection in the "Power Management Properties" window.

  Note: The computer does not accept any input immediately after it enters suspend mode. Wait a few seconds before taking any action to reenter operation mode.

Hibernation mode

Note for Windows NT

A Windows NT user cannot create a hibernation file in a Windows NT system that uses NTFS format, the Windows NT default format. If you want to use hibernation mode, you will need to reinstall Windows NT with FAT format.

In hibernation mode, the following occurs:

- The system status, RAM, VRAM, and setup data are stored on the hard disk.
- The system is powered off.

> **Notes:**
>
> 1. In the ThinkPad Configuration program, the com-
>   puter can be set to **suspend/hibernate while
>   docked**.
> 2. The computer cannot enter hibernation mode
>   when it is powered with AC power and a commu-
>   nication PC Card is used.
> 3. If the computer enters the hibernation mode
>   when it is docked to the docking station, do not
>   undock it from the docking station before
>   resuming normal operation. If you do undock it,
>   then if you try to resume normal operation, you
>   will get an error message, and you will have to
>   restart the system.

Any one of the following events causes the computer to
enter hibernation mode:

- The **Fn** + **F12** keys are pressed.
- The power switch is turned off and the mode is set to
  Power switch mode Hibernation".
- The timer conditions are satisfied in suspend mode
  (for operating systems other than Windows 98).
- A critically low battery condition occurs and the mode
  is set to **Hibernate when battery becomes low.**

When the power is turned on, the computer leaves
hibernation mode and resumes operation. The hibernation
file in the boot record on the hard disk drive is read, and
system status is restored from the hard disk drive.

Checkout guide

Use the following procedures as a guide in identifying and correcting problems with the ThinkPad computer.

Note: The diagnostic tests are intended to test only IBM products. The use of non-IBM products, prototype cards, or modified options can lead to false indications of errors and invalid system responses.

1. Identify the failing symptoms in as much detail as possible.
2. Verify the symptoms. Try to re-create the failure by running the diagnostic test or by repeating the operation.

Testing the computer

The ThinkPad computer has a test program called PC-Doctor DOS (hereafter called PC-Doctor). You can detect errors by running the diagnostics test included in PC-Doctor. This section is an overview of the procedure. For details that depend on model-unique functions, refer to "Product overview" on page 32

For some possible configurations of the computer, PC-Doctor might not run correctly. To avoid this problem, you need to initialize the computer setup by running the IBM BIOS Setup Utility before you run PC-Doctor. In the IBM BIOS Setup Utility screen, press **F9**, **Enter**, **F10**, then **Enter**.

Note: When you initialize the computer configuration, some devices are disabled, such as the serial port. If you test one of these devices, you will need to enable it by using PS2.EXE.

PC-Doctor cannot be used to test a device that is in the docking station. If a device is in the Ultrabay 2000 or connected to the USB connector of the docking station, remove it and install it in the Ultrabay 2000 or connect it to the USB connector of the computer. Then test it with PC-Doctor.

To run the test, do as follows:

Note: In the following procedure, you can select an item not only with the arrow keys, but also with the TrackPoint. Instead of pressing **Enter**, click the left button.

1. Insert the PC-Doctor disk into the diskette drive; then power on the computer.

   If the computer cannot be powered on, go to "Power system checkout" on page 26 and check the power sources.

   If an error code appears, go to "Symptom-to-FRU index" on page 36.

On the first screen, select the model and press **Enter**. Follow the instructions on the screen.

2. The main panel of PC-Doctor appears.
3. Select **Diagnostics** with the arrow keys, and press **Enter**.

   A pull-down menu appears. (Its exact form depends on the model.)

   The options on the test menu are as follows:

Diagnostics	Interactive Tests
• Run Normal Test	• Keyboard
• Run Quick Test	• Video
• CPU/Coprocessor	• Internal Speaker
• Systemboard	• Mouse
• Video Adapter	• Joystick Test
• Serial Ports	• Diskette
• Parallel Ports	• System Load
• Fixed Disks	• CD-ROM/DVD Test
• Diskette Drives	• Stereo Speaker
• Other Devices	
• Memory Test-Full	
• Memory Test-Quick	

Note:

- In the **Keyboard Interactive tests**, the **Fn** key is scanned only once. Because of this, each key should be held down for at least 2 seconds or it will not be sensed.

- The sound card is not recognized in the **Stereo Speaker Interactive Tests**. To test it, use the **Audio** in the **Other Devices Diagnostics**.

- The internal speaker test in Interactive Tests may not sound in some cases. If this happens, reboot the system and test the item without running other test items.

---

4. Run the applicable function test.
5. Follow the instructions on the screen. If there is a problem, PC-Doctor shows messages describing it.
6. To exit the test, select **Quit-Exit Diag**. To cancel the test, press Esc.

Detecting system information with PC-Doctor

PC-Doctor can detect the following system information:

Hardware Info:
- System Configuration
- Memory Contents
- Physical Disk Drives
- Logical Disk Drives
- VGA Information
- IDE Drive Info
- PCI Information
- PNPISA Info
- SMBIOS Info
- VESA LCD Info

Utility:
- Run External Tests
- Surface Scan Hard Disk
- Benchmark System
- DOS Shell
- Tech Support Form
- Battery Rundown
- View Test Log
- Print Log
- Save Log
- Full Erase Hard Drive
- Quick Erase Hard Drive

Power system checkout

To verify the symptom of a problem, do the following:

1. Power off the computer.
2. Remove the battery pack.
3. Connect the AC adapter.
4. Check that power is supplied when you power on the computer.
5. Power off the computer.
6. Disconnect the AC adapter and install the charged battery pack.
7. Check that the battery pack supplies power when you power on the computer.

If you suspect a power problem, see the appropriate one of the following power supply checkouts:

- "Checking the AC adapter" 27
- "Checking operational charging" 27

- "Checking the battery pack" 27
- "Checking the backup battery" 28

Checking the AC adapter: You are here because the computer fails only when the AC adapter is used:

- If the power problem occurs only when the port replicator is used, replace the port replicator.
- If the power-on indicator does not turn on, check the power cord of the AC adapter for correct continuity and installation.
- If the computer does not charge during operation, go to "Checking operational charging."

1. Unplug the AC adapter cable from the computer and measure the output voltage at the plug of the AC adapter cable. See the following figure:
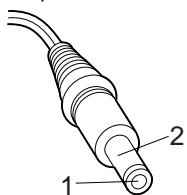
(16 - 10 V)

Pin	Voltage (V dc)
1	+15.5 to +17.0
2	Ground

If the voltage is not correct, replace the AC adapter. If the voltage is acceptable, do the following:

- Replace the system board.
- If the problem persists, go to "Product overview" on page 32.

Note: Noise from the AC adapter does not always indicate a defect.

Checking operational charging: To check operational charging, use a discharged battery pack or a battery pack that has less than 50% of the total power remaining when installed in the computer.

Perform operational charging. If the battery status indicator or icon does not turn on, remove the battery pack and let it return to room temperature. Reinstall the battery pack.

If the charge indicator or icon still does not turn on, replace the battery pack. If the charge indicator still does not turn on, replace the system board. Then reinstall the battery pack. If the reinstalled battery pack has not been charged, go to the next section.

Checking the battery pack: Battery charging does not start until the Fuel Gauge shows that less than 95% of the

total power remains; under this condition the battery pack can charge to 100% of its capacity. This protects the battery pack from being overcharged or from having a shortened life.

Note: If the battery pack becomes hot, it may not be able to charge. Remove it from the computer and leave it at room temperature for a while. After it cools down, reinstall and recharge it.

To check the battery pack, do the following:

1. Power off the computer.
2. Remove the battery pack and measure the voltage between battery terminals 1 (+) and 4 (-). See the following figure:
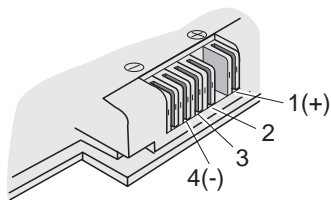
Terminal	Voltage (V dc)
1	+ 0 to + 12.6 (6-cell) +0 to 16.8(4-cell)
4	Ground (-)

3. If the voltage is less than +11.0 V dc, the battery pack has been discharged.
4. If the voltage is more than +11.0 V dc, measure the resistance between

   Note: Recharging will take at least 3 hours, even if the indicator does not turn on.

   If the voltage is still less than +11.0 V dc after recharging, replace the battery. battery terminals 3 and 4. The resistance between battery terminals 3 and 4 must be from 4 to 30k ohms.

Checking the backup battery: Do the following:

1. Power off the computer, and unplug the AC adapter from it.
2. Turn the computer upside down.
3. Remove the backup battery (see "1030 Backup battery" on page 48).
4. Measure the voltage of the backup battery. See the following figure.

Red(+)
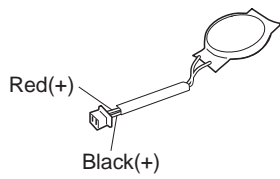
Black(+)

Wire	Voltage (V dc)
Red	+2.5 to +3.2
Black	Ground

a. If the voltage is correct, replace the system board.

b. If the voltage is not correct, replace the backup battery.

c. If the backup battery discharges quickly after replacement, replace the system board.

ThinkPad X20

Product overview

This section presents the following product-unique
information:

- "Specifications"
- "Status indicators"
- "Fn key combinations" on page 35

Specifications

The following table lists the specifications of the ThinkPad
X20 series:

Feature	Description
Processor	• Intel®mobile Pentium®III 600MHz, L2 256–KB cache • Intel®Celeron processor 500MHz, L2 128–KB cache
Bus architecture	• PCI BUS
Memory (standard)	• 64 MB (on the system board)
Memory (optional)	• 64 MB, 128 MB, or 256 MB SDRAM card (maximum of 320 MB)
CMOS RAM	• 114 bytes +4 Kbytes
Display	• 12.1-inch, 16M colors SVGA (800×600 resolution) TFT color LCD • 12.1-inch, 16M colors XGA (1024×768 resolution) TFT color LCD
Hard disk drive	10GB, 20GB
I/O port	USB, RJ11, RJ45, VGA, Mic, Line-in, Headphone, Docking
Internal modem	V.90 D/F
Audio	CS4281/CS4279A Mono Speaker
PC Card	T2, Cardbus
AC adapter	72W AC/DC

Status indicators

The system status indicators show the current computer
status in different colors (green or orange):
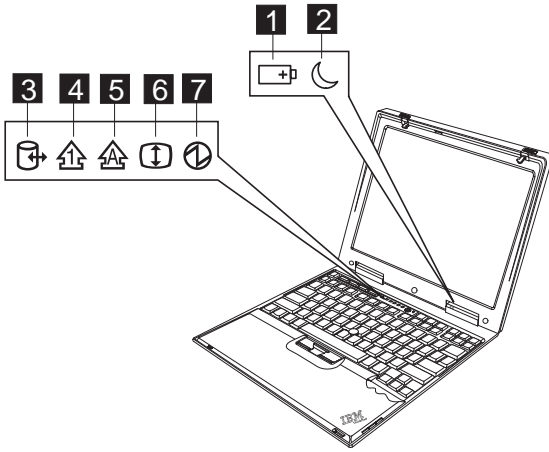
Indicator	Meaning
1 Battery	**Green:**The battery is fully charged.
	Blinking green: The battery has enough power to operate but is charging.
	Orange: The battery power is low. The battery is charging.
	Blinking orange: The battery needs charging.
2 Standby status	**Green:**The computer is in standby mode.
	Blinking green: The computer is entering standby mode or hibernation mode, or is resuming normal operation.
3 Drive in use	**Green:**Data is read from or written to the hard disk drive, diskette drive, or drive in the Ultrabay 2000.
4 Num lock	**Green:**The numeric keypad on the key-board is enabled.
5 Caps lock	**Green:**Caps Lock mode is enabled.
6 Scroll lock	**Green:**Arrow keys can be used as screen-scroll function keys.
7 Power on	**Green:**The power is on.

The following table shows the test for each FRU.

FRU	Applicable test
System board	1. **Diagnostics** --> **CPU/Coprocessor**
	2. **Diagnostics** --> **Systemboard**
Power	**Diagnostics --> IBM AC Adapter, IBM Battery**
	1. **IBM Battery**
	2. in **Other Devices**

LCD unit	1. **Diagnostics** --> **Video Adapter**
	2. **Interactive Tests** --> **Video**
Modem	1. Make sure the modem is set up correctly.

	2. Replace the modem jack and the modem card in turn, and run the following test in **Other Devices** (**Diagnostics**):
	
	   a. Modem Register Test
	   b. Modem DTMF/LoopBack Test
	   c. Internal Modem Register
	   d. Internal Modem LoopBack/DTMT

	Note: After modem DTMF/LoopBack Test has been done, the system internal speaker may not sound in some cases. This is current technical limitation and will be improved later on via the IBM Web site.
Audio	1. Interactive Tests --> Internal Speaker
	2. **Diagnostics** --> **Crystal SoundFusion**tm **Test** in **Other Devices**
Speaker	**Interactive Tests** --> Internal Speaker
PC Card slots	**Diagnostic** --> **PCMCIA, PCMCIA External Loop** in **Systemboard**
Keyboard	1. **Diagnostics**--> **Keyboard** in **Systemboard** 2. **Interactive Test**--> **Keyboard**
TrackPoint or pointing device	If the TrackPoint does not work, check the configuration in the ThinkPad Configuration program. If the TrackPoint is disabled, select **Enable** to enable it.
	After you use the TrackPoint, the pointer may drift on the screen for a short time. This drift can occur when a slight, steady pressure is applied to the TrackPoint pointer. This symptom is not a hardware problem. No service action is necessary if the pointer stops after a short time
	If enable the TrackPoint does not correct the problem, continue with the following.
	• **Interactive Tests --> Mouse**
Hard disk drive	**Diagnostics** --> **Fixed Disks**
Diskette drive	1. **Diagnostics** --> **Diskette Drives**
	2. **Interactive Tests** --> **Diskette**
CD-ROM or DVD drive	1. **Diagnostics** --> **CD-ROM/DVD in Other Devices**
	2. **Interactive Tests** --> **CD-ROM/DVD**

Memory	1. If two DIMMs are installed, remove one of them and run **Memory Test - Quick**(**Diagnostics**).
	2. If the problem does not recur, replace the DIMM, remove the other one, and run the test again.
	3. If the test does not detect the error, run **Memory Test - Full**(**Diagnostics**).
Fan	1. Turn on the computer and check the air turbulence at the louver near the power switch.
	2. In **Other Devices** (**Diagnostics**), run **IBM Fan**

Fn key combinations

The following table shows the function of each combination of Fn with a function key.

The Fn key works independently from the operating system.

Key Combi-nation	Result
Fn + F1	Reserved.
Fn + F2	Reserved.
Fn + F3	Standby mode.
Fn + F4	Suspend mode.
Fn + F5	Reserved.
Fn + F6	Reserved.
Fn + F7	Switch between the LCD, the external monitor, and both the LCD and external monitor.
Fn + F8	Reserved.
Fn + F9	Reserved.
Fn + F12	Hibernation mode.
Fn + PgUp	ThinkLight On/Off.
Fn + Home	The LCD becomes brighter.
Fn + End	The LCD becomes less bright.

Symptom-to-FRU index

The symptom-to-FRU index lists symptoms and errors and their possible causes. The most likely cause is listed first, in boldface type.

Note: Do the FRU replacement or other actions in the sequence shown in the column headed "FRU or action, in Sequence". If replacing a FRU does not solve the problem, put the original part back in the computer. Do not replace a nondefective FRU.

This index can also help you determine, during regular servicing, what FRUs are likely to need to be replaced next.

A numeric error is displayed for each error detected in POST or system operation. In the displays, n can be any number.

If no numeric code is displayed, check the narrative descriptions of symptoms. If the symptom is not described there, go to "Intermittent problems" on page 40.

Note: For an IBM devices not supported by diagnostic codes in the ThinkPad notebook computers, see the manual for that device.

Numeric error codes

Symptom or error	FRU or action, in sequence
0175 Bad CRC1, stop POST task. The EEPROM checksum is not correct.	1. **System board**.
0187 EAIA data access error	1. **System board**.
0190 Critical low battery error.	1. **Critical low battery error. Charge the battery pack.** 2. Battery pack.
0193 RF antenna has been removed.	1. **Enter the supervisor password.**
0194 The computer has been carried through a security gate.	1. **Enter the supervisor password.**
0200 Fixed disk failure	1. **Reseat the hard disk drive.** 2. Load Setup Defaults in IBM BIOS Setup Utility. 3. Hard disk drive. 4. System board.

021x Monitor type does not match CMOS	1. **Load Setup Defaults in IBM BIOS Setup Utility.**
0220 Shadow RAM failure at offset nnnn	1. **System board**.
0232 Extended RAM failure at offset nnnn	1. **DIMM.** 2. System board.
0250 System battery is dead—replace and run setup	1. **Replace the backup battery and run IBM BIOS Setup Utility to reset the time and date.**
0251 System CMOS checksum bad—Default configuration used	1. **Replace the backup battery and run IBM BIOS Setup Utility to reset the time and date..**
0252 Password checksum bad.	1. **Reset the password by running IBM BIOS Setup Utility.**
0260 System timer error	1. **Replace the backup battery. and run IBM BIOS Setup Utility to reset the time and date.** 2. System board.
0270 Real time clock error	1. **Replace the backup battery and run IBM BIOS Setup Utility to reset the time and date.**System board.
0271 Date and time error	1. **Run IBM BIOS Setup Utility to reset the time and date..**
0280 Boot incomplete error—Default configuration used	1. **Load Setup Defaults in IBM BIOS Setup Utility.** 2. DIMM. 3. System board.
02F4 EISA CMOS not writable.	1. **Load Setup Defaults in IBM BIOS Setup Utility.**Replace the backup battery. 2. System board.
02F5 DIMM test failure	1. **DIMM.**System board.
02F6 Software NMI failure	1. **DIMM.**System board.
02F7 Fail-safe timer NMI failure	1. **DIMM.**System board.

Error messages

Symptom or error	FRU or action, in sequence
Device address conflict	1. **Load Setup Defaults in IBM BIOS Setup Utility.** 2. Backup battery. 3. System board.
Allocation error for device	1. **Load Setup Defaults in IBM BIOS Setup Utility.** 2. Backup battery. 3. System board.
Failing bits: nnnn	1. **DIMM.** 2. System board.
Invalid system configuration data	1. **DIMM.** 2. System board.
I/O device IRQ conflict	1. **Load Setup Defaults in IBM BIOS Setup Utility.** 2. Backup battery. 3. System board.
Operating system not found	1. **Enter IBM BIOS Setup Utility and see whether the hard disk drive and the diskette drive are properly identified.** 2. Diskette drive. 3. Hard disk drive. 4. System board.
Hibernation error	1. **Restore the system configuration to what it was the before the computer entered hibernation mode.** 2. If memory size has been changed, re-create the hibernation file.
Operating system not found	1. **Reseat the hard disk drive.** 2. Check the book sequence by use of IBM BIOS Setup
Fan error	1. **Fan**.

Beep symptoms

Symptom or error	FRU or action, in sequence

One beep and a blank, unreadable, or flashing LCD	1. **Reseat the LCD connector.**
	2. LCD assembly.
	3. System board.
One long and two short beeps, and a blank or unreadable LCD	1. **System board.**
	2. LCD assembly.
Two short beeps with error codes	**POST error. See "Numeric error codes" on page 36**
Two short beeps with blank screen	1. **System board.**
Only cursor appears	1. **Reinstall operating system.**

No beep symptoms

Symptom or error	FRU or action, in sequence
No beep, power-on indicator on, LCD blank, and no POST	1. **Make sure that every connector is connected tightly and correctly.**
	2. DIMM.
	3. System board.
No beep, power-on indicator on, and LCD blank during POST	1. **Reseat DIMM.**
	2. System board.
No beep during POST, but system runs correctly	1. **Speaker.**
The power-on password prompt	A power-on password or a supervisor password is set. Type the password and press **Enter**.
The hard disk password prompt	A hard disk password is set. Type the password and press **Enter**.
The DOS-full screen looks smaller.	Start the ThinkPad Configuration program and set the **Screen expansion** function.

LCD-related symptoms

Important

The TFT LCD for the notebook computer contains many thin-film transistors (TFTs). A small number of dots that are missing, discolored, or always lighted is characteristic of TFT LCD technology, but excessive pixel problems can cause viewing concerns. The LCD should be replaced if the number of missing, discolored, or lighted dots in any background is:

- **SVGA:** 5 or more bright dots, 5 or more dark dots, or a total of 9 or more bright and dark dots.

- **XGA:** 8 or more bright dots, 8 or more dark dots, or a total of 9 or more bright and dark dots.

Symptom or error	FRU or action, in sequence
No beep, power-on indicator on, and a blank LCD during POST	1. **System board.**
• LCD backlight not working • LCD too dark • LCD brightness cannot be adjusted • LCD contrast cannot be adjusted	1. **Reseat the LCD connectors.** 2. LCD assembly. 3. System board.
• LCD screen unreadable • Characters missing pixels • Screen abnormal • Wrong color displayed	1. **See important note for "LCD-related symptoms".** 2. Reseat all LCD connectors. 3. LCD assembly.
• Horizontal or vertical lines displayed on LCD	1. **LCD assembly.**

Intermittent problems

Intermittent system hang problems can be due to a variety of causes that have nothing to do with a hardware defect, such as: cosmic radiation, electrostatic discharge, or software errors. FRU replacement should be considered only when a recurring problem exists.

When analyzing an intermittent problem, do the following:

1. Run the diagnostic test for the system board in loop mode **at least 10 times**.
2. If no error is detected, do **not** replace any FRUs.
3. If any error is detected, replace the FRU shown by the FRU code. Rerun the test to verify that no more errors exist.

Undetermined problems

You are here because the diagnostic tests did not identify which adapter or device failed, installed devices are incorrect, a short circuit is suspected, or the system is inoperative. Follow these procedures to isolate the failing FRU (do not isolate FRUs that have no defects).

Verify that all attached devices are supported by the computer.

Verify that the power supply being used at the time of the failure is operating correctly. (See "Power system checkout" on page 26)

1. Power off the computer.

2. Visually check each FRU for damage. Replace any damaged FRU.
3. Remove or disconnect all of the following devices:
    a. Non-IBM devices
    b. Devices attached to the port replicator
    c. Printer, mouse, and other external devices
    d. Battery pack
    e. Hard disk drive
    f. External diskette drive
    g. DIMM
    h. CD-ROM and diskette drive in the UltraBase X2
    i. PC Cards
4. Power on the computer.
5. Determine whether the problem has changed.
6. If the problem does not recur, reconnect the removed devices one at a time until you find the failing FRU.
7. If the problem remains, replace the following FRUs one at a time (do not replace a nondefective FRU):
    a. System board
    b. LCD assembly

FRU replacement notices

This section contains notices related to removing and replacing parts. Read this section carefully before replacing any FRU.

Screw notices

Loose screws can cause a reliability problem. The an IBM ThinkPad computer address this problem with special nylon-coated screws that have the following characteristics:

- They maintain tight connections.
- They do not easily come loose, even with shock or vibration.
- They are harder to tighten.
- They should be used only once.

Do the following when you service this machine:

- Keep the screw kit (P/N 05K4841) in your tool bag.
- Always use new screws.
- Use a torque screwdriver if you have one.

Tighten screws as follows:

- **Plastic to plastic**

  Turn an additional 90 degrees after the screw head touches the surface of the plastic part:
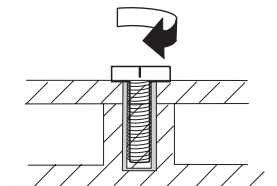
  90 degrees more
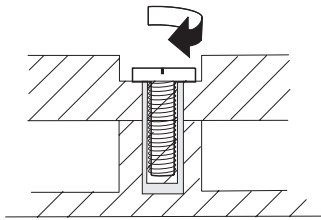
  (Cross section)

- **Logic card to plastic**

  Turn an additional 180 degrees after the screw head touches the surface of the logic card:

  180 degrees more

  (Cross section)

- **Torque driver**

If you have a torque driver, refer to the "Torque" column with each step.

- Make sure you use the correct screw. If you have a torque screwdriver, tighten all screws firmly to the torque shown in the table. **Never use a screw that you removed. Use a new one. Make sure the screws are tightened firmly**

Retaining serial numbers

This section includes the following descriptions:

- "Restoring the serial number of the system unit"
- "Retaining the UUID"

Restoring the serial number of the system unit:

When the computer was manufactured, the EEPROM on the system board was loaded with the serial numbers of the system and all major components. The numbers need to remain the same throughout the life of the computer.

If you replace the system board, you must restore serial number of the system unit to its original value.

Before replacing the system board, save the original serial number by doing the following:

1. Install the ThinkPad Hardware Maintenance Diskette Version 1.60, and restart the computer.
2. From the main menu, select **1. Set System Identification.**
3. Select **2. Read S/N data from EEPROM.**

The serial number for each device is displayed. Write down the serial number of the system unit, designated as follows:

20:System unit serial number

After you have replaced the system board, restore the serial number by doing the following:

1. Install the ThinkPad Hardware Maintenance Diskette Version 1.60 and restart the computer.
2. From the main menu, select **1. Set System Identification.**
3. Select **1. Add S/N data from EEPROM.**

   Follow the instructions on the screen.

   Note: The serial number of the system unit is written on the label attached on the bottom of the computer.

Retaining the UUID: The Universally Unique Identifier (UUID) is a 128-bit number uniquely assigned to your computer at production and stored in the EEPROM of your system board. The algorithm that generates the unique number is designed to provide unique IDs until the year A.D. 3400. No two computers in the world have the same number.

When you replace the system board, you must set the UUID on the new system board as follows:

1. Install the ThinkPad Hardware Maintenance Diskette Version 1.60, and restart the computer.
2. Select **4. Assign UUID** from the main menu. A new UUID is created and written. If a valid UUID already exists, it is not overwritten.

Removing and replacing a FRU

This section presents information and drawings for use in removing and replacing a FRU. Be sure to observe the following general rules:

1. Do not try to service the computer unless you have been trained and certified. An untrained person runs the risk of damaging parts.

2. Before replacing any FRU, review "FRU replacement notices" on page 42

3. Begin by removing any FRUs that have to be removed before the failing FRU. Any such FRUs are listed at the top of the page. Remove them in the order in which they are listed.

4. Follow the correct sequence in the steps for removing the FRU, as indicated in the drawings by the numbers in square callouts.

5. When turning a screw to replace a FRU, turn it in the direction indicated by the arrow in the drawing.

6. When removing the FRU, move it in the direction indicated by the arrow in the drawing.

7. To put the new FRU in place, reverse the removal procedure and follow any notes that pertain to replacement. For information about connecting and arranging internal cables, see "Locations" on page 66.

8. When replacing a FRU, use the correct screw as shown in the procedures.

CAUTION:

Before removing any FRU, power off the computer, unplug all power cords from electrical outlets, remove the battery pack, and then disconnect any interconnecting cables.

CAUTION:

Do not disassemble it, throw it into fire or water, or short-circuit it. Dispose of the battery pack as required by local ordinances or regulations.

Attention:

Before the computer is powered on after FRU replace-
ment, make sure all screws, springs, and other small parts
are in place and are not loose inside the computer. Verify
this by shaking the computer gently and listening for rat-
tling sounds. Metallic parts or metal flakes can cause elec-
trical short circuits.

Attention:

The system board is sensitive, and can be damaged by,
electrostatic discharge. Establish personal grounding by
touching a ground point with one hand before touching
these units.

You must use an electrostatic discharge (ESD) strap (P/N
6405959) to establish personal grounding.

1010 Battery pack
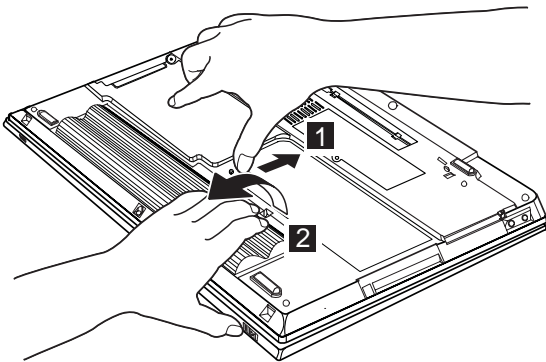
1020 DIMM

• Battery pack (1010)
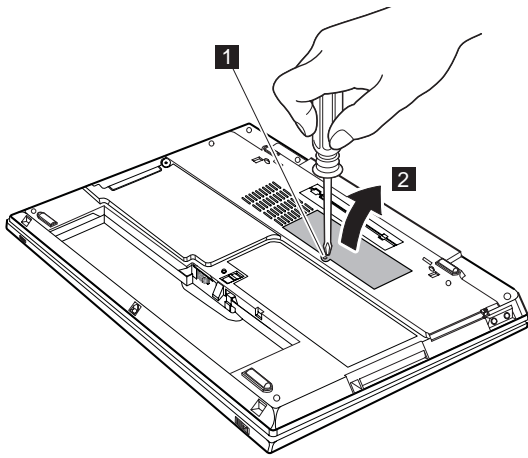
Note: Loosen the screw `1` but do not remove it.

Step	Screw (quantity)	Torque
`1`	M2 × 3.4 mm, Nylock-coated (1) BK	14.7 Ncm (1.5 kgfcm)
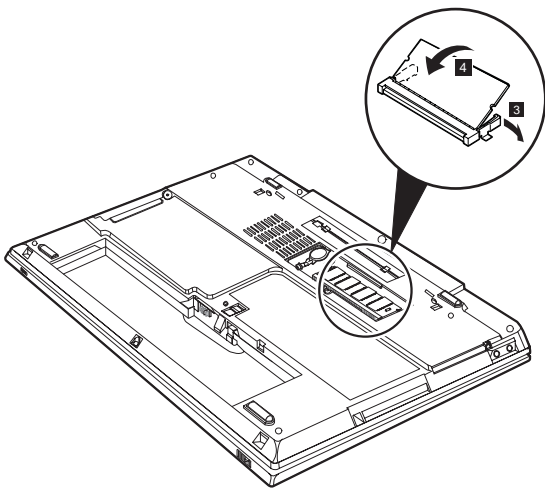
1030 Backup battery

- Battery pack (1010)
- DIMM (1020)

CAUTION:
The backup battery is a lithium battery and can cause a fire, an explosion, or severe burns. Do not recharge it, remove its polarized connector, disassemble it, heat it above 100°C (212°F), incinerate it, or expose its cell contents to water. Dispose of the battery as required by local ordinances or regulations. The use of an incorrect battery can result in ignition or explosion of the battery.
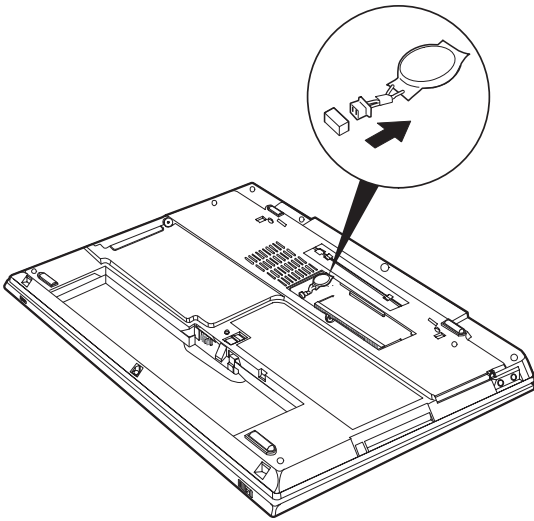
1040 Hard disk drive

- Battery pack (1010)

**Attention: Do not drop the hard disk drive or apply any
shock to it.** The hard disk drive is sensitive to physical
shock. Incorrect handling can cause damage and perma-
nent loss of data. Before removing the drive, have the user
make a backup copy of all the information on the drive if
possible. Never remove the drive while the system is oper-
ating or is in suspend mode.
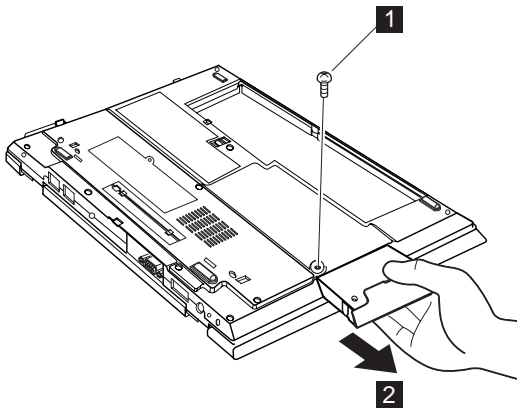
Note: The hard disk is attached to the cover.

Step	Screw (quantity)	Torque
1	M3 × 3.5mm, Nylock-coated (1) BK	19.6 Ncm (2 kgfcm)
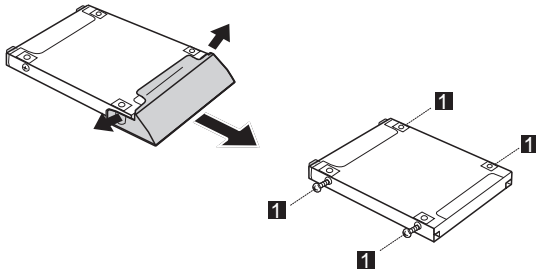
When installing: Make sure that the HDD connector is
firmly connected.

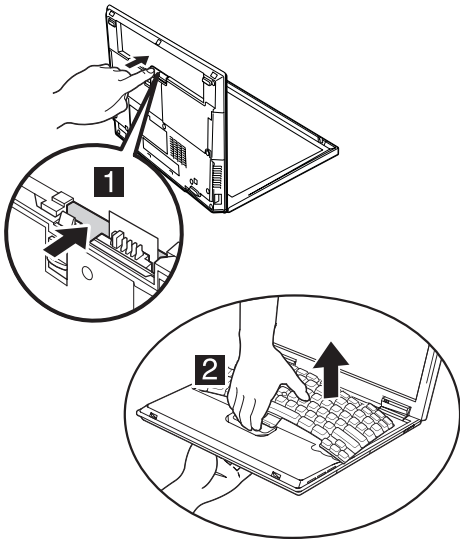| Step	Screw (quantity)	Torque
1	M3 ×3 mm (4) Red	19.6 Ncm (2 kgfcm)

1050 Keyboard

- Battery pack (1010)
- Hard Disk Drive (1040)
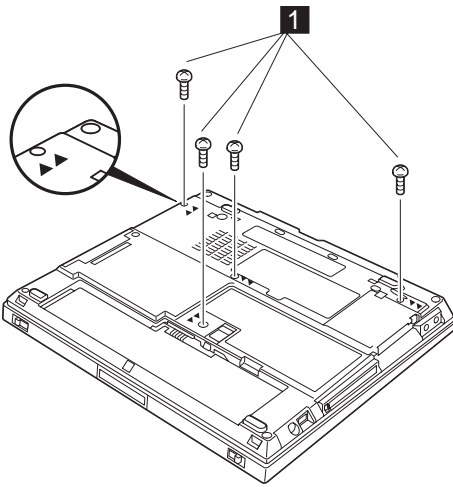
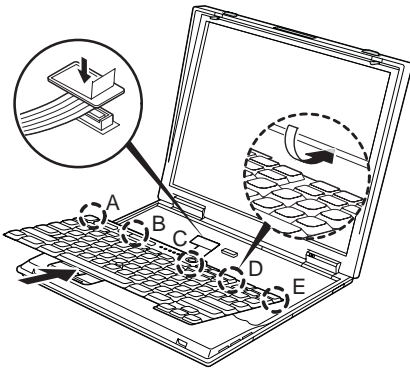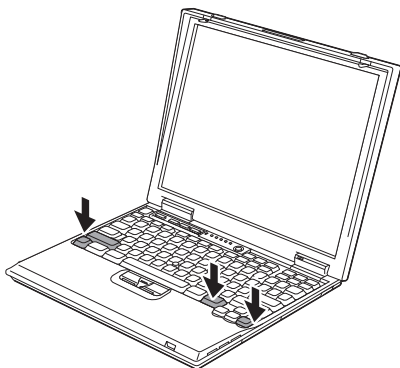| Step	Screw (quantity)	Torque
1	M2 × 4.5 mm, Nylock-coated (4) BK	19.6 Ncm (2 kgfcm)
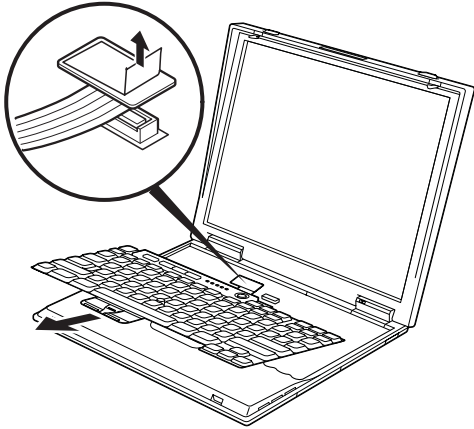
When installing: When installing the keyboard, do as follows:

1. Install the new keyboard, following the directions in the figure. Make sure that the keyboard edges, shown in the figure as (A), (B), (C), (D)and (E), are under the frame.
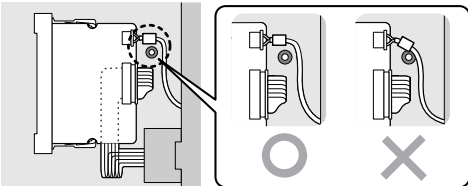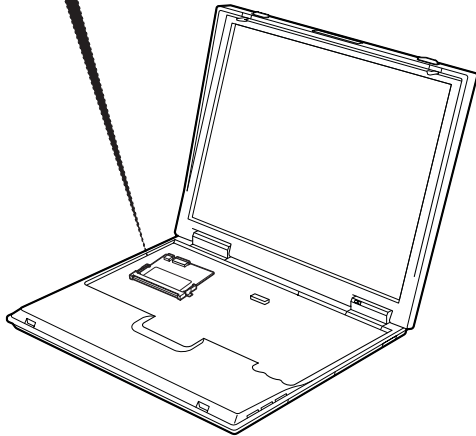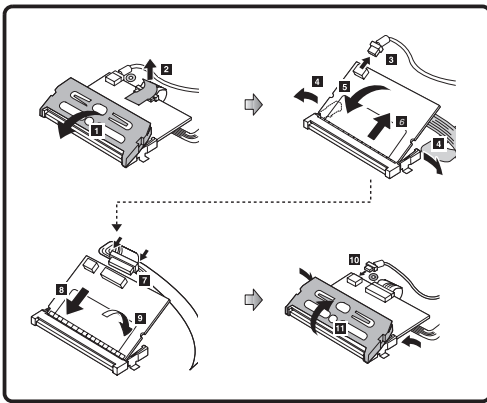

2. Align the tabs of the keyboard with the corresponding slots; then press the keyboard until it snaps into place.
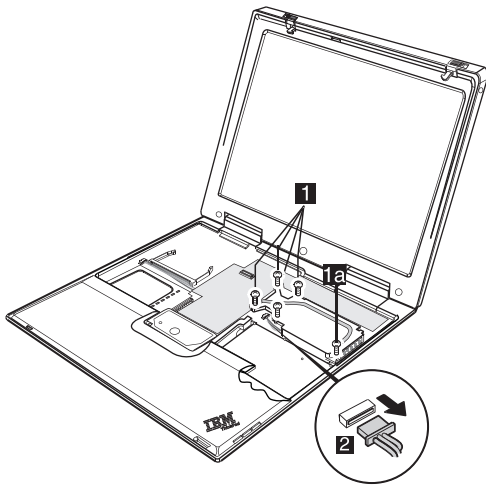
1060 Mini PCI adapter

- Battery pack (1010)
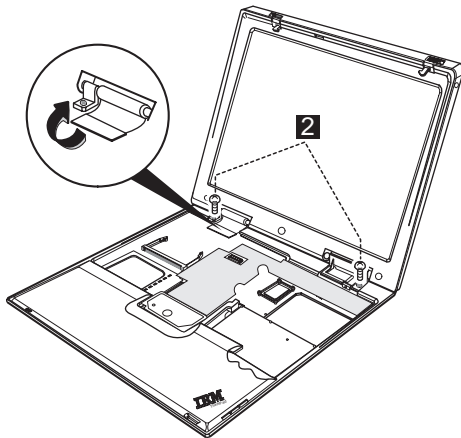- Keyboard assembly (1050)

1070 Fan assembly

- Battery pack (1010)
- Keyboard assembly (1050)

Step	Screw (quantity)	Torque
1	M2 × 3mm (4) White	19.6 Ncm (2 kgfcm)
1a	M2 × 6mm, Nylock-coated (1) BK	19.6 Ncm (2 kgfcm)

1080 LCD assembly

- Battery pack (1010)
- Keyboard assembly (1050)
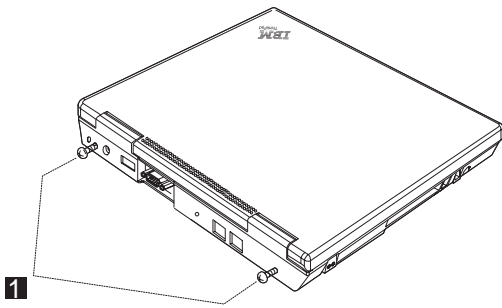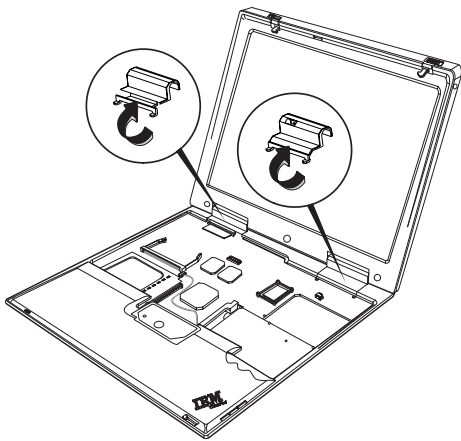
Step	Screw (quantity)	Torque
1	M2.6 × 4mm (2) BK	24.5 Ncm (2.5 kgfcm)
2	M2 × 8mm, Nylock-coated(2) BK	19.6 Ncm (2 kgfcm)

1090 Case Keyboard deck
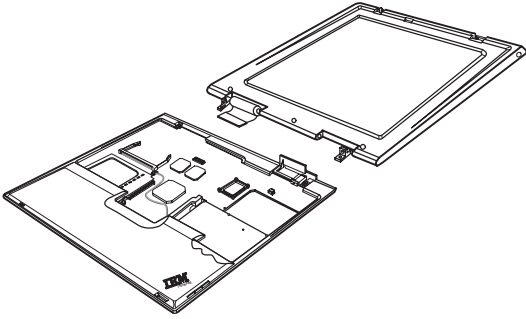
- Battery pack (1010)
- Keyboard assembly (1050)
- Fan assembly (1070)
- LCD assembly (1080)
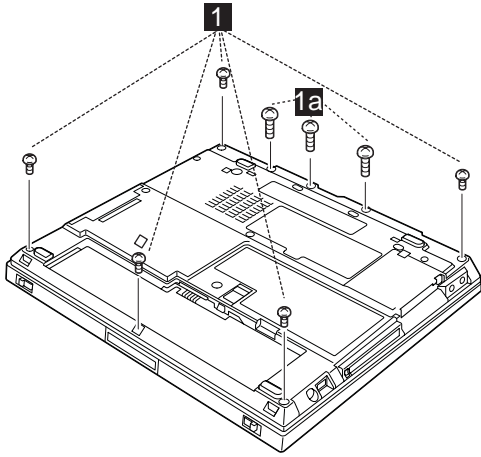
Step	Screw (quantity)	Torque
1	M2 × 3.5mm, Nylock-coated (5) BK	19.6 Ncm (2 kgfcm)
1a	M2 × 6mm, Nylock-coated (3) BK	19.6 Ncm (2 kgfcm)
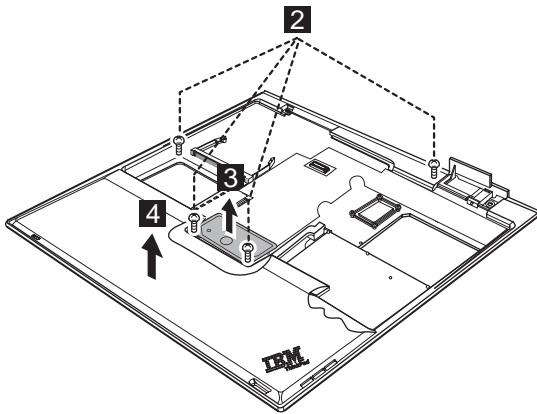
Case Keyboard deck up; then remove it

Step	Screw (quantity)	Torque
2	M2 × 6mm, Nylock-coated (4) BK	19.6 Ncm (2 kgfcm)

1100 Speaker

- Battery pack (1010)
- Keyboard assembly (1050)
- Fan assembly (1070)
- LCD assembly (1080)
- Case keyboard deck (1090)
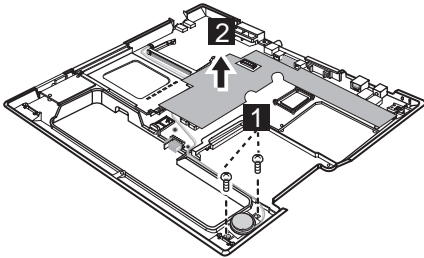
Step	Screw (quantity)	Torque
1	M2 × 3mm, Nylock-coated (2) White	19.6 Ncm (2 kgfcm)
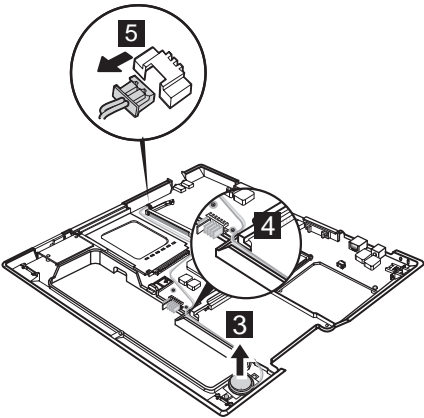
When installing: Make sure that you fasten the connector firmly.

1110 PC Card slot assembly

- Battery pack (1010)
- Keyboard assembly (1050)
- Fan assembly (1070)
- LCD assembly (1080)
- Case keyboard deck (1090)

Step	Screw (quantity)	Torque
1	M2 × 3mm (2) White	14.7 Ncm (1.5 kgfcm)
1a	M2 × 6mm, Nylock-coated (2) BK	19.6 Ncm (2 kgfcm)

1120 RJ11, RJ45

- Battery pack (1010)
- Keyboard assembly (1050)
- Fan assembly (1070)
- LCD assembly (1080)
- Case keyboard deck (1090)

Step	Screw (quantity)	Torque
2	M2 × 6mm, Nylock-coated (2) BK	19.6 Ncm (2 kgfcm)

1130 System board

- Battery pack (1010)
- Keyboard assembly (1050)
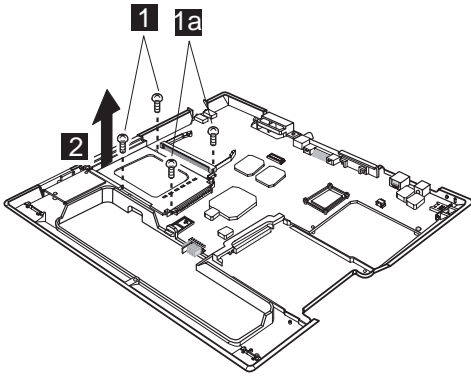- Fan assembly (1070)
- LCD assembly (1080)
- Case keyboard deck (1090)
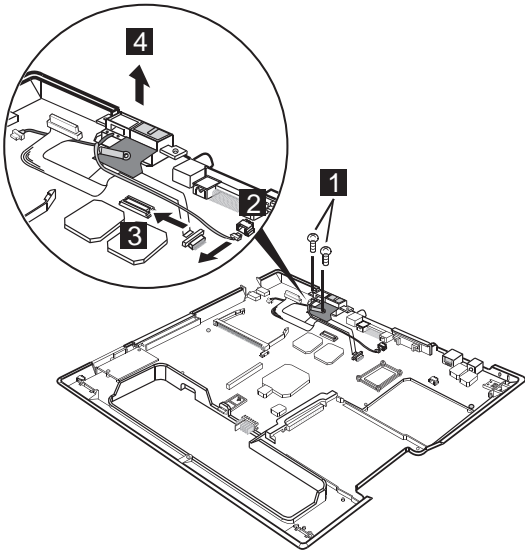- Speaker (1100)
- PC Card slot assembly (1110)
- RJ11, RJ45 (1120)
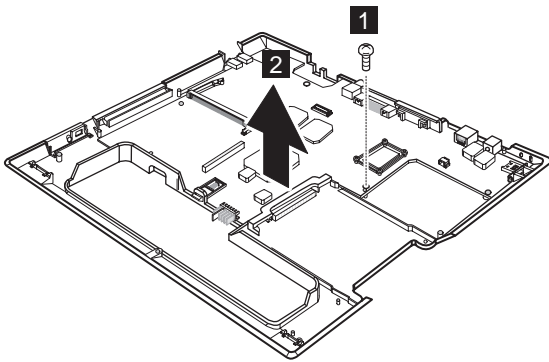
Step	Screw (quantity)	Torque
2	M2 × 3mm (1) White	19.6 Ncm (2 kgfcm)

1140 LCD USB cover
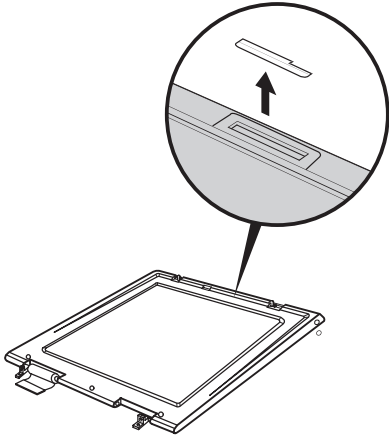
1150 Front bezel

- Battery pack (1010)
- Keyboard assembly (1050)
- LCD assembly (1080)
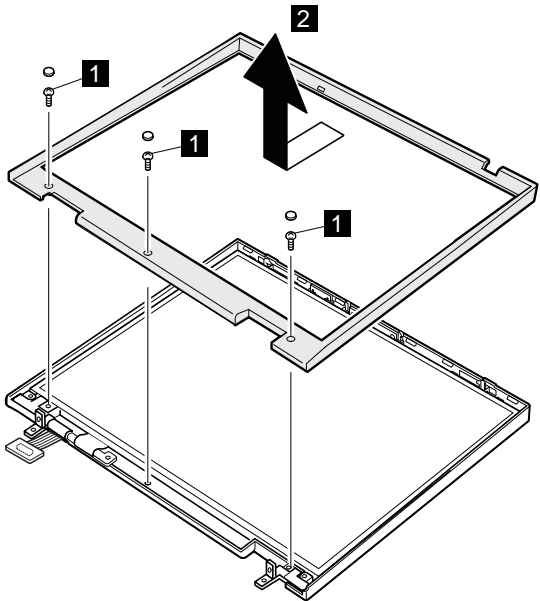
Step	Screw (quantity)	Torque
1	M2.6 × 5mm (3) BK	19.6 Ncm (2 kgfcm)

1160 LCD panel

- Battery pack (1010)
- Keyboard assembly (1050)
- LCD assembly (1080)
- Front bezel (1150)

XGA:
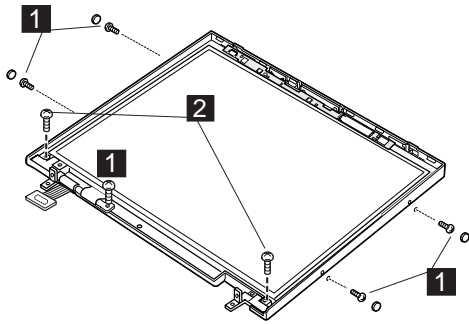
Step	Screw (quantity)	Torque
1	M2 × 3.5mm (5) BK	19.6 Ncm (2 kgfcm)
2	M2.6 × 4mm (2) BK	19.6 Ncm (2 kgfcm)
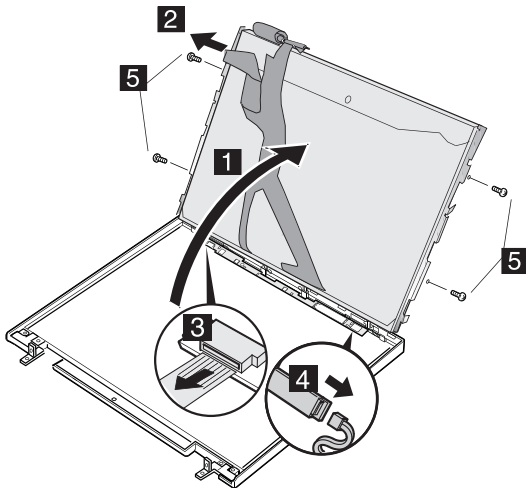
Step	Screw (quantity)	Torque
5	M2 × 3mm (4) WH	19.6 Ncm (2 kgfcm)
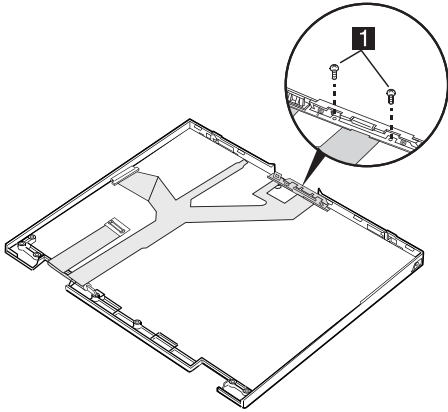
Step	Screw (quantity)	Torque
1	M2 × 3.5mm (2) BK	19.6 Ncm (2 kgfcm)

SVGA:
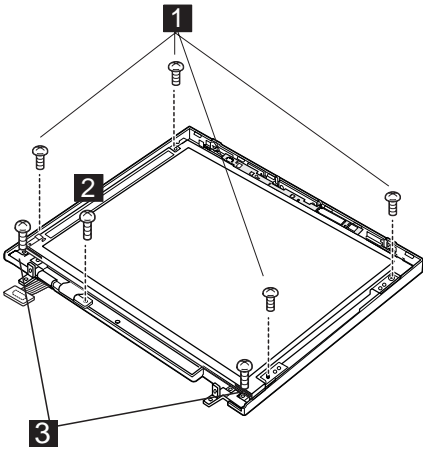
Step	Screw (quantity)	Torque
1	M2 × 2.7mm (4) White	19.6 Ncm (2 kgfcm)
2	M2 × 3.5mm (1) BK	19.6 Ncm (2 kgfcm)
3	M2.6 × 4mm (1) BK	19.6 Ncm (2 kgfcm)
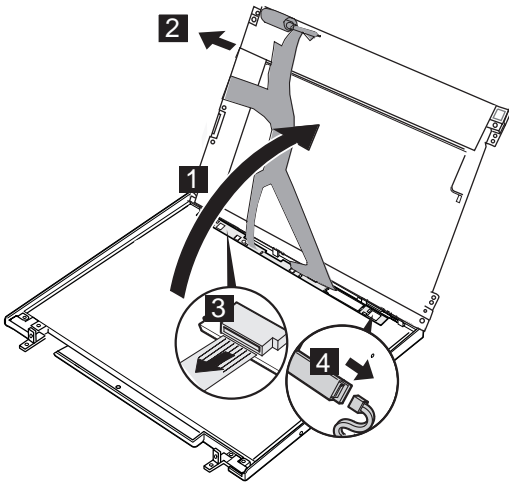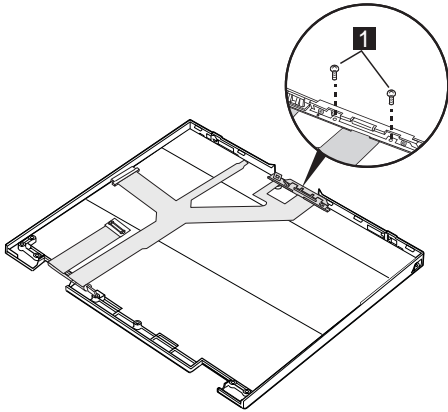
Step	Screw (quantity)	Torque
1	M2 × 3.5mm (2) BK	19.6 Ncm (2 kgfcm)

Locations

Front view

1. System status indicators

2. Power switch

3. Battery and standby mode status indicators

4. Hard Disk Drive

5. Ultraport connector

6. Think Light

7. Volume Buttons

8. ThinkPad Button

9. TrackPoint pointing stick

10. TrackPoint Buttons
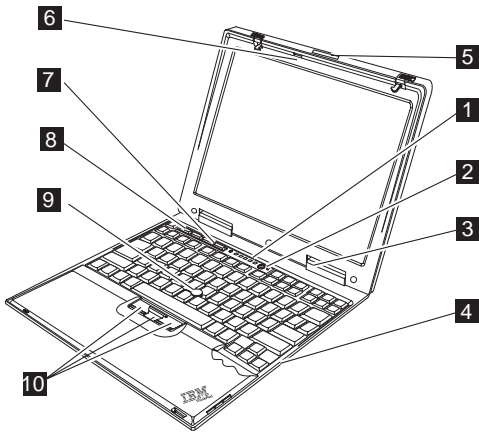
Rear view

1 Headphone jack

2 Mic jack

3 Compact flash slot

4 PC card slot

5 PC Card eject button

6 Security keyhole

7 Power jack

8 Universal serial bus (USB) connector

9 External-monitor connector

10 Line-in jack

11 LAN connector

12 Modem connector
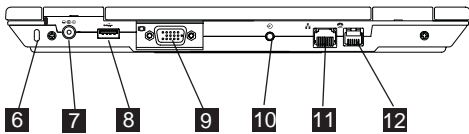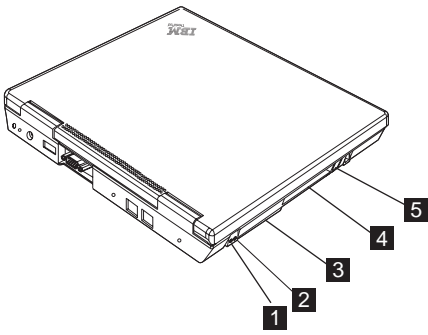
Bottom view

1 Battery Pack

2 Battery Pack latches

3 Docking connector

4 Memory cover

5 Headphone jack

6 Mic jack

7 Compact flash slot

8 PC card slot

9 PC Card eject button

10 LCD latches
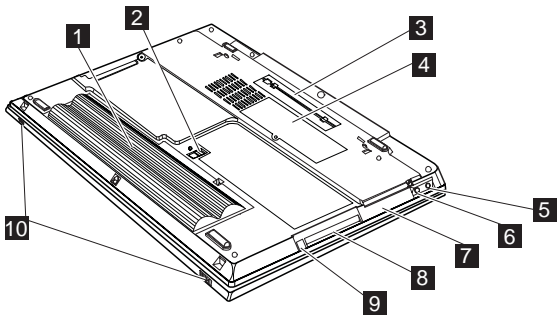
Parts List

X20 series model matrix
The X20 series includes several models. The following table summaries the characteristics of each model, to help you determine which FRU in the part list meets your need.

CPU	LCD	Mini PCI
2662-11X / 12X		
• Celeron 500 LV	12.1" TFT, SVGA	V.90 DF Modem
2661-21J / 22J		
• Celeron 500 LV	12.1" TFT, XGA	V.90 DF Modem
2661-24J / 25J		
• Celeron 500 LV	12.1" TFT, XGA	Intel Ether. Combo
2662-31X /32X		
• Pentium III 600 LV	12.1" TFT, XGA	V.90 DF Modem
2662-34X /35X		
• Pentium III 600 LV	12.1" TFT, XGA	Intel Ether. Combo
2662-36X /37X		
• Pentium III 600 LV	12.1" TFT, XGA	3COM Ether. Combo
2662-38X /39X		
• Pentium III 600 LV	12.1" TFT, XGA	Empty Slot

LCD FRU

12.1-inch XGA TFT:
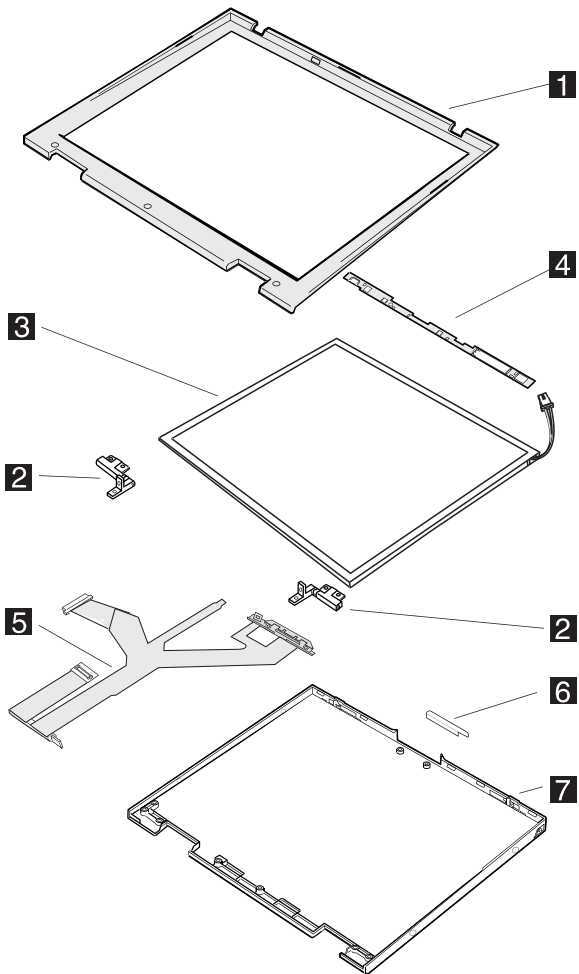
No	FRU	P/N
1	LCD front Bezel BK	04P3174
	LCD front Bezel Grey	04P3175
2	Hinges	04P3169
3	LCD panel (IBM)	05K9676
4	Inverter card (SUMIDA)	08K3222
	Inverter card (ALPS)	08K3356
5	LCD Interface cables 12.1"XGA	27L0584
6	LCD USB Cover	04P3179
7	LCD Rear Cover BK	04P3171
	LCD Rear Cover Grey	04P3172
	LCD Rear Cover BK (Korea)	04P3526

12.1-inch SVGA TFT:
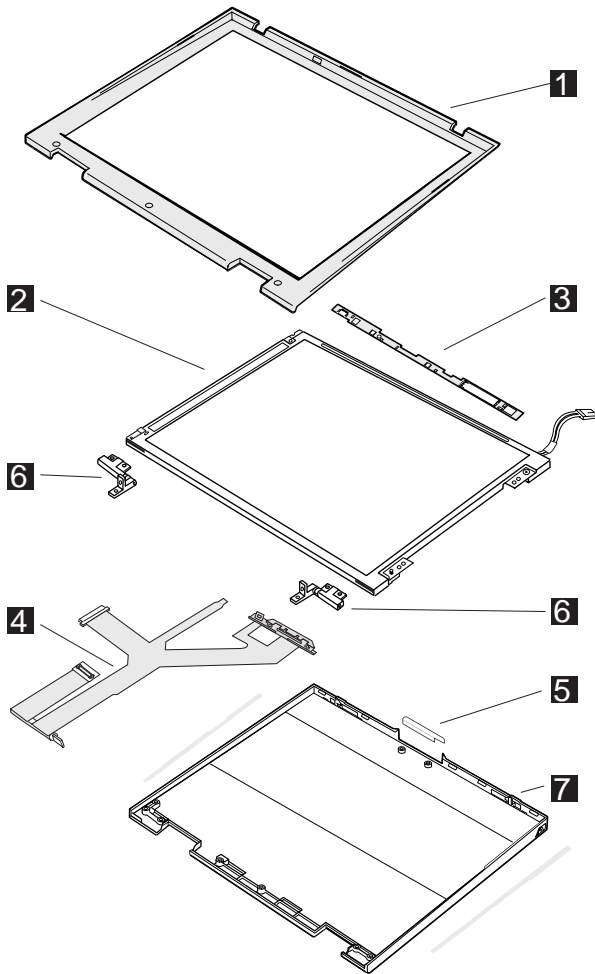
No	FRU	P/N
1	LCD front Bezel	04P3173
2	LCD panel (LG-Philips)	05K9675
3	Inverter card (SUMIDA)	08K3221
	Inverter card (ALPC)	08K3355
4	LCD Interface cables 12.1" SVGA	27L0583
5	LCD USB Cover	04P3179
6	Hinges	04P3168
7	LCD Rear Cover BK	04P3170
	LCD Rear Cover BK (Korea)	04P3527

System
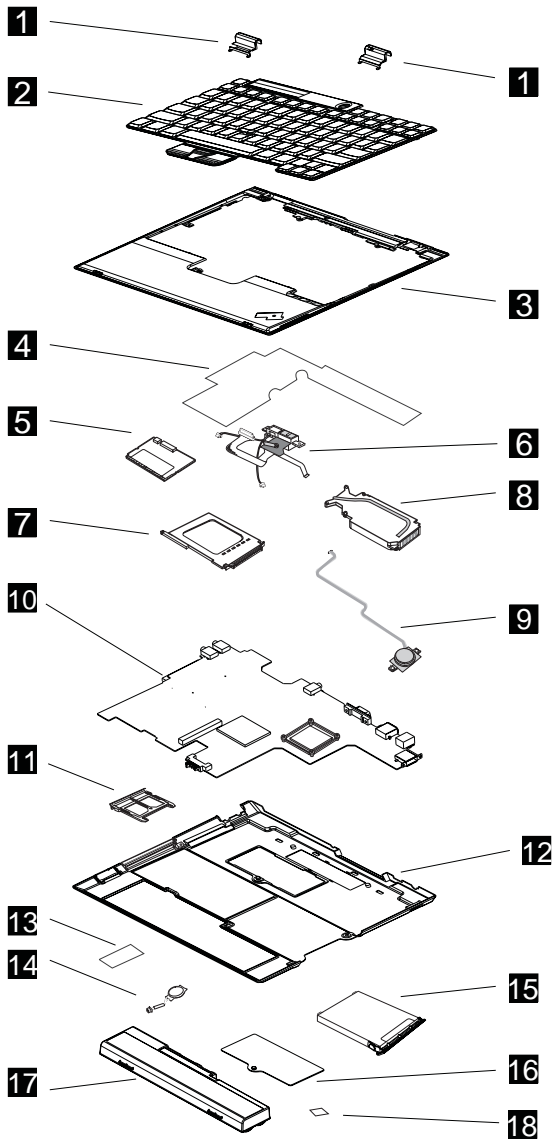
No.	FRU	P/N
1	Hinge cover	
	SVGA Black	04P3162
	XGA Black	04P3163
	XGA Grey	04P3164
2	Keyboard FRU	
3	Keyboard bezel	

	Keyboard bezel	04P3159
	Keyboard bezel Grey	04P3160
	Keyboard bezel Korea	04P3525
4	Insulation	04P3702
5	Mini PCI Combo card (INTEL)	08K3125
	Mini PCI Combo card (3COM)	00N8117
	Mini PCI modem	08K3252
6	Modem Cable Conn. ASM (RJ11/RJ45)	27L0585
7	Card-Bus Slot	04P3180
8	FAN	04P3161
9	Speaker	04P3158
10	Planer	
	Celeron 500 LVMHz	08K3218
	Celeron 500 LVMHz W/1394	08K3223
	GVL LV 600MHz	08K3217
11	CF Dummy Socket	04P3184
12	Base Cover FRU	
13	1394 Sub Card	08K3224
14	RTC Battery Asm	02K6715
15	HDD 10 GB Hitachi	08K9550
	HDD10 GB IBM Jasper	27L3440
	HDD 20 GB Hitachi	08K9548
	HDD 20 GB IBM Jasper	27L3441
16	Memory Cover	04P3185
17	Battery Li-Ion 6cell Panasonic	02K6710
	Battery Li-Ion 6cell Sanyo	02K6653
	Battery Li-Ion 4cell Sanyo	02K6652
18	Screw Cap Bottom	04P3528

Keyboard

Language	P/N
US English	02K5220
Canadian French	02K5221
LA Spanish	02K5222
Japanese	02K5223
Japanese iSeries	02K5510
Korean	02K5224
Traditional Chinese	02K5225
UK English	02K5246
German	02K5232
French	02K5231

Italian	02K5236
Swiss	02K5244
Dutch	02K5230
Belgian	02K5227
Spanish	02K5242
Portuguese	02K5238
Swedish/Finnish	02K5243
Norwegian	02K5237
Danish	02K5229
Russian	02K5239
Turkish	02K5245
Hebrew	02K5234
Arabic	02K5226
Czech	02K5228
Greek	02K5233
Hungarian	02K5235
Slovakian	02K5240
Slovenian	02K5241
Thai	02K5573

Base Cover FRU

FRU	P/N
2660 W/W	04P3155
2660 Korea	04P3453
2660 China	04P3454
2660 Taiwan	04P3455
2661 W/W	04P3456
2661 Korea	04P3457
2661 China	04P3458
2661 Taiwan	04P3459
2662 W/W	04P3460
2662 Korea	04P3461
2662 China	04P3462
2662 Taiwan	04P3463
2661 W/W i Series	04P3464

Miscellaneous parts

FRU	P/N
Screw kit (for i Machine):	04P3181
HDD Metal Case	04P3165
Cover HDD	04P3166
HDD Screw	04P3167

MISC PCB	08K3225
Pointing Stick Cap Set	84G6536
HEXA Screw	04P3405
M2 × 3mm WH	04P3402
M2 × 3.5mm BK	04P3404
M2 × 4.5mm BK for KBD	04P3182
M2 × 4.5mm WH	04P3406
M2 × 6mm BK	04P3403
M2 × 8mm BK for Hinge Top	04P3400
M2.6 × 4mm BK	04P3401
M2.6 × 5mm BK	08K7092
M2 × 3.5mm BK Head 0.6T	04P3407
M2 × 2.7mm WH 0.8 for LCD	08K7093
M3 × 3mm Red for HDD Side	04P3399
M3 × 3.5mm BK For Bottom HDD	04P3408
Screw Cap LCD Front Black	04P3529
Screw Cap LCD Front Grey	08K7067
Screw Cap LCD XGA side Black	08K7062
Screw Cap LCD XGA side Grey	04P3530
Misc Parts Kit 1394	04P3157
Misc Parts Kit	04P3156
LCD Misc SVGA	04P3176
LCD Misc XGA	04P3177
LCD Misc XGA Grey	04P3178
Tape	04P3703

Options FRU list

Telephone Cable	27L0619
CD-ROM drive (LG)	05K9159
CD-ROM drive (TOSHIBA)	05K9158
CD-ROM drive (TEAC)	27L3436
DVD-ROM drive (MKE)	05K9188
DVD-ROM drive (TOSHIBA)	05K9160
SODIMM Card 128MB	20L0265
SODIMM Card 256MB	33L3070
SODIMM Card 64MB	20L0264
UltraBase X2	04P3304
UltraBase X2 Security Screw	08K7004
2nd HDD Adapter	08K6067
USB FDD	05K9283
LS-120	05K9235
Common Battery Charger	02K6642

CD-RW	00N7955

Common parts list
Tools

Triconnector wrap plug	72X8546
PC test card	35G4703
Audio wrap cable	66G5180
USB parallel test cable	05K2580
USB FDD Tool Kit	27L3452
Screwdriver kit	95F3598
Torque screwdriver	05K4695
5mm socket wrench	05K4694
Screwdriver	27L8126
ThinkPad hardware maintenance diskette version 1.60 **Note:** Download the file from the Web site.	—

Power code (system):   IBM power cords for a specific country are usually available only in that region:

For 2-pin power cords:

Region	P/N
Canada, Thailand, United States of America	13H5264

For 3-pin power cords:

Region	P/N
Canada, Thailand, United States of America	76H3516
Japan	13H5273
Australia, New Zealand	76H3514
Korea	76H3535
PRC	02K0539
Europe-France, Germany, etc.	76H3518
Argentina	36L8867
Denmark	76H3520
South Africa, India	76H3522
Switzerland	76H3528
Italy	76H3530
Israel	76H3532
UK	76H3524

AC adapter: IBM power cords for a specific country are usually available only in that region:

Region	P/N

72W 2–prong NON-PFC Astec	02K6669
72W 3–prong PFC Astec	02K6666
72W 2–prong NON-PFC Delta	02K6673
72W 3–prong PFC Delta	02K6670

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