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**ThinkPad 770 (9548), 770E/ED (9548)
770X (9549), 770Z (9549)**

Hardware Maintenance Manual

January 1999



Note

Before using this information and the product it supports, be sure to read the general information under "Notices" on page 129.

Third Edition (January 1999)

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Related Publications

The following product publications are available through IBM or your IBM Authorized Dealer.

Publication	Part, Form Number
Mobile Systems HMM Volume 1: Laptop, Notebook, Portable, and ThinkPad Computers (Models L40, CL57, N45, N51, P70/P75, ThinkPad 300, 350, 500, 510, 710T, Expansion Unit, Dock I, Dock II)	30H2356, S82G-1501-01
Mobile Systems HMM Volume 2: ThinkPad Computers (Models 340, 355, 360, 370, 700, 701, 720, 750, 755)	30H2357, S82G-1502-03
Mobile Systems HMM Volume 3: ThinkPad Computers (Models 365, 380, 385, 560, 760, SelectaDock)	84H8099, S82G-1503-05
Mobile Systems HMM Volume 4: ThinkPad Computers (Models 380, 385, 560, 760, 765)	05L1271, S05L-1270-01

Related Diskettes

The following diskettes are available through IBM or your IBM Authorized Dealer.

Diskette	Part, Form Number
ThinkPad 300 (2615) Advanced Diagnostics Diskette	33G9361, S33G-9361
ThinkPad 350, 350C, 425, 425C (2618) Advanced Diagnostics Diskette	A211000, GA21-1000
ThinkPad 365 (2625) Advanced Diagnostics Diskette	76H7578, S30H-2498
ThinkPad 380/385 (2635) Maintenance Diskette	06J0333, S06J-0333
ThinkPad 390/i Series 1700 (2626, 2627) Diagnostic and Utilities Diskettes	10L9942, S10L-9942
ThinkPad 500 (2603) Advanced Diagnostics Diskette	71G3702, S71G-3702
ThinkPad 510 (2604) Advanced Diagnostics Diskette	83G8095, S83G-8095
ThinkPad 700 (9552) Reference Diskette	42G2017, S42G-2017
ThinkPad 700C (9552) Reference Diskette	42G2023, S42G-2023
ThinkPad 720/720C (9552) Reference Diskette	61G1194, S61G-1194
ThinkPad Hardware Maintenance Diskette (for all Models 355, 360, 560, 750, 755, 760)	78H5384, S78H-5384
ThinkPad Dock I (3545)	71G4140, S71G-4140
Docking Station (3550)	42G2428, S42G-2428
Data/Fax Modem	61G1556, S61G-1556
FaxConcentrator/A	84F8540, S84F-8540

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General Descriptions

This chapter includes the descriptions for all ThinkPad models. Some descriptions might not apply to the particular computer.

Introduction

Important Service Information

Important

Diskette fixes are customer installable. The diskette fixes are located on the PC Company Bulletin Board Service (BBS). The direct phone line for modem connection is 919-557-0001 or tieline 255-0001.

Advise customers to contact the PC Company HelpCenter at 800-772-2227 if they need assistance in obtaining or installing any diskette fixes.

Customers in Canada should call IBM HelpPC at 800-565-3344 for assistance or down-load information. The Canadian BBS phone numbers are:

Montreal	514-938-3022
Toronto	905-316-4255
Vancouver	604-664-6464
Winnipeg	204-934-2735

FRU Replacement Strategy

Before Replacing Parts

Ensure that all diskette fixes are installed prior to 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 and that 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 replaced does not correct the problem, reinstall the original board, then replace the other (processor or system) board.
- If an adapter or device consists of more than one FRU, an error code may be caused by any of the FRUs. 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 settings. Note the current configuration settings (using the View Configuration option) and verify that the settings are in place when service is complete.

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. Data or programs can be overwritten if you select an incorrect drive.

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. The cause of the first error code can result in false error codes being displayed. 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 highlighted in this index. Some digits will represent different information for SCSI errors versus non-SCSI errors.

The following example shows which digits display the shorter POST error messages and also defines the SCSI information in an eight-digit error message.

```
Shorter POST Messages
=====
" " " " " " " " " "
=====
" 0 " 0 " 0 " 0 " 0 " 0 " 0 "
=====
" " " " " " " " " "
Reserved " " " " " " " " Size (SCSI)
          " " " " " " " " Slot Number (SCSI)
          Device Code " Logical Unit Number (SCSI)
                      ID (SCSI)
```

All SCSI devices are set to a different SCSI ID. Duplicate SCSI ID settings can generate a false error message. Use the SCSI ID to determine whether the error message is coming from an internal or an external device.

Drive and Diskette Compatibility Matrix

The following table provides identification information for 3.5-inch drives.

Diskette Drive	Identifying Mark
3.5-Inch - 1.44MB	1.44 on the eject button
3.5-Inch - 2.88MB	2.88 on the eject button

The following table provides compatibility information for 3.5-inch diskettes and 3.5-inch diskette drives.

Diskette Capacity	1.44MB Drive	2.88MB Drive
1.0MB	Read/Write	Read/Write
2.0MB	Read/Write	Read/Write
4.0MB	Not Compatible	Read/Write

The following table provides identification information for 5.25-inch diskette drives.

Diskette Drive	Identifying Mark
5.25-Inch - 360KB (External)	Asterisk on bezel
5.25-Inch - 1.2MB (Internal)	1.2 on the eject button

The following table provides compatibility information for 5.25-inch diskettes and 5.25-inch diskette drives.

Diskette Capacity	360KB Drive	1.2MB Drive
360KB	Read/Write	Read/Write
1.2MB	Not Compatible	Read/Write

Note
A 360KB diskette written to or formatted on a 1.2MB drive can be read reliably only on a 1.2MB drive.

Safety Notices (Multi-lingual 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 2

Some standby batteries contain a small amount of nickel and cadmium. Do not disassemble it, recharge it, throw it into fire or water, or short-circuit it. 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.

Certaines batteries de secours contiennent du nickel et du cadmium. Ne les démontez pas, ne les rechargez pas, ne les exposez ni au feu ni à l'eau. Ne les mettez pas en court-circuit. Pour les mettre au rebut, conformez-vous à la réglementation en vigueur. Lorsque vous remplacez la pile de sauvegarde ou celle de l'horloge temps réel, veillez à n'utiliser que les modèles cités dans la liste de pièces détachées adéquate. Une batterie ou une pile inappropriée risque de prendre feu ou d'exploser.

Die Bereitschaftsbatterie, die sich unter dem Diskettenlaufwerk befindet, kann geringe Mengen Nickel und Cadmium enthalten. Sie darf nur durch die Verkaufsstelle oder den IBM Kundendienst ausgetauscht werden. Sie darf nicht zerlegt, wiederaufgeladen, kurzgeschlossen, oder Feuer oder Wasser ausgesetzt werden. Die Batterie kann schwere Verbrennungen oder Verätzungen verursachen. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Beim Ersetzen der Bereitschafts- oder Systembatterie nur Batterien des Typs verwenden, der in der Ersatzteilliste aufgeführt ist. Der Einsatz falscher Batterien kann zu Entzündung oder Explosion führen.

Alcune batterie di riserva contengono una piccola quantità di nichel e cadmio. Non smontarle, ricaricarle, gettarle nel fuoco o nell'acqua né cortocircuitarle. Smaltirle secondo la normativa in vigore (DPR 915/82, successive disposizioni e disposizioni locali). Quando si sostituisce la batteria dell'RTC (real time clock) o la batteria di supporto, 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.

Algunas baterías de reserva contienen una pequeña cantidad de níquel y cadmio. 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. La utilización de una batería no apropiada puede provocar la ignición o explosión de la misma.

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 température 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 Systematterie ist eine Lithiumatterie. 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 è una batteria al litio e può 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 batería de repuesto es una batería 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 5

If the LCD breaks and the fluid from inside the LCD gets into your eyes or on your hands, immediately wash the affected areas with water for at least 15 minutes. Seek medical care if any symptoms from the fluid are present after washing.

Si le panneau d'affichage à cristaux liquides se brise et que vous recevez dans les yeux ou sur les mains une partie du fluide, rincez-les abondamment pendant au moins quinze minutes. Consultez un médecin si des symptômes persistent après le lavage.

Die Leuchtstoffröhre im LCD-Bildschirm enthält Quecksilber. Bei der Entsorgung die örtlichen Bestimmungen für Sondermüll beachten. Der LCD-Bildschirm besteht aus Glas und kann zerbrechen, wenn er unsachgemäß behandelt wird oder der Computer auf den Boden fällt. Wenn der Bildschirm beschädigt ist und die darin befindliche Flüssigkeit in Kontakt mit Haut und Augen gerät, sollten die betroffenen Stellen mindestens 15 Minuten mit Wasser abgespült und bei Beschwerden anschließend ein Arzt aufgesucht werden.

Nel caso che caso l'LCD si dovesse rompere ed il liquido in esso contenuto entrasse in contatto con gli occhi o le mani, lavare immediatamente le parti interessate con acqua corrente per almeno 15 minuti; poi consultare un medico se i sintomi dovessero permanere.

Si la LCD se rompe y el fluido de su interior entra en contacto con sus ojos o sus manos, lave inmediatamente las áreas afectadas con agua durante 15 minutos como mínimo. Obtenga atención medica si se presenta algún síntoma del fluido despues de lavarse.

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 Kurzschluß 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 muß 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 to the customer, 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 tool case 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: There must be a complete circuit to cause electrical shock. 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 intent of this inspection guide is to assist you in identifying potentially unsafe conditions on these products. Each machine, as it was designed and built, had required safety items installed to protect users and service personnel from injury. This guide addresses only those items. However, good judgment should be used 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 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 appropriate type as specified in the parts listings.
 - 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.

Notes

1. Use product-specific ESD procedures when they exceed the requirements noted here.
2. Make sure that the ESD protective devices you use have been certified (ISO 9000) as fully effective.

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, beállítástól 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 kontrol, 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.

READ THIS FIRST

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:

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

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. Vyhňte sa priamemu pohľadu a nehládte priamo s optickými nástrojmi do lúča a vyhňte 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.

Read This First

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

READ THIS FIRST

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 servicing might have been rearranged, or the drive startup sequence might have been 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 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 from a variety of reasons 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. If this is suspected, clear the error log and run the test again. Do not replace any FRUs if log errors do not reappear.
- **Be careful not to replace a nondefective FRU.**

What to Do First: The servicer must include the following in the parts exchange form or parts return form that is attached to the returned FRU:

- ___ 1. Name and phone number of servicer
- ___ 2. Date of service
- ___ 3. Date that 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

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

READ THIS FIRST

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 may indicate that the system was subjected to stress beyond normal use.

The following is 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 FDD.
- Diskette drive damage caused by the diskette drive cover being pressed 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.
- HDD spindles can become noisy from being subjected to excessive force or from being dropped.
- I9990303 errors can be caused by exposure to strong magnetic fields.

FRU Replacement Notices

This section contains notices for removal and replacement. Read this section carefully before replacing any FRU.

LCD Replacement Notice

The TFT LCD for the computer contains over 2,359,296 thin-film transistors (TFTs). A small number of missing, discolored, or lighted dots (on all the time) 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 **21 or more**.

Screw Notices

This computer uses special nylon-coated screws with the following characteristics:

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

Do the following when you service this machine:

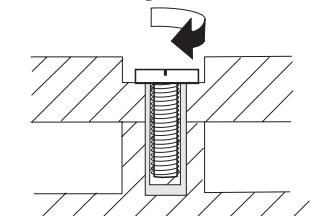
- Keep the screw kit (P/N 05K4841) in your tool bag.
- Always use new screws if you are instructed.
- Use a torque screwdriver if you have one.

Loose screws can cause a reliability problem. The IBM ThinkPad computer addresses this problem with nylon-coated screws. 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

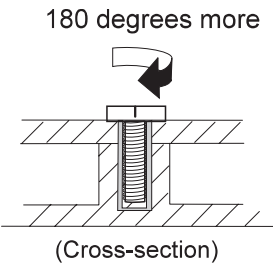


(Cross-section)

- **Logic card to plastic**

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

FRU REPLACEMENT NOTICES



- **Torque driver**
If you have a torque driver, refer to the “Torque” column with each step.
- Make sure you use the correct screw, and tighten all screws firmly to the torque shown in the table if you have a torque screwdriver. **Never use a screw that you removed. Use a new one. Make sure the screws are tightened firmly**

System Board Replacement Notice

Notice for 770E and 600: Restoring the System Unit Serial Number: The EEPROM on the system board contains vital product data (VPD), such as the system unit serial number and the system board serial number. You must restore the system unit serial number to its original number when the system board is replaced.

To restore the system unit serial number, do the following:

1. Press and hold **F1** and power on the computer.
2. Hold down **F1** until the Easy-Setup menu appears.
3. Click on **Config**.
4. Press **Ctrl + N**. The System Unit Serial Number menu appears.
5. Follow the instructions on the menu.

Notes

1. Do not power-off the computer during the restoration process.
2. The serial number label is attached to the bottom of the computer.

Notice for 770X and 600E

Serial Numbers: 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 EEPROM contains the following serial numbers:

- System board serial number
- System unit serial number
- CPU Card serial number
- DC-DC Card serial number

FRU REPLACEMENT NOTICES

You must restore each of those serial numbers except the system board serial number to its original number when replacing the system board.

To save the original serial numbers, do the following:

1. Boot from DOS, or open an MS-DOS prompt.
2. Insert the ThinkPad Hardware Maintenance Diskette Version 1.05 into the diskette drive.
3. Enter A:\SERUPDT.EXE at the DOS prompt.

The usage of this tool is displayed.

Note

SERUPDT.EXE is in the ThinkPad Hardware Maintenance Diskette Version 1.05 or a later version.

4. Enter SERUPDT R

Each serial numbers is displayed with its device type. Write down all numbers except the system board serial number. The device type designations for the each serial number are as follows:

08: CPU card serial number
20: System unit serial number
38: DC-DC card serial number
40: System board serial number
78–7F: Hard disk drive serial number

Note

You can disregard the hard disk drive serial number.

To restore the serial numbers, do the following:

1. Boot from DOS, or open a MS-DOS prompt.
2. Enter SERUPDT.EXE at the DOS prompt.
The usage of this tool is displayed.
3. Enter SERUPDT W nn SSSSSS for each serial number you saved.

Notes

1. nn is the device type, and SSSSSS is the serial number.
2. The system unit serial number is written in the label attached on the bottom of the computer.

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. Consequently, no two computers in the world have the same number.

FRU REPLACEMENT NOTICES

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

1. Press and hold **F1** and power on the computer.
2. Hold down **F1** until the Easy-Setup menu appears.
3. Click on **Config**.
4. Press **Ctrl + G**. The UUID menu appears.
5. Press **F5** to generate a new UUID, and press **Enter** to overwrite it to EEPROM.

CPU Card Replacement Notice (600E and 770X Only)

You must restore the CPU card serial number to its original number, when the CPU card is replaced. To save and restore the CPU card serial number, follow the instruction in "Serial Numbers" on page 20.

DC-DC Card Replacement Notice (600E and 770X Only)

You must restore the DC-DC card serial number to its original number, when the DC-DC card is replaced. To save and restore the DC-DC card serial number, follow the instruction in "Serial Numbers" on page 20.

Related Service Information

This section provides information about the following:

- “How to Use Error Messages”
- “How to Diagnose Multiple FRUs”
- “Reset Switch”
- “Running a Low-Level Format”
- “Service Web Site” on page 24
- “Passwords” on page 24
- “Power Management Features” on page 25
- “Fn Key Combinations” on page 29

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 caused the first error code can result in false error codes being displayed. If no error code is displayed, see if the error symptom is listed in the “Symptom-to FRU Index” section.

How to Diagnose Multiple FRUs

When the adapter or device has more than one FRU, the error code could be caused by any of them. Before replacing multiple FRUs, try removing or exchanging each FRU, one by one in the designated sequence, to see if the symptoms change.

Reset Switch

The Reset switch resets the system (regardless of the microcode status) and forces the power off. Use this push button to power off when power is not completely off or the microcode is in a hung state. See the “Locations” section of each model for Reset switch location.

Running a Low-Level Format

Do the following to format the hard disk.

Attention: Make sure the drive address to be formatted is correct. This procedure erases all information on the disk.

1. Power off the computer.
2. Hold **F1** until the Easy-Setup menu appears.
3. Click on the **Test** icon. The Basic Diagnostics menu appears.
4. Press **Ctrl+A** to enter advanced diagnostic mode. The ThinkPad FRU Connections window appears.
5. Click on **Exit**. The Keyboard Test menu appears.
6. Click on **Exit** again.
7. Press **Ctrl+L**. The Low-Level Format menu appears.
8. Follow the instructions on the screen

If you are prompted to use the Maintenance Diskette, do the following:

RELATED SERVICE INFORMATION

1. Insert the ThinkPad Hardware Maintenance Diskette Version 1.05 or a later version into the diskette drive and power on the computer.
2. Select **Format the hard disk** from the main menu.
3. Select the drive from the menu.
4. Follow the instructions on the screen.

Service Web Site

When the latest system program service diskette is available, it will be posted on:

System program service diskette:

<http://www.pc.ibm.com/us/files.html>

Passwords

When the power-on password (POP), hard disk password (HDP), and supervisor password (PAP) are used, the following situations may occur:

- **If the POP is the same as the HDP**, the POP prompt appears, but the HDP prompt does not appear.
- **If the POP is not the same as the HDP**, both prompts appear.
- **The PAP and the HDP:**
If the PAP is used, the HDP is enabled automatically, but no HDP prompt appears. The HDP is set the same as the PAP.

The ThinkPad computer that has the bay can support more than two HDPs.

- If the **POP** is the same as one of the **HDPs** (HDP-1 or HDP-2), a POP prompt appears. The passwords are different.
- If the **POP** is not the same as either of the **HDPs** (HDP-1 or HDP-2);, both prompts appear.
- If the **PAP** is used, the **HDP-1** or the **HDP-2** is automatically enabled, but the HDP prompt does not appear. The HDP-1 and HDP-2 are then set to the same password as the PAP.

Supervisor and Hard Disk Passwords: The supervisor password and the hard disk password (HDP) are security features that are used to protect the system and the hard disk data from unauthorized access. No overriding capability is provided. If only a hard disk password is set, obtaining permission from the password owner to unlock the password is a prerequisite for running diagnostic tests and performing service. If both supervisor password and hard disk password are set, you can enter Easy-Setup by pressing the **Enter** key or by entering the power-on password at the supervisor password prompt. In this case, the **Password**, **Start up**, **Network**, and **Initialize** or **Asset ID** (for some models) icons cannot be selected.

RELATED SERVICE INFORMATION

Note

The supervisor password and hard disk password cannot be replaced if they are forgotten. If the customer forgets the supervisor password, the system board must be replaced. If the customer forgets the hard disk password, the hard disk drive must be replaced.

How to Remove the Power-On Passwords:

If only the power-on password is set, do the following to remove the power-on password.

1. Power off the computer
2. Remove the DIMM cover on the bottom side of the computer.
3. Short-circuit the two password pads or put the jumper.

For the location of the password pads or jumper, see the "Locations" section for each model.

4. Under the short-circuit condition, power on the computer and wait until the POST ends.

After the POST ends, the password prompt does not appear. The power-on password is removed.

5. Reinstall the DIMM cover.

If both the power-on password and the supervisor password are set, do the following to remove the passwords:

1. Power on the computer by pressing and holding **F1**.
2. Enter the supervisor password. The Easy-Setup menu appears.
3. Click on the **Password** icon.
4. Click on the **Power on** icon.
5. Enter the supervisor password and press the **Space bar**.
6. Press **Enter** twice.
7. Click on **Exit**; then click on **Restart**.

The power-on password has been removed.

Power Management Features

Three power management modes are provided by the computer to reduce power consumption and prolong battery power.

Standby Mode: In standby mode, the following occurs:

- The LCD backlight turns off.
- The hard disk drive motor stops.
- The speaker is muted.

RELATED SERVICE INFORMATION

Note

Standby mode in Windows 98 is called *suspend mode* in Windows 95.

The computer enters standby mode when the **Fn + F3** keys are pressed.

The computer exits standby and resumes normal operation when any key is pressed.

Suspend Mode: The following events occur in addition to what occurs in standby mode when the computer enters suspend mode:

- The LCD is powered off.
- The hard disk drive is powered off.
- The CPU stops.

Note

Suspend mode in Windows 95 is called *standby mode* in Windows 98.

The following events cause the computer to enter suspend mode:

- The **Fn + F4** keys are pressed.
- The LCD cover is closed. If you add a check mark to the **Will not suspend even if LCD is closed** box in the Power Management Properties window, the computer will not enter suspend mode even if the LCD is closed. The LCD only turns off.
- The **Suspend** button is selected in the Fuel-Gauge program.
- The specified time has elapsed from the last operation with the keyboard, the TrackPoint, the hard disk drive, the parallel connector, or the diskette drive; or the AC Adapter is plugged in.

In Windows 95, the timer is set by the **Suspend Timer** selection in the Power Properties window. In Windows 98, the timer is set by the **System standby timer** selection in the Power Management Properties window.

- The battery indicator blinks orange indicating that the battery power is low. If you add a check mark to the **Hibernate when battery becomes low** box in the Power Management Properties window, the computer enters hibernation mode under this condition.

RELATED SERVICE INFORMATION

Note

Even if you don't set the low-battery alarm, the charge indicator will let you know that the battery is low, and then the ThinkPad will automatically enter the power-saving mode. This default low-battery behavior is independent of the operating system, so the computer might behave differently from your setting if you set the low-battery alarm. The computer chooses appropriately between your setting and the default setting.

Note

The computer cannot enter suspend mode if it is attached to a docking station.

The following events cause the computer to resume operation from suspend mode:

- The **Fn** key is pressed.
- The LCD cover is opened.
- The ring indicator (RI) is signaled by a serial device or PC Card device.
- The power switch is turned on.
- The resume timer is set. In Windows 95, you can set the time with the **Resume on timer** selection in the Power Management Properties window. 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 event immediately after it enters suspend mode. Therefore, wait a few seconds before taking any action to reenter operation mode.

Hibernation Mode

For the Windows NT User

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

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.

RELATED SERVICE INFORMATION

Notes

1. In the ThinkPad Configuration program, the computer can be set to **suspend/hibernate while docked**.
2. The computer cannot enter hibernation mode when:
 - It is powered with ac power and a communication PC Card is used.
 - It is attached to a Dock I docking station.

The following events cause the computer to enter hibernation mode:

- The **Fn + F12** keys are pressed.
- The **Hibernation** button is selected in the Fuel-Gauge program.
- To change from Hibernation mode to Operation mode, activate the power switch once.
- The timer conditions are satisfied in suspend mode (for operating systems other than Windows 98).
- A critically low battery condition occurs and hibernation mode is set to **Hibernate when battery becomes low**.

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

RELATED SERVICE INFORMATION

Fn Key Combinations

The following table shows the **Fn** key and function key combinations and their corresponding functions.

The **Fn** key works independently from the operating system. The operating system obtains the status through the system management interface to control the system.

Fn +	Description
F1	Reserved.
F2	Turn Fuel-Gauge display on or off.
F3	Turn standby mode on.
F4	Turn suspend mode on.
F5	Reserved.
F6	Reserved.
F7	Switch between the LCD and an external monitor.
F8	Turn screen expansion on or off. (no symbol on the key)
F9	Reserved.
F10	Reserved.
F11	Switch the power management mode (High Performance, Automatic, and Customized) Note In Windows 98, only the CPU speed is changed.
F12	Turn hibernation mode on.
Model dependent functions	
Pg Up	Increase the sound volume.
Pg Dn	Decrease the sound volume.
Back space	Mute.

Checkout Guide

Use the following procedure as a guide for computer problems.

Note

The diagnostic tests are intended to test only IBM products. Non-IBM products, prototype cards, or modified options can give false errors and invalid system responses.

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

Note

To run the diagnostics, refer to “Running the Diagnostics” on page 40.

3. Use the following table with the verified symptom to determine which page to go to. Search the “Symptoms (Verified)” column, and find the description that best matches your symptom; then go to the page shown in the “Go To” column.

Symptoms (Verified)	Go To
Power failure. (The power indicator does not go on or stay on.)	“Power Systems Checkout” on page 36.
POST does not complete. No beep or error codes are indicated.	“Symptom-to-FRU Index” section, and then use the No Beep Symptoms table.
POST beeps, but no error codes are displayed.	“Symptom-to-FRU Index” section, and then use the Beep Symptoms table.
POST detected an error and displayed numeric error codes.	“Symptom-to-FRU Index” section, and then use the Numeric Error Codes table.
The diagnostic test detected an error and displayed a FRU code.	“FRU Codes” on page 44.
The configuration is not the same as the installed devices.	“Checking the Installed Devices List” on page 43.

CHECKOUT GUIDE

Symptoms (Verified)	Go To
Other symptoms (such as LCD display problems).	"Symptom-to-FRU Index" section, and then use the Other Symptoms table.
Symptoms cannot be re-created (intermittent problems).	Use the customer-reported symptoms and go to "Symptom-to-FRU Index" section.

Audio Checkout

ISA Audio Check Out

1. Go to the diagnostic menu by selecting **Test** in the Easy-Setup menu.
2. Select **Audio** and run the diagnostic tests.
3. If the test detects a audio problem, replace the system board.

PCI Audio Check Out

1. Power off the computer.
2. Insert the ThinkPad Hardware Maintenance Diskette Version 1.05 or later version into the diskette drive.
3. Power on the computer.
4. Select **Test the audio feature** from the main menu.
5. If **FAIL** is displayed on the screen, replace the system board.

Diskette Drive Checkout

Do the following to isolate the problem to a controller, drive, or diskette. A blank, formatted, write-enabled, nondefective 2HD diskette is required.

FDD-1 represents the diskette drive in the bay. *FDD-2* represents an external diskette drive.

Attention

Make sure that the diskette does not have more than one label attached to it. Multiple labels can cause damage to the drive or cause the drive to fail.

Do the following to select the test device.
See "Running the Diagnostics" on page 40 for details.

1. Start Easy-Setup.
2. Click on **Test**.
3. Press **Ctrl+A** to enter the advanced diagnostic mode.
The ThinkPad FRU Connections window appears.
4. Click on **Exit**.
The keyboard layout window appears.

CHECKOUT GUIDE

5. Click on **Exit**.
6. Click on **FDD-1** or **FDD-2** to start the test.
7. Insert the blank diskette when instructed and follow the instructions on the screen.
8. If the controller test detects an error, FRU code 10 appears. Replace the system board.
9. If the controller test runs without errors, the drive read/write tests start automatically. If a drive test detects an error, FRU code 50 for FDD-1 or 51 for FDD-2 appears. If the diskette itself is known to be good, replace the drive.

Fan Checkout

To check the fan, do the following:

1. Start Easy-Setup.
2. Click on **Test**. The fan will start so you can check the air turbulence at the louver near the power switch.
3. Press **Ctrl+A** to enter the advanced diagnostic mode. The ThinkPad FRU Connections window appears. If the fan connector is not connected, **Fan not connected** message appears.
4. Click on **Exit**. The keyboard layout window appears.
5. Click on **Exit**.
6. Click on **System Board** and press **Enter** to run the test. Follow the description on the window. If the test detects the fan problem, replace it.

Indicator LED Checkout

If an indicator LED problem occurs, do the following:

1. Power off the computer.
2. Power on the computer. All the LEDs should turn on for a moment after the computer is powered on.
3. Verify that all LEDs turned on. If some of the LEDs do not turn on, replace the card that the LEDs are on. If the problem persists, replace the system board.

Indicator Panel Checkout

If an indicator panel problem occurs, do the following:

1. Power off the computer.
2. Power on the computer. All the icons should turn on for a moment after the computer is powered on.
3. Verify that all icons appear correctly. If some of the icons do not appear, replace the card that the indicator panel is connected to. If the problem persists, replace the DC-DC card.

Keyboard or Auxiliary Input Device Checkout

Remove the external keyboard if the internal keyboard is to be tested.

CHECKOUT GUIDE

If the internal keyboard does not work or an unexpected character appears, make sure that the flexible cable extending from the keyboard is correctly seated in the connector. If the keyboard cable connection is correct, run the keyboard test. See "Running the Diagnostics" on page 40 for details.

Note

When the **Fn** key is pressed, a black square briefly appears.

If the tests detect a keyboard problem, do the following one at a time to correct the problem. Do not replace a nondefective FRU:

1. Reseat the keyboard cable.
2. Replace the keyboard.
3. Replace the card that the keyboard is connected to.
4. Replace the system board.

The following auxiliary input devices are supported for this computer:

- Numeric keypad
- Mouse (PS/2 compatible)
- External keyboard (with keyboard/mouse cable)

If any of these devices do not work, reseat the cable connector and repeat the failing operation.

If the problem does not recur, recheck the connector. If the problem is not corrected, replace the device and then the card that the devices are directly connected to.

Memory Checkout

DIMM cards are available for increasing memory capacity.

The memory size is displayed in kilobites. 576 KB is reserved by the system, so you calculate the memory size by the following equation:
[total memory size (MB)] × 1024 – 576 (KB)

For example, if the total memory size is 64 MB, it is displayed as 64960 KB.

Memory errors might stop system operations, show error messages on the screen, or hang the system.

Use the following procedure to isolate memory problems:

1. Power off the computer and remove any installed DIMM from its slot.

Note

If the computer has a base memory slot and option memory slots, remove any DIMMs installed in the option memory slots.

CHECKOUT GUIDE

2. Press and hold the **F1** key; then power on the computer. Hold the **F1** key down until the Easy-Setup menu appears.
3. Select **Test** and press **Enter**.
4. Select **Memory** and press **Enter** to run the memory test on base memory.

See "Running the Diagnostics" on page 40 for details.

If an error appears:

- If the computer don't have the base memory slot, replace the system board.
- If the computer has the base memory slot, remove the DIMM installed in the base memory slot and go to step 2. Then if an error appears, replace the system board.

If an error does not appear, continue the following procedures.

5. Power off the computer and reinstall the DIMM one by one; then power on the computer. Verify the memory size; then test the memory. If an error appears, replace the DIMM.

Note

Make sure that the DIMM is fully installed into the connector. A loose connection can cause an error.

6. If the problem does not corrected, replace the following FRU.
 - a. System board
 - b. CPU card

If memory problems occur intermittently, use the loop option to repeat the test. When the test detects an error, an error log is printed on the printer connected to the parallel port. See "Displaying the Error Log" on page 42 for more information.

System Programs in Flash Memory: System setup programs and diagnostic tests are stored in the Flash memory.

Flash Memory Update: The Flash memory update is required for the following conditions:

- New versions of system programs
- New features or options

To update the Flash memory, do the following:

1. Get the appropriate diskette containing the update.
2. Insert the **System Program Service Diskette** into drive A and power on the computer.
3. Select **Update system programs** from the menu.

Modem (DSP) Checkout

Note

This section is for the built-in modem model.

Do the following:

1. Go to the diagnostic menu by selecting **Test** in the Easy-Setup menu.
2. Select **DSP** and run the diagnostic tests.
3. If the test detects a DSP problem, replace the modem card.

Port Replicator Checkout

Use the following procedure to isolate a port replicator problem. The port replicator attaches to the system expansion connector at the rear of the computer:

1. Power off the computer.
2. Remove the failing devices from the port replicator.
3. Unplug the AC Adapter from the port replicator, if attached.
4. Remove the port replicator from the computer.
5. Reconnect the failing device directly to the computer. (If another device is already connected to the computer, remove it first.)
6. Go to the "Running the Diagnostics" on page 40 and run the diagnostics.
7. If the advanced diagnostic device test did not find an error, suspect a problem with the port replicator.
8. Power off the computer and reconnect the port replicator.
9. Power on the computer and run the following advanced diagnostic tests:
 - Serial port test with the wrap plug installed on the port replicator
 - Universal serial bus test with the USB parallel test cable
 - Parallel port test with the wrap plug installed on the port replicator
 - FDD-2 device test on the failing device with a scratch diskette
10. If diagnostic errors appear, replace the port replicator or the diskette drive. If the problem remains after the replacement, replace the system board.
11. If power problems appear only when the port replicator is used, replace the port replicator.

Port Replicator Power Overload: If power shutdown occurs intermittently when PC Card devices are used through a port replicator with PC Card slots, suspect an over-current problem. Some PC Card devices use more power; if the maximum usage of each device occurs simultaneously, the total current will exceed the limit, thereby causing a power shutdown. Isolate this problem

CHECKOUT GUIDE

by removing one of the devices, use the computer under the same condition, and see whether a power shutdown occurs. Do this procedure for all devices to determine the cause.

Power Systems Checkout

To verify the symptom of the problem, power on the computer using each of the following power sources:

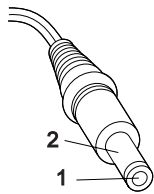
- 1. Remove the battery pack.
- 2. Connect the AC Adapter and check that power is supplied.
- 3. Disconnect the AC Adapter and install the charged battery pack; then check that power is supplied by the battery pack.

If you suspect a power problem, see the appropriate power supply checkout in the following list:

- “Checking the AC Adapter”
- “Checking Operational Charging” on page 37
- “Checking the Battery Pack” on page 37
- “Checking the Backup Battery” on page 38

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

- 1. If the power problem occurs only when the port replicator is used, replace the port replicator.
- 2. If the power-on indicator does not turn on, check the power cord of the AC Adapter for correct continuity and installation.
- 3. If the operational charge does not work, go to Checking Operational Charging.
- 4. 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

- 5. If the voltage is not correct, replace the AC Adapter.
- 6. If the voltage is within the range, do the following:
 - Replace the system board.

CHECKOUT GUIDE

- If the problem is not corrected, go to “Undetermined Problems” section of each model.

Note

An audible 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.

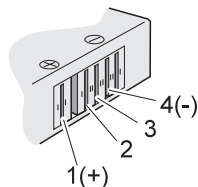
Perform operational charging. If the battery status indicator or icon does not turn on, remove the battery pack and let it return to room temperature. Reinstall the battery pack. If the charge indicator or icon still does not turn on, replace the battery pack.

If the charge indicator still does not turn on, replace either the system board or DC-DC card that the battery is connected to. Then reinstall the battery pack. If the reinstalled battery pack is not charged, go to the next section.

Checking the Battery Pack: Battery charging will not start until the Fuel-Gauge shows that less than 95% of the total power remains; with this condition the battery pack can charge to 100% of its capacity. This protects the battery pack from being overcharged or having a shortened life.

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
4	Ground (-)

3. If the voltage is less than +11.0 V dc, the battery pack has been discharged. Recharge the battery pack.

CHECKOUT GUIDE

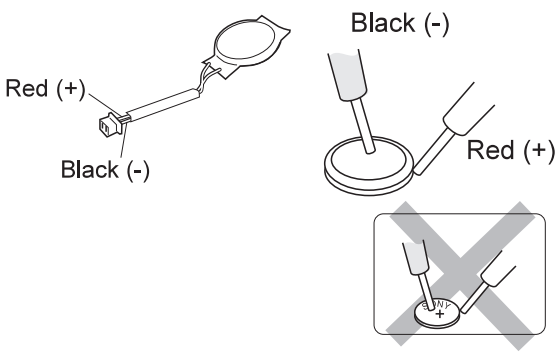
Note
In this case, the battery pack is over-discharged. It takes at least 3 hours to recharge the battery pack even if the indicator does not turn on.

- 4. If the voltage is still less than +11.0 V dc after recharging, replace the battery.
- 5. If the voltage is more than +11.0 V dc, measure the resistance between battery terminals 3 and 4. The resistance must be 4 to 30 K ohm.
- 6. If the resistance is not correct, replace the battery pack. If the resistance is correct, replace the system board.

Checking the Backup Battery: Do the following:

- 1. Power off the computer and unplug the AC Adapter from the computer.
- 2. Turn the computer upside down.
- 3. Remove the backup battery (see "Removal and Replacement" section of each model).
- 4. Measure the voltage of the backup battery. See the following figure.

Note
Be careful not to measure the wrong side of the backup battery.



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

- If the voltage is correct, replace the system board.
- If the voltage is not correct, replace the backup battery.
- If the backup battery discharges quickly after replacement, replace the system board.

System Board and CPU Card Checkout

The processing functions are performed by both the system board and the CPU card. Processor problems can be caused by either FRU. However, the CPU card generally has a lower probability of failure. If a numeric code indicates the system board or the CPU card as a failing FRU, or the CPU card is indicated by a diagnostic test by showing FRU code **11**, use the following procedure to isolate the problem:

1. Run the system board test to verify the symptom. This test verifies both the system board and the CPU card. If no error is detected, return to "Checkout Guide" on page 30.

Note

Don't touch the keyboard and pointing device when the system board test is running. This might cause an unexpected error.

2. If FRU code 10 appears, replace the system board but do not replace the CPU card. Remove the CPU card from the old system board and install it to the new system board.
3. If FRU code 11 appears, reseal the CPU card.
4. Rerun the test to verify the fix.
5. If FRU code 11 remains, replace the CPU card.

If this procedure does not correct the problem, go to the "Undetermined Problems" section for each model.

TrackPoint Checkout

If the TrackPoint does not work, check the configuration in the ThinkPad Configuration program. If the configuration of the TrackPoint is disabled, select **Enable** to enable it.

If this does not correct the TrackPoint problem, continue with the following. After you use the TrackPoint, the pointer drifts on the screen for a short time. This self-acting pointer movement can occur when a slight, steady pressure is applied to the TrackPoint pointer. This symptom is not a hardware problem. No service actions are necessary if the pointer movement stops in a short period of time.

If a click button problem or the pointing stick problem occurs, do the following:

1. Go to the Easy-Setup menu.
2. Select an item with the pointing stick.
3. Press any one of the click buttons.
4. Verify that the item is selected.
5. Move to another item with the pointing stick.
6. Press the pointing stick (press-to-select), and verify that the item is selected.

RUNNING THE DIAGNOSTICS

Note

This step is only for the model that has the press-to-select function.

7. Verify that all buttons work correctly.
- If either the pointing stick or the click button do not work, do the following actions one at a time to correct the problem. Do not replace a nondefective FRU.
1. Reseat the keyboard cables.
 2. Replace the keyboard.
 3. Reseat the card that the TrackPoint cable is directly connected to.
 4. Replace the system board.

Running the Diagnostics

The following table lists the special tools needed for the diagnostics:

Tool Name	Part Number
PC test card	35G4703
Tri-connector wrap plug	72X8546
USB parallel test cable	05K2580

Use either the TrackPoint or the cursor-moving keys to interact with the tests. The **Enter** key works the same as selecting the **OK** icon to reply OK.

1. Press and hold **F1**; then power on the computer. Hold **F1** down until the Easy-Setup menu appears.
2. Click on **Test**. The basic diagnostic menu appears.
3. Click on a device to run the test. The test progress screen appears; then **OK** appears under the tested device icon when the test ends without any errors.
4. Start the **Advanced Diagnostic test** by pressing **Ctrl+A** on the basic diagnostic menu. The ThinkPad FRU connections window appears.
5. Click on **Exit** or press the **Esc** key. The keyboard test window appears.
6. When you press a key, a mark appears or disappears on the corresponding key position on the screen. Repeat this step for any keys that need to be tested. You can run the keyboard test if you press **Ctrl+K** in the advanced diagnostic test mode.
7. To exit the keyboard test, click on **Exit** or press **Ctrl+Break**. The advanced diagnostics window appears.
8. Click on a device to test it, or click on **Test All** to test all devices.

RUNNING THE DIAGNOSTICS

Click on **Looptest** to run the tests in a repeated loop. The loop option menu appears. Click on a device; the ✓ mark appears beside the selected device. Repeat this step to select multiple devices. Click on **OK** to start the diagnostic loop. If no device is selected, all devices tests are looped.

9. To exit the loop, keep pressing **Ctrl+Pause** until the test exits. A beep sounds to notify that the exit interrupt is sensed by the test program. Press **Esc** to exit from the loop test.

PC Card Slots Test

The green LED on the PC test card turns on when the PC Card slot test is running. If the LED does not turn on, check that the card is installed correctly by reseating it. If the LED still does not turn on after the card is reseated, try using another slot for the test. If the LED still does not turn on and the test fails, replace the FRU shown by the diagnostic error code.

Universal Serial Bus (USB) Test

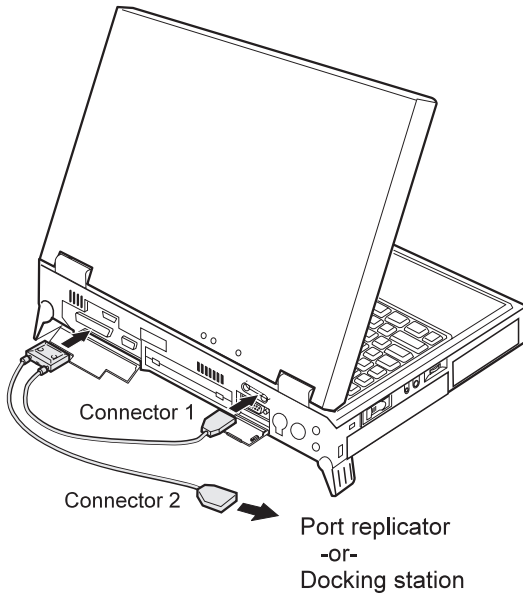
At the advanced diagnostic window, do the following:

1. Connect the USB parallel test cable to the parallel connector of the computer.
2. Connect Connector 1 of the cable to the USB connector of the computer.

Note

The illustration shows a ThinkPad 770 computer, but the procedure is the same for the other model.

RUNNING THE DIAGNOSTICS



3. Click on **USB-1** to run the test.

Follow the instructions on the screen. **OK** appears if the test passed, but three lines of error codes appear if the test failed. The defective FRU must be the system board.

If you want to test the USB port on the port replicator, connect the USB parallel test cable to a port replicator and click on **USB-2**.

If you want to test the USB ports on a docking station, connect the USB parallel test cable to the USB ports of the docking station and click on **USB-3** and **USB-4**.

Displaying the Error Log

Diagnostic errors are printed on a printer attached to the parallel port when the error is detected. The error is also logged in the system memory.

Use the following procedure to display the errors:

1. Enter the advanced diagnostic test.
2. Press **Ctrl+E**.
3. The error log appears.
4. To exit the screen, click on **Exit** or press **Esc**.

The error log is not saved when system power is turned off.

RUNNING THE DIAGNOSTICS

Checking the Installed Devices List

If a device is installed but the icon appears in a gray shade rather than a dark shade on the basic diagnostics menu, the device is defective. If necessary, adjust the contrast control to clearly distinguish the shades of the icon. Reseat the device connectors. If the symptom remains, replace the device or the system board.

If a device that is not installed appears in a dark shade (for example, FDD-2 appears in a dark shade when *no* second FDD is installed), do the following:

1. Replace the **first** device in the configuration, such as an FDD-1.
2. If the problem persists, replace the card that the device is connected to.

The Parallel, and Serial icons are always displayed in a dark shade, because the icons represent subsystems of the system board and not the attachment of devices.

The FDD-1 icon represents a device in the computer. The FDD-2 icon represents another device, such as:

- An external diskette drive attached to the computer
- An external diskette drive attached to a port replicator
- A diskette drive in a docking station

Diagnostic Error Codes

If an error is detected, the following appears:

- Large **X** on the left side of the device icon.
- Device ID (three digits).
- Error code (two digits).
- FRU code (four digits).


SystemBoard
DEV 001
ERR 02
FRU 0010

The device ID and error code indicate the detailed portion of the FRU that caused the error. If replacing a FRU does not correct the problem, see the device ID or error code from the previous failure. If they have changed, the cause might be that the new FRU is defective or that the FRU was incorrectly installed.

Device ID: If an error is detected by the diagnostic tests, a three-digit device ID is displayed, indicating the suspected device.

RUNNING THE DIAGNOSTICS

Icon	Device ID	Suspected Device
SystemBoard	001	System board
	003	Keyboard
	007	Math coprocessor
	086	Pointing device
Memory	002	Memory
FDD-1	006	Diskette drive in the computer
FDD-2	066	External diskette drive or FDD connector
Parallel	009	Parallel port
Serial	011	Serial port
HDD-1	017	Hard disk drive
HDD-2	151	First (external) hard disk drive
HDD-3	067	Second (external) hard disk drive
HDD-4	152	Third (external) hard disk drive
Display	050	Display
	052	
	053	
	054	
PCMCIA-1	080	1. Connection of the PC Card slot 2. PC Card
PCMCIA-2	088	External PC Card
Infrared	103	IR
DPS	113	DPS
Audio (ISA)	153	ISA audio
USB-1	154	USB
USB-2	155	External USB
USB-3	156	External USB
USB-4	157	External USB
Audio (PCI)	158	PCI audio
CDROM-1	215	CD-ROM
CDROM-2	216	External CD-ROM
DVD-1	217	DVD drive
DVD-2	218	External DVD drive

FRU Codes: If an error is detected by the diagnostic tests, a four-digit FRU code is displayed. The FRU code indicates two suspected FRUs. Replace the FRU that is indicated by the **two leftmost digits** first; then replace the FRU that indicated by the **two rightmost digits**. No FRU

RUNNING THE DIAGNOSTICS

is assigned to code 00. If only one FRU is suspected, the other FRU code is 00. See the reference page before replacing the FRU.

FRU Code	FRU
10	System board
11	CPU card
12	DC-DC card
15	Audio card or system board (audio)
16	Modem card
20	Memory
30	Reserved
32	External keyboard
33	External mouse
34	AC Adapter
35	Stereo Speaker
36	Battery pack
37	Secondary battery pack
38	Fan
39	Box speaker
40	LCD assembly
41	DVD or DVD and enhanced video adapter
42	Video card or system board (video)
45	External monitor
50	1. Reseat the diskette drive (FDD-1) 2. Diskette drive (FDD-1)
51	1. Reseat the diskette drive (FDD-2) 2. Diskette drive (FDD-2)
60	1. Reseat the hard disk drive (HDD-1) 2. Hard disk drive (HDD-1)
61	1. Reseat the hard disk drive in the docking station (HDD-3) 2. Hard disk drive in the docking station (HDD-3)
62	1. Reseat the hard disk drive in the docking station (HDD-2) 2. Hard disk drive in the docking station (HDD-2)
63	1. Reseat the hard disk drive in the docking station (HDD-4) 2. Hard disk drive in the docking station (HDD-4)
70	PC Card (at the port replicator)
72	PC Card slot assembly
73	Port replicator
74	Main board in the docking station

RUNNING THE DIAGNOSTICS

FRU Code	FRU
75	USB card in the docking station
90	CD-ROM drive
91	External CD-ROM drive
92	DVD drive
93	External DVD drive

If the problem persists after replacement of the FRUs, go to the “Undetermined Problems” section for each model.

ThinkPad 770, 770E, 770X and 770Z

This chapter includes the descriptions for the ThinkPad 770 series computer.

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MODEL-UNIQUE FUNCTIONS

Model-Unique Functions

Product Overview

The following table shows an overview of the system features of the ThinkPad 770 series:

Feature	Description
Processor	For 770: - Intel Pentium® MMX™ 200 MHz, 512-KB L2 Cache - Intel Pentium® MMX™ 233 MHz, 512-KB L2 Cache For 770E or 770ED: - Intel Pentium® II 233 MHz, 512-KB L2 Cache - Intel Pentium® II 266 MHz, 512-KB L2 Cache For 770X: - Intel Pentium® II 300 MHz, 512-KB L2 Cache For 770Z: - Intel Pentium® II 366 MHz, 556-KB L2 Cache
Bus architecture	PCI bus
Memory (standard)	For 770 or 770E: 32 MB on the system board For 770ED: 32 MB on the system board + 32MB on the SO-DIMM slot For 770X: 64 MB in the base DIMM slot 64 MB in the base DIMM slot + 64 MB on the option DIMM slot For 770Z: 64 MB in the base DIMM slot + 64 MB on the option DIMM slot
Memory (option)	16MB, 32MB, 64MB, or 128MB DIMM card Note: For 770, 770E, or 770ED: maximum of 288 MB is available For 770X or 770Z: maximum of 320 MB is available
CMOS RAM	114 bytes + 4KB

MODEL-UNIQUE FUNCTIONS

Feature	Description
Video	For 770, 770E, or 770ED: 13.3-inch, 64K colors, 1024×768 pixel XGA TFT color LCD 14.1-inch, 64K colors, 1024×768 pixel XGA TFT color LCD For 770X or 770Z: 13.7-inch, 64K colors, 1280×1024 pixel SXGA TFT color LCD 14.1-inch, 16K colors, 1024×768 pixel XGA TFT color LCD
Video RAM	For 770, 770E, or 770ED: 4 MB For 770X or 770Z: 4 MB or 8 MB
Diskette drive (removable)	720 KB, 1.2 MB, 1.44 MB (3-mode), 3.5-inch
Hard disk drive (removable)	3.2 GB, 2.5-inch 4.0 GB, 2.5-inch 5.1 GB, 2.5-inch 8.1 GB, 2.5-inch 14 GB, 2.5-inch
Modem card	- Fax/modem function - Telephony function - ThinkPad modem function
Crystal audio	Stereo audio function
Infrared transfer	- Two IR ports - IrDA 1.0 - ASK 1.15 million bps
PC Card, CardBus, MPEG card	One Type-III or two Type-II

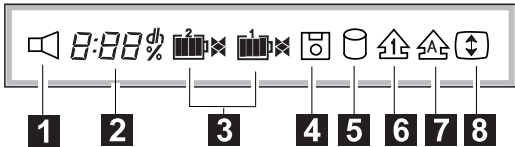
MODEL-UNIQUE FUNCTIONS

Status Indicators

The system status indicators show the current computer status in different colors (green and orange):

Symbol	Color	Meaning
	Green	The battery is fully charged
	Orange	The battery is charging
	Blinking orange	The battery needs charging
	Green	The computer is in suspend mode.
	Blinking green	The computer is entering suspend mode or hibernation mode, or resuming normal operation.
	Green	Power on

Indicator Panel: The indicator panel shows the current computer status using these icons.



Icon	Meaning
1	Speaker
2	Remaining battery
3	Secondary battery status (left) Main battery status (right)
4	Diskette drive in-use
5	Hard disk in-use
6	Numeric lock
7	Caps lock
8	Scroll lock

Symptom-to-FRU Index

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

Note

Perform the FRU replacement or actions in the sequence shown in the "FRU/Action in Sequence" column. If a FRU replacement did 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 the next possible FRUs to be replaced when servicing a computer.

Numeric error codes show the errors detected in POST or system operation. In the following error codes, X can be any number.

If no codes are available, use narrative symptoms.

If the symptom is not listed, go to "Undetermined Problems" on page 66.

Note

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

Numeric Error Codes

Symptom / Error	FRU / Action in Sequence
10X 101: Interrupt failure. 102: Timer failure. 103: Timer interrupt failure. 104: Protected mode failure. 105: Last 8042 command not accepted. 107: NMI test failure. 108: Timer bus test failure. 109: Low meg-chip select test.	1. System board

SYMPTOM-TO-FRU INDEX

Symptom / Error	FRU / Action in Sequence
110 (Planar parity.)	1. Go to "Memory Checkout" on page 33. 2. DIMM card 3. Detach the expansion unit if it is attached to the computer. 4. System board
111 (I/O parity.)	1. Go to "Memory Checkout" on page 33. 2. Expansion unit or port replicator 3. System board
11XX 1101: Serial_A test failure.	1. Serial device 2. Communication cable 3. System board
12XX 1201: Serial_B test failure.	1. System board (infrared)
158 (The hard disk password was not set even though the supervisor password is set.)	Set the password for the hard disk drive.
159 (The hard disk password is not set the same as the supervisor password.)	Set the correct password for the hard disk drive.
161 (Dead battery.)	1. Go to "Checking the Backup Battery" on page 38. 2. Backup battery 3. System board
163 (Time and date were not set.)	1. Set time and date. 2. System board
173 (Configuration data was lost.)	1. Select OK in the error screen; then set the time and date. 2. Backup battery 3. System board
174 (Configuration error: Perform "Checking the Installed Devices List" on page 43 before changing any FRUs.)	1. Check device configuration. 2. Hard disk drive assembly 3. System board
175, 177, 178 175: EEPROM CRC #1 error. 177: Supervisor password check sum error. 178: EEPROM is not functional.	1. System board

SYMPTOM-TO-FRU INDEX

Symptom / Error	FRU / Action in Sequence
17XX 1701: Hard disk controller failure. 1780, 1790: Hard disk 0 error. 1781, 1791: Hard disk 1 error.	1. Hard disk drive 2. System board
183 (Incorrect password entered at the supervisor password prompt.)	Have the user examine the password.
184 (Power-on password check sum error.)	Reset the power-on password in Easy-Setup.
185 (The startup sequence is not valid. Suspect that power was off when the startup sequence was being updated.)	Reset the startup sequence in Easy-Setup.
186	1. System Board
189	(Bad EEPROM CRC #1 error) 1. System Board
190 (A depleted battery pack was installed when the power was on.)	Go to “Checking the Battery Pack” on page 37.
191XX (PM initialization error.)	1. System board
195 (The configuration read from the hibernation area does not match the actual configuration.)	Check if the configuration was changed. For example, check if the DIMM card is removed.
196 (A read error occurred in the hibernation area of the hard disk drive.)	1. Run the hard disk drive test. 2. Hard disk drive
199XX (Resume error.)	1. System board
1XX	1. System board
225 (Unsupported memory module.)	1. Check if a supported DIMM is installed. 2. DIMM card 3. System board
24XX	1. Video card 2. System board

SYMPTOM-TO-FRU INDEX

Symptom / Error	FRU / Action in Sequence
2XX 201: Memory data error. 202: Memory line error 00–15. 203: Memory line error 16–23. 205: Memory test failure on on-board memory. 221: ROM to RAM remap error.	1. Go to “Memory Checkout” on page 33. 2. DIMM card 3. System board
301, 303, 304, 305, 3XX (301: Keyboard error.)	1. Go to “Keyboard or Auxiliary Input Device Checkout” on page 32. 2. Keyboard 3. External numeric keypad 4. External keyboard 5. Keyboard/mouse cable 6. System board 7. DC-DC Card
601, 6XX (601: Diskette drive or controller error.)	1. Go to “Diskette Drive Checkout” on page 31. 2. Diskette drive assembly 3. Diskette 4. System board
602 (Diskette read error.)	1. Go to “Diskette Drive Checkout” on page 31. 2. Diskette 3. Diskette drive assembly
604 (Unacceptable ID was read from the diskette drive.)	1. Go to “Diskette Drive Checkout” on page 31. 2. Diskette drive assembly 3. System board
808X 8081: PCMCIA presence test failure. (PCMCIA revision number also checked.) 8082: PCMCIA register test failure.	1. Reseat the PC Card slot assembly. 2. PCMCIA device 3. System board

SYMPTOM-TO-FRU INDEX

Symptom / Error	FRU / Action in Sequence
860X (A pointing device error when the TrackPoint is disabled.) 8601: System bus error—8042 mouse interface. 8602: External mouse error. 8603: System bus error or mouse error.	1. External mouse 2. External keyboard 3. System board 4. DC-DC card
861X (Pointing device error when TrackPoint III is enabled.) 8611: System bus error—I/F between 8042 and IPDC. 8612: TrackPoint error. 8613: System board or TrackPoint error.	1. Reseat the keyboard cable on the video card. 2. Keyboard 3. External mouse 4. Video card 5. System board 6. Video card
I9990301 I9990302 I9990305 I9990301: Hard disk error. I9990302: Invalid hard disk boot record. I9990305: No bootable device.	1. Check that the operating system is installed in the hard disk drive. If not, install the operating system. 2. Reseat the boot device. 3. Check the startup sequence for the correct boot device. 4. Check that the operating system has no failure and is installed correctly.
I9990303 (Bank—2 flash ROM check sum error.)	1. System board
Other codes not listed above.	Go to “Undetermined Problems” on page 66.

SYMPTOM-TO-FRU INDEX

Beep Symptoms

Symptom / Error	FRU / Action in Sequence
Continuous beeps.	1. Reseat the CPU card. 2. Reseat the video card. 3. System board
One beep and a blank, unreadable, or flashing LCD.	1. Reseat the LCD connector. 2. Reseat the CPU card. 3. LCD assembly 4. System board 5. CPU card
One beep, and the message "Unable to access boot source."	1. Boot device 2. System board
One long and two short beeps, and a blank or unreadable LCD.	1. Reseat the video card. 2. Reseat the CPU card. 3. Video card 4. System board 5. LCD assembly
One long beep followed by four short beeps each time the power switch is operated. (System cannot power on due to low battery voltage.)	Connect the AC Adapter or install a fully charged battery.
One beep every second. (System is shutting down due to low battery voltage.)	Connect the AC Adapter or install a fully charged battery. (Allow the system to completely shut down before changing the battery.)
Two short beeps with error codes.	POST error. See "Numeric Error Codes" on page 52.
Two short beeps with blank screen.	1. System board

No Beep Symptoms

Symptom / Error	FRU / Action in Sequence
No beep, power-on indicator not on, and a blank LCD during POST.	1. Go to "Power Systems Checkout" on page 36. 2. System board 3. Check the power outlet.
No beep, power-on indicator on, and a blank LCD during POST.	1. Reseat the CPU card. 2. System board
No beep, power-on indicator on, and a blinking cursor only during POST.	1. System board

SYMPTOM-TO-FRU INDEX

Symptom / Error	FRU / Action in Sequence
No beep during POST but system runs correctly.	1. Turn the volume up and check the speaker. 2. Speaker 3. System board

Audio-Related Symptoms

Symptom / Error	FRU / Action in Sequence
In OS/2, DOS, or Windows multimedia programs, no sound comes from the computer. (Only system beeps are heard at power-on.)	Check that the device driver is installed correctly.

CD-ROM-Related Symptoms

Symptom / Error	FRU / Action in Sequence
You hear a noise from the CD-ROM drive when the CD-ROM is spinning.	1. CD-ROM drive 2. System board
The CD-ROM tray does not open even if you press the CD-ROM eject button.	Insert a pin into the CD-ROM emergency eject hole and eject the CD-ROM tray.
The compact disc cannot be read.	Make sure that: • The compact disc is not dirty. If it is, clean it with a CD-ROM cleaner kit. • The compact disc is not defective. If it is, try another compact disc. • The compact disc is placed in the tray with the label side up. • The compact disc format conforms with one of the following: – Music CD – CD-ROM or CD-ROM XA – Multisession photo CD – Video CD and CD-i movie (Windows 95 does not support CD-i movies) 1. CD-ROM drive 2. System board

SYMPTOM-TO-FRU INDEX

Symptom / Error	FRU / Action in Sequence
The CD-ROM does not work.	Make sure that: - The computer power is turned on and a compact disc is in the CD-ROM drive. - The CD-ROM drive connector is firmly connected to the computer. - The CD-ROM drive tray is firmly closed. - The device drivers are correctly installed. 1. CD-ROM drive If the CD-ROM drive in the docking station does not work, do the following: - Click on Start. - Move the cursor to Programs and ThinkPad; then click on ThinkPad Configuration. - Click on Docking Station. - Make sure that you checked Enable IDE device in the docking station. Note Do not use IRQ 11 and 15 for the PCI device setting. - Click on OK. 2. System board

DVD-Related Symptoms

Symptom / Error	FRU / Action in Sequence
You hear a noise from the DVD drive when the DVD disk or compact disk is spinning.	DVD drive - System board
The DVD tray does not open even if you press the DVD eject button.	Insert a pin into the DVD emergency eject hole and eject the DVD tray.

SYMPTOM-TO-FRU INDEX

Symptom / Error	FRU / Action in Sequence
The DVD disc or compact disc cannot be read.	Make sure that: • The DVD disc or compact disc is not dirty. If it is, clean it. • The DVD disc is not defective. If it is, try another DVD disc. • The DVD disc is placed in the tray with the label side up. • The DVD disc format conforms with one of the following: – Music CD – CD-ROM or CD-ROM XA – Multisession photo CD – Video CD and CD-i movie (Windows 95 does not support CD-i movie) – DVD-ROM (DVD-video) – DVD-movie with MPEG hardware and software 1. DVD drive 2. System board

SYMPTOM-TO-FRU INDEX

Symptom / Error	FRU / Action in Sequence
The DVD does not work.	Make sure that: • The computer power is turned on and a DVD disc or a compact disc is in the DVD drive. • The DVD drive connector is firmly connected to the computer. • The DVD drive tray is firmly closed. • The device drivers are correctly installed. • If the DVD drive in the docking station does not work, do the following: 1. Click on Start. 2. Move the cursor to Programs and ThinkPad; then click on ThinkPad Configuration. 3. Click on Docking Station. 4. Make sure that you checked Enable IDE device in the docking station. Note Do not use IRQ 11 and 15 for the PCI device setting. 5. Click on OK. 1. DVD drive 2. System board

Function-Related Symptoms

Symptom / Error	FRU / Action in Sequence
The system does not suspend or resume when the LCD is closed or opened.	1. Go to “Suspend Mode” on page 26, and check that the computer can enter suspend mode. 2. Boot an operating system and press Fn+F4. If the computer enters suspend mode, suspect that the application program is not working properly. 3. LCD assembly 4. System board
The battery Fuel-Gauge does not go higher than 90%.	Go to “Checking the Battery Pack” on page 37 and see the note.
The memory count (size) appears different from the actual size.	Go to “Memory Checkout” on page 33.
The system configuration does not match the installed devices.	Go to “Checking the Installed Devices List” on page 43.
The system hangs intermittently.	Go to “Intermittent Problems” on page 66.

Indicator-Related Symptoms

Symptom / Error	FRU / Action in Sequence
Indicator incorrectly remains off or on, but system runs correctly.	1. Reseat the LCD connector on the DC-DC card. 2. LCD cable assembly 3. DC-DC card 4. System board
The indicator incorrectly remains off or on, but system runs correctly.	1. Reseat the DC-DC card. 2. DC-DC card 3. System board
The battery power status indicator blinks from green, yellow, to orange.	1. Check that a correct battery is installed. 2. Reseat the inverter cable. 3. Battery pack 4. DC-DC card 5. System board
The battery indicator does not turn on when the battery is installed.	1. Reseat the inverter cable. 2. Battery pack 3. System board

SYMPTOM-TO-FRU INDEX

Infrared-Related Symptoms

Symptom / Error	FRU / Action in Sequence
Unable to communicate using the Infrared (IR) Port.	1. Make sure the setup for the IR is correct. Use the ThinkPad Configurations utility. 2. Make sure there are no fluorescent lights near the computer. The computer may receive optical noise from the fluorescent light. 3. Run the advanced diagnostic test. If an error occurs and a FRU code is displayed, replace the parts shown by the FRU code.

Keyboard- or TrackPoint-Related Symptoms

Symptom / Error	FRU / Action in Sequence
Keyboard (one or more keys) does not work.	1. Reseat the keyboard cables on the video card. 2. Keyboard 3. Video card 4. System board
TrackPoint does not work.	1. Reseat the keyboard cables on the video card. 2. Go to "TrackPoint Checkout" on page 39. 3. Keyboard 4. Video card 5. System board
Pointer moves automatically or does not work correctly.	See "TrackPoint Checkout" on page 39.

LCD-Related Symptoms

Important

The TFT LCD for the notebook computer contains over 921,000 thin-film transistors (TFTs). A small number of missing, discolored, or lighted dots (on all the time) 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 **21 or more**.

SYMPTOM-TO-FRU INDEX

Symptom / Error	FRU / Action in Sequence
No beep, power-on indicator on, and a blank LCD during POST.	1. Reseat the CPU card 2. Reseat the video card. 3. 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. Video card 4. System board
• LCD screen unreadable. • Characters missing pels. • Screen abnormal. • Wrong color displayed.	1. See important note for "LCD-Related Symptoms." 2. Reseat all LCD connectors. 3. LCD assembly 4. Video card 5. System board
LCD has extra horizontal or vertical lines displayed.	1. LCD assembly

Modem (DSP)-Related Symptoms

Symptom / Error	FRU / Action in Sequence
In OS/2, DOS, or Windows multimedia programs, no sound comes from the computer. (Only system beeps are heard at power-on.)	Check that the device driver is installed correctly.
In OS/2, DOS, or Windows, the modem does not work.	Check that the DSP Modem is active. OS/2 and Windows: Click on the DSP Modem icon in the ThinkPad Configuration program. DOS: Run the MWMODEM ON command.

PC Card-Related Symptoms

Symptom / Error	FRU / Action in Sequence
The PC Card does not work in either the upper slot or the lower slot. Diagnostic error code: DEV 080 ERR 33 FRU 7210	1. Reseat the PCMCIA slot assembly. 2. PCMCIA slot assembly 3. System board
The PCMCIA slot pin is damaged.	1. PCMCIA slot assembly

SYMPTOM-TO-FRU INDEX

Symptom / Error	FRU / Action in Sequence
The PC Card does not work.	1. Reseat the PC Card 2. Check that the PC Card is enabled in the ThinkPad Configuration program 3. Reseat the PCMCIA slot assembly. 4. PCMCIA slot assembly 5. System board

Peripheral-Device-Related Symptoms

Symptom / Error	FRU / Action in Sequence
The external monitor does not work correctly.	Connect the external monitor to another PC. If the monitor works fine, replace the system board. If not, replace the external monitor.
Printer problems.	1. Run printer self-test. 2. Parallel port wrap test. 3. System board 4. Printer cable
Serial or parallel port device problems.	1. Serial/parallel port wrap test. 2. Device 3. Reseat the DC-DC card 4. DC-DC card 5. System board 6. Device cable

Power-Related Symptoms

Symptom / Error	FRU / Action in Sequence
Power shuts down during operation.	1. Go to "Power Systems Checkout" on page 36. 2. Battery pack 3. Remove the battery pack and let it cool for 2 hours. 4. DC-DC card 5. System board 6. Check the power outlet
The system does not power off. (See "Reset Switch" on page 23.)	1. Press the power shutdown switch. 2. DC-DC card 3. System board

Other Symptoms

Symptom / Error	FRU / Action in Sequence
Errors occur only when the port replicator is used.	See “Port Replicator Checkout” on page 35.

Note

If you cannot find a symptom or an error in this list and the problem remains, see “Undetermined Problems.”

Intermittent Problems

Intermittent system hang problems can be caused by a variety of reasons 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 advanced 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 nondefective FRUs).

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 Systems Checkout” on page 36):

1. Power off the computer.
2. Visually check them for damage. If any problems are found, replace the 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. Device in UltraBay II (FDD, CD-ROM, or DVD)
 - i. PC Cards
4. Power on the computer.

SYMPTOM-TO-FRU INDEX

5. Determine if 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
 - c. DC-DC card
 - d. Video card
 - e. CPU card

FRU Removals and Replacements

This section contains information about removals and replacements:

- Do not damage any part. Only certified and trained personnel should service the computer.
- The arrows in the "Removals and Replacements" section show the direction of movement to remove a FRU, or to turn a screw to release the FRU. The arrows are marked in numeric order, in square callouts, to show the correct sequence of removal.
- If other FRUs must be removed before the failing FRU is removed, they are listed at the top of the page.
- To replace a FRU, reverse the removal procedure and follow any notes that pertain to replacement. See "Locations" for internal cable connections and arrangement information.
- When replacing a FRU, use the correct screw as shown in the procedures.

Reviews "FRU Replacement Notices" on page 19 before replacing any FRU.

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

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.

Attention

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 short circuits.

FRU REMOVALS AND REPLACEMENTS

Attention

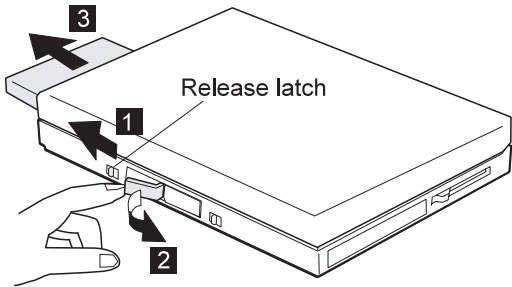
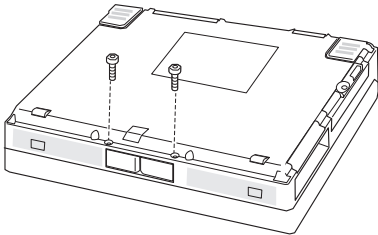
The system board is sensitive to, and can be damaged by, electrostatic discharge. Establish personal grounding by touching a ground point with one hand before touching these units.

An electrostatic discharge (ESD) strap (P/N 6405959) must be used to establish personal grounding.

1010 Battery Pack

Note

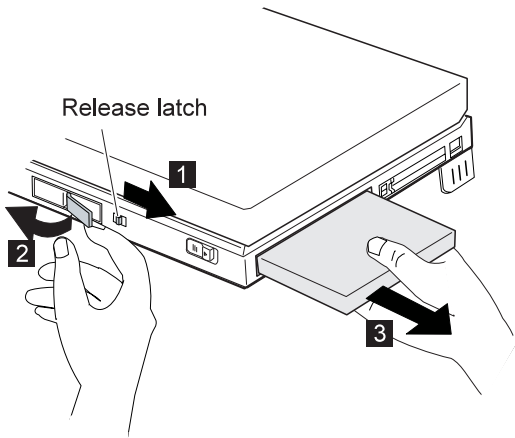
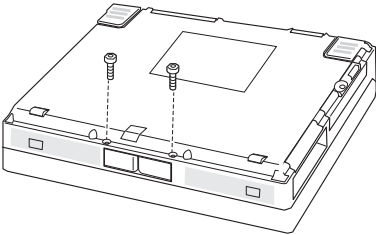
If the customer has locked the eject lever with security screws, remove the screws first. To remove the security screw, use a 2.5-mm allen wrench.



1020 UltraBay II Device or Second Battery Pack

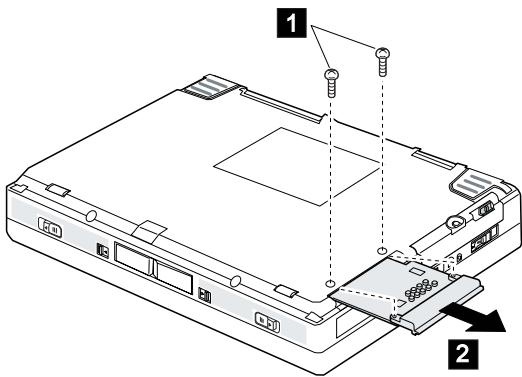
Note

If the customer has locked the eject lever with security screws, remove the screws first. To remove the security screw, use a 2.5-mm allen wrench.



FRU REMOVALS AND REPLACEMENTS

1030 DVD and Enhanced Video Adapter



Step	Size (Quantity)	Color	Torque (kgcm)
1	M2.5 x 6 mm, nylon coating (2)	Black	4

1040 Hard Disk Drive

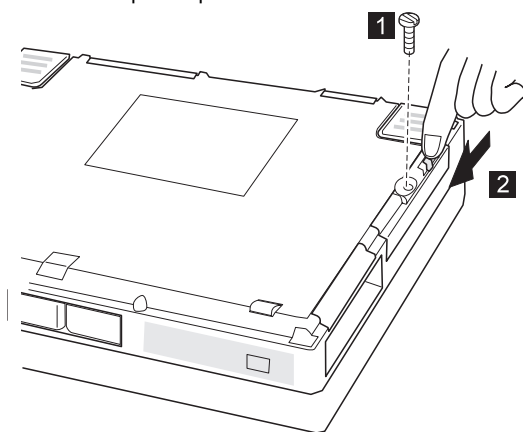
Attention

Do not drop or apply any shock to the hard disk drive. The hard disk drive is sensitive to physical shock. Incorrect handling can cause damage and permanent loss of data on the hard disk.

Before removing the hard disk drive, have the user make a backup copy of all the information on the hard disk.

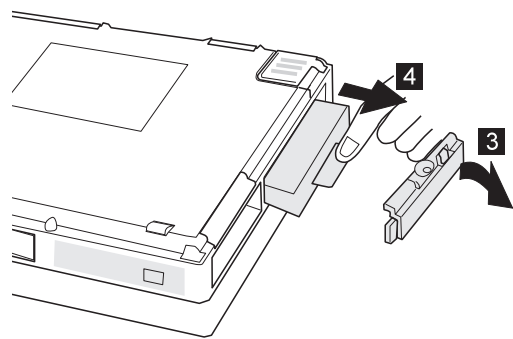
Never remove the hard disk drive while the system is operating or is in suspend mode.

Turn the computer upside down.



Step	Size (Quantity)	Color	Torque (kgcm)
1	Coin screw (1) —or— Security screw (1)	Black	—
Note: To remove the security screw, use a 2.5-mm allen wrench.			

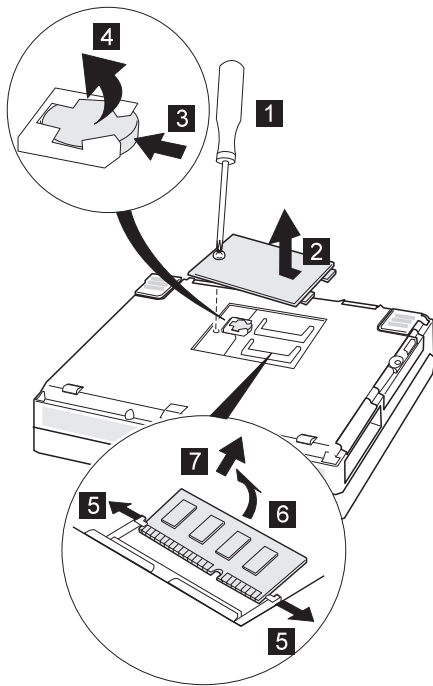
FRU REMOVALS AND REPLACEMENTS



1050 Backup Battery and DIMM

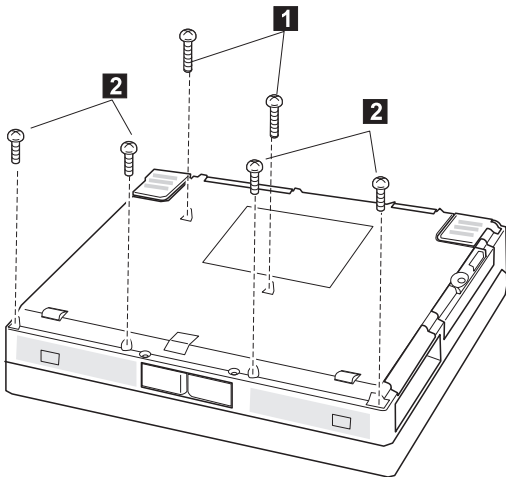
Backup battery 1 2 3 4

DIMM 1 2 5 6 7



1060 Keyboard Assembly

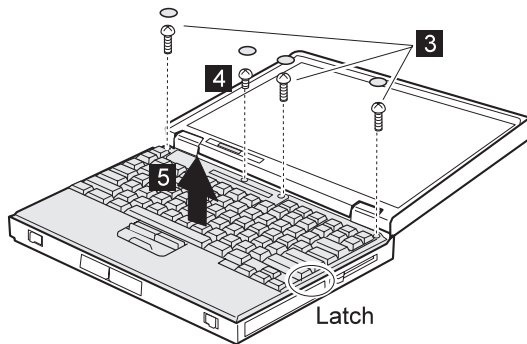
- Battery Pack (1010)
- UltraBay II Device or Second Battery Pack (1020)



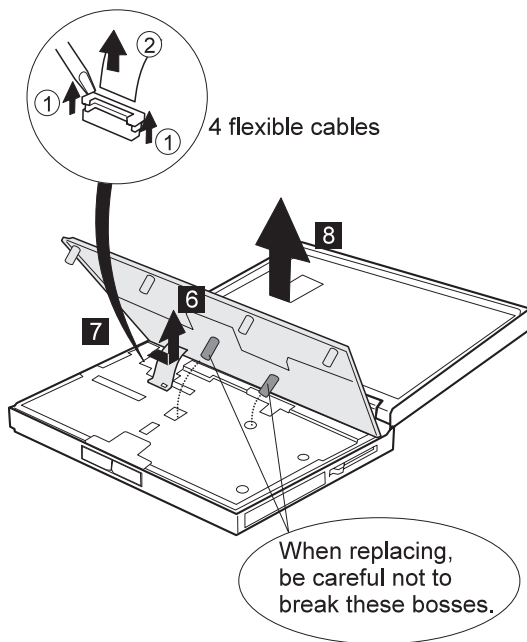
Open the computer.

Step	Size (Quantity)	Color	Torque (kgcm)
1	M2.5 x 8 mm, nylon coating (2)	Black	4
2	M2.5 x 6 mm, nylon coating (4)	Black	4

FRU REMOVALS AND REPLACEMENTS



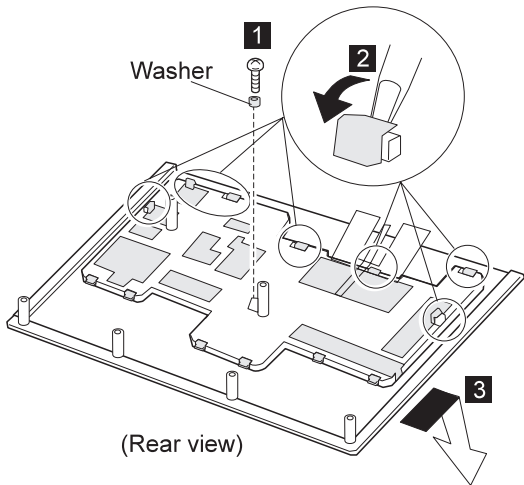
Step	Size (Quantity)	Color	Torque (kgcm)
3	M2.5 x 8 mm, nylon coating (3)	Black	4
4	M2.5 x 4 mm, nylon coating (1)	Black	4



1065 Keyboard and Indicator Panel

- Battery Pack (1010)
- UltraBay II Device or Second Battery Pack (1020)
- Keyboard Assembly (1060)

Keyboard

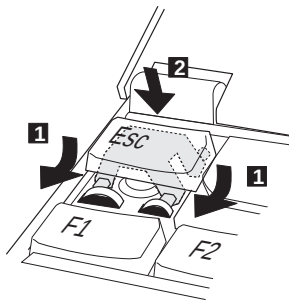


Step	Size (Quantity)	Color	Torque (kgcm)
1	M2.5 x 4 mm, nylon coating (1)	Yellow	4

FRU REMOVALS AND REPLACEMENTS

Notes

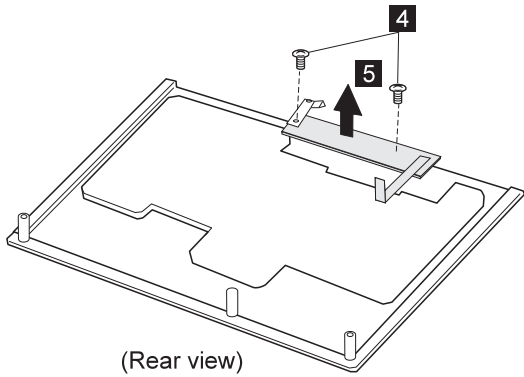
- Be careful not to remove any key when removing the frame. If you do remove key, replace it as shown:



- When replacing the frame, check whether the click buttons of TrackPoint III can be pressed correctly. (If the frame is not in place, the click buttons do not work.)

FRU REMOVALS AND REPLACEMENTS

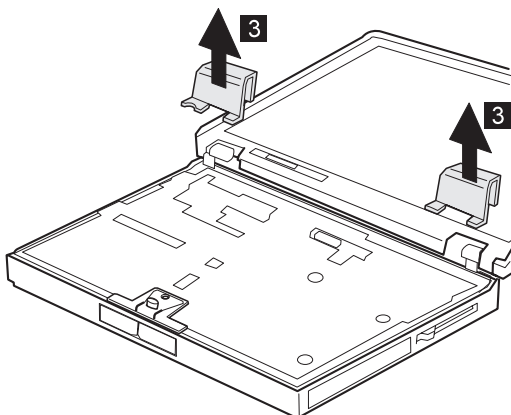
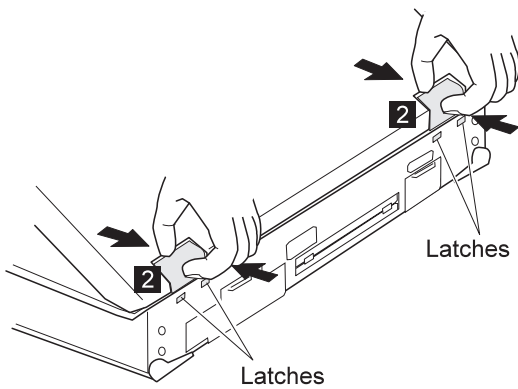
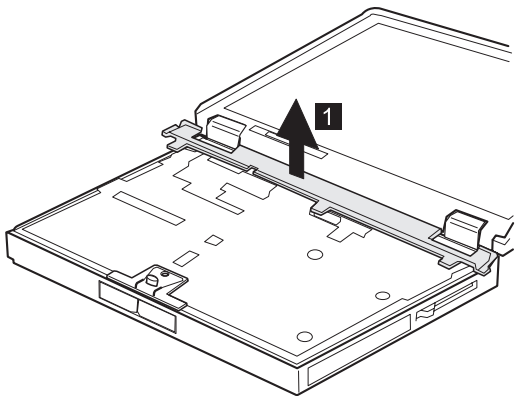
Indicator Panel



Step	Size (Quantity)	Color	Torque (kgcm)
4	M2.5 x 4 mm, nylon coating, flathead (2)	Black	4

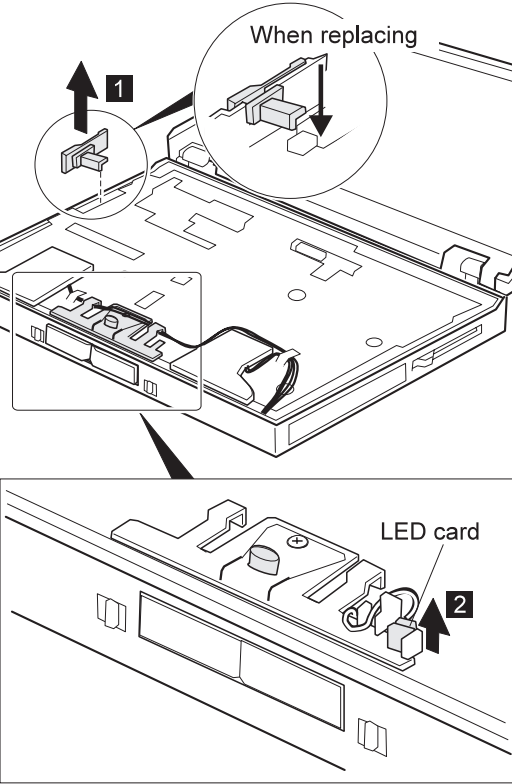
1070 Center Cover and Hinge Cap

- Battery Pack (1010)
- UltraBay II Device or Second Battery Pack (1020)
- Keyboard Assembly (1060)

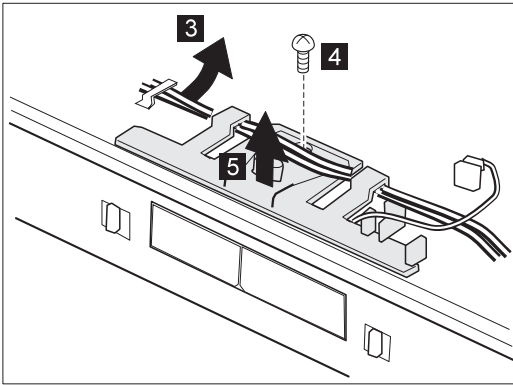


1080 Power Switch and Bay Eject Lever

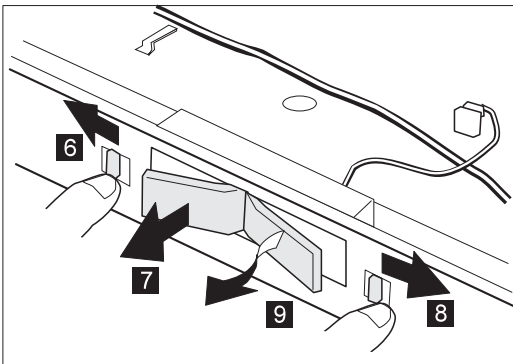
- Battery Pack (1010)
- UltraBay II Device or Second Battery Pack (1020)
- Keyboard Assembly (1060)



FRU REMOVALS AND REPLACEMENTS

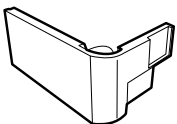


Step	Size (Quantity)	Color	Torque (kgcm)
4	M2.5 x 4 mm, nylon coating (1)	Yellow	4

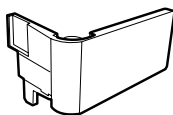


1. Be sure to distinguish the right and left bay eject lever; then replace the correct lever.

If you have replaced the right lever, open and close it at least twice to ensure that it is seated in the correct position. The right lever must touch the sensor switch correctly. Incorrect placement of the lever can damage the switch, thereby causing the bay LED not to work.



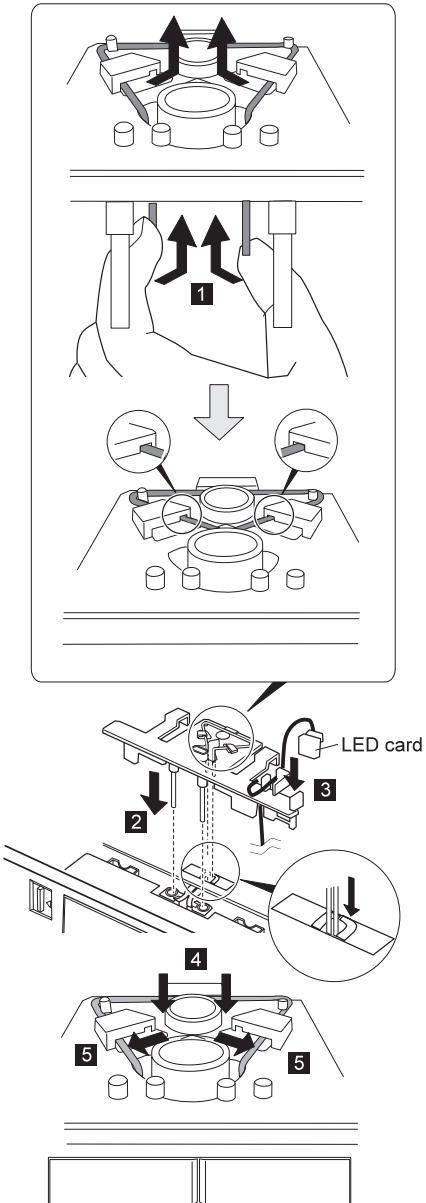
Left



Right

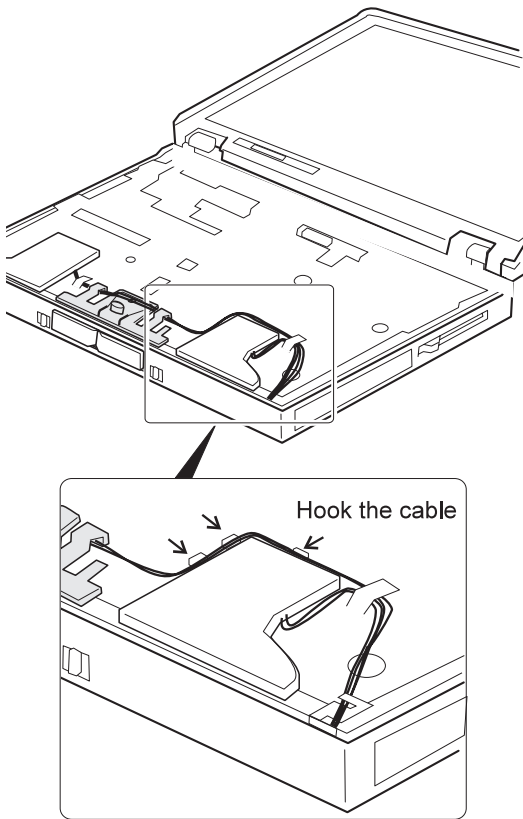
FRU REMOVALS AND REPLACEMENTS

2. Follow the procedure shown in the figure. After replacing the bay eject lever assembly, make sure that both levers pop out.



FRU REMOVALS AND REPLACEMENTS

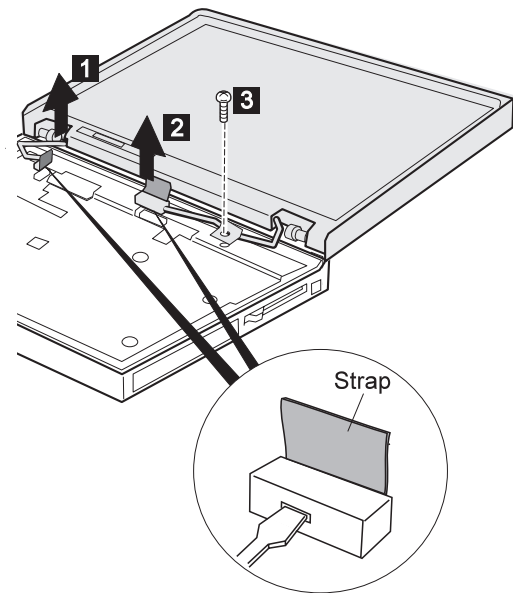
3. Refer to the following figure for the speaker cable route:



1090 LCD Unit

- Battery Pack (1010)
- UltraBay II Device or Second Battery Pack (1020)
- Keyboard Assembly (1060)
- Center Cover and Hinge Cap (1070)

Pull the straps to disconnect the connectors. If the connectors do not disconnect, use a screwdriver.

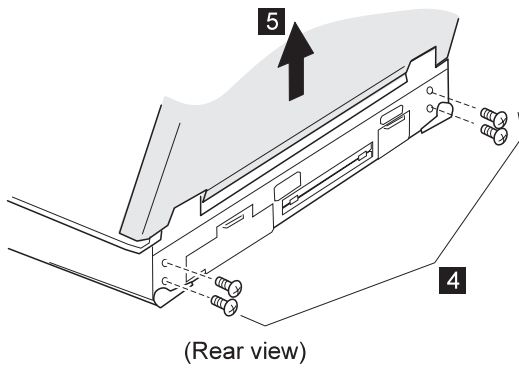


Note

When replacing the LCD unit, do not place the hinge between the lower shield and the base cover.

Step	Size (Quantity)	Color	Torque (kgcm)
3	M2.5 x 4 mm, nylon coating (1)	Yellow	4

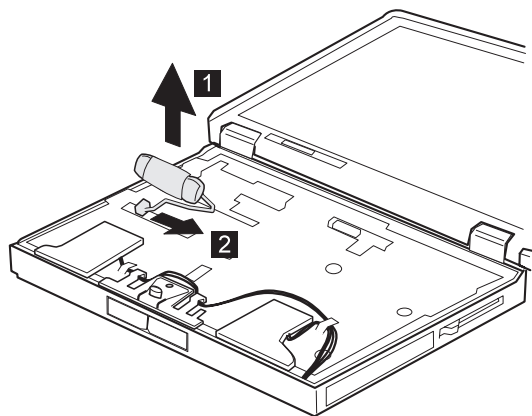
FRU REMOVALS AND REPLACEMENTS



Step	Size (Quantity)	Color	Torque (kgcm)
4	M2.5 x 6 mm, nylon coating (4)	Black	4

1100 Standby Battery

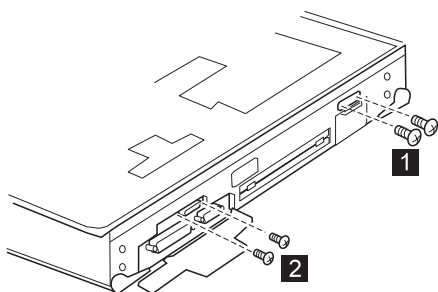
- Battery Pack **(1010)**
- UltraBay II Device or Second Battery Pack **(1020)**
- Keyboard Assembly **(1060)**



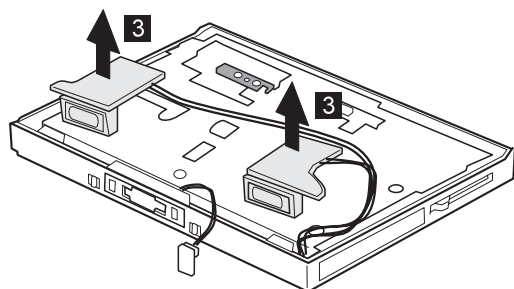
FRU REMOVALS AND REPLACEMENTS

1110 Upper Shield

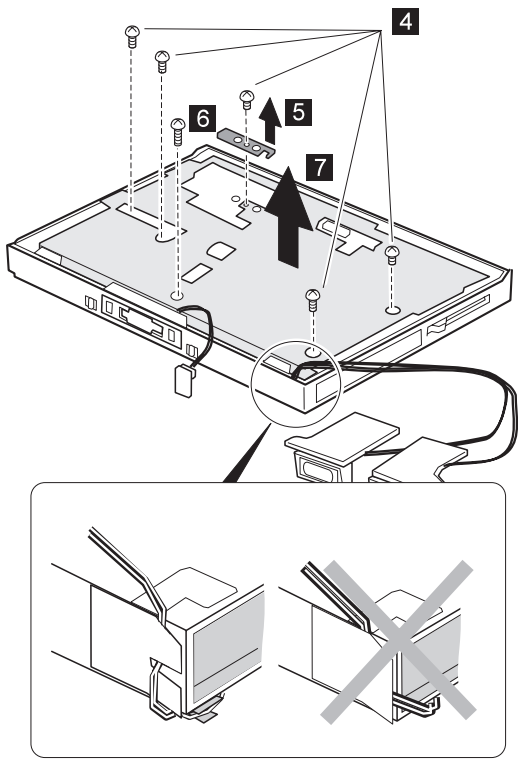
- Battery Pack **(1010)**
- UltraBay II Device or Second Battery Pack **(1020)**
- Keyboard Assembly **(1060)**
- Center Cover and Hinge Cap **(1070)**
- Power Switch and Bay Eject Lever **(1080)**
- LCD Unit **(1090)**
- Standby Battery **(1100)**



Step	Size (Quantity)	Color	Torque (kgcm)
1	M2.5 x 6 mm, nylon coating (2)	Black	4
2	M1.6 x 4 mm, flathead (2)	Black	2



FRU REMOVALS AND REPLACEMENTS



Note

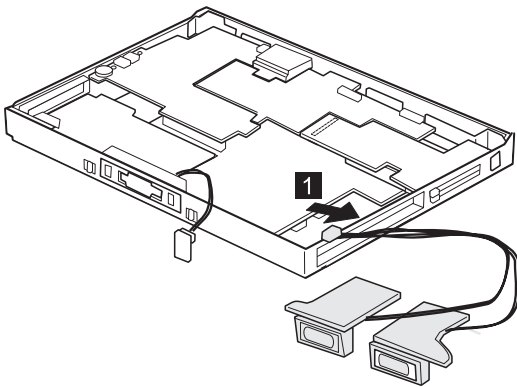
When you reinstall the upper shield, make sure you thread the cable as shown above. Do not thread it in front of the bay opening.

Step	Size (Quantity)	Color	Torque (kgcm)
4	M2.5 x 4 mm, nylon coating (5)	Yellow	4
6	M2.5 x 6 mm, nylon coating (1)	Black	4

FRU REMOVALS AND REPLACEMENTS

1120 Speaker

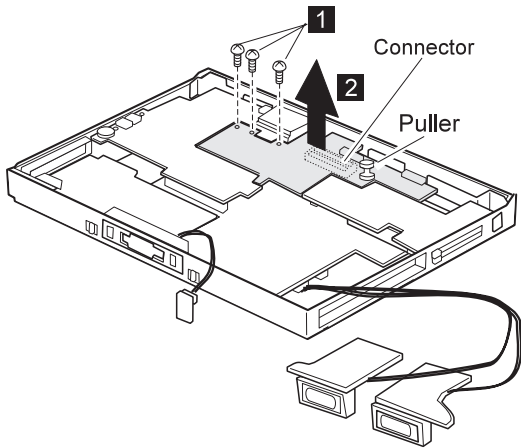
- Battery Pack **(1010)**
- UltraBay II Device or Second Battery Pack **(1020)**
- Keyboard Assembly **(1060)**
- Center Cover and Hinge Cap **(1070)**
- Power Switch and Bay Eject Lever **(1080)**
- LCD Unit **(1090)**
- Standby Battery **(1100)**
- Upper Shield **(1110)**



1130 Video Card

- Battery Pack (1010)
- UltraBay II Device or Second Battery Pack (1020)
- Keyboard Assembly (1060)
- Center Cover and Hinge Cap (1070)
- Power Switch and Bay Eject Lever (1080)
- LCD Unit (1090)
- Standby Battery (1100)
- Upper Shield (1110)

Pull the puller on the card:

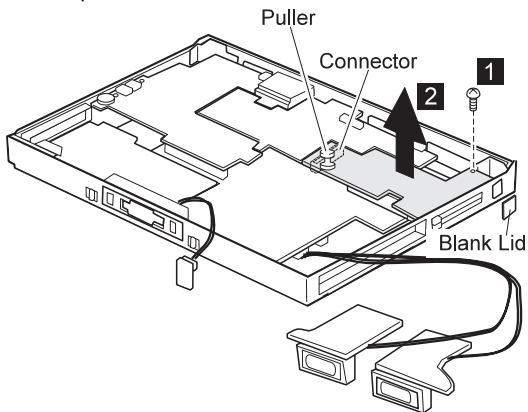


Step	Size (Quantity)	Color	Torque (kgcm)
1	M2.5 x 3 mm, nylon coating (3)	Black	4

1140 Modem Card

- Battery Pack **(1010)**
- UltraBay II Device or Second Battery Pack **(1020)**
- Keyboard Assembly **(1060)**
- Center Cover and Hinge Cap **(1070)**
- Power Switch and Bay Eject Lever **(1080)**
- LCD Unit **(1090)**
- Standby Battery **(1100)**
- Upper Shield **(1110)**

Pull the puller on the card:



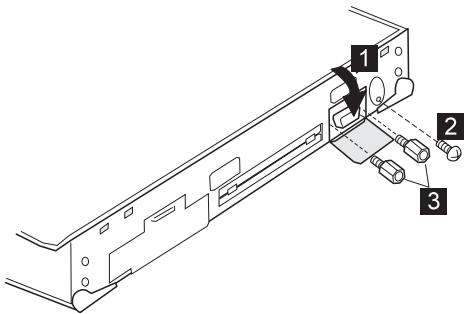
Note

Don't forget to replace the blank lid.

Step	Size (Quantity)	Color	Torque (kgcm)
1	M2.5 x 3 mm, nylon coating (1)	Black	4

1150 DC-DC Card

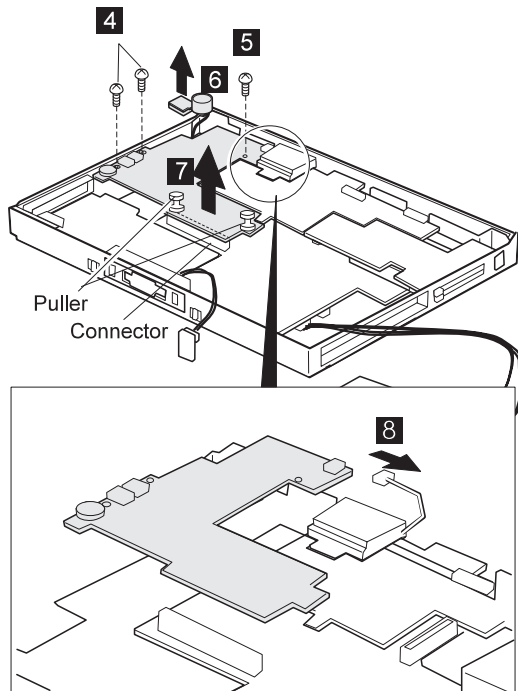
- Battery Pack (1010)
- UltraBay II Device or Second Battery Pack (1020)
- Keyboard Assembly (1060)
- Center Cover and Hinge Cap (1070)
- Power Switch and Bay Eject Lever (1080)
- LCD Unit (1090)
- Standby Battery (1100)
- Upper Shield (1110)



Step	Size (Quantity)	Color	Torque (kgcm)
2	M2.5 x 6 mm, nylon coating (1)	Black	4
3	Hex head (2)	Silver	4

FRU REMOVALS AND REPLACEMENTS

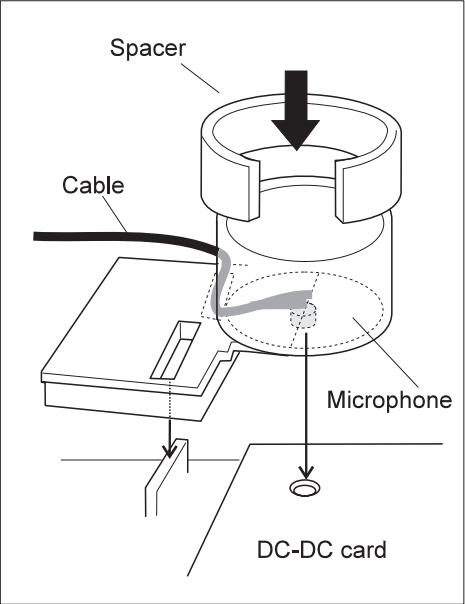
Pull the pullers on the card:



Step	Size (Quantity)	Color	Torque (kgcm)
4	M2.5 x 3 mm, nylon coating (2)	Black	4
5	M2.5 x 4 mm, nylon coating (1)	Black	4

FRU REMOVALS AND REPLACEMENTS

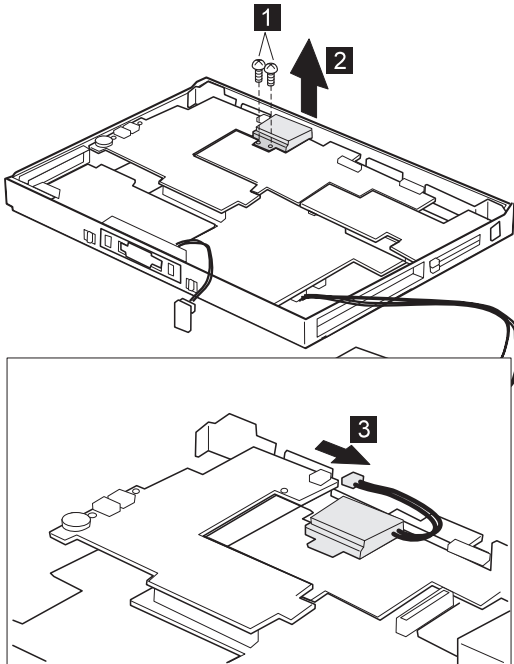
Locate the microphone, spacer, and cable.



FRU REMOVALS AND REPLACEMENTS

1160 Fan

- Battery Pack **(1010)**
- UltraBay II Device or Second Battery Pack **(1020)**
- Keyboard Assembly **(1060)**
- Center Cover and Hinge Cap **(1070)**
- Power Switch and Bay Eject Lever **(1080)**
- LCD Unit **(1090)**
- Standby Battery **(1100)**
- Upper Shield **(1110)**



Step	Size (Quantity)	Color	Torque (kgcm)
1	M2.5 x 8 mm, nylon coating (2)	Black	4

1170 CPU Card and Heat Sink

- Battery Pack (1010)
- UltraBay II Device or Second Battery Pack (1020)
- Keyboard Assembly (1060)
- Center Cover and Hinge Cap (1070)
- Power Switch and Bay Eject Lever (1080)
- LCD Unit (1090)
- Standby Battery (1100)
- Upper Shield (1110)
- Video Card (1130)
- DC-DC Card (1150)
- Fan (1160)

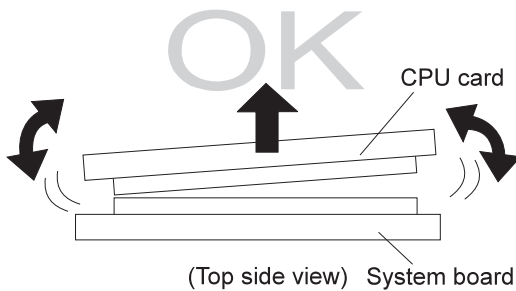
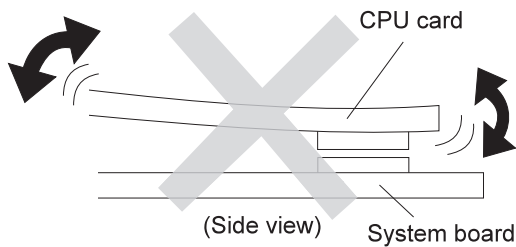
Attention

When replacing the CPU card;

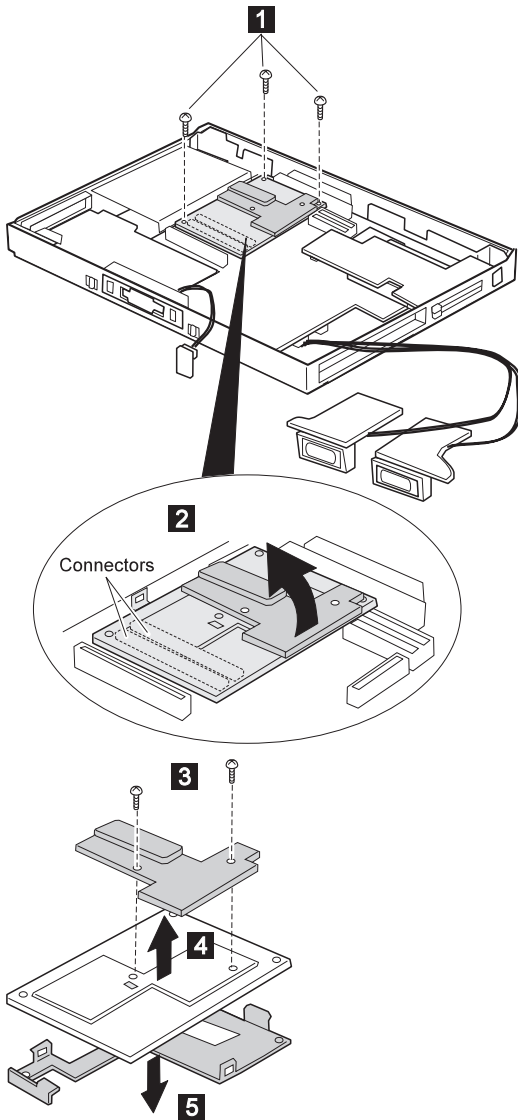
- Be careful not to damage it.
- Make sure that it is connected firmly.

A loose connection or damage to the card might cause serious problems, such as not being able to powered on.

- Do not bend the CPU card as shown in the figure.



FRU REMOVALS AND REPLACEMENTS



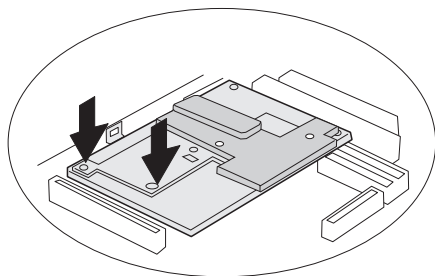
Step	Size (Quantity)	Color	Torque (kgcm)
1	M2 x 10 mm (3)	Yellow	2.5 kgcm
3	M2 x 3.5 mm, nylon coating (2)	Black	4

FRU REMOVALS AND REPLACEMENTS

Notes

When replacing:

1. Make sure that each connector is facing correctly.
2. Press the CPU card only at the indicated places in the figure. **Press both sides at the same time. Do not press only one side or any other part of the card..**

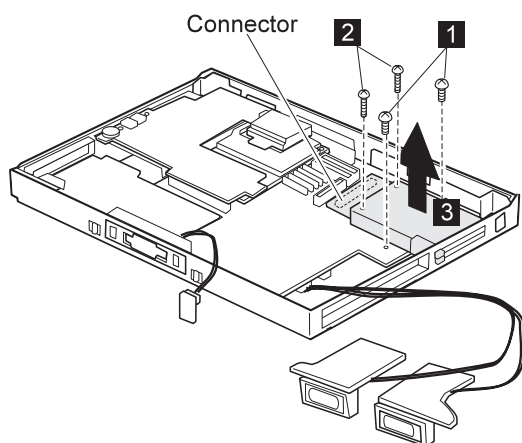


1180 PC Card Slot

- Battery Pack **(1010)**
- UltraBay II Device or Second Battery Pack **(1020)**
- Keyboard Assembly **(1060)**
- Center Cover and Hinge Cap **(1070)**
- Power Switch and Bay Eject Lever **(1080)**
- LCD Unit **(1090)**
- Standby Battery **(1100)**
- Upper Shield **(1110)**
- Video Card **(1130)**
- Modem Card **(1140)**

Note

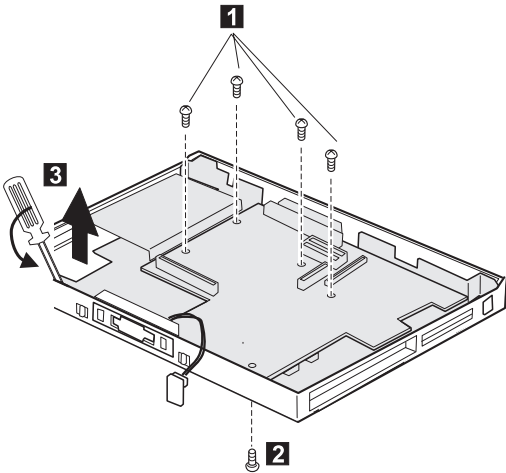
When removing the PC Card slot, make sure that the PC Card eject buttons do not pop out.



Step	Size (Quantity)	Color	Torque (kgcm)
1	M2 x 14 mm, nylon coating (2)	Yellow	2.5 kgcm
2	M2.5 x 4 mm, nylon coating (2)	Yellow	4

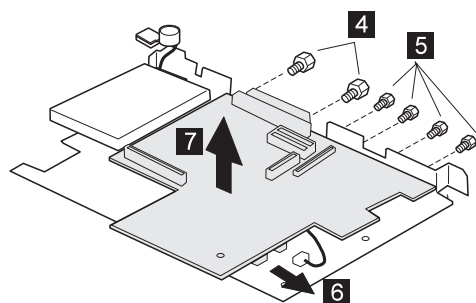
1190 System Board, Base Memory, or Cable for RFID

- Battery Pack (1010)
- UltraBay II Device or Second Battery Pack (1020)
- Hard Disk Drive (1040)
- Keyboard Assembly (1060)
- Center Cover and Hinge Cap (1070)
- Power Switch and Bay Eject Lever (1080)
- LCD Unit (1090)
- Standby Battery (1100)
- Upper Shield (1110)
- Video Card (1130)
- Modem Card (1140)
- DC-DC Card (1150)
- Fan (1160)
- CPU Card (1170)
- PC Card Slot (1180)

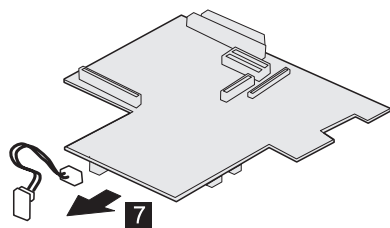


Step	Size (Quantity)	Color	Torque (kgcm)
1	M2.5 x 4 mm, nylon coating (4)	Yellow	4
2	M2.5 x 6 mm, nylon coating (1)	Black	4

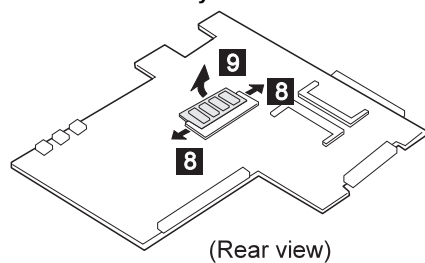
FRU REMOVALS AND REPLACEMENTS



Step	Size (Quantity)	Color	Torque (kgcm)
4	5.5, hex head (2)	Silver	4
5	5.0, hex head (4)	Silver	4

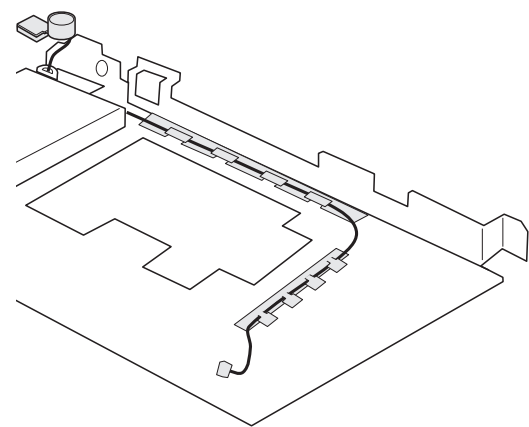


ThinkPad 770X only

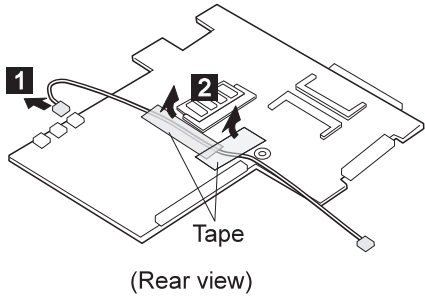


FRU REMOVALS AND REPLACEMENTS

Microphone cable route:



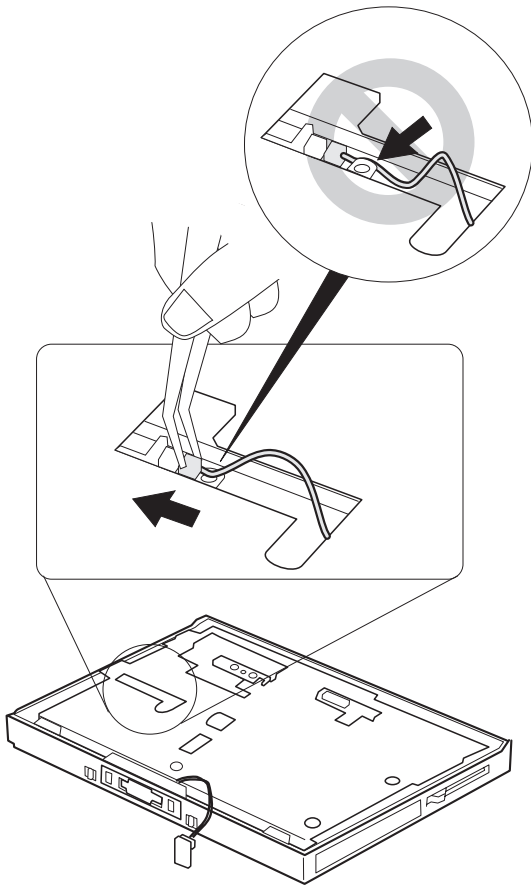
ThinkPad 770Z only



Note

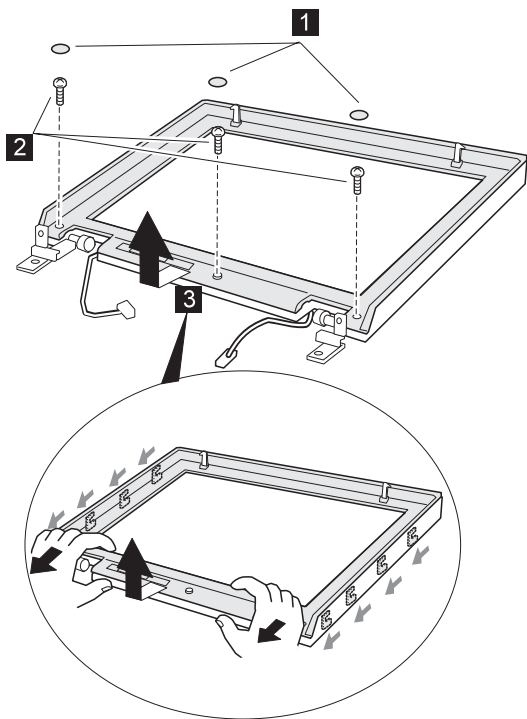
If you replace the cable of the RFID, after replacing the upper shield, connect the cable as follow. Make sure that the cable is not caught by the upper shield.

FRU REMOVALS AND REPLACEMENTS



2010 LCD Front Cover

- Battery Pack (1010)
- UltraBay II Device or Second Battery Pack (1020)
- Keyboard Assembly (1060)
- Center Cover and Hinge Cap (1070)
- LCD Unit (1090)

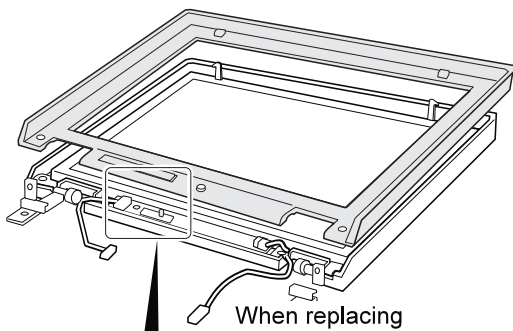


Step	Size (Quantity)	Color	Torque (kgcm)
2	M2.5 x 6 mm, nylon coating (3)	Black	4

FRU REMOVALS AND REPLACEMENTS

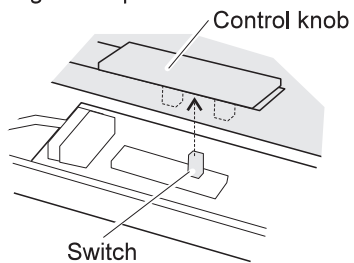
Note

When replacing the front bezel, align the LCD front-cover control knob and inverter-card switch to either the leftmost or the rightmost position, so that they engage easily, as shown. After replacing the LCD front cover, make sure that the control knob works correctly.

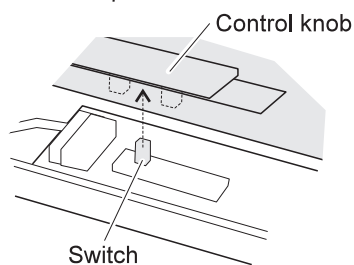


When replacing

Rightmost position



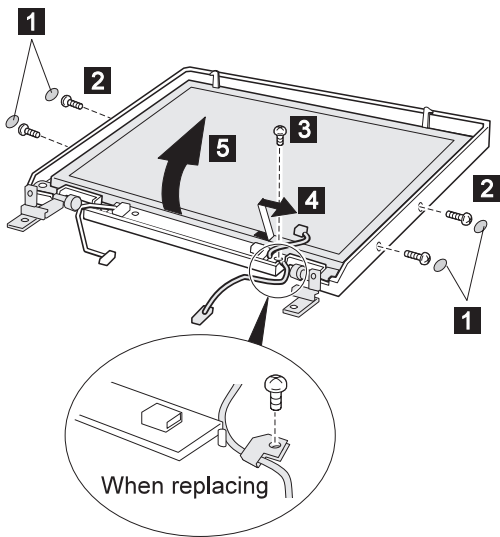
Leftmost position



2020 LCD Panel Assembly

- Battery Pack (1010)
- UltraBay II Device or Second Battery Pack (1020)
- Keyboard Assembly (1060)
- Center Cover and Hinge Cap (1070)
- LCD Unit (1090)
- LCD Front Cover (2010)

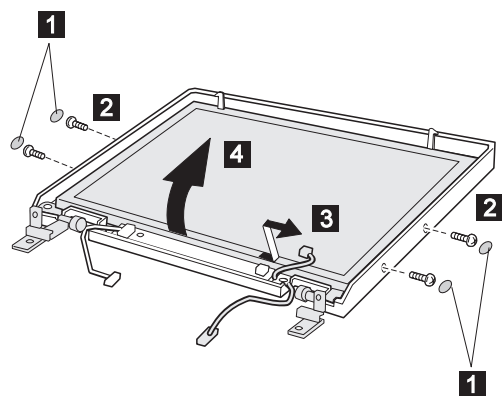
14.1-Inch LCD



Step	Size (Quantity)	Color	Torque (kgcm)
2	M2.5 x 6 mm, nylon coating (4)	Black	4
3	M2.5 x 4 mm, nylon coating (1)	Yellow	4

FRU REMOVALS AND REPLACEMENTS

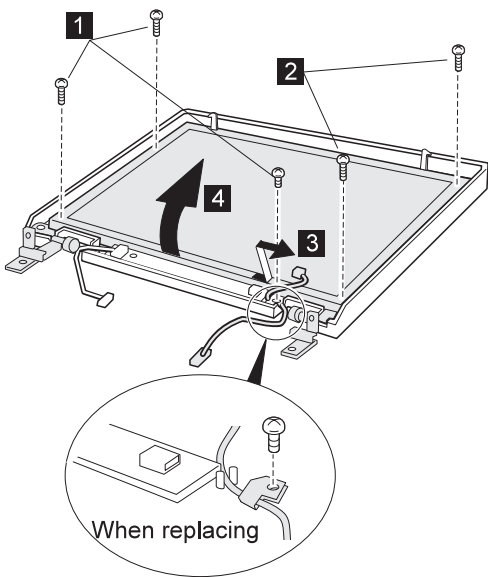
13.7-Inch LCD



Step	Size (Quantity)	Color	Torque (kgcm)
1	M2.5 x 4 mm, nylon coating (4)	Black	4

FRU REMOVALS AND REPLACEMENTS

13.3-Inch LCD

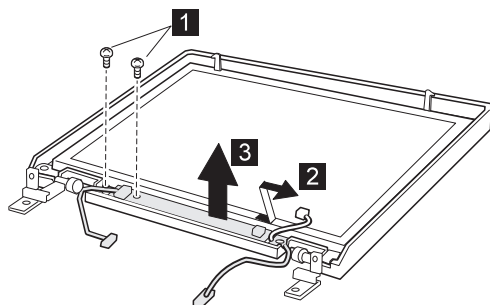


Step	Size (Quantity)	Color	Torque (kgcm)
1	M2.5 x 4 mm, nylon coating (3)	Black	4
2	M2.5 x 6 mm, nylon coating (2)	Black	4

FRU REMOVALS AND REPLACEMENTS

2030 Inverter Card

- Battery Pack **(1010)**
- UltraBay II Device or Second Battery Pack **(1020)**
- Keyboard Assembly **(1060)**
- Center Cover and Hinge Cap **(1070)**
- LCD Unit **(1090)**
- LCD Front Cover **(2010)**

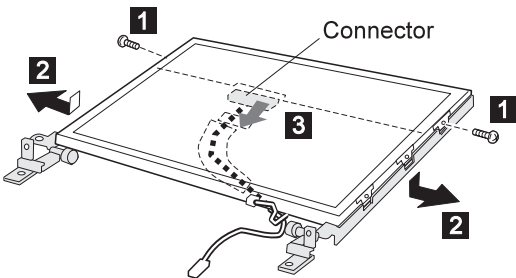


Step	Size (Quantity)	Color	Torque (kgcm)
1	M2.5 x 4 mm, nylon coating (2)	Yellow	4

2050 Hinge and LCD Cable

- Battery Pack (1010)
- UltraBay II Device or Second Battery Pack (1020)
- Keyboard Assembly (1060)
- Center Cover and Hinge Cap (1070)
- LCD Unit (1090)
- LCD Front Cover (2010)
- Inverter Card (2030)

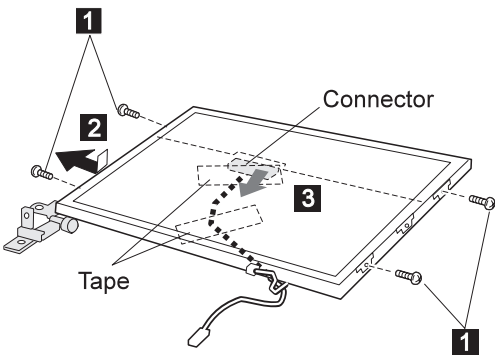
14.1-Inch LCD



Make sure connector 3 is not loose.

Step	Size (Quantity)	Color	Torque (kgcm)
1	M2.5 x 4 mm (2)	Yellow	4

13.7-Inch LCD

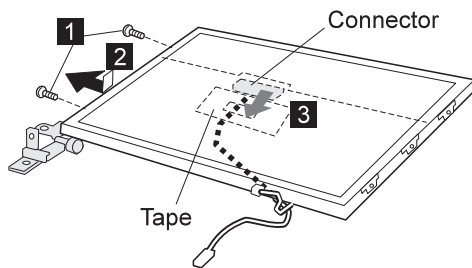


Make sure the connector 3 is not loose.

Step	Size (Quantity)	Color	Torque (kgcm)
1	M2.5 x 4 mm (4)	Yellow	4

FRU REMOVALS AND REPLACEMENTS

13.3-Inch LCD



Make sure connector **3** is not loose.

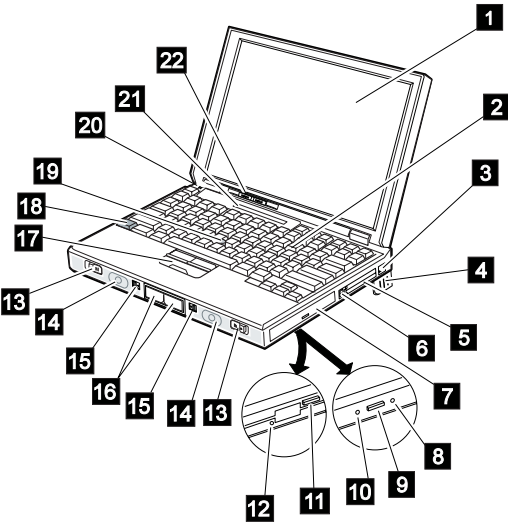
Step	Size (Quantity)	Color	Torque (kgcm)
1	M2.5 x 4 mm (2)	Yellow	4

LOCATIONS

Locations

Front View

- 1 LCD
- 2 Numeric Keypad
- 3 Internal modem port
- 4 Legs
- 5 PC Card slots
- 6 PC Card eject button
- 7 UltraBay II
- 8 Emergency eject hole
- 9 Eject button
- 10 Drive-in-use indicator
- 11 Diskette eject button
- 12 Diskette drive-in-use indicator
- 13 Cover release latches
- 14 Stereo speakers
- 15 Release latches
- 16 Bay eject lever
- 17 Click buttons
- 18 Fn key
- 19 TrackPoint
- 20 Built-in microphone
- 21 Indicator panel
- 22 Brightness control knob



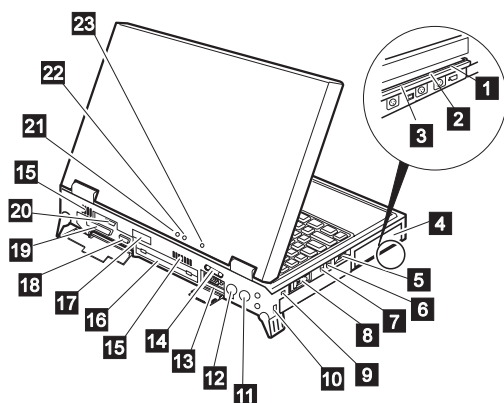
LOCATIONS

Rear View

- 1** Video-in port
- 2** Video-out port
- 3** Dolby Digital audio port
- 4** Battery pack
- 5** Volume control
- 6** Microphone/line-in jack
- 7** Headphone jack
- 8** Power switch
- 9** Reset switch
- 10** Security keyhole
- 11** ac power jack
- 12** External input device port
- 13** Serial port
- 14** Universal serial (USB) port
- 15** Fan louvers
- 16** System expansion port
- 17** Rear infrared port
- 18** External display port
- 19** Parallel port
- 20** External diskette drive
- 21** Power-on indicator
- 22** Suspend indicator
- 23** Charge indicator

Note

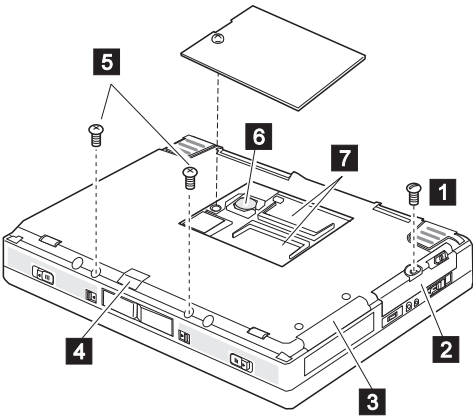
If the DVD and Enhanced Video Adapter is installed, **1** **2** **3** are available.



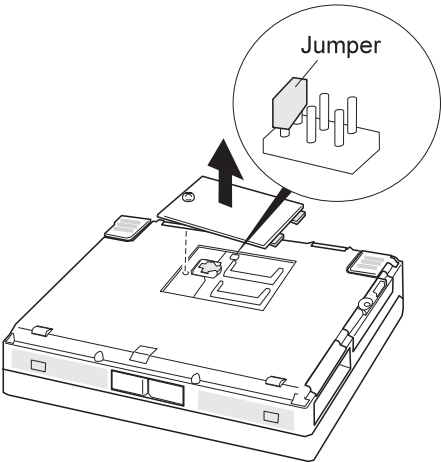
LOCATIONS

Bottom View

- 1 Coin screw or security screw
- 2 Hard disk drive
- 3 Advanced multimedia adapter card
- 4 Front infrared port
- 5 Security screws
- 6 Backup battery
- 7 DIMM slots

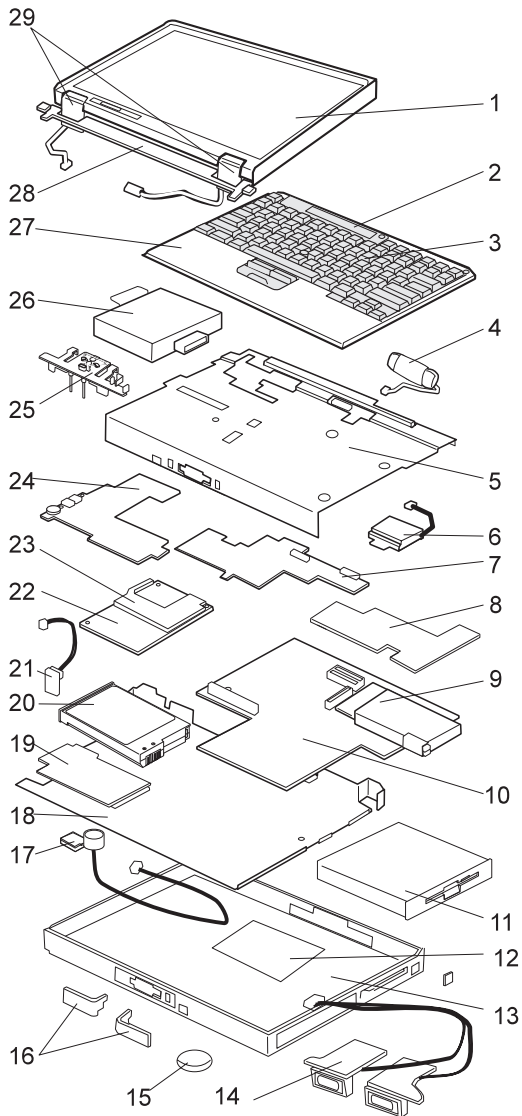


Password Jumper



PARTS LIST

Parts List



PARTS LIST

Index	Part	
1	LCD Assembly (see "LCD FRU" on page 122)	
2	Indicator Panel	
	-For 770	12J0448
	-For 770E/770ED/770X	05K9364
3	Keyboard (see "Keyboard Unit" on page 124)	
4	Standby Battery	12J0428
5	Upper Shield Case	
	-For 770	05K4468
	-For 770E/770ED	05K5373
	-For 770X	05K5177
6	Fan	
	-For 770	05K4469
	-For 770E/770ED	05K4941
	-For 770X	05K5179
7	Video Card	
	-For 770	12J0410
	-For 770E/770ED	10L0889
	-For 770X 14.1" model	10L0908
	-For 770X 13.7"	10L0911
	-For 770Z 14.1" model	10L0908
	-For 770Z 13.7" model	10L0911
8	Modem Card	10L1572
	-For Austria	10L1572
	-For U.S./Japan	12J0412
	-For 770, Korea	10L0934
	-For 770X	05K3179
	-For 770X, Korea	10L0934
9	PC Card Slots Assembly	05K4475
10	System Board	
	-For 770	10L1559
	-For 770E/770ED	10L1766
	-For 770X	10L0906
	-For 770Z	10L1259
11	FDD Assembly	12J0425
	CD-ROM Drive (x 24)	02K0515
	CD-ROM Drive (x 20)	05K9012
	DVD Drive Toshiba SD-C2002	27L3527
	DVD Drive Matsushita SR8171-L	05K9066

PARTS LIST

12	DIMM Cover	12J0421
	-For 770X	05K5555
	-For 770Z	05K6132
13	Base Cover	
	-For 770 14.1" model	05K5308
	-For 770 14.1" model, Korea	05K7025
	-For 770 13.3" model	05K5309
	-For 770 13.3" model, Korea	05K7026
	-For 770 APS	05K5310
	-For 770ED	05K5345
	-For 770ED, Austria	05K5528
	-For 770ED, PRCa	05K5529
	-For 770E	05K5346
	-For 770X	05K5742
	-For 770X, Korea	05K5743
	-For 770X, PRC	05K5963
	-For 770X, Austria	05K5965
	-For 770Z	05K6148
	-For 770Z, PRC	05K6149
	-For 770Z, Australia	05K6150
	-For 770Z, Korea	05K6151
14	Stereo Speaker Assembly	
	-For 14.1" model	12J0415
	-For 13.3" model	12J2001
15	Backup Battery	12J0453
16	Eject Lever (<i>See Mechanical Group</i>)	
17	Microphone Assembly (with holder)	05K4476
18	Lower Shield Case	12J0407
	-For 770X/770Z	05K5178
19	DVD and Enhanced Video Adapter	12J0411
20	Battery Pack (Lithium-Ion)	02K7019
21	LED Card	05K4460
22	CPU Card for 770	
	-Pentium MMX 200 MHz /L2 512	12J0409
	-Pentium MMX 233 MHz /L2 512	12J0408
	CPU Card for 770E/770ED	
	-Pentium II 266 MHz /L2 512	10L1721
	CPU Card for 770X	
	-Pentium II 300 MHz /L2 512	10L0907
	CPU Card for 770Z	
	-Pentium II 366 MHz /L2 512	10L1260
23	Heat Sink	
	-For 770	05K7039
	-For 770E/770ED	05K7041
	-For 770X	05K5176

PARTS LIST

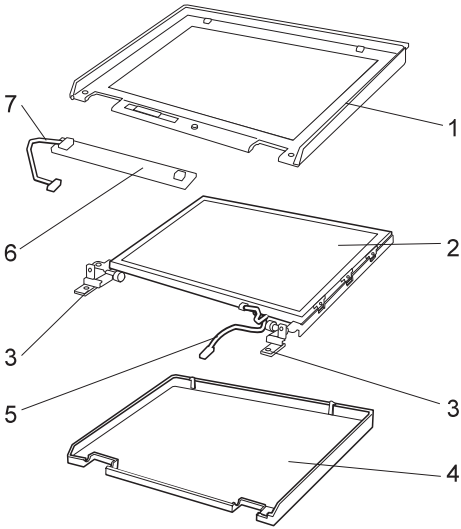
24	DC-DC Card	
	-For 770	12J0413
	-For 770E/770ED	10L0890
	-For 770X	10L1022
25	Eject Holder Asm.(See Mech. Group)	
26	Hard Disk Drive	
	-3.2 GB	12J0427
	-4.0 GB	12J0426
	-5.1 GB	12J0449
	-8.1 GB	02K0514
	-14.1 GB	02K0525
27	Keyboard Bezel	
	-For 770 14.1" model	05K7051
	-For 770 14.1" model, Korea	05K7053
	-For 770 13.3" model	05K7056
	-For 770 13.3" model, Korea	05K7058
	-For 770E/770ED	05K7061
	-For 770X model	05K5181
	-For 770X Korea	05K5924
	-For 770Z	05K6152
	-For 770Z Korea	05K6153
28	Center Cover	12J0422
29	Hinge Cap (Left and Right)	12J0423
	Spacer for Mic.	05K6043
	AC Adapter (56 W)	
	2-pin	02K6497
	3-pin	02K7007
	3-pin	02K7011
	Slim AC Adapter for 770Z	
	For Japan	02K6554
	For Japan	02K6556
	3-pin	02K6555
	3-pin	02K6557
	-For 770X	02K7007
	AC Adapter for Japan	11J8974
	Enhanced Video Cable	85G1897
	FDD Cable	12J0432
	Flap Bus Connector	05K4471
	Foot	05K5549
	HDD Door	05K4473
	I/O Door (Left)	12J0419
	I/O Door (Right)	12J0420
	Cable, for RFID (770Z)	05K2847

PARTS LIST

PC Card Lid	05K4470
TrackPoint Cap	84G6536
Carrying Case for 770E/770ED	05K4843
USB/Parallel Wrap Cable	05K2580
Security Screws (3) & Coin Screw (1)	05K4477
Logic Miscellaneous Parts	12J0406
Includes the following:	
-M5 Nut Bus Connector	
-Screw Cap	
Miscellaneous Parts for Base Cover	12J0429
Includes the following:	
-Blank Cover Adv. MM Adapter	
-Blank Lid for Telephone Jack (RJ11)	
-EMI Finger-LCD Icon	
-Keyboard Spacer	
-Keyboard Washer	
-Power Switch	
-Screw Cap	
-Spacer for Non modem Model	
Mechanical Group	
-For 14.1" model	12J0403
-For 13.3" model	12J0404
Includes the following:	
-Eject Lever (Left and Right)	
-Eject Holder Assembly	
-For 13.7" model	12J0403

PARTS LIST

LCD FRU



Note

When replacing the LCD panel or inverter, replace an A part with an A part, or replace a B part with a B part.

PARTS LIST

Index	Part	
1	LCD Front Cover	
	-For 14.1" models	12J0446
	-For 13.3" models	12J0447
	-For 13.7" models	05K5842
2	LCD Panel	
	-For 770 14.1" models	12J0438
	-For 770E/770ED 14.1" models	05K9359
	-For 13.3" models-A part	12J0439
	-For 13.3" models-B part	05K9305
	-For 770X/770Z 14.1" models	05K9391
	-For 770X/770Z 13.7" models	05K9350
3	Hinge (Left and Right)	
	-For 14.1" models	12J0436
	-For 13.3" models	12J0437
	-For 13.7" models	05K5183
4	LCD Rear Cover	
	-For 14.1" models	12J0434
	-For 14.1" (Korea)	05K4573
	-For 13.3" models	12J0435
	-For 13.3" (Korea)	05K4574
	-For 770X/770Z (13.7"/14.1") models	05K5182
	-For 770X/770Z (Korea)	05K4573
5	LCD Cable	
	-For 770/770E/770ED models	12J0440
	-For 770X/770Z 14.1" models	05K2810
	-For 770X 13.7" models	05K2651
	-For 770Z 13.7" models	05K2853

PARTS LIST

<i>Index</i>	<i>Part</i>	
6	Inverter	
	-For 14.1" models	10L1161
	-For 13.3" model-A part	12J0445
	-For 13.3" model-B part	05K3114
	-For 770X	10L1161
	-For 770Z	10L1255
7	Inverter Cable	
	-For 13.7"/14.1" models	12J0441
	-For 770X 13.7" models	05K2830
	LCD Miscellaneous Parts	12J0442
	for 14.1" models	
	LCD Miscellaneous Parts	12J0443
	for 13.3" models	
	Includes the following:	
	-Control Knob	
	-Latch (Right and Left)	
	-Screw Cap	

Keyboard Unit
For 770

Arabic	02K4733
Belgian	02K4656
Canadian French	12J2009
Danish	12J2021
Dutch	12J2015
French	12J2013
German	12J2011
Italian	12J2023
Japanese	12J2007
Korea	02K4315
Latin American Spanish	02K4313
Norwegian	12J2019
Portuguese	12J2031
Spanish	12J2025
Swedish, Finnish	12J2017
Swiss	12J2027
Turkish	02K4655
U.K. English	12J2006
U.S. English	12J2005

PARTS LIST

For 770E and 770ED

Arabic	02K4735
Belgian	02K4696
Canadian French	02K4681
Danish	02K4689
Dutch	02K4686
French	02K4685
German	02K4683
Italian	02K4690
Japanese	02K4682
Latin American Spanish	02K4694
Norwegian	02K4688
Portuguese	02K4693
Spanish	02K4691
Swedish, Finnish	02K4687
Swiss	02K4692
Turkish	02K4695
Taiwan	02K4698
U.K. English	02K4684
U.S. English	02K4680

For 770X and 770Z

Arabic	02K4847
Belgian	02K4702
Canadian French	02K4634
Czech	02K4895
Danish	02K4642
Dutch	02K4639
French	02K4638
German	02K4636
Hungarian	02K4893
Italian	02K4643
Japanese	02K4635
Korea	02K4647
Latin American Spanish	02K4648
Norwegian	02K4641
Portuguese	02K4646
Russian	02K4891
Spanish	02K4644
Swedish, Finnish	02K4640
Swiss	02K4645
Taiwan	02K4805
Turkish	02K4701
U.K. English	02K4637
U.S. English	02K4633

PARTS LIST

Miscellaneous Parts

Security screw	05K4477
Screw Kit	05K4478
Including nylon-coated screws:	
Pan head screw M2.5 x 6 mm (29)	
Pan head screw M2.5 x 4 mm (23)	
Pan head screw M2 x 14 mm (2)	
Pan head screw M2 x 10 mm (3)	
Pan head screw M2.5 x 3 mm (8)	
Pan head screw M1.6 x 4 mm (2)	
Pan head screw M2.5 x 8 mm (5)	
Flat head screw M2.5 x 3 mm (2)	
M5 Nut Bus Conn (2)	
Security screw (3)	
Coin screw (1)	
Screw Cap	

Option Parts List

SelectaBase PC Card Enabler	11J8823
56 AC Adapter (2-pin)	02K7007
ThinkPad 770 Lithium-Ion Battery	02K7019
SelectaBase 770	05K7037
SelectaDock III	3547003
External Battery Charger	11J9003
For 560 Attach	11J9002
For 600 Attach	02K6501
For 770 Attach	11J9001
5.1 GB Hard Disk Drive	12J0449
8.1 GB Hard Disk Drive	02K0514
24X-10X IDE CD-ROM Drive	02K0515
2nd Hard Disk Drive Adapter for ThinkPad 770	11J8941
ThinkPad 770 DVD/CD-ROM Drive	
-For US and Canada	05K9014
-For China	05K8953
8 MB EDO DIMM (770)	42H2767
16 MB EDO DIMM (770)	42H2768
32 MB EDO DIMM (770)	42H2769
64 MB EDO DIMM (770)	42H2817
DVD and Enhanced Video Adapter	12J0411
16 MB SDRAM SO DIMM (770, 770E/ED)	42H2818
32 MB SDRAM SO DIMM	42H2819
64 MB SDRAM SO DIMM (770, 770E/ED)	42H2820
64 MB SDRAM SO DIMM	20L0242
128 MB SDRAM SO DIMM	01K1153
Keyboard/Mouse Cable	54G0441
RFID Option	05K6134

PARTS LIST

Common Parts List

Tools

Tri-Connector Wrap Plug	72X8546
PC Test Card	35G4703
Audio Wrap Cable	66G5180
USB Parallel Test Cable	05K2580
Screwdriver Kit	95F3598
Torque Screwdriver	05K4695
5mm Socket Wrench	05K4694
Screwdriver	27L8126
ThinkPad Hardware Maintenance Diskette Version 1.50	

PARTS LIST

Power Cords: IBM power cords for a specific country are usually available only in that country:

For 2-pin power cords:

P/N	Used in These Countries
13H5273	Japan

For 3-pin power cords:

P/N	Used in These Countries
02K0539	People's Republic of China (other than Hong Kong)
76H3514	Argentina, Australia, New Zealand, Papua New Guinea, Paraguay, Uruguay
76H3516	Aruba, Bahamas, Barbados, Bermuda, Bolivia, Brazil, Canada, Cayman Islands, Colombia, Costa Rica, Curacao, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Haiti, Honduras, Jamaica, Korea (South), Liberia, Mexico, Netherlands Antilles, Nicaragua, Panama, Peru, Philippines, Saudi Arabia, Suriname, Taiwan, Thailand, Trinidad (West Indies), United States of America, Venezuela
76H3518	Austria, Belgium, Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic, Egypt, Finland, France, Germany, Greece, Hungary, Iceland, Indonesia, Macao, Macedonia, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Turkey, Yugoslavia
76H3520	Denmark
76H3522	Bangladesh, Myanmar, Pakistan, South Africa, Sri Lanka
76H3524	Abu Dhabi, Albania, Antigua, Bahrain, Brunei, Dubai, Fiji, Hong Kong, India, Ireland, Kenya, Kuwait, Malaysia, Nigeria, Oman, Qatar, Singapore, United Kingdom
76H3528	Switzerland, Liechtenstein
76H3530	Chile, Ethiopia, Italy, Libya
76H3532	Israel
76H3535	Korea

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