Note: Before using this information and the product it supports, be sure to read the general information under Appendix A “Notices” on page 105.
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About this manual

This manual contains service and reference information for the following ThinkPad® products.

ThinkPad T470 Machine Type (MT) 20HD, 20HE, 20JM, and 20JN

Use this manual along with the advanced diagnostic tests to troubleshoot problems.

**Important:** This manual is intended only for trained service technicians who are familiar with ThinkPad products. Use this manual along with the advanced diagnostic tests to troubleshoot problems effectively. Before servicing a ThinkPad product, be sure to read all the information under Chapter 1 “Safety information” on page 1 and Chapter 2 “Important service information” on page 21.
Chapter 1. Safety information

This chapter presents following safety information that you need to be familiar with before you service a ThinkPad notebook computer.

- “General safety” on page 1
- “Electrical safety” on page 1
- “Safety inspection guide” on page 2
- “Handling devices that are sensitive to electrostatic discharge” on page 3
- “Grounding requirements” on page 4
- “Safety notices (multilingual translations)” on page 4

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. Make sure that 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 object that weighs more than 16 kg (35 lb) or that you think is 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, make sure that other service technicians and the customer's personnel are not in a hazardous position.
- Place removed covers and other parts in a safe place, away from all personnel, while you are servicing the machine.
- Keep your toolcase away from walk areas so that other people will not trip over it.
- Do not wear loose clothing that can be trapped in the moving parts of a machine. Make sure 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, about 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.
- Fan louvers on the machine help to prevent overheating of internal components. Do not obstruct fan louvers or cover them with labels or stickers.

Electrical safety

Observe the following rules when working on electrical equipment.

Important: Use only approved tools and test equipment. Some hand tools have handles covered with a soft material that does not insulate you when working with live electrical currents. Many customers have, near their equipment, rubber floor mats that contain small conductive fibers to decrease electrostatic discharges. Do not use this type of mat to protect yourself from electrical shock.
• Find the room emergency power-off (EPO) switch, disconnecting switch, or electrical outlet. If an electrical accident occurs, you can then operate the switch or unplug the power cord quickly.
• Do not work alone under hazardous conditions or near equipment that has hazardous voltages.
• Disconnect all power before:
  – Performing a mechanical inspection
  – Working near power supplies
  – Removing or installing main units
• Before you start to work on the machine, unplug the power cord. If you cannot unplug it, ask the customer to power-off the wall box that supplies power to the machine, and to lock the wall box in the off position.
• If you need to work on a machine that has exposed electrical circuits, observe the following precautions:
  – Ensure that another person, familiar with the power-off controls, is near you.

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

  **Attention:** An electrical shock can occur only when there is a complete circuit. By observing the above rule, you may prevent a current from passing through your body.
  – When using testers, set the controls correctly and use the approved probe leads and accessories for that tester.
  – Stand on suitable rubber mats (obtained locally, if necessary) to insulate you from grounds such as metal floor strips and machine frames.

Observe the special safety precautions when you work with very high voltages; Instructions for these precautions 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
  – Similar units as listed above

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

---

**Safety inspection guide**

The purpose of this inspection guide is to assist you in identifying potentially unsafe conditions. As each machine was designed and built, required safety items were installed to protect users and service technicians from injury. This guide addresses only those items. You should use good judgment to identify potential safety hazards due to attachment of non-ThinkPad 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 cathode ray tube (CRT) face or a bulging capacitor
- Mechanical hazards, such as loose or missing hardware

To determine whether there are any potentially unsafe conditions, use the following checklist at the beginning of every service task. 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 the frame ground.
   b. The power cord should be the authorized type specified for your computer. Go to: http://www.lenovo.com/serviceparts-lookup
   c. Insulation must not be frayed or worn.
4. Check for cracked or bulging batteries.
5. Remove the cover.
6. Check for any obvious non-ThinkPad alterations. Use good judgment as to the safety of any non-ThinkPad alterations.
7. 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.
8. Check for worn, frayed, or pinched cables.
9. Check that the power-supply cover fasteners (screws or rivets) have not been removed or tampered with.

**Handling devices that are sensitive to electrostatic discharge**

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 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 to guard against ESD damage is desirable but not necessary.
- Attach the ESD ground clip to any frame ground, ground braid, or green-wire ground.
- When working on a double-insulated or battery-operated system, use an ESD common ground or reference point. 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.

**Safety notices (multilingual translations)**

The safety notices in this section are provided in the following languages:
- English
- Arabic
- Brazilian Portuguese
- French
- German
- Hebrew
- Japanese
- Korean
- Spanish
- Traditional Chinese

⚠️

**DANGER**

Before the computer is powered on after FRU replacement, make sure that all screws, springs, and 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.

⚠️

**DANGER**

Some standby batteries contain a small amount of nickel and cadmium. Do not disassemble a standby battery, 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.

⚠️

**DANGER**
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.

DANGER

The lithium battery can cause a fire, an explosion, or a 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.

DANGER

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.

DANGER

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

DANGER

Though the main batteries have low voltage, a short-circuited or grounded battery can produce enough current to burn personnel or combustible materials.
Unless hot swap is allowed for the FRU being replaced, do as follows before removing it: power off the computer, unplug all power cords from electrical outlets, remove the battery pack, and disconnect any interconnecting cables.

⚠️

Before making any changes, be sure that FRU replacement is allowed.

⚠️

System and subassembly changes to the FRU should not be attempted in this environment. If changes are necessary, they must be done on a dedicated server.

⚠️

Use only the battery specified in the manual. DO NOT substitute an incompatible battery. Use only the battery model specified in the service manual.

⚠️

Replacing a battery in this system is not recommended. If a battery must be replaced, use only the battery model specified in the service manual.

⚠️

Avoid damaging the system when handling the battery. If the battery is damaged, use only the battery model specified in the service manual.

⚠️

Do not use an incompatible battery. Use only the battery model specified in the service manual.

⚠️

Avoid damage to the system when handling the battery. If the battery is damaged, use only the battery model specified in the service manual.

⚠️

Do not use an incompatible battery. Use only the battery model specified in the service manual.

⚠️

Avoid damage to the system when handling the battery. If the battery is damaged, use only the battery model specified in the service manual.

⚠️

Do not use an incompatible battery. Use only the battery model specified in the service manual.
Chapter 1. Safety information

PERIGO

Antes de ligar o computador após a substituição da FRU, certifique-se de que todos os parafusos, molas e outras peças pequenas estejam no lugar e não estejam soltos dentro do computador. Verifique isso sacudindo o computador e procurando ouvir sons de peças soltas. Peças metálicas ou lascas de metal podem causar curto-circuito.

PERIGO


PERIGO

A bateria de lítio pode causar incêndio, explosão ou graves queimaduras. Não a recarregue, remova seu conector polarizado, desmonte-a, aqueça-a acima de 100°C (212°F), incinere-a, ou exponha o conteúdo de sua célula à água. Descarte a bateria conforme requerido pelas leis ou regulamentos locais. Use somente a bateria nas partes listadas apropriadas. O uso de uma bateria incorreta pode resultar em combustão ou explosão da bateria.

PERIGO

Se o LCD quebrar e o fluido de dentro dele entrar em contato com seus olhos ou com suas mãos, lave as áreas afetadas imediatamente com água durante pelo menos 15 minutos. Procure cuidados médicos se algum sintoma causado pelo fluido surgir após a lavagem.

PERIGO

Para evitar choque elétrico, não remova a capa plástica que protege a parte inferior da placa inversora.
Embora as principais baterias possuam baixa voltagem, uma bateria em curto-circuito ou aterrada pode produzir corrente o bastante para queimar materiais de pessoal ou inflamáveis.

⚠️

PERIGO

A menos que uma hot swap seja permitida para a FRU que está sendo substituída, faça o seguinte antes de removê-la: desligue o computador, desconecte todos os cabos de energia das tomadas, remova o pacote de baterias e desconecte quaisquer cabos de interconexão.

⚠️

DANGER

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.

⚠️

DANGER

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 replacez 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.

⚠️

DANGER

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 replacez 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.
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.

DANGER

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.

DANGER

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

DANGER

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.

DANGER

Si le remplacement à chaud n'est pas autorisé pour l'unité remplaçable sur site que vous remplacez, procédez comme suit avant de retirer l'unité : mettez l'ordinateur hors tension, débranchez tous les cordons d'alimentation des prises de courant, retirez le bloc de batterie et déconnectez tous les câbles d'interconnexion.

VORSICHT

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**VORSICHT**

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

**VORSICHT**

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.

**VORSICHT**

Wenn ein Austausch der FRU bei laufendem Betrieb nicht erlaubt ist, gehen Sie beim Austausch der FRU wie folgt vor: Schalten Sie den Computer aus, ziehen Sie alle Netzkabel von den Netzsteckdosen ab, entfernen Sie den Akku und ziehen Sie alle miteinander verbundenen Kabel ab.
FRUの交換後、ThinkPadの電源を入れる前に、ねじ、バック、その他の小さな部品がすべて正しい位置にある、またThinkPadの内部が破壊されていないことを確認してください。
これを確認するには、ThinkPadを振って、カチャカチャ音がしないか確かめます。金属部品や金属破片はショートの原因になることがあります。

警告

予備バッテリーの中には少量のニッケルとカドミウムが含まれているものがあります。したがって、予備バッテリーの分解、再充電、火または水の中への投棄、またはショートさせることは決して行わないでください。バッテリーを保管する場合は地方自治体の条例に従ってください。適切なバッテリーをセールスする場合は、適切なバッテリーをセールスしてください。誤ったバッテリーを使用すると、バッテリーが発火したり、爆発したりすることがあります。

警告

バッテリー・バックには少量のニッケルが含まれています。バッテリー・バックを分解したり、火または水の中に投げ込んだり、ショートさせないでください。バッテリー・バックの解体にあたっては、地方自治体の条例または規則に従ってください。バッテリー・バックをジャンプときは、適切なバッテリーをセールスする場合は、適切なバッテリーをセールスしてください。誤ったバッテリーを使用すると、バッテリーが発火したり、爆発したりすることがあります。

警告

リチウム・バッテリーは、火災、爆発、または短絡の可能性を引き起こすことがあります。バックアップ・バッテリーの充電、その接続ケーブルの取り外し、バッテリー自体の分解、100℃（212°F）以上での加熱、焼却、電池の中を水に浸すことはしないでください。バッテリーを保管する場合は地方自治体の条例に従ってください。適切なバッテリーをセールスする場合は、適切なバッテリーをセールスしてください。誤ったバッテリーを使用すると、バッテリーが発火したり、爆発したりすることがあります。

警告

LCDが破損し、LCDの中の液体が目に入ったり、手に触れたりした場合は、液
体が触れた部分を少なくとも15分間洗い流してください。流れ落ちた後に、液体
によって何らかの症状が現れた場合は、医師の治療を受けてください。

警告

感電を防ぐため、インパーターやカードの下部を保護しているプラスチック・カ
バーを外さないでください。
危険

メイン・バッテリーの電圧は低くても、ショートしたり、接地したバッテリー、作業者に電を通すと、可燃物を燃やすだけの電流を発生させる場合があります。

危険

交換しようとしている FRU がホット・スワップに対応していない場合、それを取り外す前に、コンピューターの電源をオフにし、すべての電源コードをコンセントから抜き、バッテリー・パックを取り外して、相互接続しているケーブルをすべて切り離してください。

危険

FRUを교체하고 나서 컴퓨터 전원을 켜기 전에 모든 나사, 스프링 및 기타 작은 부품들이 올바른 위치에 있는지, 컴퓨터 내부에 단단하게 연결되어 있는지 확인하십시오. 컴퓨터를 훼손하여 닫아기를하는 소리가 나지 않는지 확인하십시오. 금속 부분 또는 금속 조각은 누전을 일으킬 수 있습니다。

危険

 일부 보조 배터리에는 소량의 니켈 및 카트륨이 포함되어 있습니다. 보조 배터리를 분해하거나, 다시 충전하거나, 불 또는 용액에 먼저거나, 닫아기를 마십시오. 배터리를 폐기할 때에는 해당 지역의 법률 규정을 따르십시오. 배터리를 교체할 때에는 올바른 배터리만 사용하십시오. 올바르지 않은 배터리를 사용하면 배터리가 발화되거나 폭발할 수 있습니다。

危険

배터리 촉촉에는 소량의 니켈이 포함되어 있습니다. 배터리를 분해하거나, 불 또는 용액에 먼저거나, 닫아기를 마십시오. 배터리를 폐기할 때에는 해당 지역의 법률 규정을 따르십시오. 배터리를 교체할 때에는 올바른 배터리만 사용하십시오. 올바르지 않은 배터리를 사용하면 배터리가 발화되거나 폭발할 수 있습니다。

危険
리튬 배터리는 화재, 폭발 또는 심각한 화상을 일으킬 수 있습니다. 리튬 배터리를 다시 충전하거나, 극성 커넥터를 제거하거나, 분해하거나, 100C(212°F) 이상으로 가열하거나, 소각하거나, 전지 내용물을 품에 노출시키지 마십시오. 배터리를 폐기할 때에는 해당 지역을 법률 규정을 따르십시오. 손바닥 배터리를 안 사용하시는 것. 온바르지 않은 배터리를 사용하면 배터리가 발화되거나 폭발할 수 있습니다.

위험

LCD가 파손되어 LCD 내부의 액체가 눈에 들어가거나 손에 묻으면 즉시 깨끗한 물로 15분 이상 타아내십시오. 토해한 후에도 조급함으로 어색한 특성에 가서 의사의 진찰을 받아야 합니다.

위험

전기적 위험을 방지하려면 인터터 카드의 아래 부분을 보호하는 플라스틱 덮개를 제거하지 마십시오.

위험

기본 배터리의 전압은 낮지만, 단락되거나 전지된 배터리는 화상을 입히기에 충분한 전류와 가열성 온도를 발생할 수 있습니다.

위험

FRU 교체 시 Hot Swap이 지원되지 않는 경우, FRU를 제거하기 전에 컴퓨터의 전원을끄고 전기 콘센트에서 전원 코드를 분리하고, 배터리를 제거한 후, 연결된 모든 케이블을 분리하십시오.

PELIGRO

Antes de encender el sistema después 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.

PELIGRO
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.

PELIGRO

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.

PELIGRO

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.

PELIGRO

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 médica si se presenta algún síntoma del fluido después de lavarse.

PELIGRO

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

PELIGRO

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.
PELGRO

Salvo que se permita el intercambio en caliente para la unidad sustituible localmente, realice lo siguiente antes de extraerla: apague el sistema, desconecte todos los cables de alimentación de las tomas de alimentación eléctrica, extraiga la batería y desconecte los cables de interconexión.

DANGER

在更换 FRU 前，请确保所有螺栓、弹簧及其他小零件已归位，没有遗留在系统内部。
请确认这一点，移除电容器，听是否有爆炸的声响。
金属零件或单极的火花会造成本路线的短路。

DANGER

部分备用电池含有微量的锂和镉。请勿拆开备用电池、再充电、丢入火或水中，或将其形成短路。请按照当地法令或规定来处置电池。
仅限使用原厂済品中的电池。使用不适当的电池会导至电池起火或爆炸。

DANGER

电池套件含有微量的锂。请勿拆开电池套件、丢入火或水中，或将其形成短路。
请按照当地法令或规定来处置电池套件。
更换电池套件时，仅限使用原厂済品中的电池。使用不适当的电池会导至电池起火或爆炸。

DANGER

锂电池会导至起火、爆炸或严重烧伤。请勿再充电、拔除其电樞接頭、拆開、
加热超过 100°C (212°F) 、焚烧，或讓电池组成物浸到水。请按照当地法令或规定来处置电池。
请仅使用原厂済品中的电池。使用不适当的电池会导至电池起火或爆炸。
如果 LCD 破裂導致 LCD 流出的液體沾到您的眼睛或手，請立即以清水沖洗沾染部位至少 15 分鐘。如果在清洗後出現該液體所造成的任何症狀，請就醫治療。

![警告]

為避免電擊，請勿拆下轉換卡下面的塑膠護蓋。

![警告]

雖然主電池的電壓很低，但短路或接地電池所產生的電流，仍足以使人燒傷或使可燃物質起火。

![警告]

除非 FRU 允許以熱抽換來替換，否則請依下列方式將其移除：將電腦關機，拔除插座上所有電源線，移除電池包，並拔開任何相互連接的線材。
Chapter 2. Important service information

This chapter introduces following important service information that applies to all machine types supported by this manual:
• “Strategy for replacing FRUs” on page 21
  – “Strategy for replacing a hard disk drive or a solid-state drive” on page 21
  – “Important notice for replacing a system board” on page 22
  – “How to use error message” on page 22
• “Strategy for replacing FRUs for CTO, special-bid, and standard models” on page 22
  – “Product definition” on page 22
  – “FRU identification” on page 22

Important:
• Advise customers to contact the Lenovo® Customer Support Center if they need any assistance in obtaining or installing any software fixes, drivers, and Unified Extensible Firmware Interface basic input/output system (UEFI BIOS) downloads. Telephone numbers for Lenovo Support are available at: [http://www.lenovo.com/support/phone](http://www.lenovo.com/support/phone)
• System Disassembly/Reassembly videos that show the FRU removals or replacements for the Lenovo authorized service technicians are available in the following support site: [http://www.lenovoservicetraining.com/ion/](http://www.lenovoservicetraining.com/ion/)

Strategy for replacing FRUs

Before replacing parts:

Ensure that all software fixes, drivers, and UEFI BIOS downloads are installed before replacing any FRUs listed in this manual.

After a system board is replaced, ensure that the latest UEFI BIOS is loaded to the system board before completing the service action.

To download software fixes, drivers, and UEFI BIOS, go to [http://www.lenovo.com/ThinkPadDrivers](http://www.lenovo.com/ThinkPadDrivers) and follow the instructions on the screen.

Use the following strategy to prevent unnecessary expense for replacing and servicing FRUs:
• If you are instructed to replace a FRU but the replacement does not correct the problem, reinstall the original FRU before you continue.
• Some computers have both a processor board and a system board. If you are instructed to replace either the processor board or the system board, and replacing one of them does not correct the problem, reinstall that board, and then replace the other one.
• If an adapter or a device consists of more than one FRU, any of the FRUs might be the cause of the error. Before replacing the adapter or device, remove the FRUs, one by one, to see if the symptoms change. Replace only the FRU that changed the symptoms.

Strategy for replacing a hard disk drive or a solid-state drive

Always try to run a low-level format before replacing a hard disk drive or a solid-state drive. This will cause all customer data on the drive to be lost. Be sure that the customer has a current backup of the data before doing this task.

Attention: The drive startup sequence in the computer you are servicing may have been changed. Be extremely careful during write operations such as copying, saving, or formatting. If you select an incorrect drive, data or programs can be overwritten.
Important notice for replacing a system board

Some components mounted on a system board are very sensitive. Improper handling of a system board can cause damage to those components, and may cause a system malfunction.

Attention: When handling a system board:
• Do not drop a system board or apply any excessive force to it.
• Avoid rough handling of any kind.
• Avoid bending a system board and hard pushing to prevent cracking at each ball-grid-array (BGA) chipset.

How to use error message

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

Strategy for replacing FRUs for CTO, special-bid, and standard models

This topic provides information about the model types and FRU identification.

Product definition

This topic introduces different model types and how to identify each type.

Dynamic configure-to-order (CTO) model

This model provides the ability for a customer to configure a Lenovo solution from a Web Site, and have this configuration sent to fulfillment, where it is built and shipped directly to the customer. The machine label and eSupport will load these products as the 4-character MT, 4-character model, and 2-character country code. The model is “CTO1” and the default country code is “WW” (example: 20AACTO1WW).

Special-bid model

This is a unique configuration that has been negotiated between Lenovo and the customer. A unique machine type model (MTM) consists of a 4-character MT, a 4-character model, and a numeric 2-character country code is provided to the customer to place orders (example: 20AA000955). The country code assigned is numeric and does not designate a specific country or region. The custom model factsheet for the MTM indicates which country the special bid MTM is set up for. Special-bid offering is not generally announced.

Standard model

Standard models (fixed configuration) are announced and offered to all customers. The MTM portion of the machine label consists of a 4-character MT, a 4-character model, and an alphabetic 2-character country code. The country code assigned is alphabetic and represents a designated country or region (example: 20AA0009UK).

FRU identification

Use Lenovo eSupport to identify major FRUs, FRU part numbers, and FRU descriptions for a product at an MT - serial number level. Examples of major FRUs are hard disk drive, system board, liquid crystal display (LCD), and memory module.

To identify the major FRUs for a product, do the following:

1. Go to:
2. Click **Warranty & Services**.
3. Click **Check Warranty Status**.
4. On the Warranty Status Lookup page, click **Parts Lookup**.
5. Type your machine type and serial number, and then click **Submit**.

eSupport also can be used to view the general FRU list for a product.

To get the general FRU list for a product, do the following:

1. Go to:  
   [http://www.lenovo.com/support](http://www.lenovo.com/support)
2. Click **Parts & Accessories**.
3. Follow the instructions on the screen to select product.
4. Click **Products and Parts Detail**.
5. On the PRODUCT AND PARTS DETAIL page, click the **Parts Detail** tab to view the FRU list.

   **Note:** The FRU list is a general list of components and does not contain specific model information.
Chapter 3. General checkout

This chapter introduces following information:

- “What to do first” on page 25
- “Checkout guide” on page 26
  - “Diagnosing problems” on page 26
  - “Quick test programs” on page 27
  - “UEFI diagnostic program” on page 27
  - “Bootable diagnostic programs” on page 28
- “Power system checkout” on page 29

Before you go to the checkout guide, be sure to read the following important notes.

Important notes:

- Only certified trained personnel should service the computer.
- Before replacing any FRU, read the entire page on removing and replacing FRUs.
- When you replace FRUs, it is recommended use new nylon-coated screws.
- Be extremely careful during such write operations as copying, saving, or formatting. The sequence of the drives in the computer that you are servicing might have been altered. If you select an incorrect drive, data or programs might be overwritten.
- Replace a FRU only with another FRU of the correct model. When you replace a FRU, ensure that the model of the machine and the FRU part number are correct by referring to the web site: http://www.lenovo.com/serviceparts-lookup
- A FRU should not be replaced because of a single, unreproducible failure. Single failures can occur for a variety of reasons that have nothing to do with a hardware defect, such as cosmic radiation, electrostatic discharge, or software errors. Consider replacing a FRU only when a problem recurs. If you suspect that a FRU is defective, clear the error log and run the test again. If the error does not recur, do not replace the FRU.
- Be careful not to replace a nondefective FRU.

What to do first

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

1. Name and phone number of service technician
2. Date of service
3. Date on which the machine failed
4. Date of purchase
5. Failure symptoms, error codes appearing on the display, and beep symptoms
6. Procedure index and page number in which the failing FRU was detected
7. Failing FRU name and part number
8. Machine type, model number, and serial number
9. Customer’s name and address

Note: 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. Following is a list of some common items that are not covered under warranty and some symptoms that might indicate that the system was subjected to stress beyond normal use.
Before checking problems with the computer, determine whether the damage is covered under the warranty by referring to the following list:

The following are not covered under warranty:
- LCD panel cracked from the application of excessive force or from being dropped
- Scratched (cosmetic) parts
- Distortion, deformation, or discoloration of the cosmetic parts
- Plastic parts, latches, pins, or connectors that have been cracked or broken by excessive force
- Damage caused by liquid spilled into the system
- Damage caused by the improper insertion of a personal-computer card (PC card) or the installation of an incompatible card
- Improper disc insertion or use of an external optical drive
- Fuses blown by attachment of a nonsupported device
- Forgotten computer password (making the computer unusable)
- Sticky keys caused by spilling a liquid onto the keyboard
- Use of an incorrect ac power adapter on laptop products

The following symptoms might indicate damage caused by nonwarranted activities:
- Missing parts might be a symptom of unauthorized service or modification.
- Check for obvious damage to a hard disk drive. If the spindle of a hard disk drive becomes noisy, the hard disk drive might have been dropped or subject to excessive force.

Checkout guide

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

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

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

Diagnosing problems

Many computer problems can be solved without outside assistance. If you experience a problem with your computer, the first place to start is the troubleshooting information in your computer documentation. If you suspect a software problem, see the documentation, including readme files and help information systems, that come with the operating system or program. ThinkPad notebook computers come with a set of diagnostic programs that you can use to help you identify hardware problems.

Diagnosing problems with Lenovo Solution Center on the Windows 7 operating system

Lenovo Solution Center is preinstalled on your computer and also is available for download at:

http://www.lenovo.com/diags

Notes:
- If you are using another Windows operating system rather than the Windows 7, you can find the latest information about diagnostics for your computer at:
  http://www.lenovo.com/diagnose
- If you are unable to isolate and repair the problem yourself after running Lenovo Solution Center, save and print the log files created by the program. You need the log files when you speak to a Lenovo technical support representative.
Lenovo Solution Center enables you to troubleshoot and resolve computer problems. It combines diagnostic tests, system information collection, security status, and support information, along with hints and tips for optimal system performance.

When you are setting up your computer, the Lenovo Solution Center program prompts you to create recovery media. You can use the recovery media to restore the storage drive to the factory default settings.

For additional information, see the Lenovo Solution Center help system.

**Diagnosing problems with Lenovo Companion on the Windows 10 operating system**

Lenovo Companion is preinstalled on your computer and also is available for download at:


**Note:** If you are unable to isolate and repair the problem yourself after running Lenovo Companion, save and print the log files created by the program. You need the log files when you speak to a Lenovo technical support representative.

Lenovo Companion supports the hardware scan function. It combines diagnostic tests, system information collection, security status, and support information, along with hints and tips for optimal system performance.

The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. You can get the latest technical information and download device drivers and updates from the Lenovo Support Web site at:

http://www.lenovo.com/support

For additional information, see the Lenovo Companion help system.

**Quick test programs**

Lenovo provides quick test programs to troubleshoot and resolve computer problems, especially when the computer does not have the Lenovo Solution Center program installed.

To download and install a quick test program, go to http://www.lenovo.com/diags, and follow the instructions on the Web site.

To run a test using quick test program, do the following:

1. Go to the C:\SWTOOLS\ldiag directory.
2. Double-click the lsc_lite.exe file.
3. When the **User Account Control** window opens, click **Yes**.
4. Select the device class to be tested.
5. Select the devices to be tested.
6. Select the test to be performed.
7. Follow the instructions on the screen to start the test. When a problem is detected, information messages are displayed. Refer to the messages to troubleshoot the problem.

**UEFI diagnostic program**

A UEFI diagnostic program is preinstalled on the computer. It enables you to test memory modules and internal storage devices, view system information, and check and recover bad sectors on internal storage devices.
To run the UEFI diagnostic program, do the following:

1. Turn on the computer. If the computer cannot be turned on, go to “Power system checkout” on page 29, and check the power sources. If an error code is displayed, go to “Symptom-to-FRU index” on page 39 for error code descriptions and troubleshooting hints.

2. When the logo screen is displayed, repeatedly press and release the F10 key. The main screen of the UEFI diagnostic program is displayed.

3. Follow the instructions on the screen to use the diagnostic program.

The options on the main screen are as follows:

Table 1. Items on the main screen of the UEFI diagnostic program

<table>
<thead>
<tr>
<th>Tests</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Quick Memory Test</td>
<td>• System Information</td>
</tr>
<tr>
<td>• Quick Storage Device Test</td>
<td>• Generate configuration file</td>
</tr>
<tr>
<td>• LCD test</td>
<td>• Execute from configuration file</td>
</tr>
<tr>
<td>• PCI-e test</td>
<td>• Recover Bad Sectors Tool*</td>
</tr>
<tr>
<td>• Exit Application</td>
<td></td>
</tr>
</tbody>
</table>

* Recover Bad Sectors Tool is only available on computers that have hard disk drives installed.

Bootable diagnostic programs

If the computer you are servicing is not installed with the UEFI diagnostic program, you can download a bootable diagnostic program from the Lenovo Support Web site. The bootable diagnostic programs enable you to test computer memory and internal storage devices, view system information, and check and recover the internal storage devices. To use the bootable diagnostic programs, you can create a bootable diagnostic medium on a Universal Serial Bus (USB) device or CD.

To create a bootable diagnostic medium, do the following:

2. Click Lenovo Bootable Diagnostics.
3. Follow the instructions on the Web site to create a bootable diagnostic medium on a USB device or CD.

To use the diagnostic medium you have created, do one of the following:

- If you have created the bootable diagnostic medium on a USB device, do the following:
  1. Attach the USB device to the computer.
  2. Turn on the computer. If the computer cannot be turned on, go to “Power system checkout” on page 29, and check the power sources. If an error code is displayed, go to “Symptom-to-FRU index” on page 39 for error code descriptions and troubleshooting hints.
  3. When the logo screen is displayed, repeatedly press and release the F12 key. When the Boot Menu window opens, release the F12 key.
  4. Use the arrow keys to select USB HDD and then press Enter. The diagnostic program will be launched automatically.
  5. Follow the instructions on the screen to use the diagnostic program.

- If you have created the bootable diagnostic medium on a CD, do the following:
  1. Turn on the computer. If the computer cannot be turned on, go to “Power system checkout” on page 29, and check the power sources. If an error code is displayed, go to “Symptom-to-FRU index” on page 39 for error code descriptions and troubleshooting hints.
  2. Connect an external optical drive to the computer, and insert the CD into the optical drive.
3. Restart the computer.
4. When the logo screen is displayed, repeatedly press and release the F12 key. When the Boot Menu window opens, release the F12 key.
5. Use the arrow keys to select \textit{ATAPI CDx} (x: 0, 1, ...) and then press Enter. The diagnostic program will be launched automatically.
6. Follow the instructions on the screen to use the diagnostic program.

\textbf{Power system checkout}

To verify if a battery or an ac power adapter is functional, do the following:
1. Turn off the computer.
2. Connect the ac power adapter.
3. Turn on the computer. If the computer can be turned on, it means that either the battery or the ac power adapter is functional.
4. Insert a straightened paper clip into the emergency-reset hole to reset the computer. If the computer is still powered on, it means that the ac power adapter is functional.
5. Turn off the computer.
6. Disconnect the ac power adapter and turn on the computer. If the computer can be turned on, it means that the battery is functional.

If you suspect a power problem, see the appropriate one of the following power supply checkouts:
- “Checking the ac power adapter” on page 29
- “Checking the removable battery and the operational charging” on page 30
- “Checking the coin-cell battery” on page 31

\textbf{Checking the ac power adapter}

You are here because the computer fails only when the ac power adapter is used.
- If the power problem occurs only when the docking station or the port replicator is used, replace the docking station or the port replicator.
- If the system status indicator does not blink three times when an ac power source is connected, check the power cord of the ac power adapter for correct continuity and installation.
- If the computer does not charge during operation, go to “Checking the removable battery and the operational charging” on page 30.

\textit{Note:} Noise from the ac power adapter does not always indicate a defect.

\textbf{Checking the traditional ac power adapter}

To check the ac power adapter, do the following:
1. Unplug the ac power adapter cable from the computer.
2. Measure the output voltage at the plug of the ac power adapter cable.

\begin{center}
\begin{tabular}{ |c|c| }
\hline
\textbf{Pin} & \textbf{Voltage (V dc)} \\
\hline
1 & +20 \\
2 & 0 \\
3 & Ground \\
\hline
\end{tabular}
\end{center}

\textit{Note:} Output voltage of pin 2 of the ac power adapter might differ from the one you are servicing.
3. If the voltage is not correct, replace the ac power adapter.
4. If the voltage is acceptable, replace the system board.

**Checking the USB-C type ac power adapter**

Ensure that you use the USB-C type ac power adapter that is shipped with the computer to provide enough power to the computer.

To check the USB-C type ac power adapter, do the following:

1. Connect the computer to a power outlet and turn on the computer.
2. Check the adapter status from the following Lenovo programs:
   - For Windows 10: Open the Lenovo Settings program and click **Power**.
   - For Windows 7: Open the Power Manager program and click **Battery**.

If the USB-C type ac power adapter is working well, adapter information will be displayed on the screen. If a message is displayed warning that the power supply is not enough, replace the adapter with a proper one that is supported by the computer. If you do not see any information about the adapter, replace the adapter with a new one.

**Checking the removable battery and the operational charging**

**Checking the removable battery**

This system supports only batteries specially designed for this specific system and manufactured by Lenovo or an authorized builder. The system does not support unauthorized batteries or batteries designed for other systems. If an unauthorized battery or a battery designed for another systems is installed, the system will not charge.

**Attention:** Lenovo has no responsibility for the performance or safety of unauthorized batteries, and provides no warranties for failures or damage arising out of their use.

Move your pointer to the battery-status icon in the Windows® notification area to check the battery status. The battery-status icon displays the percentage of battery power remaining and how long you can use your computer before you must charge the battery.

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

To check the removable battery, do the following:

1. Turn off the computer.
2. Remove the removable battery and measure the voltage between battery terminals 1 (+) and 7 (-). See the following figure:

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Voltage (V dc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2</td>
<td>+0 to +12.6</td>
</tr>
<tr>
<td>6, 7</td>
<td>Ground (-)</td>
</tr>
</tbody>
</table>

3. If the voltage is less than +11.0 V dc, the removable battery has been discharged.
   If the voltage is still less than +11.0 V dc after recharging, replace the removable battery.
4. If the voltage is more than +11.0 V dc, measure the resistance between battery terminals 5 and 7. The resistance must be 4 to 30 KΩ. If the resistance is not correct, replace the removable battery. If the resistance is correct, replace the system board.

**Checking the operational charging**

To check whether the battery charges properly during operation, do the following:
1. Discharge the battery until the remained battery power is less than 50%.
2. Connect the computer to ac power to charge the battery. If the battery status icon in the Windows notification area indicates that the battery is not charging, remove the battery and let it return to room temperature.
3. Reinstall the battery. If the battery is still not charging, replace the battery.
4. Check the battery status icon again. If the same error still exists, replace the system board.

**Checking the coin-cell battery**

To check the coin-cell battery, do the following:
1. Disable the built-in battery. See “Disabling the built-in battery” on page 68.
2. Remove the coin-cell battery. See “1100 Coin-cell battery” on page 81.
3. Measure the voltage of the coin-cell battery. See the following illustration.

<table>
<thead>
<tr>
<th>Wire</th>
<th>Voltage (V dc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>+2.5 to +3.2</td>
</tr>
<tr>
<td>Black</td>
<td>Ground</td>
</tr>
</tbody>
</table>

- If the voltage is correct, replace the system board.
- If the voltage is not correct, replace the coin-cell battery.
- If the coin-cell battery discharges quickly after replacement, replace the system board.
Chapter 4. Related service information

This chapter presents following information:
• “Recovery information” on page 33
• “Passwords” on page 36
• “Power management” on page 38
• “Symptom-to-FRU index” on page 39

Service Web site: When the latest maintenance diskette and the system program service diskette become available, they will be posted on http://www.lenovo.com/support

Recovery information

This section provides information about recovery solutions. There are various methods to choose from when considering how to recover in the event of a software- or hardware-related problem. Recovery methods vary depending on the type of operating system that is installed. Ensure that you follow the correct recovery procedures.

Restoring the factory contents with the Recovery Disc Set for the Windows 7 operating system

When the main storage drive is replaced because of a failure, no product recovery program is on the new drive. In this case, the customer must use the Recovery Disc Set to recover the computer. Order the Recovery Disc Set and the drive at the same time so that the customer can restore the computer to the factory default settings by using the Recovery Disc Set after the new drive is installed. For information about which discs to order, go to http://www.lenovo.com/serviceparts-lookup.

Depending on the model, the number of recovery discs included in the Recovery Disc Set differs. The Recovery Disc Set might consist of the user instructions and the following set of DVDs to restore the computer to the original factory configuration.

• Operating System Recovery Disc (one disc): This disc restores the Microsoft Windows operating system. Use this disc to start the recovery process.
• Applications and Drivers Recovery Disc (one or more discs): This disc restores the preinstalled applications and drivers on the computer.
• Supplemental Recovery Disc: This disc contains additional content, such as updates to the software that was preinstalled on the computer. Not all recovery disc sets come with a Supplemental Recovery Disc.

Notes:
• You must have a DVD drive to use the recovery discs. If you do not have an internal DVD drive, you can use an external USB DVD drive.
• During the recovery process, all data on the drive will be deleted. If possible, copy any important data or personal files that you want to keep onto removable media or a network drive before you start the recovery process.
• Recovery can take one to two hours to complete. The length of time depends on the method you use. If you use recovery discs, the recovery process will take about two hours.

To restore the computer to the original factory configuration using the Recovery Disc Set, do the following:
1. Make the CD/DVD drive the first startup device in the startup sequence using the following procedure:
a. Press and hold down the F1 key, and then turn on the computer. When the logo screen is displayed or when you hear repeating beeps, release the F1 key. The ThinkPad Setup program opens.

b. Use the arrow keys to select Startup ➔ Boot.

c. Select the CD/DVD drive as the 1st Boot Device.

2. Insert the Operating System Recovery Disc into the DVD drive.

3. Press F10 to save the ThinkPad Setup program configuration changes. Follow the instructions on the screen to begin the recovery process.

4. Select your language and click Next.

5. Read the license. If you agree with the terms and conditions, select I accept these terms and conditions and then click Next. If you do not agree with the terms and conditions, follow the instructions on the screen.

6. Click Yes in the displayed window to begin the operating system recovery process.

7. Insert the Applications and Drivers Recovery Disc when prompted and then click OK to begin the process of recovering applications and drivers.

8. If you have a Supplemental Recovery Disc, insert it when prompted and click Yes. If you do not have a Supplemental Recovery Disc, click No.

9. When all of the data has been copied from the last disc in the set and has been processed, remove the disc and restart the computer.

   **Note:** The rest of the recovery process is fully automated and no action from you is required. The computer will restart into the Microsoft Windows desktop several times and you might experience periods when no activity is apparent on the screen for several minutes at a time. This is normal.

10. When the recovery process is complete, the Set Up Windows screen is displayed. Follow the instructions on the screen to complete the Windows setup.

11. After you have completed the Windows setup, you might want to restore the original startup sequence. Start the ThinkPad Setup program and then press F9 to restore the default settings. Press F10 to save changes and exit the ThinkPad Setup program.

   **Note:** After restoring a drive to the factory default settings, you might need to reinstall some device drivers.

**Recovery information for the Windows 10 operating system**

The Windows recovery programs enable you to reset your computer or use advanced startup options.

It is recommended that you create a recovery USB drive as early as possible. Store the recovery USB drive as a backup or replacement for the Windows recovery programs.

For more information, see “Creating and using a recovery USB drive” on page 35.

**Resetting your computer**

If your computer does not perform well, you might consider resetting your computer. In the resetting process, you can choose to keep your files or remove them, and then reinstall the Windows operating system.

To reset your computer, do the following:

   **Note:** The graphical user interface (GUI) items of the operating system might change without notice.

1. Open the Start menu and then click Settings. If Settings is not displayed, click All apps to display all programs, and then click Settings ➔ Update & security ➔ Recovery.

2. In the Reset this PC section, click Get started.

3. Follow the instructions on the screen to reset your computer.
Using advanced startup options
With advanced startup options, you can change the firmware settings of the computer, change the startup settings of the Windows operating system, start the computer from an external device, or restore the Windows operating system from a system image.

To use advanced startup options, do the following:

**Note:** The GUI items of the operating system might change without notice.

1. Open the Start menu and then click **Settings**. If **Settings** is not displayed, click **All apps** to display all programs, and then click **Settings ➔ Update & security ➔ Recovery**.
2. In the **Advanced startup** section, click **Restart now ➔ Troubleshoot ➔ Advanced options**.
3. Select a desired startup option, then follow the instructions on the screen.

Recovering your operating system if Windows 10 fails to start
The Windows recovery environment on your computer is capable of operating independently from the Windows 10 operating system. This enables you to recover or repair the operating system even if the Windows 10 operating system fails to start.

After two consecutive failed boot attempts, the Windows recovery environment starts automatically. Then you can choose repair and recovery options by following the instructions on the screen.

**Note:** Ensure that your computer is connected to ac power during the recovery process.

Creating and using a recovery USB drive
You can create a recovery USB drive as a backup for the Windows recovery programs. With the recovery USB drive, you can troubleshoot and fix the problems even if the preinstalled Windows recovery programs are damaged.

Creating a recovery USB drive
The USB drive that you use to create the recovery USB drive must be at least 16 GB of storage. The actual USB capacity that is required depends on the size of the recovery image.

**Attention:** The creation process deletes anything stored on the USB drive. To avoid data loss, make a backup copy of all the data that you want to keep.

To create a recovery USB drive, do the following:

**Note:** Ensure that your computer is connected to ac power during the following process.

1. Connect a proper USB drive (at least 16 GB of storage).
2. Type **recovery** in the search box on the taskbar. Then click **Create a recovery drive**.
3. Click **Yes** in the User Account Control window to allow the Recovery Media Creator program to start.
4. In the Recovery Drive window, follow the on-screen instructions to create a recovery USB drive.

Using the recovery USB drive
If you cannot start your computer, use the recovery USB drive to recover your computer.

To use a recovery USB drive, do the following:

**Note:** Ensure that your computer is connected to ac power.

1. Connect the recovery USB drive to the computer.
2. Turn on or restart the computer. Before the Windows operating system starts, repeatedly press the F12 key. The Boot Menu window opens.

3. Select the recovery USB drive as the boot device.

4. Select a preferred keyboard layout.

5. Click Troubleshoot to display the optional recovery solutions.

6. Select a corresponding recovery solution according to your situation. Then follow the instructions on the screen to complete the process.

**Passwords**

As many as three passwords may be needed for any ThinkPad notebook computer: the power-on password, the hard disk password, and the supervisor password.

If any of these passwords has been set, a prompt for it will be displayed on the screen whenever the computer is turned on. The computer does not start until the password is entered.

**Note:** If only a supervisor password is set, the password prompt will not be displayed when the operating system is started.

**Power-on password**

A power-on password protects the system from being powered on by an unauthorized person. The password must be entered before an operating system can be started. For instructions on how to remove the power-on password, see “How to remove the power-on password” on page 37.

**Hard disk password**

There are two kinds of hard disk passwords:
- User hard disk password - for the user
- Master hard disk password - for the system administrator, who can use it to get access to the hard disk even if the user has changed the user hard disk password

**Note:** There are two modes for the hard disk password: **User only** and **Master + User**. The **Master + User** mode requires two hard disk passwords; the system administrator enters both in the same operation. The system administrator then provides the user hard disk password to the system user.

**Attention:** If the user hard disk password has been forgotten, check whether a master hard disk password has been set. If it has, it can be used for access to the hard disk drive. If no master hard disk password is available, neither Lenovo nor Lenovo authorized service technicians provide any services to reset either the user or the master hard disk password, or to recover data from the hard disk drive. The hard disk drive can be replaced for a scheduled fee.

For how to remove the hard disk password, see “How to remove the hard disk password” on page 37.

**Supervisor password**

The supervisor password protects the system information stored in the ThinkPad Setup program. It provides the following security features:
- If only a supervisor password is set, a password prompt is displayed when you try to start the ThinkPad Setup program. Unauthorized users cannot change most of the system configuration options in the ThinkPad Setup program without the password.
- The system administrator can use the supervisor password to access a computer even if the user of that computer has set a power-on password. The supervisor password overrides the power-on password.
The system administrator can set the same supervisor password on many ThinkPad notebook computers to make administration easier.

**Attention:** If the supervisor password has been forgotten and cannot be made available to the service technician, there is no service procedure to reset the password. The system board must be replaced for a scheduled fee.

### How to remove the power-on password

To remove a power-on password, do the following:

If no supervisor password has been set, do the following to remove the power-on password:

1. Turn off the computer.
2. Remove the removable battery. For instructions on how to remove the removable battery, see “1010 Removable battery” on page 68.
3. Remove the built-in battery. For instructions on how to remove the built-in battery, see “1120 Built-in battery” on page 83.
4. Remove the coin-cell battery. For instructions on how to remove the coin-cell battery, see “1100 Coin-cell battery” on page 81.
5. Reinstall the coin-cell battery. For instructions on how to install the coin-cell battery, see “1100 Coin-cell battery” on page 81.
6. Reinstall the built-in battery. For instructions on how to reinstall the built-in battery, see “1120 Built-in battery” on page 83.
7. Reinstall the removable battery. For instructions on how to install the removable battery, see “1010 Removable battery” on page 68.
8. Turn on the computer and wait until the power-on self-test (POST) ends. After the POST ends, the password prompt does not appear. The power-on password has been removed.

If a supervisor password has been set and is known to the service technician, do the following to remove the power-on password:

1. Turn on the computer.
2. When the logo screen comes up, immediately press F1.
3. Type the supervisor password to enter the ThinkPad Setup program.
4. Select **Security**.
5. Select **Password**.
6. Select **Power-On Password**.
7. Type the current supervisor password in the **Enter Current Password** field. Then leave the **Enter New Password** field blank, and press Enter twice.
8. In the Changes have been saved window, press Enter.
9. Press F10 to save changes and exit the ThinkPad Setup program.

### How to remove the hard disk password

**Attention:** If **User only** mode is selected and the user hard disk password has been forgotten and cannot be made available to the service technician, neither Lenovo nor Lenovo authorized service technicians provide any services to reset the user hard disk passwords or to recover data from the hard disk drive. To put the system back to operational status, the only Lenovo and Lenovo-authorized service solution would be to replace the hard disk drive or solid-state drive with a scheduled fee.

To remove a user hard disk password that has been forgotten, when the supervisor password and master hard disk password are known, do the following:
1. Turn on the computer.
2. When the logo screen comes up, immediately press F1 to enter the ThinkPad Setup program.
3. Select **Security**.
4. Select **Password**.
5. Select **Hard disk x password**, where x is the letter of the hard disk drive. A pop-up window opens.
6. Select **Master hard disk password**.
7. Type the current master hard disk password in the **Enter Current Password** field. Then leave the **Enter New Password** field blank, and press Enter twice.
9. Press F10 to save changes and exit the ThinkPad Setup program. The user hard disk password and the master hard disk password have been removed.

---

**Power management**

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

**Screen blank mode (for the Windows 7 operating system only)**

If the time set on the “Turn off monitor” timer in the operating system expires, the LCD backlight turns off.

To put the computer into screen blank mode, do the following:

1. Right-click the battery status indicator on the taskbar.
2. Select **Power off display**.

To end screen blank mode and resume normal operation, press any key.

**Sleep mode**

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

- The LCD is powered off.
- The hard disk drive or solid-state drive is powered off.
- The microprocessor stops.

To put your computer into sleep mode, press Fn+4 or do the following:

- **For Windows 7**: Click the arrow beside the **Shut down** icon, and then select **Sleep**. To return from sleep mode, press the Fn key.
- **For Windows 10**: Open the Start menu, click **Power**, and then click **Sleep**.

To return to normal operation, press the Fn key only.

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

- After a period of inactivity specified in power plan settings
- When the battery power is low

**Hibernation mode**

In hibernation mode, the following occurs:

- The system status, random access memory (RAM), video random access memory (VRAM), and setup data are stored on the hard disk drive or solid-state drive.
• The system is powered off.

Note: If the computer enters the hibernation mode while it is docked to the docking station or the port replicator, do not undock it before resuming normal operation. If you do undock it and then try to resume normal operation, you will get an error message, and you will have to restart the system.

If you have defined one of the following actions as the event that causes the system to go into hibernation mode, perform that action.
• Closing the lid.
• Pressing the power button.

Also, the computer goes into hibernation mode automatically after a period of inactivity specified in power plan settings.

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

Symptom-to-FRU index

This section contains following information:
• “Numeric error codes” on page 40
• “Error messages” on page 41
• “Beep errors” on page 41
• “No-beep symptoms” on page 43
• “LCD-related symptoms” on page 43
• “Intermittent problems” on page 44
• “Undetermined problems” on page 44

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

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

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

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

If no numeric code is displayed, check the narrative descriptions of symptoms. If the symptom is not described there, go to “Intermittent problems” on page 44.

Note: For a device not supported by diagnostic codes in the ThinkPad notebook computers, see the manual for that device.
## Numeric error codes

**Table 2. Numeric error codes**

<table>
<thead>
<tr>
<th>Symptom or error</th>
<th>FRU or action, in sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>0177 Bad SVP data, stop POST task—The checksum of the supervisor password in the</td>
<td>Replace the system board.</td>
</tr>
<tr>
<td>EEPROM is not correct.</td>
<td></td>
</tr>
<tr>
<td>0183 Bad CRC of Security Settings in EFI Variable. Enter the ThinkPad Setup</td>
<td>1. Run the ThinkPad Setup program. The settings will be corrected</td>
</tr>
<tr>
<td>program. – The checksum of the Security settings in the EFI Variable is not</td>
<td>automatically. Then save the current settings by pressing F10.</td>
</tr>
<tr>
<td>correct.</td>
<td>2. Replace the system board.</td>
</tr>
<tr>
<td>0187 EAIA data access error—The access to EEPROM is failed.</td>
<td>Replace the system board.</td>
</tr>
<tr>
<td>0188 Invalid RFID Serialization Information Area.</td>
<td>Replace the system board.</td>
</tr>
<tr>
<td>0189 Invalid RFID configuration information area—The EEPROM checksum is not</td>
<td>Replace the system board.</td>
</tr>
<tr>
<td>correct.</td>
<td></td>
</tr>
<tr>
<td>0190 Critical low-battery error</td>
<td>1. Charge the battery pack.</td>
</tr>
<tr>
<td>0191 System Security—Invalid Remote Change requested.</td>
<td>2. Replace the battery pack.</td>
</tr>
<tr>
<td>0199 System Security — Security password retry count exceeded.</td>
<td>1. Run the ThinkPad Setup program, and then save current setting by</td>
</tr>
<tr>
<td></td>
<td>pressing F10.</td>
</tr>
<tr>
<td></td>
<td>2. Replace the system board.</td>
</tr>
<tr>
<td>0270 Real Time Clock Error — System Real Time Clock is not functional.</td>
<td>Have the computer serviced.</td>
</tr>
<tr>
<td>0271 Check Date and Time settings — Neither the date nor the time is set in the</td>
<td>Set the date and time, using ThinkPad Setup.</td>
</tr>
<tr>
<td>computer.</td>
<td></td>
</tr>
<tr>
<td>1802 Unauthorized network card is plugged in—Turn off and remove the network</td>
<td>1. Remove network card.</td>
</tr>
<tr>
<td>card.</td>
<td>2. Replace the system board.</td>
</tr>
<tr>
<td>1820 More than one external fingerprint reader is attached. Power off and</td>
<td>Remove all but the reader that you set up for the authentication.</td>
</tr>
<tr>
<td>remove all but the reader that you set up within your main operating system.</td>
<td></td>
</tr>
<tr>
<td>2100 Detection error on Storage Device (Main HDD)</td>
<td>1. Reseat the solid-state drive.</td>
</tr>
<tr>
<td></td>
<td>2. Replace the solid-state drive.</td>
</tr>
<tr>
<td></td>
<td>3. Replace the system board.</td>
</tr>
<tr>
<td>2101 Detection error on Storage Device (M.2)</td>
<td>1. Reseat the M.2 solid-state drive.</td>
</tr>
<tr>
<td></td>
<td>2. Replace the M.2 solid-state drive.</td>
</tr>
<tr>
<td></td>
<td>3. Replace the system board.</td>
</tr>
<tr>
<td>2102 Detection error on Storage Device (Main HDD)</td>
<td>1. Reseat the hard disk drive or the solid-state drive.</td>
</tr>
<tr>
<td></td>
<td>2. Replace the hard disk drive or the solid-state drive.</td>
</tr>
<tr>
<td></td>
<td>3. Replace the system board.</td>
</tr>
</tbody>
</table>
Table 2. Numeric error codes (continued)

<table>
<thead>
<tr>
<th>Symptom or error</th>
<th>FRU or action, in sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>2110 Read error on Storage Device (Main HDD)</td>
<td>1. Reseat the hard disk drive.</td>
</tr>
<tr>
<td></td>
<td>2. Replace the hard disk drive.</td>
</tr>
<tr>
<td></td>
<td>3. Replace the system board.</td>
</tr>
<tr>
<td>2111 Read error on Storage Device (Main HDD)</td>
<td>1. Reseat the M.2 solid-state drive.</td>
</tr>
<tr>
<td></td>
<td>2. Replace the M.2 solid-state drive.</td>
</tr>
<tr>
<td></td>
<td>3. Replace the system board.</td>
</tr>
<tr>
<td>2112 Read error on Storage Device (Main HDD)</td>
<td>1. Reseat the hard disk drive or the solid-state drive.</td>
</tr>
<tr>
<td></td>
<td>2. Replace the hard disk drive or the solid-state drive.</td>
</tr>
<tr>
<td></td>
<td>3. Replace the system board.</td>
</tr>
<tr>
<td>2200 Machine Type and Serial Number are invalid.</td>
<td>Replace the system board.</td>
</tr>
<tr>
<td>2201 Machine UUID is invalid</td>
<td>Replace the system board.</td>
</tr>
</tbody>
</table>

Error messages

Table 3. Error messages

<table>
<thead>
<tr>
<th>Symptom or error</th>
<th>FRU or action, in sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fan error.</td>
<td>1. Replace the thermal fan assembly.</td>
</tr>
<tr>
<td></td>
<td>2. Apply thermal grease.</td>
</tr>
<tr>
<td></td>
<td>3. Replace the system board.</td>
</tr>
<tr>
<td>Thermal sensing error.</td>
<td>Replace the system board.</td>
</tr>
<tr>
<td>The battery installed is not supported by this system and will not charge. Please replace the battery with the correct Lenovo battery for this system. Press the ESC key to continue.</td>
<td>Replace the battery pack.</td>
</tr>
<tr>
<td>This system does not support batteries that are not genuine Lenovo made or authorized. The system will continue to boot, but may not charge unauthorized batteries. Press the ESC key to continue. <strong>Attention:</strong> Lenovo has no responsibility for the performance or safety of unauthorized batteries, and provides no warranties for failures or damage arising out of their use.</td>
<td>Replace the battery pack.</td>
</tr>
</tbody>
</table>

Beep errors

Lenovo SmartBeep technology enables you to decode beep errors with your smartphone when a black screen occurs with beeps from your computer. To decode the beep error with Lenovo SmartBeep technology, do the following:

1. Go to [http://support.lenovo.com/smartbeep](http://support.lenovo.com/smartbeep) or scan the following QR Code.
2. Download the proper diagnostic app and install it on your smartphone.
3. Run the diagnostic app and place the smartphone near the computer.
4. Press the Fn key on your computer to emit the beep again. The diagnostic app decodes the beep error and shows possible solutions on the smartphone.

The following section describes some beep errors and the corresponding solutions.

**Note:** Do not attempt to service a product yourself unless instructed to do so by the Customer Support Center or product documentation. Only use a Lenovo-authorized service provider to repair your product.

<table>
<thead>
<tr>
<th>Error codes</th>
<th>Solutions</th>
</tr>
</thead>
</table>
| 0001: Reset error (platform reset not de-asserted)                         | 1. Remove all power resources (the ac power adapter, removable battery, and coin-cell battery). If your computer has a built-in battery, reset the computer by inserting a straightened paper clip into the emergency-reset hole. Wait for one minute. Then reconnect all power resources.  
  2. Replace the system board (service provider only).                      |
| 0002: Internal bus error                                                   | Replace the system board (service provider only).                                                                                                                                                           |
| 0281: General embedded controller error                                    | Replace the system board (service provider only).                                                                                                                                                           |
| 0282: Memory module error                                                  | 1. Reinstall or replace the memory module.  
  2. Replace the system board (service provider only).                         |
| 0283: PCI resource error                                                   | 1. Remove PCIe devices (the M.2 card, PCIe card, and so on) (service provider only).  
  2. Replace the system board (service provider only).                       |
| 0284: TCG-compliant functionality-related error (might be the BIOS code validation failure) | Replace the system board (service provider only).                                                                                                                                                           |
| 0285: TCG-compliant functionality-related error (might be the TPM initialization failure) | Replace the system board (service provider only).                                                                                                                                                           |
| 0286: Integrated graphics error                                            | Replace the system board (service provider only).                                                                                                                                                           |
### Error codes

<table>
<thead>
<tr>
<th>Error codes</th>
<th>Solutions</th>
</tr>
</thead>
</table>
| 0287: Discrete graphics error | 1. Reinstall or replace the discrete graphics card (service provider only).  
2. Replace the system board (service provider only). |
| 0288: Computer display error | 1. Reconnect the display cable on both the system board side and the computer display side (service provider only).  
2. Replace the system board (service provider only). |

### No-beep symptoms

Table 4. No-beep symptoms

<table>
<thead>
<tr>
<th>Symptom or error</th>
<th>FRU or action, in sequence</th>
</tr>
</thead>
</table>
| No beep, power-on indicator on, LCD blank, and no POST. | 1. Ensure that every connector is connected tightly and correctly.  
2. Reseat memory module.  
3. Replace the system board. |
| No beep, power-on indicator on, and LCD blank during POST. | 1. Reseat memory module.  
2. Replace the system board. |
| The power-on password prompt appears. | A power-on password or a supervisor password is set. Type the password and press Enter. |
| The hard disk password prompt appears. | A hard disk password is set. Type the password and press Enter. |

### LCD-related symptoms

**Important:** The TFT LCD for the notebook computer contains many thin-film transistors (TFTs). The presence of a small number of dots that are missing, discolored, or always lighted is characteristic of TFT LCD technology, but excessive pixel problems can cause viewing concerns. If the LCD you are servicing has two or less visible defective pixels, it should not be considered faulty. However, if the LCD has three or more visible defective pixels, it will be deemed as defective by Lenovo and it should be replaced.

**Notes:**
- This policy applies to all ThinkPad notebooks purchased on 1 January, 2008 or later.
- Lenovo will not provide warranty replacement if the LCD is within specifications because we cannot guarantee that any replacement LCD will have zero pixel defects.
- One pixel consists of R, G, B sub-pixels.

Table 5. LCD-related symptoms

<table>
<thead>
<tr>
<th>Symptom or error</th>
<th>FRU or action, in sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>No beep, power-on indicator on, and a blank LCD during POST.</td>
<td>Replace the system board.</td>
</tr>
</tbody>
</table>
| LCD backlight not working.  
LCD too dark.  
LCD brightness cannot be adjusted.  
LCD contrast cannot be adjusted. | 1. Reseat the LCD cable.  
2. Replace the LCD unit.  
3. Replace the system board. |
Table 5. LCD-related symptoms (continued)

<table>
<thead>
<tr>
<th>Symptom or error</th>
<th>FRU or action, in sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>• LCD screen unreadable.</td>
<td>1. See important note for “LCD-related symptoms.”</td>
</tr>
<tr>
<td>• Characters missing pixels.</td>
<td>2. Reseat all LCD cable.</td>
</tr>
<tr>
<td>• Screen abnormal.</td>
<td>3. Replace the LCD unit.</td>
</tr>
<tr>
<td>• Wrong color displayed.</td>
<td>4. Replace the system board.</td>
</tr>
<tr>
<td>Horizontal or vertical lines displayed on LCD.</td>
<td>Replace the LCD unit.</td>
</tr>
</tbody>
</table>

Intermittent problems

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

When analyzing an intermittent problem, do the following:

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

Undetermined problems

If the diagnostic tests did not identify the adapter or device that has failed, if wrong devices are installed, or if the system simply is not operating, follow these procedures to isolate the failing FRU (do not isolate FRUs that have no defects).

Verify that all attached devices are supported by the computer.

Verify that the power supply being used at the time of the failure is operating correctly. See “Power system checkout” on page 29.

1. Turn off the computer.
2. Visually check each FRU for damage. Replace any damaged FRU.
3. Remove or disconnect all of the following devices:
   a. Non-ThinkPad devices
   b. Devices attached to the docking station or the port replicator
   c. Printer, mouse, and other external devices
   d. Battery
   e. Hard disk drive or solid-state drive
   f. External diskette drive or optical drive
   g. Memory module
   h. PC cards
4. Turn on the computer.
5. Determine whether the problem has been solved.
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 unit
Chapter 5. Status indicators

This chapter presents the status indicators that show the status of the computer.

Table 6. Status indicators

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Camera status indicator" /></td>
<td><strong>On:</strong> The conventional camera is in use, or the infrared camera is in recognition mode.</td>
</tr>
</tbody>
</table>
| ![System status indicator](image) | **Blinks fast:** The computer is entering sleep or hibernation mode.  
**Blinks for three times:** The computer is initially connected to power.  
**Blinks slowly:** The computer is in sleep mode.  
**On:** The computer is on (in normal mode).  
**Off:** The computer is off or in hibernation mode.  
**On:** The microphones are muted. |
| ![Caps Lock indicator](image) | **On:** You can type uppercase letters by directly pressing the letter keys. |
| ![Fn Lock indicator](image) | **Off:** The Fn Lock function is disabled. You can use the default function. You can change the default function in the Keyboard Properties window. |
| ![Speaker-mute indicator](image) | **On:** The speakers are muted. |
| ![Microphone-mute indicator](image) | **On:** The microphones are muted. |
| ![ac power status indicator](image) | This indicator shows the ac power and charging status of the computer.  
**Green:** Connected to ac power (battery power 80%–100%)  
**Yellow:** Connected to ac power (battery power 1%–80%)  
**Off:** Not connected to ac power |
Chapter 6. Function keys

The following table describes the functions of function keys and key combinations.

Table 7. Function keys

<table>
<thead>
<tr>
<th>Function key and key combination</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Mute or unmute the speakers. When the speakers are muted, the indicator on the key is on. If you mute the sound and turn off your computer, the sound will remain muted when you turn on your computer again. To turn on the sound, press F2 or F3.</td>
</tr>
<tr>
<td>F3</td>
<td>Decrease the speaker volume.</td>
</tr>
<tr>
<td>F4</td>
<td>Increase the speaker volume.</td>
</tr>
<tr>
<td>F6</td>
<td>Mute or unmute the microphones. When the microphones are muted, the indicator on the key is on.</td>
</tr>
<tr>
<td>F10</td>
<td>Darken the computer display.</td>
</tr>
<tr>
<td>F11</td>
<td>Brighten the computer display.</td>
</tr>
<tr>
<td>F12</td>
<td>Manage external displays.</td>
</tr>
<tr>
<td>F13</td>
<td>Enable or disable the built-in wireless features.</td>
</tr>
<tr>
<td>F14</td>
<td>• For Windows 7: Open Control Panel. • For Windows 10: Open the Settings window.</td>
</tr>
<tr>
<td>F15</td>
<td>Enable or disable the built-in Bluetooth features.</td>
</tr>
<tr>
<td>F16</td>
<td>Open a keyboard setting page.</td>
</tr>
</tbody>
</table>
### Table 7. Function keys (continued)

<table>
<thead>
<tr>
<th>Function key and key combination</th>
<th>Description</th>
</tr>
</thead>
</table>
| F12                              | Invoke the function defined by yourself. If no function is defined, the following default function works:  
  - **For Windows 7**: Open the search box.  
  - **For Windows 10**: Open the Cortana personal assistant.  
  To define or change the function, do the following:  
  - **For Windows 7**:  
    1. Open Control Panel, and then change the view of Control Panel from Category to Large icons or Small icons.  
    2. Click **Lenovo - Keyboard Manager**. In the Keyboard Manager window, click the **USER-DEFINED KEY** tab.  
    3. Follow the instructions on the screen to complete the setting.  
  On this setting page, you can also define different functions for the key combinations with F12, such as Shift+F12, Alt+F12, or Ctrl+F12.  
  - **For Windows 10**:  
    1. Open the Lenovo Settings program.  
    2. Click the input icon.  
    3. Locate the **KEYBOARD: USER-DEFINED KEY** section and follow the instructions on the screen to complete the setting.  
  On this setting page, you can also define different functions for the key combinations with F12, such as Shift+F12, Alt+F12, or Ctrl+F12. |
| Fn+PrtSc                          | Open the Snipping Tool program. |
| Fn+Esc                            | Switch the key function between the standard F1–F12 function and the special function printed as an icon on each key. When the Fn Lock indicator is off, you can use the default function. You can change the default function in the Keyboard Properties window. |
| Fn+Spacebar                       | If your computer supports keyboard backlight, press Fn+Spacebar to switch between the different keyboard backlight status (off, low, or high). |
| Fn+4                              | Press Fn+4 to put the computer into sleep mode. To wake up the computer, press any key or the power button. |
| Fn+B                              | This key combination has the same function as the Break key on a conventional external keyboard. |
| Fn+P                              | This key combination has the same function as the Pause key on a conventional external keyboard. |
| Fn+S                              | This key combination has the same function as the SysRq key on a conventional external keyboard. |
| Fn+K                              | This key combination has the same function as the ScrLK or Scroll Lock key on a conventional external keyboard. |
Chapter 7. Locations

This chapter introduces the locations of the hardware components on your computer.

Locating computer controls, connectors, and indicators

This topic introduces the locations of the computer controls, connectors, and indicators.

Front view

1 Conventional camera (available on some models)
2 Microphones
3 Infrared camera (available on some models)
4 Power button
5 Fingerprint reader (available on some models)
6 Security-lock slot
7 Media-card slot
8 Ethernet connector
9 USB 3.0 connector
10 High-Definition Multimedia Interface (HDMI™)
11 USB 3.0 connector
12 Audio connector
13 TrackPoint buttons
14 Trackpad
15 Near field communication (NFC) label (available on some models)
16 TrackPoint® pointing stick
17 Screen (multi-touch screen available on some models)
Bottom view

1 Removable battery
2 Docking-station connector
3 Power connector
4 USB 3.0 connector
5 USB-C connector (Thunderbolt™ 3 compatible)
6 Fan louvers
7 Smart-card slot (available on some models)
8 Speakers
9 Keyboard drainage holes
10 Emergency-reset hole
11 Micro-SIM-card slot (available on some models)

Locating FRUs and CRUs

This topic introduces the following service parts:
• “Major FRUs and CRUs” on page 52
• “LCD FRUs” on page 54
• “Connector and cable guide” on page 55
### Notes:

- Each FRU is available for all types or models, unless otherwise specified.
- **CRU statement for customers:**
  
  You can resolve some problems with your product with a replacement part you can install yourself, called a “Customer Replaceable Unit” or “CRU.” Some CRUs are designated as self-service CRUs and others are designated as optional-service CRUs. **Installation of self-service CRUs is your responsibility.** For optional-service CRUs, you can either install the CRU yourself or you can request that a Service Provider install the CRU according to the warranty service for your product. If you intend on installing the CRU, Lenovo will ship the CRU to you. CRU information and replacement instructions are shipped with your product and are available from Lenovo at any time upon request. You can find a list of CRUs for your product in this Hardware Maintenance Manual. An electronic version of this manual can be found at [http://www.lenovo.com/UserManuals](http://www.lenovo.com/UserManuals). Follow the on-screen instructions to find the manual for your product. You might be required to return the defective part that is replaced by the CRU. When return is required: (1) return instructions, a prepaid shipping label, and a container will be included with the replacement CRU; and (2) you might be charged for the replacement CRU if Lenovo does not receive the defective CRU within thirty (30) days of your receipt of the replacement CRU. See your Lenovo Limited Warranty documentation for full details.

ThinkPad computers contain the following types of CRUs and FRU:

- **Self-service CRUs:** Refer to parts that can be installed or replaced easily by customer themselves or by trained service technicians at an additional cost.
- **Optional-service CRUs:** Refer to parts that can be installed or replaced by customers with a greater skill level. Trained service technicians can also provide service to install or replace the parts under the type of warranty designated for the customer’s machine.
- **FRUs:** Refer to parts that must be installed or replaced only by trained service technicians. If customers choose to replace the FRUs by themselves, the product warranty might be affected.
## Major FRUs and CRUs

### Table 8. Major FRUs

<table>
<thead>
<tr>
<th>No.</th>
<th>FRU descriptions</th>
<th>Self-service CRU</th>
<th>Optional-service CRU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LCD unit</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Trackpad</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>Keyboard bezel assembly</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Power button board</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>Fingerprint-reader bracket (on some models)</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Table 8. Major FRUs (continued)

<table>
<thead>
<tr>
<th>No.</th>
<th>FRU descriptions</th>
<th>Self-service CRU</th>
<th>Optional-service CRU</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Fingerprint-reader card (on some models)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>7</td>
<td>Wireless-LAN/Bluetooth card</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>8</td>
<td>WiGig module (on some models)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td>Wireless-WAN card/M.2 solid-state drive (on some models)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>10</td>
<td>Hard disk drive and hard disk drive bracket</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>11</td>
<td>M.2 solid-state drive and M.2 solid-state drive adapter (on some models)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>12</td>
<td>Internal storage drive cable</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>13</td>
<td>RJ45 bracket</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>14</td>
<td>Removable battery</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>15</td>
<td>SIM card (on some models)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>16</td>
<td>Base cover assembly</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>17</td>
<td>Built-in battery</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>18</td>
<td>Speaker assembly</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>19</td>
<td>Thermal fan assembly</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>20</td>
<td>System board</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>21</td>
<td>Coin-cell battery</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>22</td>
<td>Memory modules</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>23</td>
<td>Smart card reader and cable (on some models)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>24</td>
<td>NFC antenna</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>25</td>
<td>NFC module and cable (on some models)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>26</td>
<td>IO bracket</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>27</td>
<td>dc-in cable assembly</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>28</td>
<td>Keyboard</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>29</td>
<td>TrackPoint cap</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>a</td>
<td>Miscellaneous parts kits</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>b</td>
<td>Power cord</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>c</td>
<td>ac power adapter</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>d</td>
<td>Lenovo recovery disc set*</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>e</td>
<td>Lenovo factory recovery USB key*</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
## LCD FRUs

<table>
<thead>
<tr>
<th>N- no.</th>
<th>FRU descriptions</th>
<th>Self-service CRU</th>
<th>Optional-service CRU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>LCD-bezel sheet</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>LCD panel</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>LCD cable</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Camera/microphone-module and LED cable</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>Conventional camera/microphone module</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>Infrared camera/microphone module (on some models)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>7</td>
<td>Wireless-LAN antenna, Wireless-WAN antenna (on some models), and WiGig antenna (on some models)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>8</td>
<td>LCD hinge assembly</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Table 9. LCD FRUs (continued)

<table>
<thead>
<tr>
<th>No.</th>
<th>FRU descriptions</th>
<th>Self-service CRU</th>
<th>Optional-service CRU</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>LCD rear-cover support bracket assembly</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>10</td>
<td>LCD rear-cover assembly</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**Miscellaneous parts**

Table 10. Miscellaneous parts

<table>
<thead>
<tr>
<th>FRU descriptions</th>
<th>Self-service CRU</th>
<th>Optional-service CRU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw kit</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>• Screw, M2.0*L4.6, silver (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Screw, M2.5*4, silver (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Screw, M2*L3.5, silver (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Screw, M2.5*2.5, silver (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Screw, M2.0*2.5, silver (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Screw, M2*L3, silver (10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Screw, M2*L3, black (20)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>System miscellaneous parts kit</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>• IO bracket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• RJ45 bracket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Speaker rubbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Sheet support rubber</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Microphone rubbers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Fingerprint reader bracket assembly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• NFC ferrite sheet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• NFC sponge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Smartcard safety mylar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEO label assembly</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

**Connector and cable guide**

This section provides information for Lenovo authorized service technicians to help identify connectors and cables for replacement purpose. To view each FRU and the exploded illustration of the computer, see “Major FRUs and CRUs” on page 52 and “LCD FRUs” on page 54.

**Note:** Depending on your model, some connectors or cables might not be available.
Table 11. System board

<table>
<thead>
<tr>
<th>Item</th>
<th>Connector (location)</th>
<th>Internal cable required</th>
<th>Cable connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Camera/microphone connector (internal)</td>
<td>Camera/microphone cable</td>
<td>The camera/microphone cable comes with the camera/microphone combo card. Connect the cable to this connector.</td>
</tr>
<tr>
<td>2</td>
<td>Power-button-card connector (internal)</td>
<td>Power-button-card cable</td>
<td>The power-button-card cable comes with the power-button card. Connect the cable to this connector.</td>
</tr>
<tr>
<td>3</td>
<td>Removable battery connector (external)</td>
<td>No</td>
<td>Connect the removable battery to this connector.</td>
</tr>
<tr>
<td>4</td>
<td>Micro-SIM-card slot (external)</td>
<td>No</td>
<td>Insert the micro-SIM card into this slot.</td>
</tr>
<tr>
<td>5</td>
<td>Docking-station connector (external)</td>
<td>No</td>
<td>Connect the dock to this connector.</td>
</tr>
<tr>
<td>6</td>
<td>Coin-cell battery connector (internal)</td>
<td>Coin-cell battery cable</td>
<td>The coin-cell battery comes with cable. Connect the cable to this connector.</td>
</tr>
<tr>
<td>7</td>
<td>LCD connector (internal)</td>
<td>LCD cable</td>
<td>Connect one end to the LCD panel and the other end to this connector.</td>
</tr>
<tr>
<td>8</td>
<td>dc-in connector (external)</td>
<td>No</td>
<td>The ac power connector comes with the dc-in cable. Connect the ac power adapter.</td>
</tr>
<tr>
<td>9</td>
<td>USB 3.0 connector (external)</td>
<td>No</td>
<td>Connect USB-compatible devices to this connector.</td>
</tr>
</tbody>
</table>
Table 11. System board (continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Connector (location)</th>
<th>Internal cable required</th>
<th>Cable connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>USB-C connector (external)</td>
<td>No</td>
<td>Connect USB-C-compatible devices to this connector.</td>
</tr>
<tr>
<td>11</td>
<td>Thermal fan connector (internal)</td>
<td>Thermal fan cable</td>
<td>The thermal fan cable comes with the thermal fan. Connect the cable to this connector.</td>
</tr>
<tr>
<td>12</td>
<td>Built-in battery connector (internal)</td>
<td>Built-in battery cable</td>
<td>The built-in battery cable comes with the cable. Connect the cable to this connector.</td>
</tr>
<tr>
<td>13</td>
<td>NFC connector (internal)</td>
<td>NFC cable</td>
<td>The NFC cable comes with the NFC module. Connect the cable to this connector.</td>
</tr>
<tr>
<td>14</td>
<td>Smart-card-reader connector (internal)</td>
<td>Smart-card-reader cable</td>
<td>The smart-card-reader cable comes with the smart card reader. Connect the cable to this connector.</td>
</tr>
<tr>
<td>15</td>
<td>Memory module slot (internal)</td>
<td>No</td>
<td>Insert the memory module into this slot.</td>
</tr>
<tr>
<td>16</td>
<td>Internal storage drive connector (internal)</td>
<td>Internal storage drive cable</td>
<td>The internal storage drive cable comes with the internal storage drive. Connect the cable to this connector.</td>
</tr>
<tr>
<td>17</td>
<td>Fingerprint reader connector (internal)</td>
<td>Fingerprint reader cable</td>
<td>Connect one end to the fingerprint reader and the other end to this connector.</td>
</tr>
<tr>
<td>18</td>
<td>Trackpad connector (internal)</td>
<td>Trackpad cable</td>
<td>Connect the Trackpad cable to this connector.</td>
</tr>
<tr>
<td>19</td>
<td>Wireless-WAN card slot (internal)</td>
<td>No</td>
<td>Insert the wireless-WAN card into this slot.</td>
</tr>
<tr>
<td>20</td>
<td>Speaker connector (internal)</td>
<td>Speaker assembly cable</td>
<td>The speaker assembly comes with cable. Connect the cable to this connector.</td>
</tr>
<tr>
<td>21</td>
<td>Audio connector (external)</td>
<td>No</td>
<td>Connect headphones or a headset with 3.5-mm (0.14-inch) 4-pole plug to this connector.</td>
</tr>
<tr>
<td>22</td>
<td>HDMI connector (external)</td>
<td>No</td>
<td>Connect a compatible digital audio device or video monitor to this connector.</td>
</tr>
<tr>
<td>23</td>
<td>Wireless-LAN card slot (internal)</td>
<td>No</td>
<td>Insert the wireless-LAN card into this slot.</td>
</tr>
<tr>
<td>24</td>
<td>Ethernet connector (internal)</td>
<td>No</td>
<td>Connect the computer to a local area network (LAN) with the Ethernet connector.</td>
</tr>
<tr>
<td>25</td>
<td>Media-card slot (internal)</td>
<td>No</td>
<td>Insert a flash media card into the media-card slot for data access or storage.</td>
</tr>
<tr>
<td>26</td>
<td>Keyboard connector (internal)</td>
<td>Keyboard cable</td>
<td>Connect the keyboard cable to this connector.</td>
</tr>
<tr>
<td>27</td>
<td>Trackpoint connector (internal)</td>
<td>Trackpoint cable</td>
<td>Connect the trackpoint cable to this connector.</td>
</tr>
</tbody>
</table>

Camera/microphone combo card connector and cable
**Table 12. Camera/microphone combo card**

<table>
<thead>
<tr>
<th>Item</th>
<th>Connector (location)</th>
<th>Internal cable required</th>
<th>Cable connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Camera/microphone card connector (internal)</td>
<td>Cable for camera and microphone combo card</td>
<td>Connect one end to the camera/microphone connector on the system board, and the other end to this connector.</td>
</tr>
</tbody>
</table>

**Wireless-LAN card connectors and cables**

<table>
<thead>
<tr>
<th>Item</th>
<th>Connector (location)</th>
<th>Internal cable required</th>
<th>Cable connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wireless-LAN antenna connector (internal)</td>
<td>Wireless-LAN antenna kit</td>
<td>Connect one end of the wireless-LAN gray antenna to the A-cover and the other end to this connector.</td>
</tr>
<tr>
<td>2</td>
<td>Wireless-LAN antenna connector (internal)</td>
<td>Wireless-LAN antenna kit</td>
<td>Connect one end of the wireless-LAN black antenna to the A-cover and the other end to this connector.</td>
</tr>
</tbody>
</table>

**Wireless-WAN card connectors and cables**

<table>
<thead>
<tr>
<th>Item</th>
<th>Connector (location)</th>
<th>Internal cable required</th>
<th>Cable connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Wireless-WAN antenna connector (internal)</td>
<td>Wireless-WAN antenna kit</td>
<td>Connect one end of the wireless-WAN orange antenna to the A-cover and the other end to this connector.</td>
</tr>
<tr>
<td>2</td>
<td>Wireless-WAN antenna connector (internal)</td>
<td>Wireless-WAN antenna kit</td>
<td>Connect one end of the wireless-WAN blue antenna to the A-cover and the other end to this connector.</td>
</tr>
</tbody>
</table>
WiGig module connectors and cables

Table 15. WiGig module

<table>
<thead>
<tr>
<th>Item</th>
<th>Connector (location)</th>
<th>Internal cable required</th>
<th>Cable connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WiGig antenna connector (internal)</td>
<td>WiGig antenna kit</td>
<td>Connect one end of the WiGig white antenna to the A-cover and the other end to this connector.</td>
</tr>
<tr>
<td>2</td>
<td>Wireless-LAN antenna connector (internal)</td>
<td>Wireless-LAN antenna kit</td>
<td>Connect one end of the wireless-LAN gray antenna to the A-cover and the other end to this connector.</td>
</tr>
<tr>
<td>3</td>
<td>Wireless-LAN antenna connector (internal)</td>
<td>Wireless-LAN antenna kit</td>
<td>Connect one end of the wireless-LAN black antenna to the A-cover and the other end to this connector.</td>
</tr>
</tbody>
</table>

Fingerprint reader connector and cable

Table 16. Fingerprint reader connector and cable

<table>
<thead>
<tr>
<th>Item</th>
<th>Connector (location)</th>
<th>Internal cable required</th>
<th>Cable connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fingerprint reader card connector (internal)</td>
<td>Fingerprint reader card cable</td>
<td>Connect one end to the fingerprint reader card connector on the system board and the other end to this connector.</td>
</tr>
</tbody>
</table>

Smart-card reader connector and cable
Table 17. Smart-card reader connector and cable

<table>
<thead>
<tr>
<th>Item</th>
<th>Connector (location)</th>
<th>Internal cable required</th>
<th>Cable connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Smart-card reader connector (internal)</td>
<td>smart-card reader cable</td>
<td>Connect one end to the smart-card reader connector on the system board, and the other end to this connector.</td>
</tr>
</tbody>
</table>

NFC module and cable

Table 18. NFC module

<table>
<thead>
<tr>
<th>Item</th>
<th>Connector (location)</th>
<th>Internal cable required</th>
<th>Cable connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NFC module connector (internal)</td>
<td>NFC module cable</td>
<td>Connect one end to the NFC module connector on the system board and the other end to this connector.</td>
</tr>
<tr>
<td>2</td>
<td>NFC antenna connector (internal)</td>
<td>NFC antenna cable</td>
<td>Connect the NFC antenna cable to this connector.</td>
</tr>
</tbody>
</table>

Power button card and cable

Table 19. Power button card

<table>
<thead>
<tr>
<th>Item</th>
<th>Connector (location)</th>
<th>Internal cable required</th>
<th>Cable connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power-button-card connector (internal)</td>
<td>Power-button-card cable</td>
<td>Connect one end to the power-button-card connector on the system board and the other end to this connector.</td>
</tr>
</tbody>
</table>

dc-in cable

Table 20. dc-in cable

<table>
<thead>
<tr>
<th>Item</th>
<th>Connector (location)</th>
<th>Internal cable required</th>
<th>Cable connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>dc-in cable connector (internal)</td>
<td>No</td>
<td>Connect this end to the dc-in connector on the system board.</td>
</tr>
<tr>
<td>2</td>
<td>ac adapter connector (external)</td>
<td>No</td>
<td>Connect the ac adapter to this connector.</td>
</tr>
</tbody>
</table>
TrackPad connector and cable

Table 21. TrackPad connector

<table>
<thead>
<tr>
<th>Item</th>
<th>Connector (location)</th>
<th>Internal cable required</th>
<th>Cable connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Trackpad connector (internal)</td>
<td>Trackpad cable</td>
<td>Connect one end to the trackpad connector on the system board and the other end to this connector.</td>
</tr>
</tbody>
</table>

Looking up FRU information

For detailed FRU information, including part numbers, descriptions, and substitution part numbers, go to: http://www.lenovo.com/serviceparts-lookup
Chapter 8. FRU replacement notices

This chapter presents notices related to removing and replacing parts. Read this chapter carefully before replacing any FRU.

CRU statement for customers:
You can resolve some problems with your product with a replacement part you can install yourself, called a “Customer Replaceable Unit” or “CRU.” Some CRUs are designated as self-service CRUs and others are designated as optional-service CRUs. Installation of self-service CRUs is your responsibility. For optional-service CRUs, you can either install the CRU yourself or you can request that a Service Provider install the CRU according to the warranty service for your product. If you intend on installing the CRU, Lenovo will ship the CRU to you. CRU information and replacement instructions are shipped with your product and are available from Lenovo at any time upon request. You can find a list of CRUs for your product in this Hardware Maintenance Manual. An electronic version of this manual can be found at http://www.lenovo.com/UserManuals. Follow the on-screen instructions to find the manual for your product. You might be required to return the defective part that is replaced by the CRU. When return is required: (1) return instructions, a prepaid shipping label, and a container will be included with the replacement CRU; and (2) you might be charged for the replacement CRU if Lenovo does not receive the defective CRU within thirty (30) days of your receipt of the replacement CRU. See your Lenovo Limited Warranty documentation for full details.

Screw notices
Loose screws can cause a reliability problem. In the ThinkPad notebook computer, this problem is addressed with special nylon-coated screws that have the following characteristics:

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

Do the following when you service this machine:

- Keep the screw kit in your tool bag. For the part number of the screw kit, go to http://www.lenovo.com/serviceparts-lookup.
- It is recommended to use new screws.
- It is recommended to use each screw only once.

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.
Notes:

- Ensure that you use the correct screw. It is recommended to use new screws for replacements. If you have a torque screwdriver, tighten all screws firmly to the torque specified in the screw information table for each step.
- Ensure that torque screwdrivers are calibrated correctly following country specifications.

Retaining serial numbers

This topic provides instructions on the following:

- “Restoring the serial number of the system unit” on page 64
- “Retaining the UUID” on page 65

Restoring the serial number of the system unit

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

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

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

If you cannot find the serial number of the system unit on the bottom of the computer, try the following method to get the number:

Note: Before you perform the operation, ensure that the UEFI/Legacy setting within the Startup menu in the ThinkPad Setup program is set to UEFI Only.

1. Connect a USB memory key to the computer.
2. Go to http://www.lenovo.com/maintenanceutilities and follow the instructions on the screen to create a Maintenance Key.
   
   Note: Only an authorized Lenovo service technician can access the above Web site.

3. Restart the computer.
4. When the logo is displayed, press Esc. The ThinkPad Config Information Update Utility interface is displayed.
5. Type 1 under Enter the action desired, then press Enter. The ThinkPad Serial Number Update Utility for Asset ID screen is displayed.
6. Type 2 under Enter the action desired, then press Enter. The serial number of each device in your computer is displayed; the serial number of the system unit is listed as follow:
   20- Serial number
7. Record the serial number of the system unit.

After you replace the system board, do the following to restore the serial number of the system unit:

1. Connect the Maintenance Key to the computer.
2. When the logo is displayed, press Esc. The ThinkPad Config Information Update Utility interface is displayed.

3. Type 1 under **Enter the action desired**, then press Enter. The ThinkPad Serial Number Update Utility for Asset ID screen is displayed.
4. Type 1 under **Enter the action desired**, then press Enter. Then follow the instructions on the screen to restore the serial number of the system unit.

**Retaining the UUID**

The Universally Unique Identifier (UUID) is a 128-bit number uniquely assigned to your computer at production and stored in the EEPROM of your system board.

The algorithm that generates the number is designed to provide unique IDs until the year A.D. 3400. No two computers in the world have the same number.

When you replace the system board, perform the following steps to create a new UUID for the system board if the system board does not have a UUID:

**Note:** Before you perform the operation, ensure that the UEFI/Legacy setting within the Startup menu in the ThinkPad Setup program is set to **UEFI Only**.

1. Connect a USB memory key to the computer.
2. Go to [http://www.lenovo.com/maintenanceutilities](http://www.lenovo.com/maintenanceutilities) and follow the instructions on the screen to create a Maintenance Key.
   **Note:** Only an authorized Lenovo service technician can access the above Web site.
3. Restart the computer.
4. When the logo screen is displayed, press Esc. The ThinkPad Config Information Update Utility interface is displayed.
5. Type 2 under **Enter the action desired**, then press Enter. The Auto UUID generation utility interface is displayed.
6. Type y under **Change UUID. OK? [Y/N]**, then press Enter. A new UUID is created and written. If a valid UUID already exists, it is not overwritten.

**Reading or writing the ECA information**

Information on Engineering Change Announcements (ECA) is stored in the EEPROM of the system board. The electronic storage of this information simplifies the procedure to check if the ECA has been previously applied to a machine. The machine does not need to be disassembled to check for the ECA application.

To check what ECAs have been previously applied to the machine, use the ECA Information Read/Write function on the LENOVO ThinkPad Hardware Maintenance Diskette or Maintenance Key.

1. Insert the latest version of LENOVO ThinkPad Hardware Maintenance Diskette or Maintenance Key, and then restart the computer.
2. From the main menu, select **6. Set ECA Information**.
3. To read the ECA information, select **2. Read ECA/ rework number from EEPROM** and follow the instructions on the screen; To read box build date, select **5. Read box build date from EEPROM**, and follow the instructions on the screen.

After an ECA has been applied to the machine, the EEPROM must be updated to reflect the ECA’s application. Use the latest version of LENOVO ThinkPad Hardware Maintenance Diskette or Maintenance Key to update the EEPROM.

**Note:** Only the ECA number is stored in the EEPROM. The machine type of the ECA is assumed to be the same as the machine type of the machine that had the ECA applied to it.
1. Insert the latest version of LENOVO ThinkPad Hardware Maintenance Diskette or Maintenance Key, and then restart the computer.

2. From the main menu, select **6. Set ECA Information**.

3. To write the ECA information, select **1. Write ECA/ rework number from EEPROM**, and follow the instruction; To write box build date, select **4. Write box build date from EEPROM**, and follow the instruction on the screen.

If the system board is being replaced, try to read the ECA information from the old system board and transfer the information to the new system. If the system board is inoperable, this will not be possible.
Chapter 9. Removing or replacing a FRU

This chapter provides instructions on how to remove or replace a FRU.

CRU statement for customers:
You can resolve some problems with your product with a replacement part you can install yourself, called a “Customer Replaceable Unit” or “CRU”. Some CRUs are designated as self-service CRUs and others are designated as optional-service CRUs. Installation of self-service CRUs is your responsibility. For optional-service CRUs, you can either install the CRU yourself or you can request that a Service Provider install the CRU according to the warranty service for your product. If you intend on installing the CRU, Lenovo will ship the CRU to you. CRU information and replacement instructions are shipped with your product and are available from Lenovo at any time upon request. You can find a list of CRUs for your product in this Hardware Maintenance Manual. An electronic version of this manual can be found at http://www.lenovo.com/UserManuals. Follow the on-screen instructions to find the manual for your product. You might be required to return the defective part that is replaced by the CRU. When return is required: (1) return instructions, a prepaid shipping label, and a container will be included with the replacement CRU; and (2) you might be charged for the replacement CRU if Lenovo does not receive the defective CRU within thirty (30) days of your receipt of the replacement CRU. See your Lenovo Limited Warranty documentation for full details.

General guidelines

When removing or replacing a FRU, be sure to observe the following general guidelines:

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

2. Before replacing any FRU, review Chapter 8 “FRU replacement notices” on page 63.

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

4. Follow the correct sequence in the steps for removing a FRU, as given in the illustrations by the numbers in square callouts.

5. When turning a screw, turn it in the direction as given by the arrow in the illustration.

6. When removing a FRU, move it in the direction as given by the arrow in the illustration.

7. To put the new FRU in place, reverse the removal procedure and follow any notes that pertain to replacement.

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

DANGER

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

Attention: After replacing a FRU, do not turn on the computer until you have made sure that all screws, springs, and other small parts are in place and none are loose inside the computer. Verify this by shaking the computer gently and listening for rattling sounds. Metallic parts or metal flakes can cause electrical short circuits.

Attention: The system board is sensitive to, and can be damaged by, electrostatic discharge (ESD). Before touching it, establish personal grounding by touching a ground point with one hand or by using an electrostatic discharge strap.
Before servicing the computer

Carefully read this topic before servicing the computer.

Disabling the built-in battery

Before replacing any FRU, ensure that you have disabled the built-in battery.

For Windows 10, disable Fast Startup before disabling the built-in battery.

To disable Fast Startup for Windows 10, do the following:
1. From the desktop, type Power in the search box on the taskbar, and select Power Options.
2. Click Change what the power buttons do on the left pane.
3. Click Change settings that are currently unavailable at the top.
4. If prompted by User Account Control (UAC), click Yes.
5. Clear the Turn on fast startup check box, and then click Save changes.

To disable the built-in battery, do the following:
1. Turn off your computer and disconnect the ac power adapter and all cables from the computer.
2. Turn on your computer. When the logo screen is displayed, immediately press F1 to enter ThinkPad Setup.
3. Select Config → Power. The Power submenu is displayed.
4. Select Disable built-in battery and press Enter.
5. Select Yes in the Setup Confirmation window. The built-in battery is disabled and the computer turns off automatically. Wait three to five minutes to let the computer cool.

1010 Removable battery

Important notices for replacing a removable battery

Attention: Lenovo has no responsibility for the performance or safety of unauthorized batteries, and provides no warranties for failures or damage arising out of their use.

Lenovo provides a diagnostic program to do an automatic battery diagnostic test, which can determine if the removable battery is defective. A removable battery FRU should not be replaced unless this diagnostic test shows that the battery is defective. The only exception to this is if the battery is physically damaged or a customer is reporting a possible safety issue.

If no diagnostic program is installed on the computer, the customer should download and install the program to diagnose the battery, before getting a non-physically damaged battery replaced. Note that the replacement of a physically damaged battery is not covered by the warranty.

Removal steps of the removable battery

DANGER

Use only the authorized battery specified for your computer. Any other battery could ignite or explode.

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.
1020 Micro SIM card

1020 micro SIM card

**Note:** Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

**Removal steps of the micro SIM card**

1030 Base cover assembly

**Note:** Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs:

- “1010 Removable battery” on page 68
Removal steps of the base cover assembly

1. Loosen the screws 1.

2. Remove the base cover assembly in the numeric order as shown.

Applying labels to the base cover assembly:

The following illustration shows the location of each label.
1040 Memory module

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:

- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69
Removal steps of the memory module

When installing:
Insert the notched end of the memory module into the memory slot. Press the memory module in firmly, and pivot it downward until it snaps into place. Ensure that the memory module is firmly installed in the slot and does not move easily.

1050 Internal storage drive

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
• “1010 Removable battery” on page 68
• “1030 Base cover assembly” on page 69

Attention:
• Do not drop the drive or apply any physical shock to it. The drive is sensitive to physical shock. Improper handling can cause damage and permanent loss of data.
• Before removing the drive, have the user make a backup copy of all the information on it if possible.
• Never remove the drive while the system is operating or in suspend mode.
Removal steps of the 2.5-inch storage drive

1. Unplug the cable or connector from the storage drive.
2. Remove any screws or retaining mechanisms securing the storage drive.
3. Lift the storage drive out of the slot or bay.
4. Disconnect any other cables or wires connected to the storage drive.
5. Replace with the new storage drive if necessary.
Removal steps of the M.2 solid-state drive
<table>
<thead>
<tr>
<th>Step</th>
<th>Screw (quantity)</th>
<th>Color</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>M2 × 3 mm, flat-head, nylon-coated (2)</td>
<td>Black</td>
<td>0.181 Nm (1.85 kgf-cm)</td>
</tr>
<tr>
<td>7</td>
<td>M2 × 3 mm, flat-head, nylon-coated (1)</td>
<td>Black</td>
<td>0.181 Nm (1.85 kgf-cm)</td>
</tr>
</tbody>
</table>
When installing:
Ensure that the hard disk drive or solid-state drive is firmly attached and the tape does not cover the speaker.

### 1060 Wireless-WAN card

**Note:** Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69
Removal steps of the wireless-WAN card

When installing:
Plug the orange cable into the connector labeled MAIN on the card, and plug the blue cable into the connector labeled AUX on the card. If a green cable comes with your computer, plug the cable into the connector with the silkscreen GPS.

1070 Wireless-LAN module or WiGig module

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69
Removal steps of the Wireless-LAN module

When installing:
Plug the gray cable into the connector labeled **MAIN** or **2** on the card, and plug the black cable into the connector labeled **AUX** or **1** on the card.

Removal steps of the WiGig module
When installing:
Plug the gray cable into the connector labeled MAIN or 2 on the card, plug the black cable into the connector labeled AUX or 1 on the card, and plug the white cable into the WiGig connector labeled 4 on the card.

1080 M.2 solid-state drive in the Wireless-WAN-card slot

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69

Removal steps of the M.2 solid-state drive in the Wireless-WAN-card slot

When installing:
Ensure that the M.2 solid-state drive is securely seated in the wireless-WAN-card slot.

1090 Keyboard

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.
For access, remove these FRUs:
- “1010 Removable battery” on page 68

**Removal steps of the keyboard**

Loosen the two screws that secure the keyboard.

Turn the computer over and open the display. Push hard in the direction as shown to release the latches from the keyboard bezel.

Pivot the keyboard slightly upward as shown by the arrow 4 until you can see the connectors on the bottom side of the keyboard. Then turn over the keyboard as shown by the arrow 5.
Put the keyboard on the palm rest and detach the connectors. Then remove the keyboard.

1100 Coin-cell battery

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:

- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69
![DANGER]

Use only the authorized battery specified for your computer. Any other battery could ignite or explode.

Removal steps of the coin-cell battery

When installing:
Ensure that the connector of the coin-cell battery is attached firmly.

1110 Speaker assembly

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69

Removal steps of the speaker assembly
<table>
<thead>
<tr>
<th>Step</th>
<th>Screw (quantity)</th>
<th>Color</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>M2 × 4.6 mm, big head, nylon-coated (4)</td>
<td>Black</td>
<td>0.181 Nm (1.85 kgf-cm)</td>
</tr>
</tbody>
</table>

When installing:

- Ensure that the connector of the speaker assembly is attached firmly.
- Route the cables as shown in the following illustration.

**Attention:** As you route the cables, ensure that they are not subject to any tension. Tension could cause the cables to be damaged by the cable guides, or a wire to be broken.

---

**1120 Built-in battery**

**Note:** Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69

**Important notices for replacing a built-in battery**

**Attention:** Lenovo has no responsibility for the performance or safety of unauthorized batteries, and provides no warranties for failures or damage arising out of their use.

Lenovo provides a diagnostic program to do an automatic battery diagnostic test, which can determine if the removable battery is defective. A removable battery FRU should not be replaced unless this diagnostic test shows that the battery is defective. The only exception to this is if the battery is physically damaged or a customer is reporting a possible safety issue.
If no diagnostic program is installed on the computer, the customer should download and install the program to diagnose the battery, before getting a non-physically damaged battery replaced. Note that the replacement of a physically damaged battery is not covered by the warranty.

Removal steps of the built-in battery

⚠️ **DANGER**

Use only the authorized battery specified for your computer. Any other battery could ignite or explode.

<table>
<thead>
<tr>
<th>Step</th>
<th>Screw (quantity)</th>
<th>Color</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>M2 × 3 mm, small-head, nylon-coated (3)</td>
<td>Black</td>
<td>0.181 Nm (1.85 kgf-cm)</td>
</tr>
</tbody>
</table>

1130 Smart-card reader assembly

**Note:** Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
Removal steps of the smart-card reader assembly

<table>
<thead>
<tr>
<th>Step</th>
<th>Screw (quantity)</th>
<th>Color</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M2 × 3 mm, flat-head, nylon-coated (2)</td>
<td>Black</td>
<td>0.181 Nm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(1.85 kgf-cm)</td>
</tr>
</tbody>
</table>

When installing:
Ensure that the connector of the smart-card reader is attached firmly.

1140 I/O bracket and RJ45 bracket

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs:
- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69
Removal steps of the I/O bracket

<table>
<thead>
<tr>
<th>Step</th>
<th>Screw (quantity)</th>
<th>Color</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M2 × 3.5 mm, flat head, nylon-coated (2)</td>
<td>Sliver</td>
<td>0.181 Nm (1.85 kgf-cm)</td>
</tr>
</tbody>
</table>

Removal steps of the RJ45 bracket

<table>
<thead>
<tr>
<th>Step</th>
<th>Screw (quantity)</th>
<th>Color</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M2 × 3.5 mm, flat head, nylon-coated (3)</td>
<td>Sliver</td>
<td>0.181 Nm (1.85 kgf-cm)</td>
</tr>
</tbody>
</table>

1150 Thermal fan assembly

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69

Removal steps of the thermal fan assembly

Notes:
- Loosen the screws in ascending alphabetical order as illustrated.
• The screw 2e is available only in some computer models.

When installing:
• Ensure that the connector of the thermal fan is attached firmly.
• Before you attach the thermal fan assembly to the computer, apply thermal grease, at an amount of 0.2 grams, on the parts marked a and b as shown in the following illustration. Either too much or too less application of grease can cause a thermal problem due to imperfect contact with a component. For the new thermal fan assembly, you must peel off the thin film from the rubbers.
  – For integrated-graphics models

  – For discrete-graphics models
1160 System board

Important notices for handling the system board

When handling the system board, read the following:

- The system board has an accelerometer, which can be broken when several thousands of G-forces are applied.

  **Note:** Dropping a system board from a height of as little as 6 inches so that it falls flat on a hard bench can subject the accelerometer to as much as 6000 G’s of shock.

- Be careful not to drop the system board on a bench top that has a hard surface, such as metal, wood, or composite.

- Avoid rough handling of any kind.

- At every point in the process, be sure not to drop or stack the system board.

- If you put a system board down, be sure to put it only on a padded surface such as an ESD mat or a corrugated conductive material.

  **Note:** Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:

- “1010 Removable battery” on page 68
- “1020 Micro SIM card” on page 69
- “1030 Base cover assembly” on page 69
- “1040 Memory module” on page 71
- “1050 Internal storage drive” on page 72
- “1060 Wireless-WAN card” on page 76 or “1080 M.2 solid-state drive in the Wireless-WAN-card slot” on page 79
- “1070 Wireless-LAN module or WiGig module” on page 77
- “1090 Keyboard” on page 79
- “1100 Coin-cell battery” on page 81
- “1110 Speaker assembly” on page 82
- “1120 Built-in battery” on page 83
- “1130 Smart-card reader assembly” on page 84
- “1140 I/O bracket and RJ45 bracket” on page 85
- “1150 Thermal fan assembly” on page 86

The following components soldered on the top side of the system board are extremely sensitive. When you service the system board, avoid any kind of rough handling.

- Graphics processing unit (GPU)
- Central processing unit (CPU)
- Embedded controller
- Accelerometer chip for the hard disk drive Active Protection System™
Note: The graphics chip 1 is only for discrete-graphics models.

Removal steps of the system board
Step | Screw (quantity) | Color | Torque
--- | --- | --- | ---
12 | M2 × 3 mm, flat head, nylon-coated (6) | Black | 0.181 Nm (1.85 kgf-cm)

When installing:
Ensure that the connectors are attached firmly.

### 1170 Power-button card

**Note:** Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1020 Micro SIM card” on page 69
- “1030 Base cover assembly” on page 69
- “1040 Memory module” on page 71
- “1050 Internal storage drive” on page 72
- “1060 Wireless-WAN card” on page 76 or “1080 M.2 solid-state drive in the Wireless-WAN-card slot” on page 79
- “1070 Wireless-LAN module or WiGig module” on page 77
- “1090 Keyboard” on page 79
- “1100 Coin-cell battery” on page 81
- “1110 Speaker assembly” on page 82
- “1120 Built-in battery” on page 83
- “1130 Smart-card reader assembly” on page 84
- “1140 I/O bracket and RJ45 bracket” on page 85
- “1150 Thermal fan assembly” on page 86
- “1160 System board” on page 88
Removal steps of the power-button card

<table>
<thead>
<tr>
<th>Step</th>
<th>Screw (quantity)</th>
<th>Color</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M2 × 3 mm, flat-head, nylon-coated (2)</td>
<td>Black</td>
<td>0.181 Nm (1.85 kgf-cm)</td>
</tr>
</tbody>
</table>

When installing:
Ensure that the connector of the power-button card is attached firmly.

### 1180 Fingerprint-reader card

**Note:** Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1020 Micro SIM card” on page 69
- “1030 Base cover assembly” on page 69
- “1040 Memory module” on page 71
- “1050 Internal storage drive” on page 72
- “1060 Wireless-WAN card” on page 76 or “1080 M.2 solid-state drive in the Wireless-WAN-card slot” on page 79
- “1070 Wireless-LAN module or WiGig module” on page 77
- “1090 Keyboard” on page 79
- “1100 Coin-cell battery” on page 81
- “1110 Speaker assembly” on page 82
- “1120 Built-in battery” on page 83
- “1130 Smart-card reader assembly” on page 84
- “1140 I/O bracket and RJ45 bracket” on page 85
- “1150 Thermal fan assembly” on page 86
- “1160 System board” on page 88
Removal steps of the fingerprint-reader card

<table>
<thead>
<tr>
<th>Step</th>
<th>Screw (quantity)</th>
<th>Color</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M2 × 3 mm, flat-head, nylon-coated (1)</td>
<td>Black</td>
<td>0.181 Nm&lt;br&gt;(1.85 kgf-cm)</td>
</tr>
</tbody>
</table>

1190 NFC module

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1020 Micro SIM card” on page 69
- “1030 Base cover assembly” on page 69
- “1040 Memory module” on page 71
- “1050 Internal storage drive” on page 72
- “1060 Wireless-WAN card” on page 76 or “1080 M.2 solid-state drive in the Wireless-WAN-card slot” on page 79
- “1070 Wireless-LAN module or WiGig module” on page 77
- “1090 Keyboard” on page 79
- “1100 Coin-cell battery” on page 81
- “1110 Speaker assembly” on page 82
- “1120 Built-in battery” on page 83
- “1130 Smart-card reader assembly” on page 84
Removal steps of the NFC module

1200 LCD unit

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
• “1010 Removable battery” on page 68
• “1030 Base cover assembly” on page 69

Removal steps of the LCD unit
<table>
<thead>
<tr>
<th>Step</th>
<th>Screw (quantity)</th>
<th>Color</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>M2.5 × 4 mm, flat-head, nylon-coated (5)</td>
<td>Black</td>
<td>0.293 Nm (3.0 kgf-cm)</td>
</tr>
</tbody>
</table>
When installing:

Attention: As you route the cables, ensure that they are not subject to any tension. Tension could cause the cables to be damaged by the cable guides, or a wire to be broken.

- Ensure that the connectors are attached firmly.

1210 dc-in cable assembly

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69
- “1200 LCD unit” on page 93

Removal steps of the dc-in cable assembly
When installing:
Ensure that the connector of the dc-in cable is attached firmly.

1220 Keyboard bezel assembly

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1020 Micro SIM card” on page 69
- “1030 Base cover assembly” on page 69
- “1040 Memory module” on page 71
- “1050 Internal storage drive” on page 72
- “1060 Wireless-WAN card” on page 76 or “1080 M.2 solid-state drive in the Wireless-WAN-card slot” on page 79
- “1070 Wireless-LAN module or WiGig module” on page 77
- “1090 Keyboard” on page 79
- “1100 Coin-cell battery” on page 81
- “1110 Speaker assembly” on page 82
- “1120 Built-in battery” on page 83
- “1130 Smart-card reader assembly” on page 84
- “1140 I/O bracket and RJ45 bracket” on page 85
- “1150 Thermal fan assembly” on page 86
- “1160 System board” on page 88
- “1170 Power-button card” on page 90
- “1180 Fingerprint-reader card” on page 91
- “1190 NFC module” on page 92
- “1200 LCD unit” on page 93
- “1210 dc-in cable assembly” on page 95
2010 LCD-bezel sheet

*Note:* Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69

**Removal steps of the LCD-bezel sheet**

When installing:
- Install a new LCD bezel sheet whenever the old one is removed.
- Ensure that all the latches are attached firmly.

2020 LCD panel

*Note:* Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69
Removal steps of the LCD-panel

<table>
<thead>
<tr>
<th>Step</th>
<th>Screw (quantity)</th>
<th>Color</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M2 × 2.5 mm, small-head, nylon-coated (4)</td>
<td>Sliver</td>
<td>0.181 Nm (1.85 kgf-cm)</td>
</tr>
</tbody>
</table>

When installing: Ensure that the connector of the LCD cable is attached firmly.

2030 LCD hinge assembly

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69
- “1200 LCD unit” on page 93
Removal step of the LCD hinge assembly

<table>
<thead>
<tr>
<th>Step</th>
<th>Screw (quantity)</th>
<th>Color</th>
<th>Torque</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M2.5 × 2.5 mm, small-head, nylon-coated (4)</td>
<td>Sliver</td>
<td>0.293 Nm</td>
</tr>
</tbody>
</table>

(3.0 kgf-cm)

2040 Camera/microphone module

**Note:** Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69
- “1200 LCD unit” on page 93
- “2010 LCD-bezel sheet” on page 97
- “2020 LCD panel” on page 97
Removal steps of the camera/microphone module

When installing:
Ensure that the connector is attached firmly.

2050 LCD cable, camera/microphone-module, and LED cable

Note: Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69
- “1200 LCD unit” on page 93
- “2010 LCD-bezel sheet” on page 97
- “2020 LCD panel” on page 97
Removal steps of the LCD cable, the camera/microphone-module, and the LED cable

When installing:

**Attention:** As you route the cables, ensure that they are not subject to any tension. Tension could cause the cables to be damaged by the cable guides, or a wire to be broken.

2060 Wireless-LAN/WAN antenna assembly, WiGig antenna assembly, and LCD rear-cover assembly

**Note:** Before you start the servicing, disable the built-in battery. See “Disabling the built-in battery” on page 68.

For access, remove these FRUs in order:
- “1010 Removable battery” on page 68
- “1030 Base cover assembly” on page 69
- “1200 LCD unit” on page 93
- “2010 LCD-bezel sheet” on page 97
- “2020 LCD panel” on page 97
- “2030 LCD hinge assembly” on page 98
Removal steps of the wireless-LAN/WAN antenna assembly, WiGig antenna assembly, and LCD rear-cover assembly

When installing:
Route the cables as shown in the following illustration.

**Attention:** As you route the cables, ensure that they are not subject to any tension. Tension could cause the cables to be damaged by the cable guides, or a wire to be broken.
Antenna locations

1. Wireless-LAN auxiliary antenna (black)
2. Wireless-WAN auxiliary antenna (blue) (available on some models)
3. WiGig module (available on some models)
4. Wireless-WAN main antenna (orange) (available on some models)
5. Wireless-LAN main antenna (grey)
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## Appendix B. Abbreviation table

The following table lists all abbreviations and acronyms used in this manual.

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>3G</td>
<td>third generation of mobile telecommunications technology</td>
</tr>
<tr>
<td>BGA</td>
<td>Ball Grid Array</td>
</tr>
<tr>
<td>BIOS</td>
<td>basic input/output system</td>
</tr>
<tr>
<td>CMOS</td>
<td>complementary metal-oxide semiconductor</td>
</tr>
<tr>
<td>COA</td>
<td>Certificate of Authentication</td>
</tr>
<tr>
<td>CRC</td>
<td>cyclic redundancy check</td>
</tr>
<tr>
<td>CRT</td>
<td>cathode ray tube</td>
</tr>
<tr>
<td>CRU</td>
<td>customer-replaceable unit</td>
</tr>
<tr>
<td>CTO</td>
<td>configure to order</td>
</tr>
<tr>
<td>EAIA</td>
<td>Enhanced Asset Information Area</td>
</tr>
<tr>
<td>ECA</td>
<td>Engineering Change Announcements</td>
</tr>
<tr>
<td>EEPROM</td>
<td>Electrically Erasable Programmable Read-Only Memory</td>
</tr>
<tr>
<td>EFI</td>
<td>Extensible Firmware Interface</td>
</tr>
<tr>
<td>EPO</td>
<td>emergency power-off</td>
</tr>
<tr>
<td>ESD</td>
<td>electrostatic discharge</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FCC</td>
<td>Federal Communications Commission</td>
</tr>
<tr>
<td>FRU</td>
<td>Field Replaceable Unit</td>
</tr>
<tr>
<td>GAV</td>
<td>General Announce Variant</td>
</tr>
<tr>
<td>GPU</td>
<td>graphics processing unit</td>
</tr>
<tr>
<td>HDD</td>
<td>hard disk drive</td>
</tr>
<tr>
<td>HDMI</td>
<td>high-definition multimedia interface</td>
</tr>
<tr>
<td>ICs</td>
<td>integrated circuits</td>
</tr>
<tr>
<td>ICCID</td>
<td>integrate circuit card identity</td>
</tr>
<tr>
<td>ISO</td>
<td>International Standardization Organization</td>
</tr>
<tr>
<td>LAN</td>
<td>local area network</td>
</tr>
<tr>
<td>LCD</td>
<td>liquid crystal display</td>
</tr>
<tr>
<td>MAC</td>
<td>media access control</td>
</tr>
<tr>
<td>MT</td>
<td>machine type</td>
</tr>
<tr>
<td>MTM</td>
<td>machine type and model</td>
</tr>
<tr>
<td>PC</td>
<td>personal computer</td>
</tr>
<tr>
<td>PCH</td>
<td>Platform Controller Hub</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Term</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>POST</td>
<td>power-on self-test</td>
</tr>
<tr>
<td>RAM</td>
<td>random-access memory</td>
</tr>
<tr>
<td>RF</td>
<td>radio frequency</td>
</tr>
<tr>
<td>RFID</td>
<td>radio-frequency identification</td>
</tr>
<tr>
<td>RI</td>
<td>ring indicator</td>
</tr>
<tr>
<td>RJ</td>
<td>registered jack</td>
</tr>
<tr>
<td>SATA</td>
<td>Serial Advanced Technology Attachment</td>
</tr>
<tr>
<td>SIM</td>
<td>subscriber identity module</td>
</tr>
<tr>
<td>SVP</td>
<td>supervisor password</td>
</tr>
<tr>
<td>TFTs</td>
<td>thin-film transistors</td>
</tr>
<tr>
<td>UEFI</td>
<td>Unified Extensible Firmware Interface</td>
</tr>
<tr>
<td>USB</td>
<td>Universal Serial Bus</td>
</tr>
<tr>
<td>UUID</td>
<td>universally unique identifier</td>
</tr>
<tr>
<td>VGA</td>
<td>video graphics array</td>
</tr>
<tr>
<td>VRAM</td>
<td>video random-access memory</td>
</tr>
<tr>
<td>WAN</td>
<td>wide area network</td>
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