Effective: 1 August 2014

Keysight Technologies Ergonomic Information

Working in Comfort

Notice

The information contained in this document is subject to change without notice.

Keysight Technologies, Inc., 1400 Fountaingrove Parkway, Santa Rosa, California 95403 USA

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Introduction

Thank you for selecting Keysight Technologies, Inc. equipment.

To optimize your comfort and productivity, it is important that you set up your work area correctly and use your equipment properly. With that in mind, we have developed some set-up and use recommendations for you to follow based on established ergonomic principles.

Improper and prolonged use of keyboards and input devices are among those tasks that have been associated with repetitive strain injury (RSI) to soft tissues in the hands and arms. If you experience discomfort or pain while using any computing equipment, discontinue use immediately and consult your physician as soon as possible. For more information on RSI, you may wish to consult the *About Repetitive Strain Injury* section.

Please study the recommendations offered here and consult the *Information Sources* listed in this guide. Included there are references to relevant parts of international standards, regulations and guidelines, such as ISO 9241 and the European Community Display Screen Equipment directive. You may also wish to consult your employer's human resources department or other relevant departments for guidance specific to your company. For a quick summary of the recommendations, refer to the *Comfort and Safety Checklist*.

Note that the recommendations and quoted dimensions in this guide are designed to accommodate a broad range of people. If you fall outside this range you may need to adapt the recommendations accordingly. For example, if you are very tall, your work surface may need to be higher than indicated in this guide.

Thank you, again, for choosing Keysight equipment.

About Repetitive Strain Injury

Because your comfort and safety are our primary concern, we strongly recommend that you use Keysight equipment in accordance with established ergonomic principles and recommendations. Scientific literature suggests that there may be a relationship between injury to soft tissues - especially in the hands and arms-and prolonged improper use of keyboards or other equipment requiring repeated motions of the hands and forearms. This literature also suggests that there are many other risk factors that may increase the chance of such injury, commonly called Repetitive Strain Injury.

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What is RSI?

Repetitive Strain Injury (RSI-also known as cumulative trauma disorder or repetitive motion injury) is a type of injury where soft tissues in the body, such as muscles, nerves, or tendons, become irritated or inflamed. RSI has been a reported problem for those who perform repetitive tasks such as assembly line work, meatpacking, sewing, playing musical instruments, and computer work. RSI also has been observed in those who frequently engage in activities such as carpentry, knitting, housework, gardening, tennis, windsurfing, and lifting children.

What causes RSI?

The specific causes of RSI have not been established. Nevertheless, the incidence of RSI has been associated with a variety of risk factors, including:

- Too many uninterrupted repetitions of an activity or motion.
- Performing an activity in an awkward or unnatural posture.
- Maintaining static posture for prolonged periods.
- Failing to take frequent short breaks.
- Other environmental and psychosocial factors.

In addition, there have been reports associating the occurrence of RSI with the use of computer keyboards, mice, and other input devices. Also, certain medical conditions, such as rheumatoid arthritis, obesity and diabetes, may predispose some people to this type of injury.

What can I do to avoid RSI?

Some people who use computers may experience physical discomfort during their use. This discomfort may be a symptom of a repetitive strain injury. Properly setting up and using computing equipment can help to minimize your chances of experiencing this discomfort. Well designed and properly adjusted equipment alone may not be sufficient to eliminate all potential problems Maintaining good posture and positioning when working on computing equipment also has a significant bearing on your comfort.

What if I experience discomfort?

If you are experiencing any discomfort, seek professional medical advice immediately. Typically, the earlier a problem is diagnosed and treated, the easier it is to resolve.

Preparing Your Work Environment

When using computing equipment, it's important that your work environment contribute to your comfort and productivity. To help you achieve the proper environment, we have developed recommendations for optimizing your workspace, seating, work surface and lighting arrangements. You, or both you and your employer, can best determine your specific needs.

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Window
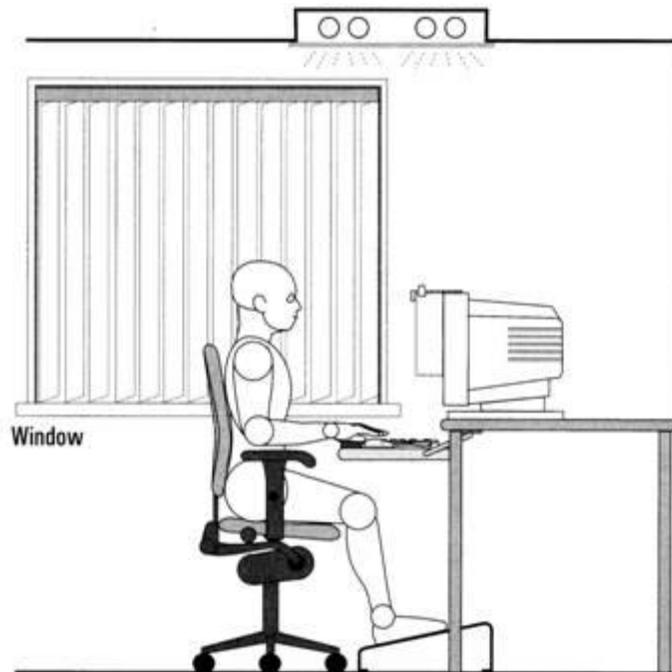
Your Workspace

Sufficient workspace should be available to allow you to set up your equipment in a convenient, comfortable arrangement.

The work environment should be as quiet and free of distraction as possible.

Preparing Your Work Environment

- For better eye comfort, you should avoid reflective coverings on the ceiling, walls and floor as well as excessive contrast between the screen and its surroundings.
- As with any indoor environment, your workspace should be well ventilated. If possible, adjust the temperature to whatever is comfortable for you. If you can't adjust the temperature, wear appropriate clothing. Try to avoid working close to air-conditioning or heater vents.
- To prevent muscle stiffness, you must have enough space to move around and vary your position. Try not to remain in one position for extended periods of time.

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Your Chair

It's very important that your chair provides a comfortable sitting position and offers the following features:

- **A stable base, such as five legs with casters.** Make sure the casters are designed for the type of floor you have in your workspace, whether it is bare or carpeted

- **A height-and-tilt-adjustment feature.** It should be easy to adjust your chair height from 40 cm to 52 cm. (15.5 inches to 20.5 inches) as measured from the top of the seat pan to the floor. If you are much taller or shorter than average, you may need a chair that can be adjusted beyond this range. Adjust your chair so that the work surface or keyboard tray is at elbow height and your feet are flat on the floor with your knees slightly bent below your hips. Ideally, the seat pan should be able to tilt both forward (minimum of 5 degrees) and backward (minimum of 10 degrees). If the chair has an adjustable seat pan, inclining the seat slightly forward will transfer some of the pressure from the spine to the thighs and feet. This will relieve pressure on your back.

- **A curved seat edge.** The front of the seat should be curved and finished in a "waterfall" edge.

- **An adjustable back support** in both height and forward and backward tilt. It is important that the backrest correctly supports the lower part, or lumbar curve, of the back.

- **A freely rotating swivel** so you can move easily from side-to-side.

- **Fully adjustable and padded armrests.** The chair arms should not interfere with adjusting the chair or moving it close to your work surface.

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Your Work Surface

Ideally, you should be able to adjust the height of your work surface.

A simple way to ensure your work surface is at the correct height is to first adjust the height of the seat-pan of your chair. With your chair properly adjusted and your feet firmly on the floor, adjust the work surface height until your forearms are parallel to the floor when you have your fingers on the keyboard or other input device.

If possible, choose a work surface with cable management capabilities. This will keep your cables and wires orderly, off the floor and out of your way.

It's also best to choose a non-reflective work surface to minimize eye discomfort from reflections and glare.

Lighting

Proper lighting can help you avoid eye discomfort. Lighting in your area should allow easy reading of documents and keyboard legends. If more light is needed for a particular task, use individual task lighting rather than increasing the general lighting.

Incoming light should be shielded or diffused to prevent glare and reflection. In cases where strong sunlight is a problem, curtains, adjustable shades, antiglare filters or monitor hoods are possible solutions.

Work Environment Specifications

- For better eye comfort in your work environment, you should avoid reflective surface coverings. The ceiling, walls, and floors should have a medium level of reflectance (approximately 75 percent, 40 percent, and 30 percent, respectively). Try to avoid excessive contrast between the screen and its surroundings.
- The work environment should be as quiet and free of distraction as possible, with background noise below 55 dBA.
- Where possible, relative air humidity should be in the range of 40 to 60 percent.
- The recommendation for room temperature is 19 to 23 degrees C (66 to 73 degrees F). The workplace should be well ventilated, as with any indoor environment.
- Recommended work surface space is 160 cm. wide by 80 to 90 cm deep (63 inches by 32 to 36 inches deep), or a corner unit of 91 to 107 cm deep (36 to 42 inches). The recommended vertical adjustment range is 66 to 77 cm. (26 to 30 inches). If the height is fixed, it should be between 72 and 75 cm. (28.5 to 29.5 inches).
- There should be at least 6 cm (2 inches) between your thighs and the work surface. If the surface has a kneehole, it should be at least 58 cm (23 inches) wide, 65 cm (25.5 inches) high, and 60 cm. (24 inches) deep.
- Recommended lighting levels are between 300 and 500 lux (30 to 50 footcandles). Values over 1000 lux (100 foot-candles) are considered to be too bright. For work on the screen, 300 lux (30 foot-candles) is enough for most work. When documents are to be read, 500 lux (50 foot candles) is recommended.

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Your Work Posture

Sitting in one position for long periods can be uncomfortable. To minimize the potential for physical discomfort or injury, it's important that you maintain proper posture.

- **Back** - While sitting at your work surface, make sure your back is supported by the chair's backrest in an erect position or angled slightly backwards.
- **Arms** - Your arms should be relaxed and loose, elbows close to your sides, with forearms and hands approximately parallel to the floor.
- **Wrist**s -Your wrists should be as straight as possible while using the keyboard, mouse or trackball. They should not be bent sideways, or more than 10 degrees up or down.
- **Legs** - Your thighs should be horizontal or angled slightly downward. Your lower legs should be near a right angle to your thighs. Your feet should rest flat on the floor. If necessary, use a footrest, but double check that you have your seat height adjusted correctly before getting a footrest.
- **Head** -Your head should be upright or tilted slightly forward. Avoid working with your head or trunk twisted.
- **Overall** -Change your position frequently and take regular breaks to avoid fatigue.

Setting Up Your Equipment

Make sure that all the elements of your system-monitor, document holder, keyboard, mice and other input devices, and headphones and speakers-are optimally arranged and adjusted to meet your personal requirements. The recommendations that follow will help you achieve this.

Note that these recommendations apply only to the use of desktop computers or notebook computers that are used with a full-size keyboard, monitor and mouse. Information for setting up and using your notebook computer in a mobile environment is available in the *Your Notebook Computer* section of this guide.

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Your Monitor
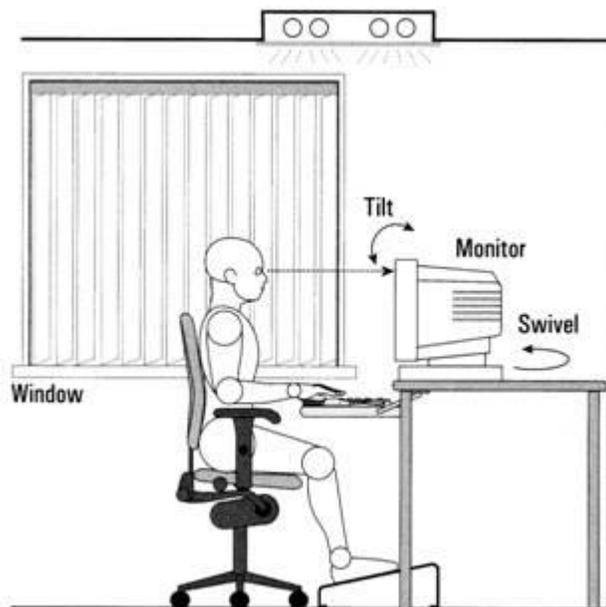
It is important that your monitor screen be clean and positioned correctly to improve readability and help you work comfortably. Glare, high contrast, reflections, dirt and dust will interfere with what you see on the screen. The recommendations that follow can help you achieve a comfortable arrangement.

- The top of your monitor screen should be at or slightly below eye level. Most monitors come with a tilt-and-swivel feature that makes it easy to adjust the screen position. If your monitor doesn't have this feature, consider acquiring an accessory that provides this capability.
- To avoid obscuring your view, the screen should be positioned perpendicular to your line of sight; that is, straight on.
- To avoid glare or reflection, try to position the monitor so the screen is at a right angle to your window rather than in front of it. If reflection or glare persists, tilting the screen forward may help. If this adjustment is not sufficient, it may be necessary to change either the position of the monitor on your work surface, or the location of your work surface. If reflection or glare is still a problem, find out where it is coming from. Common sources of glare are overhead lights, windows, or reflections from shiny surfaces including pictures or even bright clothing. See if there is a way to control the source of the problem (see Lighting). If that doesn't work, try a high quality anti-glare filter or a screen hood.
- Maintain a comfortable viewing distance to the screen. Most people prefer a viewing distance of approximately 46 to 76 cm (18 to 30 inches), depending on monitor size. Character size and the amount of space available on the work surface can affect this distance.
- Text should be easy to read. To help ease eyestrain, adjust text attributes such as character size, spacing, and color. In addition, you will need to use the controls provided with your monitor to adjust the visual settings so that contrast and brightness levels are comfortable for you. High contrast and low brightness is usually the preferable combination. Note: The ISO 9241 and ANSI/HFS 100-1998 standards give technical recommendations on how to achieve good readability.
- The monitor should be free from flicker. If the image on your screen is not stable, the monitor may require repair or adjustment.
- When possible, use a program that has a simple user interface, such as easily identifiable icons and pull-down menus. Also, screen information should be displayed in a structured and well-organized way.
- When viewing your monitor, your head should not be tilted more than 15 degrees forward.
- Optimum readability for monitor use is generally considered to be 21 minutes of arc. This corresponds to a character size of 3.7 mm (0. 15 inches) at a viewing distance of 60 cm (24 inches).

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- You should not have to look up more than 5 degrees above horizontal or down more than 30 degrees below horizontal for normal work tasks, such as typing or reading.

Document Holders

When keying in data from a hard-copy document, placing it in a document holder rather than on a flat surface will make it easier to read. The following recommendations should be observed when using a document holder:

- The document holder should be at approximately the same height and distance from your eyes as the screen, and as close to the monitor as possible to prevent neck twisting. Some users prefer a document holder mounted to the monitor while others prefer the document holder positioned between the screen and keyboard.
- If the primary task is to view documents rather than using the monitor, the document holder may be placed directly in front of the keyboard with the monitor slightly to the side.
- To help reduce stress on your neck and prevent eye fatigue, try to minimize the movement of your head and eyes while using a document holder.

Your Keyboard
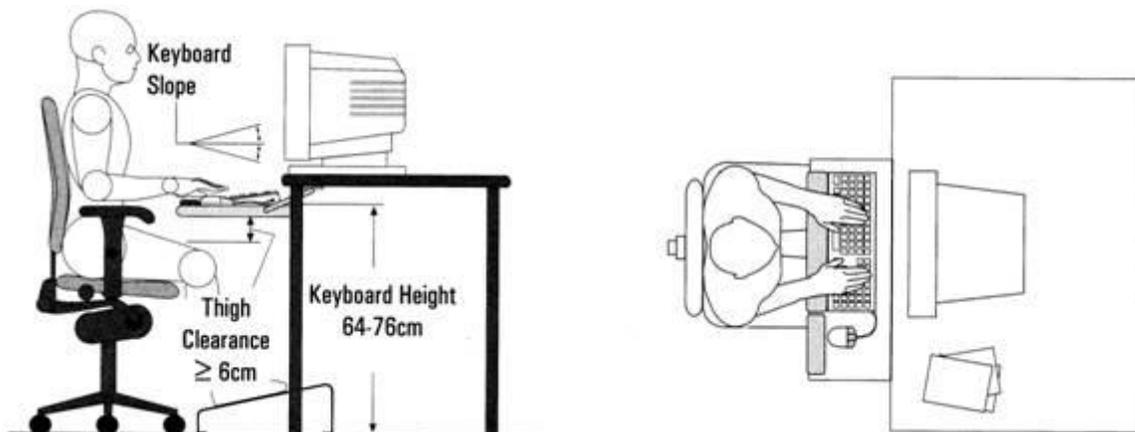
The proper positioning and use of your keyboard is important when using computing equipment. Be sure to observe the following recommendations to optimize your comfort and safety:

- We recommend you place your keyboard in front of the screen or document holder, whichever is viewed the most. Your keyboard has long cables so you can place it in the position that is most comfortable for you while you are using your system.
- Because keyboards vary in depth, you'll want to be sure that your work surface or keyboard tray has sufficient room to accommodate your model. The keyboard tray should be wide enough to hold both the keyboard and mouse or trackball: 66 to 71 cm (26 to 28 inches).
- Your keyboard may have a kickstand that can be opened or closed to raise or lower the keyboard angle. If you are in the correct sitting position with your elbows at about the same level as the work surface, you may not need to use it. However, if your elbows are below the work surface, you may wish to use the kickstand to raise the back of the keyboard.
- An adjustable keyboard tray may be useful if you cannot adjust your chair or work surface to the proper height for typing. It should adjust in height from 64 to 76 cm (25 to 30 inches) above the floor and tilt forward and backward to help you find the most comfortable position. Note that research has shown that there may be less muscle tension in shoulders and forearms with the keyboard tilted away from you.

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- When using your keyboard, remember it takes very little pressure or force from your fingers to activate the keys. Improper typing style-the use of too much force-can place unnecessary stress on the tendons and muscles in your hands, wrists, and forearms.
- Make sure that your hands are in a neutral position when you use your keyboard. This means that your forearms, wrists, and hands should be in a straight line.
- The keyboard has a low profile to help prevent excessive bending of your wrists while typing. Literature suggests that you should not bend your wrists sideways or more than 10 degrees up or down. Keep your wrists straight by moving your entire hand and forearm over to use the function keys or numeric keypad.

You may use a palm rest to help keep your hands and wrists in a comfortable and neutral position when you are not typing. Some keyboards come with an integrated palm rest. If you use a palm rest, see that it is rounded and padded, and flush in height with the front edge of the keyboard. Note that your palms-not your wrists should rest on the palm rest. If you don't have a palm rest, try not to rest your wrists on a sharp edge, such as a work surface edge.

Mice and Other Input Devices
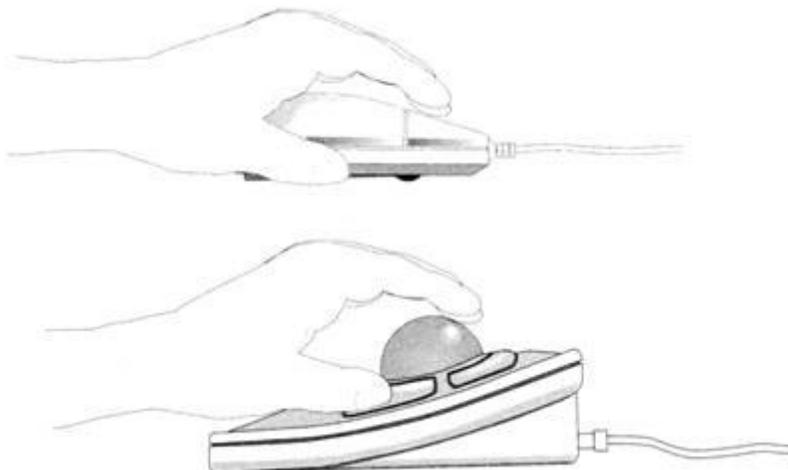
Various aspects of using mice and other input devices may increase your risk of discomfort or injury. Observing the following recommendations may reduce that risk.

As with the keyboard, try to keep your hand, wrist and forearm in a neutral position while using your mouse or other input device.

When using a stylus or light pen with a graphics tablet, don't grip the stylus tightly. Keep your hand and fingers relaxed and try to maintain a neutral posture in your hand, wrist and forearm.

If you use your thumb to rotate the ball on a trackball or spaceball, keep it in a relaxed, natural shape, and maintain a neutral posture in your hand, wrist and forearm.

Hold the mouse gently by draping your fingers over it. Keep your hand relaxed and fingers loose. Do not grip the mouse tightly.

It takes very little pressure or force from your fingers to activate the buttons or scroll wheel on your mouse, scrolling mouse, trackball or other input device. Using too much force can place unnecessary stress on the tendons and muscles in your hands, wrists and forearms.

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If you are using a scrolling mouse, be sure to keep your fingers and hand in a relaxed, neutral position when activating the scroll wheel. Also, this type of mouse features software that can minimize the number of mouse movements or button clicks.

When using a mouse, trackball, stylus and graphics tablet, or other input device, position it as close to the keyboard as possible, and keep it at the same level so you do not have to stretch while using it.

Use a good quality mouse pad to enable the mouse to work most effectively and reduce unnecessary hand and wrist movements.

Be sure to keep your mouse and trackball clean. Regular removal of accumulated dust and dirt helps ensure proper tracking and reduces unnecessary hand and wrist motions.

Headphones and Speakers

Listening to loud sounds for prolonged periods may permanently damage your hearing. To avoid discomfort from unexpected noise, always turn down the volume before connecting headphones or speakers to your equipment. When you put on the headphones, slowly increase the volume until you find a comfortable listening level, then leave the volume control in that position.

Your Notebook Computer
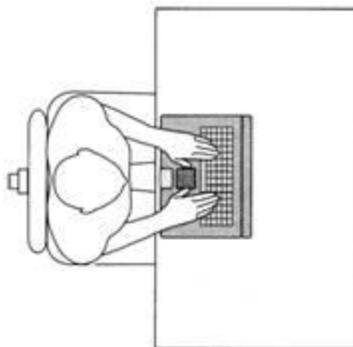
You can use your notebook computer virtually anywhere, anytime. The following recommendations should help you work more comfortably.

Note that if you are using your portable computer as your primary computer, or using it for extended periods, you should use it with a full size keyboard, monitor and mouse. This will give your portable computer the adjustability and comfort features of a desktop unit. Docking accessories offer quick, easy connections to these devices. More information on how to prepare your workspace environment and set up your equipment is available in other sections of *Working in Comfort*.

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Preparing Your Mobile Work Environment
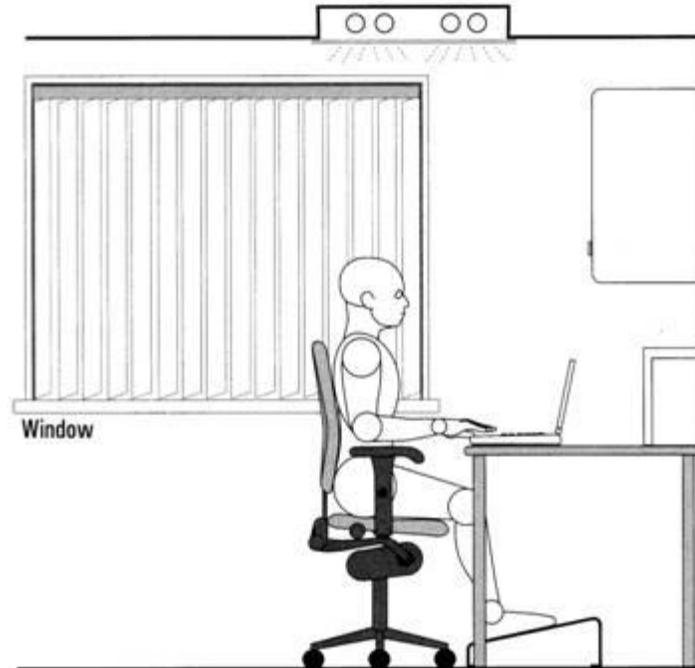
Use a chair that provides good support for your lower back. If an adjustable chair is not available, you can use a pillow or rolled-up towel to provide lower back support.

Try to keep your thighs parallel to the floor and your feet flat on the floor. In a mobile environment, you can do this by using a phone book or briefcase to support your feet.

Adjust the height of either your work surface or chair to keep your arms in a neutral position. Your arms should be relaxed and loose, elbows at your sides, with the forearms and hands parallel with the floor.

Position your notebook computer display to minimize glare and reflection. For example, on an airplane lower the window shade, or in a hotel room draw the curtains. You also should maintain a comfortable viewing distance-approximately 40 to 60 cm (16 to 24 inches). Adjust the angle of your display to help keep your head angled slightly downward in a comfortable position.

Position the computer so your wrists and hands are in a neutral position. Your wrists should be as straight as possible and should not have to bend sideways or more than 10 degrees up or down. If your notebook computer does not have a built-in palm rest, you can use a rolled-up towel.

Try to type as lightly as possible. The notebook keyboard requires little force to activate.
Take frequent, short rest breaks - this is especially important in a mobile computing environment.

Portable computers weigh between approximately 1.4 and 3.7 kilos (3 and 8 pounds). When traveling, be sure to carry your computer properly to minimize strain on your body. Shift the bag containing your notebook equipment frequently between your left and right hands and shoulders.

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Comfort and Safety Checklist

These recommendations are drawn from the latest available international ergonomics standards and recommendations, including ISO 9241 and ANSI/HFS 100-1998.
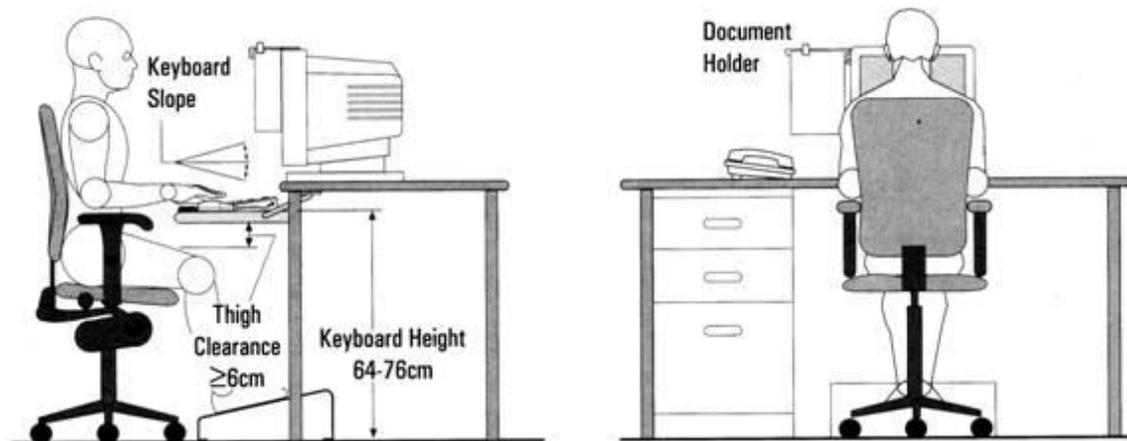
General

Work Surface Height -Adjust either your seat height, work surface or both, to position the work surface at approximately elbow height.

Work Surface Arrangement -Make sure frequently used equipment is within easy reach. For example, if you are primarily using the keyboard, place it directly in front of you, not to the side. If you are primarily using the mouse, place it in front of your hand or arm. If you are using both a mouse and keyboard, place them both at the same work surface height and close together. If a palm rest is used, the height should be flush with the front edge of the keyboard. Other items, such as your telephone or notepad, also should be considered.

Monitor -Place your monitor so that the top of the screen is at, or slightly below, eye level (up to 15 degrees).

Head -Do not tilt your head forward by more than 15 degrees, and try not to turn your head toward the side.

Back -While sitting at your work surface, make sure your back is supported by the chair's backrest in an erect position or angled slightly backwards.

Arms -Make sure your arms and elbows are relaxed and loose, with your upper arm perpendicular to the floor or slightly forward. Keep your forearms and hands approximately parallel with the floor with elbows bent between 70 and 115 degrees. Keep your elbows close to your sides (less than 20 degrees away from your body).

Legs - Your thighs should be horizontal or angled slightly downward. Your lower legs should be near a right angle to your thighs. Make sure there is sufficient room under the work surface for your legs.

Feet -If after adjusting your chair you cannot rest your feet comfortably on the floor, use a footrest, preferably one that can be adjusted in height and angle.

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Overall

Look away from the screen from time-to-time to help reduce eyestrain Focus on distant objects briefly, and blink periodically to lubricate your eyes. You also should have your eyes checked on a regular basis and ensure your eyeglass prescription is suitable for working on a monitor screen.

Remember to occasionally shift position and move your body. Keeping your body in one position for long periods is unnatural and stressful. When prolonged work is required, take frequent short breaks. As a rule of thumb, a five or ten minute break every hour is a good idea. Short frequent breaks are more beneficial than longer less frequent breaks. Data show that people who work for long periods of time without a break may be more prone to injury.

Changing tasks frequently will help prevent muscle stiffness. Examples: alternating between keyboarding, reading, writing, filing, and moving around in your work environment, helps you maintain a relaxed posture. Occasionally stretch the muscles in your hands, arms, shoulders, neck and back. You should stretch at least as often as you take brief task breaks-at least once every hour.

Discomfort may be alleviated by using alternative ergonomic designs and accessories such as ergonomically personalized chairs, palm rests, keyboard trays, alternative input devices, prescription eyeglasses, anti- glare screens, and more. Seek additional information from the sources available to you, including your employer, doctor, local office supply store, and the Information Sources provided in this guide.

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Information Sources

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