



Loss Control TIPS

Technical Information Paper Series

Innovative Safety and Health SolutionsSM

Portable Computers and Ergonomics

Introduction

The use of portable computers continues to increase as the technology improves and as a mobile workforce gains value from the practical application of computer technology. A great deal of attention has been paid to health and safety issues related to Visual Display Terminals (VDTs), with the focus primarily directed toward conventional desk top models as used in typical office settings. Portable computers, which are designed for quite different use "out in the field" pose some interesting challenges from an ergonomic perspective. This article addresses some of these issues and provides practical guidelines for safe use of portable computers.

In a general sense, ergonomic evaluation of a portable computing situation varies little from any other VDT or other ergonomic evaluation. In this case, as in others, loss control equals operations control, which requires consideration of three production factors: equipment, material, and people. The focus of this article is on equipment selection, equipment arrangement, equipment use, and training of people.

Selecting Equipment

The effectiveness of any tool or piece of equipment is in part dependent upon design factors. Therefore, selection of portable computing equipment plays a key role from both ergonomic and production standpoints. Prior to selection of any hardware, clearly define the way the portable computer will be used. Then, match the design features to the anticipated use. A list of design features is presented in the accompanying table. Consider these significant design features when selecting a portable computer.

From an ergonomic perspective, each design feature offers its own set of advantages and disadvantages. Consider the trade-offs carefully, weighing the pros and cons relative to the intended use. For example, the small size of a portable computer may be an advantage when work surface space is limited. However, the small size of a portable computer screen may be a disadvantage relative to long term visual concentration. A trial period is probably the best way to evaluate the features of any piece of equipment and to determine true usability of the equipment.

There is a perception that portable keyboards are smaller than standard desktop keyboards. Certainly, the overall size of the keyboard is smaller when the numeric keypad has been eliminated. In fact, elimination of the numeric keypad is an advantage to right handed mouse users because it brings the mouse into better position. However, actual key size and spacing may or may not differ from that of a standard keyboard. Some portable keyboards maintain standard key size and spacing. These keyboards will effect little or no change on keystroke.



The design and function of the carrying case are particularly important for portable computers, especially pentops, which are designed to be held while in use. Handles and straps on carrying cases should be accessible, reliable, and comfortable.

Arranging Equipment

Equipment arrangement is a function of equipment design, workspace configuration, and user preference. Basic principles of body mechanics guide equipment arrangement. The same principles of body mechanics apply to desktop and portable computer use. The optimal positions of body and equipment for all VDT users is described in the accompanying table.

The design differences between portable and standard desktop computers present some interesting opportunities and challenges in terms of equipment arrangement. Portable computers are "portable" and therefore easily moved. They also take up less work surface space. On the other hand, independent screen height and angle adjustment may be limited or impossible. Built-in trackballs or joysticks allow no flexibility for position adjustment. LCD monitor screens are more difficult to read and may require more frequent contrast and light level adjustment.

Many limitations may be of little ergonomic significance if the computer is used on a truly intermittent basis. However, these factors must be considered and adjustments in equipment arrangement may require compromise based on priority of needs and design features.

Equipment Use and the Work Environment

The way work is organized and the way the equipment is used can affect the health of computer users. This is true in the portable computing environment as well as other work environments. Automation may introduce changes in the pace of work and the variety and nature of tasks. These issues may be exacerbated in the environment of portable computing because, by nature of its portability, the device is always with, or available to the user. In addition, it may be more difficult to monitor these issues through remote supervision. The following guidelines address these issues:

- Provide clear job description and performance specifications.
- Consider the nature of the tasks and work flow. Implement actions to minimize monotony.
- Establish clear lines of reporting.
- Establish clear deadlines and schedule work to avoid recurrent deadline stress.
- Anticipate peak workloads.
- Discuss and agree upon workloads with staff.
- Provide ergonomic awareness training to facilitate user responsibility for comfort and health.
- Establish an ergonomics program that includes monitoring and follow-up.

Portable computers are designed for "portable use." This generally means intermittent rather than extended use in a non-traditional environment ("on the road"). Some portable equipment is not appropriate for extended desk top use. If extended desk top use is intended, it may be necessary to provide alternative desk top equipment, e.g., standard monitors and keyboards. In the case of pentop computers, mouse compatibility and availability is necessary for desk top use.

Training People

Effective integration of new technologies depends on how comfortable users are with the changes that come about as new technologies are introduced. Successful use of new technology depends upon our ability to work with it comfortably. In order to facilitate this process and to maximize proper use of portable computer equipment, users must be knowledgeable in several areas:

- familiarity with the equipment itself, including design features and components
- general understanding of the principles of body mechanics
- general understanding of ergonomic principles and the application of these principles to the work and workstations
- familiarity with appropriate channels of communication, particularly with respect to seeking assistance with equipment and ergonomic issues when necessary.

Summary

The proliferation of portable computers is further evidence of ongoing technological advances. Ergonomic related question/concerns are evident. In fact, some users have reported physical discomforts which seem to be related solely to use of these portable computers. Observation has revealed various risk factors including static postures, awkward postures and limited keyboard/mouse work space. Preliminary findings have indicated that equipment design, workstation configuration, workstation space factors, and the way the equipment is used combine to create these risk factors.

The use of portable computers must be evaluated from an ergonomic perspective. Ongoing ergonomic evaluation should address these key elements: equipment design and function, field use, desk top use, and carrying case design.

For more information, contact your local Hartford agent or your Hartford Loss Control Consultant. Visit The Hartford's Loss Control web site at <http://www.thehartford.com/corporate/losscontrol/>

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Design Features of Portable Computers

- 1) Weight
- 2) Overall size (including profile)
- 3) Screen size
- 4) Screen resolution (including back lighting, color)
- 5) Screen adjustment controls: location, function
- 6) Keyboard:
 - construction
 - sensibility (touch)
 - key layout
 - joystick or alternative
- 7) Other input device: (mouse, pen, joystick, trackball, touchpad)
 - size (diameter, length)
 - accessibility
 - sensibility (touch)
 - port (stability)
 - battery requirement
- 8) Battery:
 - size/weight
 - accessibility (for replacement)
- 9) Compatibility for left or right handed users
- 10) Mouse/trackball compatibility
- 11) Carrying case:
 - size
 - equipment accessibility
 - straps
- 12) Cable connections:
 - ease of use
 - accessibility
 - non-interference with position
- 13) Ease of desktop connection
- 14) Usability:
 - overall comfort
 - static holding
 - posture
- 15) Screen sensibility ("feel," pen control)
- 16) Stand (for desktop use):
 - available
 - stability
 - allows height adjustment
 - allows angle adjustment

Optimal Position of Body While Seated at VDT

- a. Ears, shoulders, and hips in vertical alignment.
- b. Arch in back supported by chair or pillow.
- c. Feet flat on floor or stool.
- d. Thighs supported evenly (on chair).
- e. Shoulders in neutral position (i.e., not elevated).
- f. Upper arms near sides of body.
- g. Forearms approximately parallel to floor.
- h. Wrist in neutral position (knuckles slightly higher than wrist).

Optimal Position of VDT Equipment

- a. Top line of screen slightly below eye level or lower.
- b. Monitor screen at approximately 20 to 26 inches from user's eyes.
- c. Keyboard and monitor positioned in alignment in front of user (unless monitor is looked at only intermittently).
- d. Keyboard (height) positioned such that home row (ASDF) is at approximately elbow level.
- e. Mouse (height) positioned at elbow level and as central as possible.
- f. Document holder located near monitor at same height and distance from user as screen.
- g. Work surface at height to allow appropriate arm/wrist/hand position, while also allowing adequate leg space.
- h. Chair seat and back rest height and angle adjusted to allow comfortable posture.
- i. Shelf height and location within comfortable reach.
- j. All frequently used equipment, manuals, etc. within comfortable reach.