
Ergonomic Recommendations for Work at a VDT Workstation

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“The FP Series primary objective is to develop superior quality, aesthetically pleasing products that revolutionize the modern workplace through improvement of the human-computer interface.”

Computer Workstation Use

There are a number of complaints inherent in the use of Visual Display Terminals (VDTs), including;

- constrained postures,
- eye strain,
- musculoskeletal discomfort and injury,
- and psychological problems.

EN ISO 9241-5 (1999) Ergonomic Requirements for Office Work with Visual Display Terminals gives the fundamental requirement, that a neutral working posture be maintained at all times. The best solution for VDT users is a seated, neutral, relaxed posture at an adjustable workstation. This reduces muscular tension and static loading, minimizes stresses on joints and fatigue, and enables workstations to be changed according to personal preference and requirements.

Regulations surrounding standardization and development of an optimal VDT workstation are primarily concerned with anthropometry, biomechanics and visual ergonomics, and address;

- Heights of workstation elements
- Distances – focal and reach
- Adjustability of equipment
- Illumination (monitor and ambient)
- Sedentary nature/Postural fixity

In order to maintain the desired neutral working posture;

- The seat and desk at a workstation should be adjusted so that the desk surface is at, or slightly below, operators' seated elbow height. This ensures a relaxed neutral posture of the arms and shoulders when using input devices.
- Operators feet need to be flat on the floor surface with a 90-degree bend in the knee, a footrest should be provided if necessary.

Monitor Placement:

Correct positioning of the display at the workstation is essential as it can eliminate or reduce problems such as eyestrain, headaches, and musculoskeletal disorders. The task and individual operator characteristics determine the placement of the display screen. Adjustable mounting of the screen enables an operator to select his or her viewing position. To maintain a comfortable and neutral body posture of the head, neck and shoulders, the screen must be viewed in the optimal viewing position, where:

- The line of sight in a relaxed seated or standing position is inclined 35 degrees below the horizontal. The optimum position for the primary visual display is within +/- 15 degrees in the vertical and horizontal directions from the line of sight.
- The display monitor should be positioned directly in front of the user perpendicular to the line of sight as this eliminates repetitive turning of the head and torso to the side.



Relaxed line of sight in seated position

An operator should be able to angle, tilt or swivel the visual display so that:

- a relaxed working posture can be maintained regardless of the individual's eye height or work station type (seated or standing);
- accommodative effort is minimized;
- reflections and glare are minimized.

Height adjustment is also preferable. Any adjustability of the display should be by means of purpose specific furniture or devices at the workstation, and not dependant on the operator propping up or moving the unit with books or manuscripts. Mechanisms for adjustment should be intelligible, unambiguous and easy to use.

Viewing Distances:

The optimum distance of the display from the operator is dependant on the type of work performed and individual characteristics. The European acceptable limits are 450-750mm.

Table 2: Standards and Guidelines indicating recommended monitor viewing distances at VDT workstations.

Item	EN ISO 9241-5	US MIL STD 1472-C	DIN 66234
Display viewing distance	600mm +/- 150mm	400mm for continuous viewing. 250mm minimum viewing distance for intermittently viewed displays	450-600mm, 500mm if frequent refixations between keyboard or source documents and display

Mounting the monitor on an adjustable arm, or stand, increases the adaptability of the workstation to both different users and different work tasks.

Task:



While VDT monitors are predominantly found at seated workstations, in some instances the task will be more suited to a standing posture. Tasks that require a workstation to be used from a standing position need to allow for the same relaxed posture of the head, neck and shoulders that is desirable in a seated one.

An important aspect of monitor location is the task being performed at the workstation and the individual skill level and work style of the operator. Tasks requiring referral to a source document should be set up according to an employee's skill level. The object on which the operator spends most time focused should be placed in the optimum viewing position, as above. Document holders should be adjustable in tilt, and both vertical and horizontal positioning, to allow workstations to be set

up for different users.

Standing 95th percentile male

At a workstation set-up for a touch-typist the document holder should be in line with the user, between the keyboard and screen. The primary focus point the source document, and the secondary focus point the display, should be equidistant from the users' eye to avoid frequent changes in focal distance, which is fatiguing and can cause eyestrain.

Ideally, a 'viewing arc' should be created where workstation components; keyboard, screen and document holder form an arc in front of the operator. This is particularly beneficial for less skilled 'hunt and peck' style typists who must focus on the keyboard.

Tilting the display screen

The need for a height adjustable screen surface can be critical depending on the individual, job function, and number of people using the same workstation.

When a display is viewed from angles greater than 15 to 20 degrees above, below or from the sides, an operator views it at an angle, which can cause fuzziness or distortion. This can be nearly undetectable, and as such the operator may not be conscious of the reason for experienced eyestrain. The same discomfort can result from reading a terminal screen at an angle. For the clearest interpretation of data the most effective viewing angle is perpendicular to the screen center. To rectify this problem it is recommended that there be built in tilt adjustments on screen mountings, which is increasingly significant if the mounting does not allow for height adjustment. Adding these fixtures to a VDT workstation ensures they can be adjusted to suit almost all operators.

Keyboard Placement

A reach envelope is the three-dimensional space within which an individual works, generally the space in which the hands are used. The individual operator characteristics, nature of the activity performed, equipment used, seated or standing workstation design and physical limitations of the workstation, influence functional workspace envelopes. Keyboarding recommendations:

- The home row should not be higher than 30mm above the support surface.
- Placement of a soft wrist rest in front of the keyboard to support the forearm and help keep the wrist straight.
- Split keyboards can reduce muscular activity in the arm and shoulder area for touch typists.
- Keyboards should be angled 25 degrees upward from front to back for unskilled 'hunt and peck' typists, and in the opposite direction for skilled touch typists. A back to front sloped keyboard is best suited to touch typists, as the position promotes a relaxed wrist. 'Hunt and peck' typists typically focus on the keyboard, and a back to front sloped keyboard is easier to look without inclining the torso forward.
- Positioning of the keyboard should promote a flexed arm and be level with elbow height.
- A keyboard tray lowers its height allowing operators to keep the arms in a lower position at the side of the body as they work, minimizing stress and fatigue in the arms and shoulders.

Mouse use:

Location of the mouse is dependant on how often it is used. In frequent use situations the best position for the mouse is as close to the keyboard as possible. Where a keyboard tray is used it is best for the mouse to be incorporated on the tray. At all times over-reaching for the mouse, and extension of the forearm and shoulder, should be avoided. The use of wrist rests can be beneficial in high-use mouse tasks.

Touch Screens

The SEMI S8 standard specifies that touch screen active pads be between 762mm (lowest pad) and 1067mm (highest pad) above the floor for seated workstations. The heights are 915mm and 1372mm respectively for standing workstations. The screen should always be perpendicular to the line of sight of the user.

Table 4: Recommendations for height adjustable touch screen mounting for a British Population.

Workstation Design	Adjustable Height Range (mm)
Seated	150-350 (above work surface)
Standing	1050-1400 (above floor)

Provision of adjustable height, tilt and angle mountings allows the workstation to be set up for different users

Reasons for Good Ergonomics

The ability of employees to do their jobs is influenced by workspace attributes and job content. FP Series endeavors to create improved workstation layouts and ensure that knowledge of human characteristics resolves the problems of people at work. While deviation from optimal design of work equipment and environments is tolerable, there is a limit to the amount of adaptation to unsuitable conditions an employee can reasonably be asked to make. Beyond this point there is a cost, which can be defined in terms of efficiency, discomfort, frustration and dissatisfaction, work stress, attrition, and increased potential for accidents and personal injury. There are a number of musculoskeletal disorders including include tendonitis, tenosynovitis, carpal tunnel syndrome and eyestrain, that can be attributed to poor or constrained postures, repetitive movements or bad workstation or job design.

FP Series examines the interactions between technology, work environment, and the employee, to solve and avoid workplace problems. Anatomy, biomechanics, physiology and psychology are applied toward two main objectives: the most productive use of human capabilities, and the maintenance of health and well-being.

Improved work place ergonomics has commercial and individual benefits. FP Series designs workplaces, and uses ergonomic products and equipment, to align human capabilities and job demands. Often, simple modifications to work methods, equipment or layout, can yield surprisingly large dividends to both management and employees through:

- prevention of occupational ill-health and injury,
- increasing productivity and worker comfort and morale,
- reduced staff withdrawal (turnover and absenteeism),
- improvement and maintenance of good industrial relations.

From current research findings, one of the most important points is that there is a definite need for an adjustable workstation for people using VDTs on a more or less continuous basis. This is exacerbated in situations where several people occupy the same workstation.