

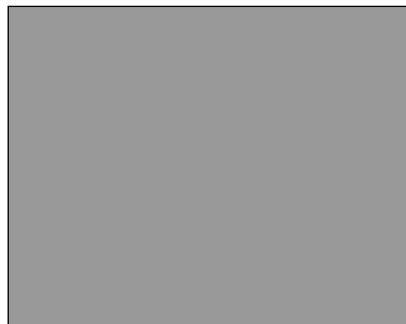
# a new perception of VDU working

*In the Netherlands, there are various schools of thought for, and ways of dealing with, the relationship between VDU level and the worker's eye level. Even today, the VDU is often placed on top of the desktop computer. The VDU's upper edge is then clearly above eye level and experts agree that this can lead to eye, neck and shoulder complaints. A frequently used rule of thumb is to adjust the VDU level to between the operator's eye level and 10 cm below this<sup>13</sup>.*

This article is a survey of the results of scientific research into the viewing distance, the ideal VDU level and what consequences these have for document holders, monitor supports and laptop supports. Furthermore, it also deals with the use of documents during VDU work and how to improve productivity.

## Viewing distance

One of the most important causes of eye complaints related to VDU operation is the fact that the VDU is placed too close to the operator. When viewing objects so close, the eye must accommodate



and converge\* even more; this represents a greater strain than looking at objects further away<sup>2,6,7</sup>.

Continuously looking at objects requiring intense convergence, represents a heavy strain on the eyes<sup>14</sup>. But when is the VDU too close? It is not possible to give an

exact standard for this, because it is relevant to the size of the characters on the VDU and to the eyes' point of convergence\*\*.

When looking straight ahead this point is at 110 cm, and with a downward viewing angle of 30°, at 85 cm. When the VDU is positioned further away it is important that the characters (letters and figures) on the VDU are enlarged. The general rule is that the height of the characters on the VDU should be 1/150 of the viewing distance<sup>20</sup>. At a distance of 50cm, for example, this is 3.3 mm.

\* Converge: the movement of the eyes towards the nose to prevent double vision.

\*\* Point of convergence: the point where the eyes are completely relaxed and do not converge.

## Ideal VDU level?

### Viewing angle

When working on a VDU the viewing distance is small, hence the eye must accommodate strongly every time. When a document is positioned lower, in line with VDU and keyboard, the eye is better able to accommodate.

For reading activities with a short viewing distance, the eye accommodates best with a viewing angle of 20 – 50°. A 20 – 50° viewing angle is therefore also ideal for working on a VDU. This means that the VDU must be positioned at a minimum of 10cm below eye level in order to reduce eye strain<sup>8,9,10,12,15,19</sup>. However, this only works if the monitor can be tilted back adequately (the angle between the viewing line and the VDU should be a little bit more than 90 degrees), which is not always possible with conventional monitors.

**SELF TEST**

Hold a document at arm's length and eye level in front of the body, and then bring it closer to the eye until the text becomes blurred. Now move the document down while maintaining the same viewing distance and head posture. You will notice that the text will become legible again. This is because the eye can accommodate better when the text is in a lower position

**Dry eyes**

Dry eyes are another frequent problem for VDU operators. With the VDU in a high position, the eyelid must be opened wider; thus the eye **will dry out** more quickly and to a higher degree.

This effect is less severe for a lower VDU position. During VDU work the eye also dries out because of staring and peering at the VDU and because the blinking frequency reduces during VDU working<sup>17</sup>.

**SELF TEST**

Hold a document close at eye level and concentrate on reading the text. You will notice that you will soon get a tendency to blink (the eyes are drying out). Now lower the document and concentrate on reading the text once again. You will notice that it will take longer before you start to blink.

**Dynamic neck strain**

Many VDU operators do not have touch typing skills and must therefore aim their eye alternately at the keyboard and the VDU. When the VDU is positioned

high (e.g. at eye level), the neck must continuously bend and stretch for alternately looking at the VDU and the keyboard. A higher VDU position would therefore result in a greater dynamic neck strain.

Conversely: a lower VDU position lessens the dynamic neck strain.

Investigations<sup>18</sup> have shown that although a lower VDU position causes a minimal greater muscle strain, this will generally remain below the recommended maximum static muscle strain (on average <5% of the maximum muscle power).

A frequently quoted counter argument for a lower VDU position is extra bending of the neck. A study<sup>5</sup> presented at the International Ergonomics Conference 2000 in San Diego (USA) showed that a VDU position of 35° below the horizontal eye line results in an almost ideal neck position. When the VDU is placed at eye level it will cause the neck to bend backwards, a well-known risk factor for causing complaints.

Investigations<sup>4</sup> further show that a low VDU position allows more variations in head postures than a high VDU position<sup>1,3</sup>.

**MORE MOVEMENT, MORE VARIATION, IS AN ESSENTIAL FACTOR IN THE PREVENTION OF COMPLAINTS!**

**Higher productivity at a lower VDU position!**

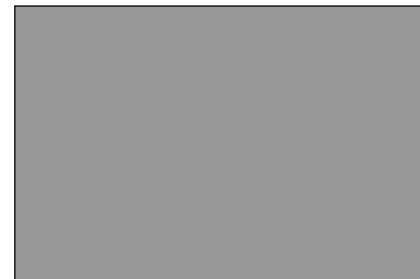
Two studies<sup>11,16</sup> compare two VDU positions. One in which the VDU is positioned 35° under the horizontal eye level line and one in which the VDU is actually on the horizontal eye level line. In the first position of 35° under the horizontal eye level line the

productivity is no less than 10% higher.

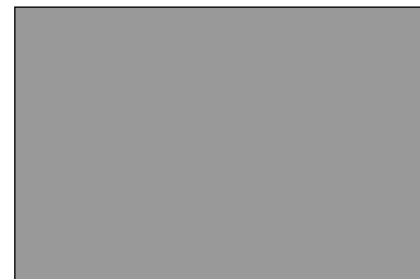
**The document holder****Body posture and use of documents**

When a document is placed between the VDU and the keyboard, the keyboard, VDU and documents are all positioned on one line. This corresponds to one of the ergonomic principles: working in the symmetrical plane, i.e. straight in front of the body.

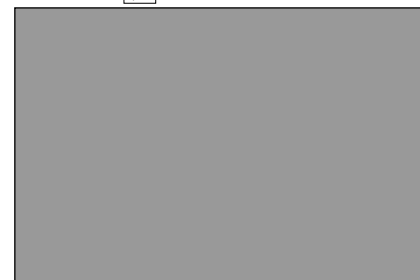
By aligning a document with the VDU and the keyboard, at the correct angle, the (body) posture will improve considerably. See photographs below.



WRONG



WRONG



RIGHT

The document holder's angle must be such that the documents

assume an angle of more than 90 degrees relative to the line of view<sup>4</sup>. This implies that a document holder must be simultaneously both low and at a large enough angle relative to the work surface.

**What consequences does the foregoing have for a document holder?**

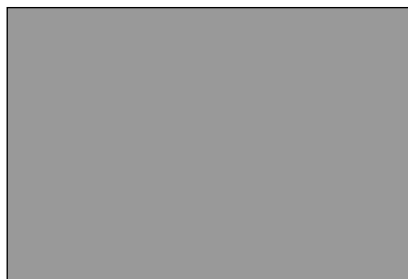
In recent years VDUs have become larger and larger and document holders must therefore be lower than some years ago. The back of the document holder must be at least 2cm below the underside of the VDU to prevent documents, including lever arch files and books, obscuring the screen.

**Reading, writing and operating a VDU**

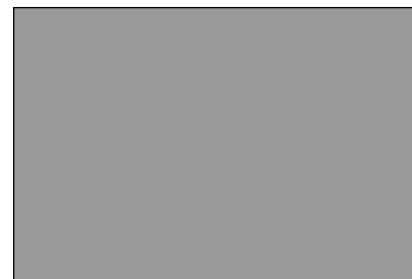
Ergonomists often advise equipping two workstations when operating a VDU: one to operate the VDU and the other for reading and writing. For reading and writing purposes, it is advisable to use a work surface that is a few centimetres above elbow level, and for operation of the VDU one at actual elbow level or slightly below.

When reading, a sloping desk can ensure that the paper document is at a favourable angle to prevent unnecessary bending of the neck. Where paper documents are used during data input via the computer, the use of a document holder is recommended.

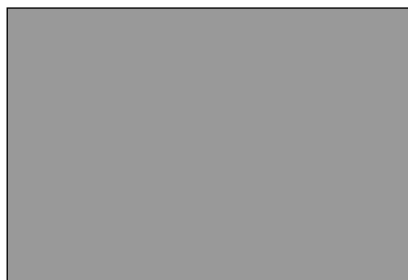
VDU operators generally skip between various tasks such as reading, writing and data input. The most efficient way is to perform all tasks at the same workstation. There are, however, various ergonomic requirements for the VDU workstation and the reading/writing workstation which should not be neglected. An integrated workstation for several tasks saves space and expense, **ensuring more efficient use of office space.**



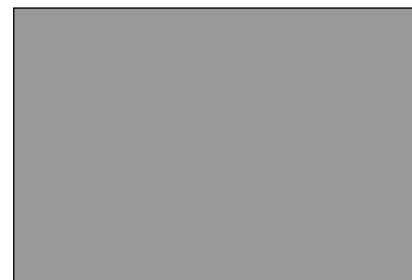
Reading **without** sliding lectern



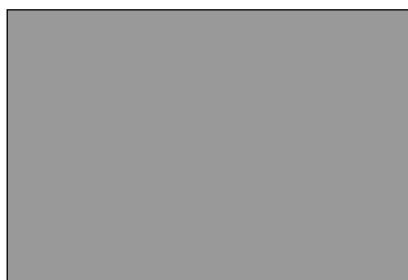
Reading **with** sliding lectern



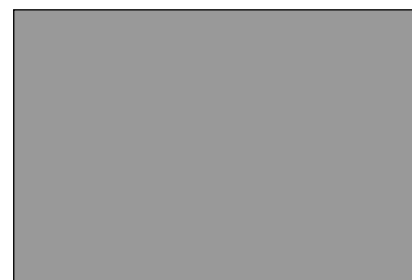
Writing **without** sliding lectern



Writing **with** sliding lectern



Data input **without** sliding lectern



Data input **with** sliding lectern

A sliding lectern has recently been developed that may meet all these requirements. This enables various tasks to be performed at one desk on the basis of ergonomic requirements for the different workstations for VDU operation and for reading and writing. The product combines a sloping desk with a document holder, so that a VDU operator can quickly and efficiently skip between the various tasks.

**The Laptop**

**Which bottlenecks and solutions accompany working with a laptop?**

When working on a laptop the characters on the screen will be comparatively small because of the small size of the screen ( $\leq 15$  inch) and the high resolution at which the work is frequently carried out.

It is therefore important that the viewing distance is not excessive. Because a laptop screen is fixed to the keyboard, the two cannot be adjusted independently from each other. We would therefore always recommend the use of an external keyboard, since they may then be adjusted independently of each other.

Another of the laptop's aspects is the rather weak ergonomic layout of its keyboard. Most VDU operators regard working on a 'normal' keyboard as rather more pleasant than on a laptop keyboard. This is another argument in favour of working with an external keyboard.

**External mini keyboard**

In addition to its 'key touch' and layout, the width of the external keyboard also plays a part. When using a 'normal' keyboard, the

shoulder and elbow of right-handed people are strained more than when using a mini keyboard as the mouse is at a greater distance from the body, because of the presence of the numeric keypad.



Working with a **standard keyboard** – extra strain on shoulder and elbow



Working with a **mini keyboard** – no extra strain on shoulder and elbow

Use of an external mini keyboard, possibly including an external numerical keypad, is therefore to be preferred above a 'normal' external keyboard

**Laptop support**

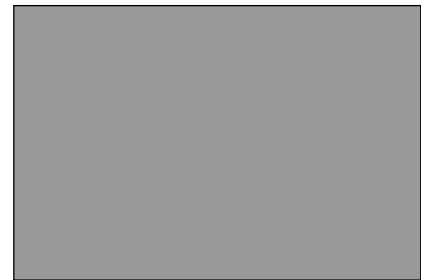
When an external mini keyboard is used exclusively, the distance to the VDU is excessive, and the user cannot read the characters on the screen clearly. The laptop user then tends to lean forward in order to reduce the viewing distance (photograph 3).

Use of a laptop support (photograph 4) will shorten the viewing distance because the screen is placed higher. However, the screen should stay 10cm or more below eye level. See the section about the correct viewing angle.



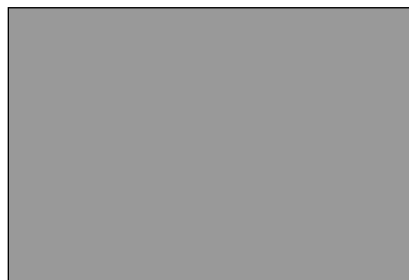
**✗** WRONG

1 Working without an external keyboard (screen too low and too close)



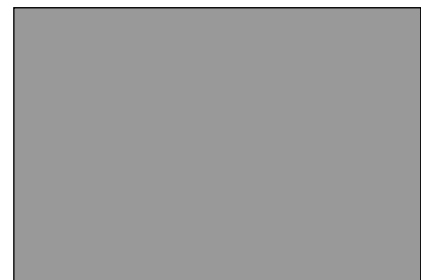
**✗** WRONG

2 Working with an external keyboard (screen too far away)



**✗** WRONG

3 Working without an external keyboard and correct viewing distance (bent posture)



**✗** RIGHT

2 Correct viewing distance and correct viewing angle through use of a laptop support

**Laptop support height**

A lower screen position also means that it must be possible to adjust the laptop support low enough for small persons and high enough for tall persons.

**Integrated laptop support**

In spite of good intentions, laptop supports are often left in the laptop case or in the office because they are forgotten, are rather heavy or will have to be unpacked and adjusted first. However, quite recently a new laptop support was introduced that can be integrated with the laptop, so that it is impossible to forget the laptop support. This idea ensures that adjustment and use of the laptop support is much easier and faster.

**Conclusion**

Regarding the ideal monitor height, this article contains many arguments in favour of adjusting the normally used viewpoint. On the basis of the arguments, which

are supported by scientific research, it seems better to place the monitor 10cm below eye level or lower.

The consequences are that many existing ergonomic aids such as document holders, monitor and laptop supports no longer meet these new requirements.

For example, a document holder should be low enough but at the same time have a sufficiently steep angle. According to this new viewpoint, monitor supports are no longer an ergonomic improvement, but a change for the worse.

A laptop support, possibly integrated with the laptop, and an external keyboard may be able to guarantee the correct viewing angle and distance when using the laptop, provided the height of the laptop support can be adjusted sufficiently low in respect of screen size and eye level.

Integration of several tasks (reading, writing and data input) in

one spot may result in a cost saving because of increased efficiency and saving space, provided that the ergonomic requirements are met; and these are different for reading/writing and for VDU operation.

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