

## BRIGHTNESS AND CONTRAST TOOL

- How is light produced on your monitor?
- Why brightness and contrast control?
- How is brightness control achieved?
- How is contrast control achieved?
- How is brightness adjusted?
- How is contrast adjusted?
- Recommendations!

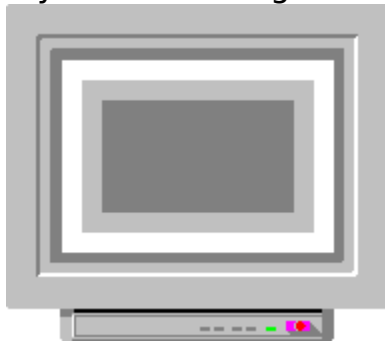
# BRIGHTNESS ADJUSTMENT



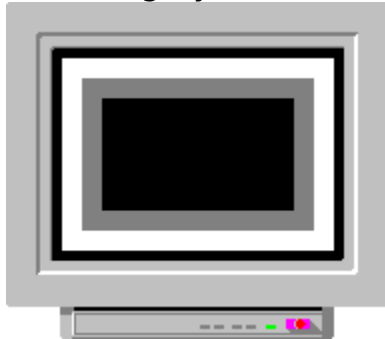
Use the brightness adjustment pattern.  
The brightness control should be used to adjust the low level light output from your monitor for different ambient light conditions.

Use the control to increase the brightness, until you can see the background (the areas intended to be black) and all the dark grey squares marked 1-9%. Decrease it again until you can just distinguish the dark grey squares brighter than 1-3%.

If you set the brightness control too high the monitor cannot produce black.



If you set the brightness control too low (blacker than black), then the dimmer grays will be lost and will be reproduced as black.

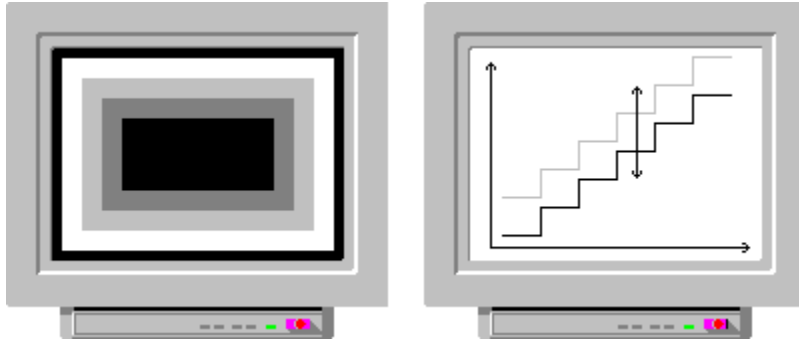


see: [How is the contrast of the monitor adjusted?](#)

see: [Recommendations!](#)

# BRIGHTNESS CONTROL

The brightness control determines the black level of the picture.



## **BRIGHTNESS AND CONTRAST RECOMMENDATIONS**

The light output of your screen can under certain conditions be affected by the resolution you are using. This means that you might have to use different settings for the brightness and contrast controls if you use more than one resolution.

It's better to set the black level a little too low, and lose some of darkest gray tones, than too high, and lose a black background and a good contrast between black and white.

In Windows you shouldn't set the Contrast control too high, as your eyes will tire more quickly!

## **HOW LIGHT IS PRODUCED ON YOUR MONITOR**

A so called video signal is sent from the control-circuitry in your computer to the monitor, telling the monitor both where on the screen to place the light dot, and the intended light output ranging from zero (black) to maximum light output.

In the monitor this signal is converted to light on the monitor screen.

## Before you start

The monitor must have been on for at least 20-30 minutes before you start to make any comparisons

; If you increase Brightness to high, it will cause the beam to spread and if this spreading is excessive, the monitor will lose sharpness.

# COLOUR TOOLS



What are colours?



How to use the colour tools



How does the monitor make colours?



How many colours?

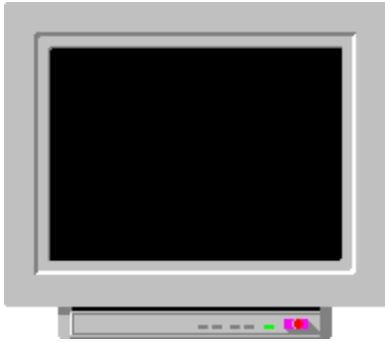


What can you do?

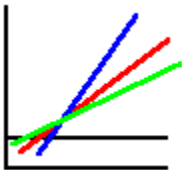


## Adjust black level or "cut-off"

**THIS ROUTINE IS NOT RECOMMENDED UNLESS YOU HAVE AN INSTRUMENT SUCH AS A COLOUR ANALYSER. CONTACT THE SERVICE ORGANIZATION**



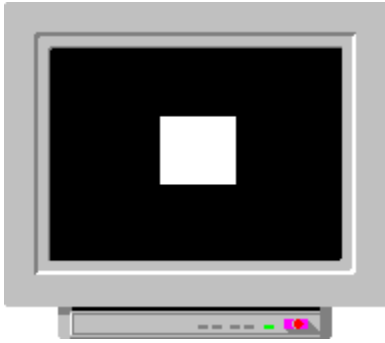
The first step consists of feeding the monitor a signal which is black. You should then adjust the brightness so that you can only just see the background ( 2 cd/m<sup>2</sup>, if you have a colour analyser for this). The second step consists of setting the red, green and blue cut-off controls of the monitor, until the colour analyser indicates that the colour is at "daylight" at low level.



What we are doing is to adjust the position of each of the individual curves up and down, until we get the correct balance at low level. In other words: all three lines cross each other at low level.

## Adjust high level

**THIS IS NOT RECOMMENDED, IF YOU DON'T HAVE AN INSTRUMENT SUCH AS A COLOUR ANALYSER. CONTACT THE SERVICE ORGANIZATION**



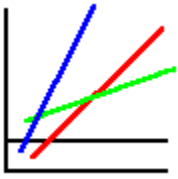
Feed the monitor a white signal. Use a colour analyser to check if the colour is "daylight" at the correct level, e.g. 100 cd/m<sup>2</sup> (adjust by means of the contrast control). Adjust the red, green and blue gain controls of the monitor until you have that colour.



What we are doing is to adjust the position of each of the individual curves up and down, until we get the correct balance at low and high level. In other words: all three lines cross each other at low level and at the maximum light output level.

**REPEAT THE CUT-OFF ADJUSTMENTS, FOLLOWED BY THE WHITE LEVEL ADJUSTMENT, UNTIL YOU GET THE SAME COLOURS ON "BLACK" AND ON "WHITE".**

## Badly aligned colours



Here you'll see how the light output of the red, green and blue phosphors varies with the beam current of the three electron guns. This is a badly aligned monitor.

## Correctly aligned colours



Here you'll see how the light output of the red, green and blue phosphors varies with the beam current of the three electron guns. This is a correctly aligned monitor.

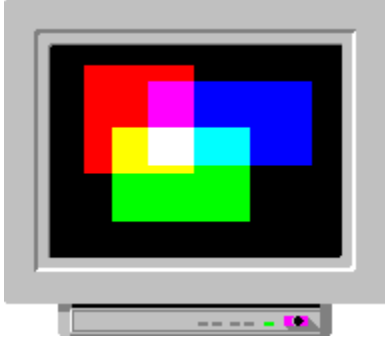
## Degauss the screen

Stray magnetic fields, and various external magnetic fields, will affect the colour purity of colour monitors. Whenever the monitor is moved or rotated in place it is subjected to a change in the earth's magnetic field, which also affects the colour purity. Degaussing removes the effects of all magnetic field changes.

See: [What to do / Misconvergence.](#)

## How does the monitor make colours?

Monitors use what is called "additive colour mixing".



This is due to the fact that if we add red, green and blue light together we get white. This is exactly what happens in a colour monitor. When we want white on the screen we turn on the electron guns hitting the red, green and blue phosphors. Together the phosphors will then emit white light.

## How many colours?

### 16-colour modes

To produce 16 different colours on your screen 4 bits/pixel of video memory is needed.

If you are running Windows in a 16 colour mode you will see dithered patterns.

Switch to a 256 colour mode, which doesn't use dithering.

### 256-colour Modes

To produce 256 different colours on your screen 8 bits/pixel of video memory is needed.

In 256 colour modes the video board can display any 256 colours, from a palette with a total of 262 144 available different colours. Each primary colour has 64 intensity levels.

### High colour

To produce 65K different colours on your screen 16 bits/pixel of video memory is needed.

In "High Colour" modes the video board can display either 32 768 colours or 65 536 colours.

Each primary colour has 32 intensity levels, except for green, which in the 65K mode has 64 levels.

To be able to use this colour mode you need at least 2M of video memory at a resolution of 1024 x 768 (or 1152 x 882).

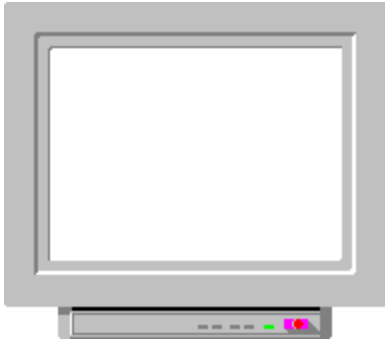
### True colour

To produce 16.8M different colours (more than the eye can readily distinguish) on your screen 24 bits/pixel of video memory is needed.

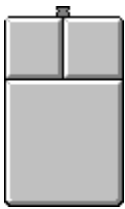
Each primary colour has 256 intensity levels.

To be able to use this colour mode you need at least 2M of video memory at a resolution of 800 x 600.

## How are the colour tools used?



This is for testing of white uniformity and flickering

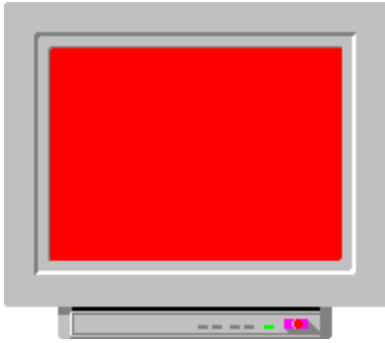


Left: Change colour

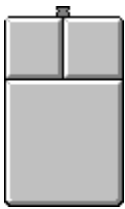
Right: Next step



## How are the colour tools used?



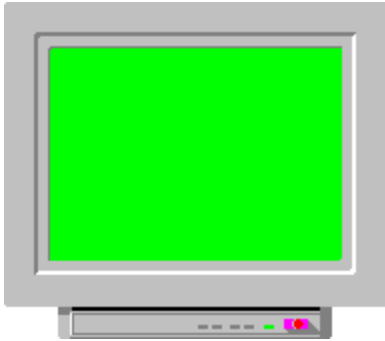
This is for testing of red uniformity, colour purity and flickering



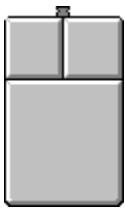
Left: Change colour

Right: Next step

## How are the colour tools used?



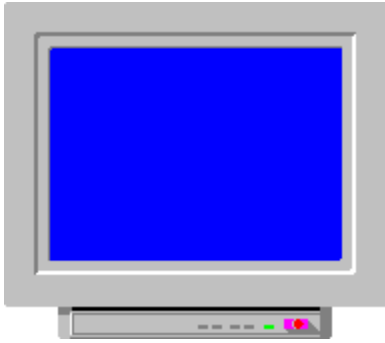
This is for testing of green uniformity, colour purity and flickering



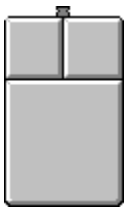
Left: Change colour

Right: Next step

## How are the colour tools used?



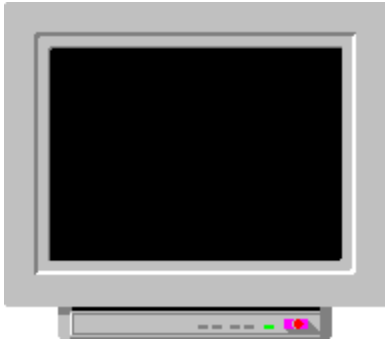
This is for testing of blue uniformity, colour purity and flickering



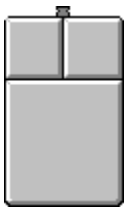
Left: Change colour

Right: Next step

## How are the colour tools used?



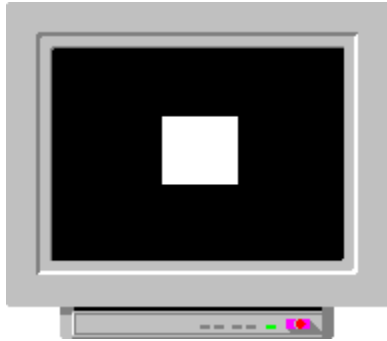
This is for testing of black level or "cut-off"



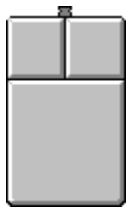
Left: Change colour

Right: Next step

## How are the colour tools used?



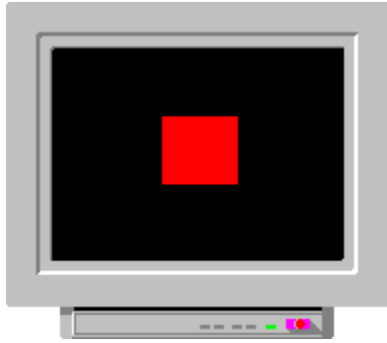
This is for testing of white amplitude



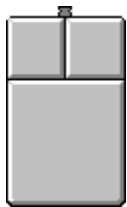
Left: Change colour                      Right: Quit

The test pattern is not a full screen pattern, since the electron guns would then have to be working at "full power" all the time. The best pattern is a square in the middle of a black screen. This will provide a more natural "average picture level", i.e. an average beam current at a more normal level.

## How are the colour tools used?



This is for testing of red amplitude

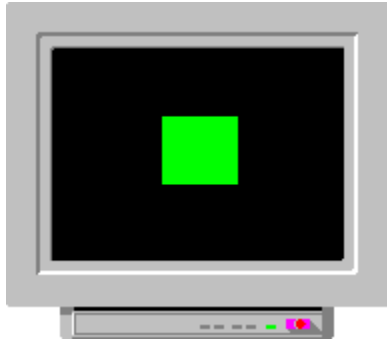


Left: Change colour

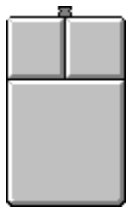
Right: Next step

The test pattern is not a full screen pattern, since the electron guns would then be working at "full power" all the time. The best pattern is a square in the middle of a black screen. This will provide a more natural "average picture level", i.e. an average beam current at a more normal level.

## How are the colour tools used?



This is for testing of green amplitude

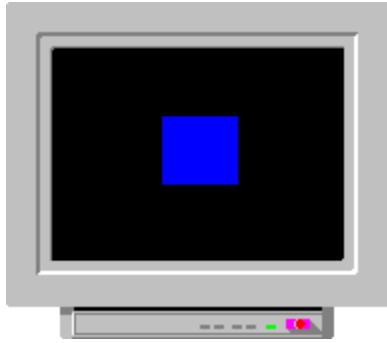


Left: Change colour

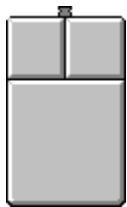
Right: Next step

The test pattern is not a full screen pattern, since the electron guns would then be working at "full power" all the time. The best pattern is a square in the middle of a black screen. This will provide a more natural "average picture level", i.e. an average beam current at a more normal level.

## How are the colour tools used?



This is for testing of blue amplitude



Left: Change colour

Right: Next step

The test pattern is not a full screen pattern, since the electron guns would then be working at "full power" all the time. The best pattern is a square in the middle of a black screen. This will provide a more natural "average picture level", i.e. an average beam current at a more normal level.

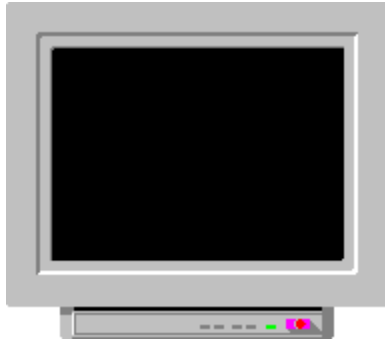


## Nearby equipment

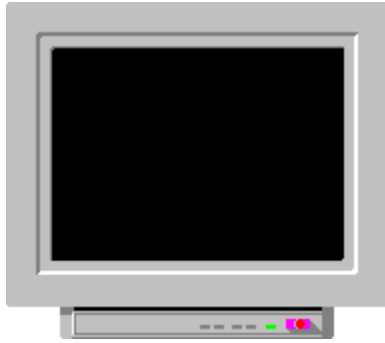
Any nearby equipment which generates a magnetic field, such as speakers, computers, old-style telephones, external disk drives, CD-ROM units, etc., can affect the colour purity.

Make sure that you do not have any fans, external power transformers (fluorescent lights), or motor-driven or solenoid actuated appliances near your monitor.

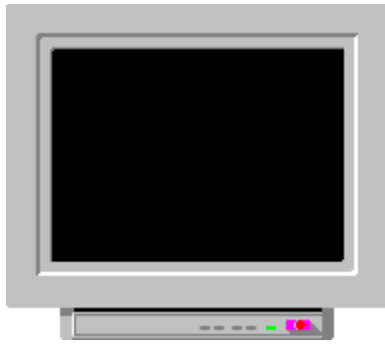
## What can you do?



Degauss the screen



Change the monitor's direction



Nearby equipment

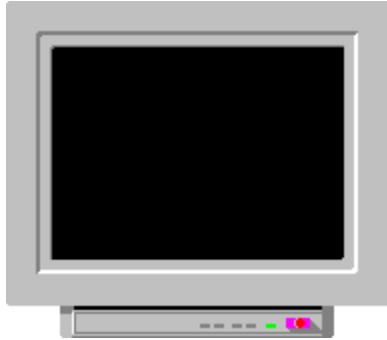
ONLY FOR SPECIALISTS, such as monitor service technicians, technical personnel, etc.



Badly aligned colours



Correctly aligned colours



Adjust black level or "cut-off"



Adjust high level white balance or tint

## What are colours?

Colours are just something that we see with our eyes. This something constitutes rays of light, i.e. electromagnetic waves with wavelengths of between 380 nm and 780 nm.

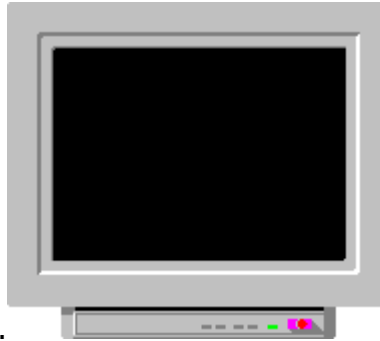
Your eyes pick up the electromagnetic waves, and your brain then translates them into that which we call "colour".

In other words: Colours only exist inside our brains. This means that one person may conceive colours slightly different from another.

## Change the monitor's direction

Monitors are generally adjusted at the manufacturing facility facing east. The monitor should therefore have it's best colour purity when facing in that direction.

## CONTRAST ADJUSTMENT



Use the brightness adjustment pattern.

The contrast control should be used set a comfortable light output from your monitor. This level depends on your application (program) as well as on the ambient light. If the ambient light has changed you should always start with adjusting the brightness control.

You can use this test pattern to set the contrast control to a default position (the best position for all the information for which you use your screen). When you run new programs you should then use the contrast control to set the light output from the screen to a comfortable level.

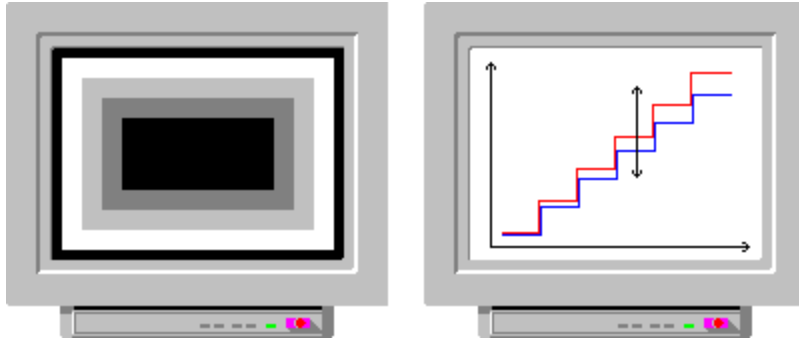
Adjust the contrast control so that all big squares are visible, sharp, and clearly distinct, and have graduated intensities.

see: [How is the brightness of the monitor adjusted?](#)

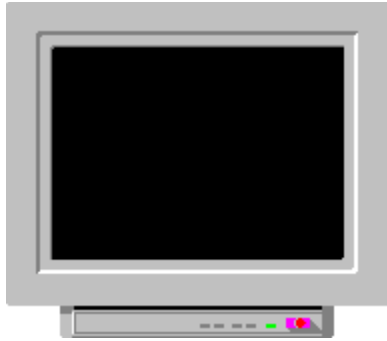
see: [Recommendations!](#)

# CONTRAST CONTROL

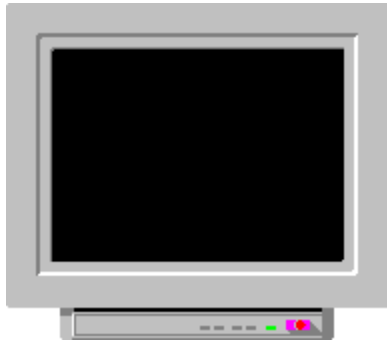
The contrast control determines the white level of the picture. (The video amplifier's gain.)



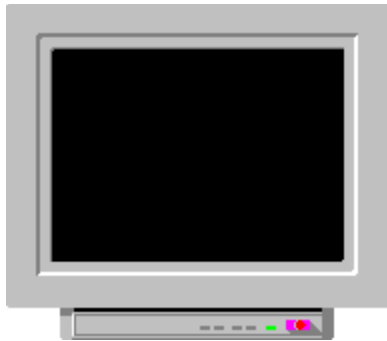
# CONVERGENCE TOOLS



What is convergence?



How the convergence tools are used



How are convergence errors identified?



How are convergence errors measured?





What can you do?



Recommendations!

## Change image position

The convergence is generally worst on the periphery of the image (one side or corner).

Shift the image away from the worst side or corner. This will reduce the problem.

## Change image size

The convergence is generally worst on the periphery of the image (one side or corner ).

Resize the image so that it moves away from the worst side or corner. This will reduce the problem.

## Change resolution

The same convergence error is not as visible at a low resolution, as at a high one, because the theoretical pixel size is then bigger.

Example: A convergence error of 0.30 mm is clearly visible if your pixel size is



0.25 mm,

but the same error is not so bad if your pixel size is



0.40 mm.

## Colour combinations

You can use different colour combinations, depending on what kind of convergence error you have on your monitor.

These combinations are:

|   |         |
|---|---------|
|  | Red +   |
|  | Blue -> |
|  | Magenta |
|  | Green + |
|  | Blue -> |
|  | Cyan    |
|  | Green + |
|  | Red ->  |
|  | Yellow  |

If you have a RED-BLUE convergence error

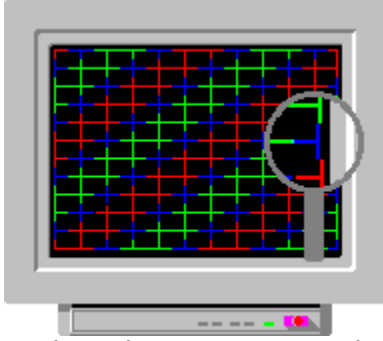
Do not use magenta, red and blue together, but instead use cyan, green and blue or yellow, green and red together.

If you have a RED-GREEN convergence error

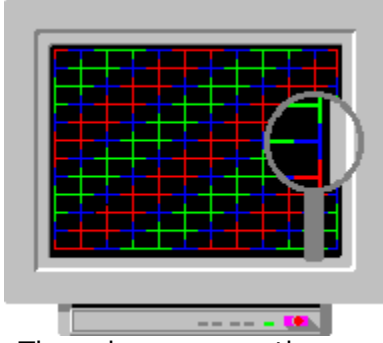
Do not use yellow, red and green together, but instead use cyan, green and blue or magenta, red and blue together.

If You have a GREEN-BLUE convergence error

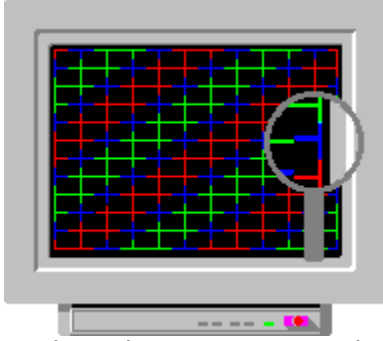
Do not use cyan, green and blue together, but instead use magenta, red and blue or yellow, green and red together.



The colours are not on the same vertical line. Horizontal misconvergence

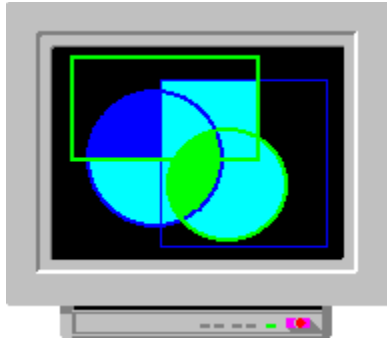


The colours are on the same line. NO MISCONVERGENCE



The colours are not on the same horizontal line. Vertical misconvergence





## Degaussing

Stray magnetic fields can affect the convergence.

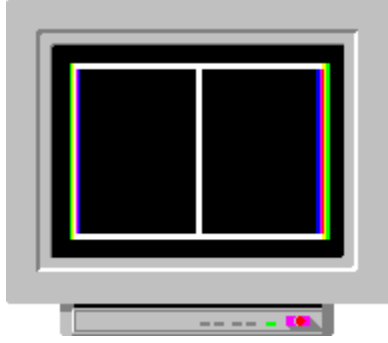
Press the manual degaussing button once. If your monitor does not have a manual degaussing function degaussing will be performed automatically. This however only takes place if the monitor is powered on after having been off for half an hour.

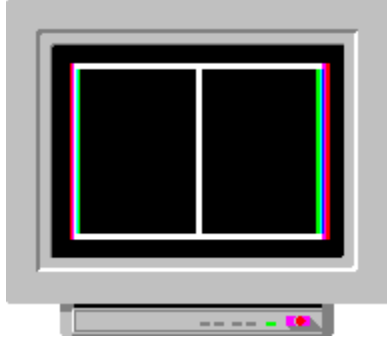
## Adjustment of dynamic convergence

The dynamic convergence is usually adjusted by means of various internal potentiometers, which will vary the voltages to the deflection coils in the yoke assembly.

Some monitors have dynamic convergence controls. These normally divide the screen into zones, and make it possible to set the convergence for each of these zones individually.

START BY ADJUSTING/CHECKING ANY STATIC CONVERGENCE FOR PERFECT CONVERGENCE AT THE CENTRE OF THE SCREEN.



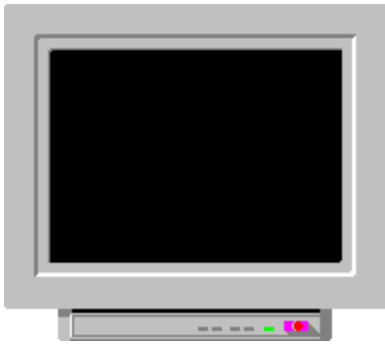


## CONVERGENCE / How is it measured?

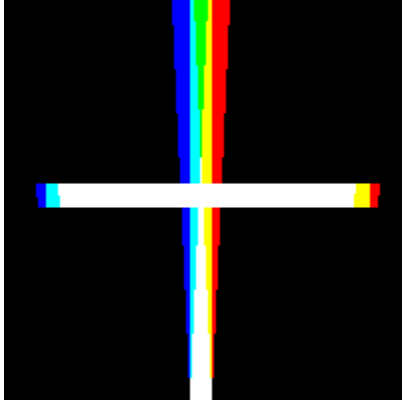


Use the convergence test pattern.

For service staff and other expert monitor users:



Use a convergence meter/convergence gauge.



## CONVERGENCE / How to identify it?

It is easier to find the MISCONVERGENCE positions if you use:

1. The convergence test picture:



No misconvergence,



Horizontal misconvergence,



Vertical misconvergence

2. The start-up test pattern crosshatch lines (red, blue)

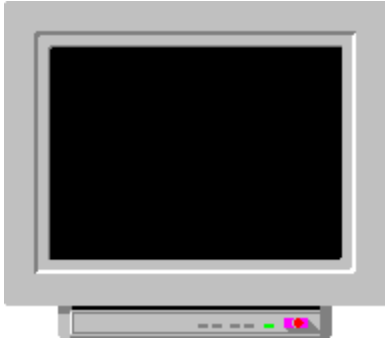


No misconvergence,



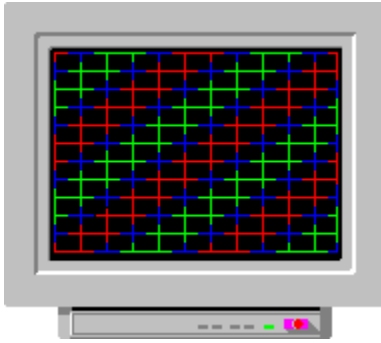


Horizontal misconvergence.



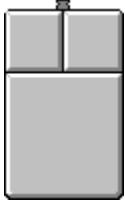
Vertical misconvergence.

## How are the convergence tools used?

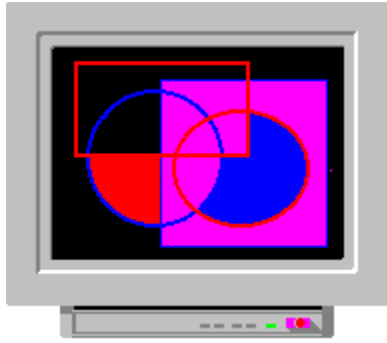


Left: Change colours

Right: Return to the start-up tool



Use this test pattern to check the convergence error. See: [MISCONVERGENCE](#)  
[/ How is it identified?](#)

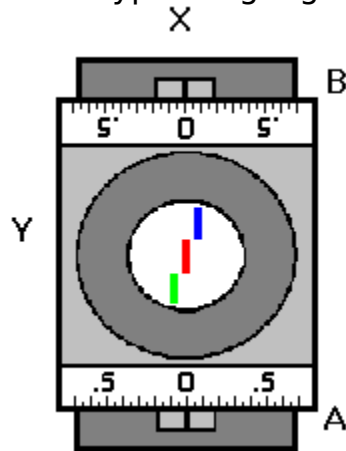


## CONVERGENCE / "Measure convergence error"

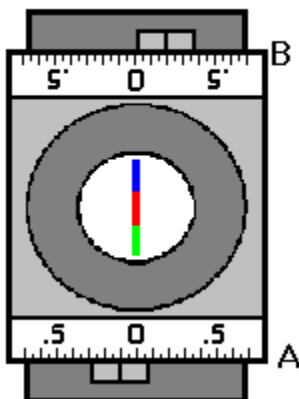


1. Use the white crosshatch test pattern
2. Adjust the contrast to near maximum
3. Adjust the brightness so that the background just disappears

These instructions have been for the Klein CM7AR convergence gauge, but other types of gauges can also be used.



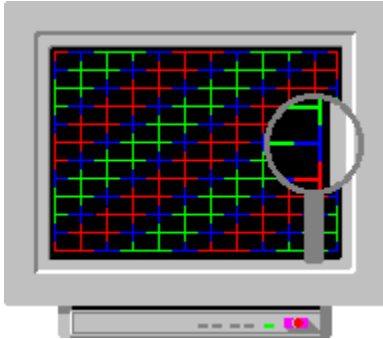
4. Place the gauge on the line, with the mark 'Y' facing upwards, when measuring a horizontal line.
5. Place the gauge on the line, with the mark 'X' facing upwards, when measuring a vertical line.
6. If the line has a convergence error, the line in the window appears to be broken.
7. Use knobs A and B to adjust the line so that it becomes continuous.



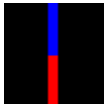
8. If the readings are on opposite sides of zero the convergence error is  $A+B$  (e.g.  $0.2+0.1 \rightarrow 0.3$ ).

9. If the readings are on the same side of zero the convergence error is equal to A if  $A > B$ , and equal to B if  $B > A$ .

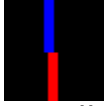
## CONVERGENCE / "Measure convergence error"



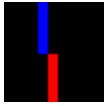
"Click" on the magnifying glass



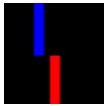
No convergence error.



A "slight" convergence error.




A "one pixel wide" converge error.



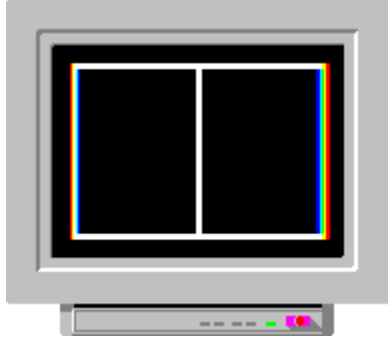
A "major" convergence error.

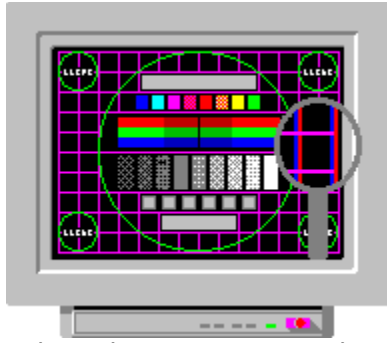
## CONVERGENCE / Recommendations

Nominally misconvergence is specified in this way: less than 0.25 mm (centre) and less than 0.35 mm (elsewhere).

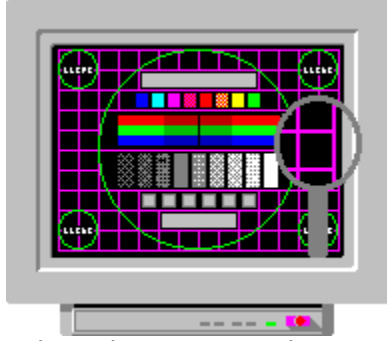
CENTRE here means the big circle in the middle of the test picture . It is highly recommended to aim for a misconvergence that is less than the theoretical pixel size.



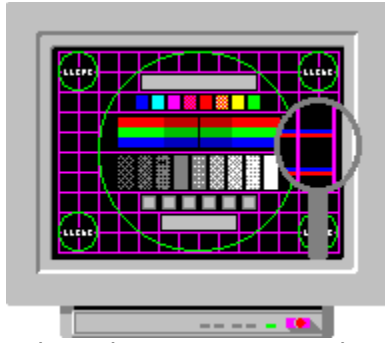




The colours are not on the same vertical line. Horizontal misconvergence



The colours are on the same line. NO MISCONVERGENCE



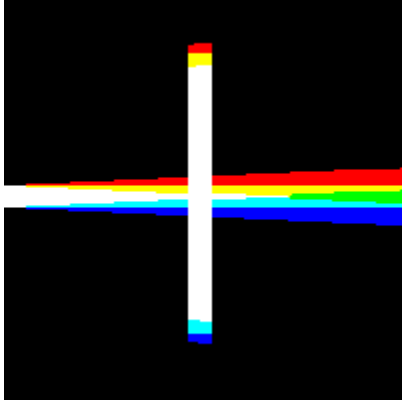
The colours are not on the same horizontal line. Vertical misconvergence

## Adjustment of static convergence

The static convergence is usually set by means of convergence magnets, which are mounted on the yoke assembly on the neck of the picture tube. Some monitors also have one or two convergence controls, which have influence on the convergence over the entire screen. Each of these controls is used to converge the red and blue lines onto the green line, as closely as possible. If the monitor has two controls, one of these is for the vertical convergence and the other for the horizontal convergence.

## Use different colours

You can use different colours, to achieve a good contrast, as the convergence error is not as visible at a lower contrast (and brightness) level.



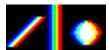
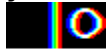
## WHAT IS CONVERGENCE (MISCONVERGENCE)?

A white line on the screen consists of three coloured lines: Red, green and blue. If the screen does not have any convergence error the lines are exactly overlaid each other, and the resulting colour is white.



NO MISCONVERGENCE

In case of a convergence error separate red, green and blue lines can be seen, instead of one white. It is similar to an out of FOCUS image, except that you will see thin coloured fringes around the edges of image detail.



HORIZONTAL MISCONVERGENCE



VERTICAL MISCONVERGENCE

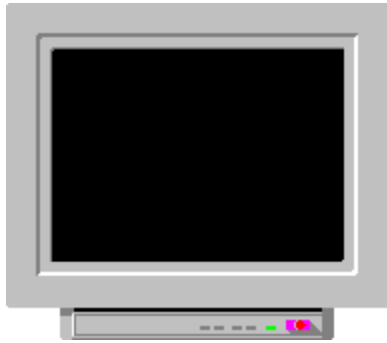


The convergence error will vary for different locations on screen, and will also be different for each of the primary colours. Generally the convergence will be best near the centre, and worst in the corners. As you can see misconvergence also has a bad influence on FOCUS.

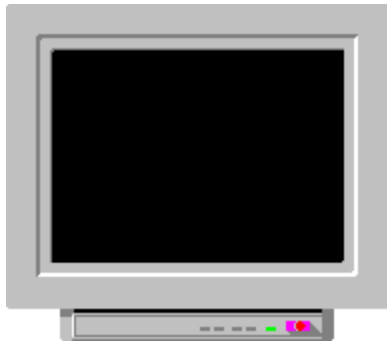


# CONVERGENCE / What can you do?

READ THE OWNER'S MANUAL FOR THE MONITOR.



DEGAUSSING



CHANGE IMAGE POSITION



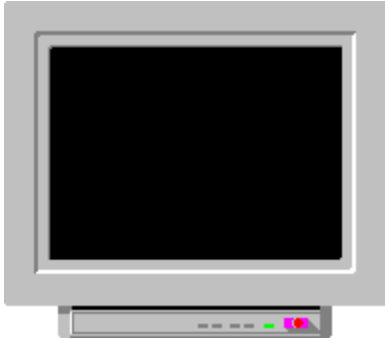
CHANGE IMAGE SIZE



CHANGE RESOLUTION



USE DIFFERENT COLOURS



COLOUR COMBINATIONS

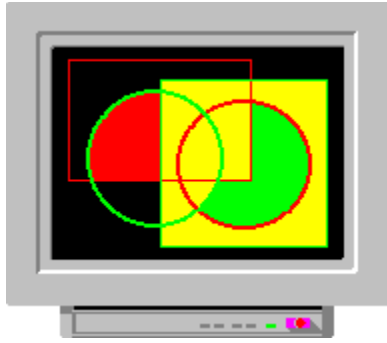


ADJUST STATIC CONVERGENCE

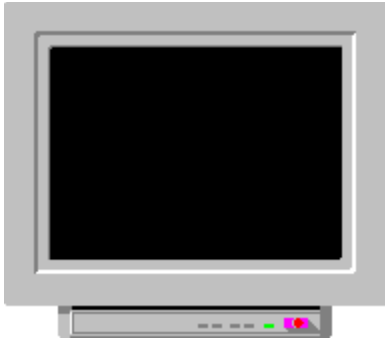


ADJUST DYNAMIC CONVERGENCE

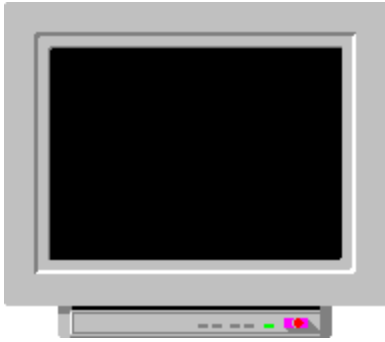
ATTENTION



# FOCUS TOOLS



What is focus?



How are the focus tools used?



What can you do?

## Adjust focus control

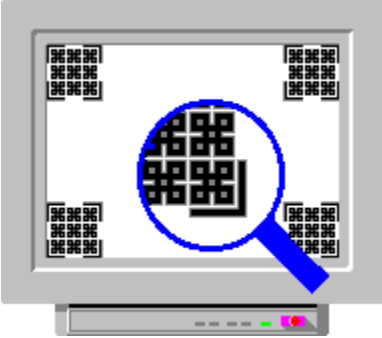
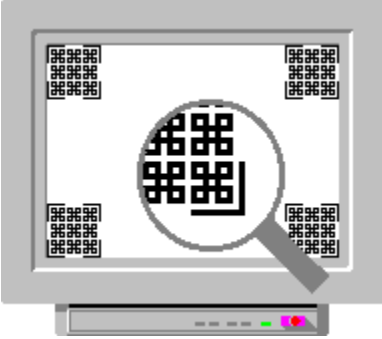
Adjust the focus control so that the pattern becomes as sharp as possible.

## Adjust the picture size

If the focus in the corners is a major problem, readjust the picture size.  
See also: [Convergence](#), [Change image size](#) and [Change image position](#).

## Decrease the contrast

Decreasing the contrast will sharpen the image, by reducing the thickness of the beam.





## Use different colours

You can use different colours, to achieve a better contrast than is possible using the contrast control. It is then possible to use a lower contrast level and have better FOCUS. Use for example blue and cyan.

## What is focus?

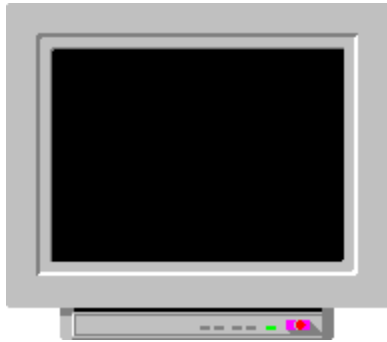
Monitors with good and bad focusing respectively

A badly focused monitor gives rise to beam spread, especially in the corners. Focus is not the only effect that influences the image sharpness, other main reasons are convergence, blooming, the video amplifier's bandwidth, and resolution.

## What can you do?



Adjust the focus control, if there is one



Adjust the picture size

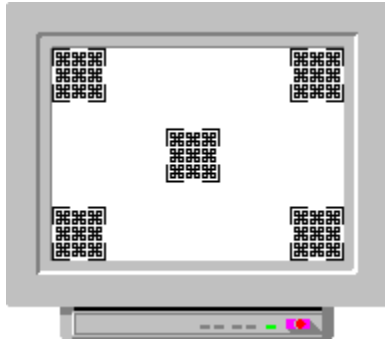


Decrease the contrast

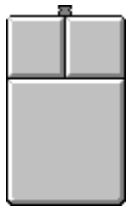


Use different colours. See also: Convergence/Use different colours

## How are the focus tools used?



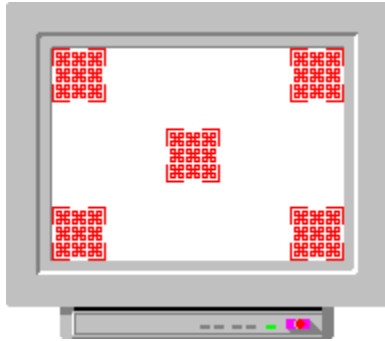
The focus tools display special patterns in each corner of the screen, and in the centre. The patterns are displayed in black on white, followed by the main colours on white. This is a difficult test for most monitors when close to their rated resolution. In particular, watch out for differences between the centre and the corners.



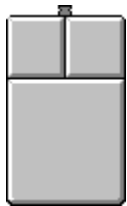
Left: Change colour

Right: Change pattern

## How are the focus tools used?



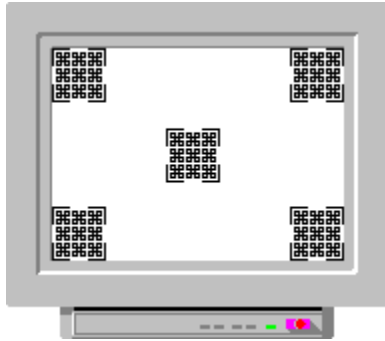
The focus tools display special patterns in each corner of the screen, and in the centre. The patterns are displayed in black on white, followed by the main colours on white. This is a difficult test for most monitors when close to their rated resolution. In particular, watch out for differences between the centre and corners.



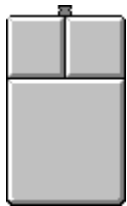
Left: Change colour

Right: Change pattern

## How are the focus tools used?



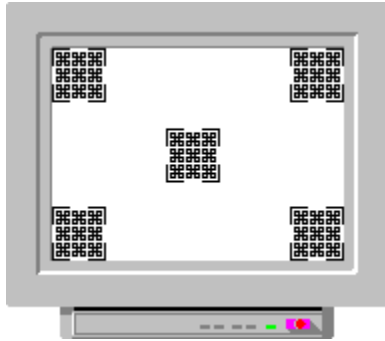
The focus tools display special patterns in each corner of the screen, and in the centre. The patterns are displayed in black on white, followed by the main colours on white. This is a difficult test for most monitors when close to their rated resolution. In particular, watch out for differences between the centre and the corners.



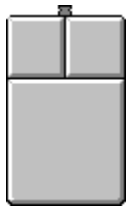
Left: Change colour

Right: Change pattern

## How are the focus tools used?



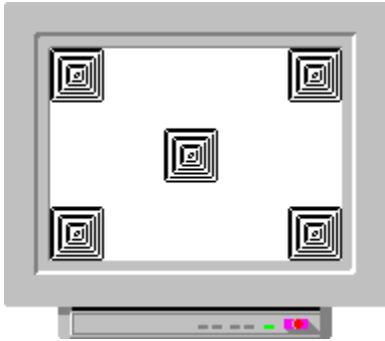
The focus tools display special patterns in each corner of the screen, and in the centre. The patterns are displayed in black on white, followed by the main colours on white. This is a difficult test for most monitors when close to their rated resolution. In particular, watch out for differences between the centre and the corners.



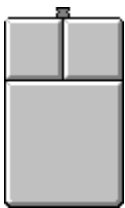
Left: Change colour

Right: Change pattern

## How are the focus tools used?



The focus tools display special patterns in each corner of the screen, and in the centre. The patterns are displayed in black on white, followed by the main colours on white. This is a difficult test for most monitors when close to their rated resolution. In particular, watch out for differences between the centre and corners.

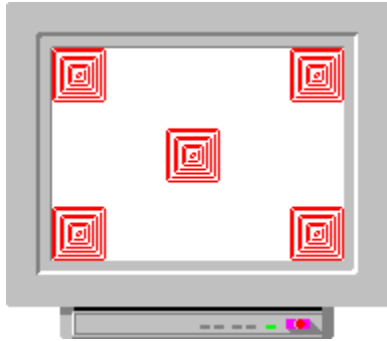


Left: Change colour

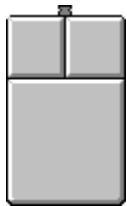
Right: Quit



## How are the focus tools used?



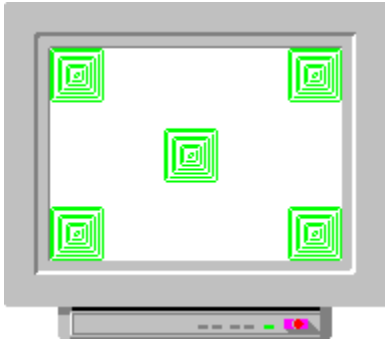
The focus tools display special patterns in each corner of the screen, and in the centre. The patterns are displayed in black on white, followed by the main colours on white. This is a difficult test for most monitors when close to their rated resolution. In particular, watch out for differences between the centre and corners.



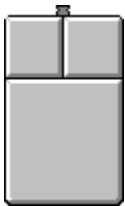
Left: Change colour

Right: Quit

## How are the focus tools used?



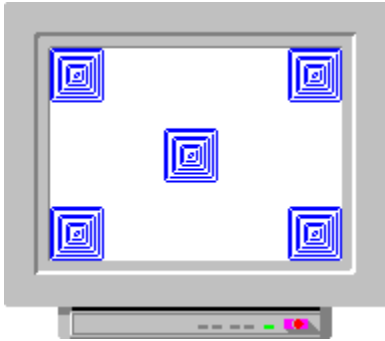
The focus tools display special patterns in each corner of the screen, and in the centre. The patterns are displayed in black on white, followed by the main colours on white. This is a difficult test for most monitors when close to their rated resolution. In particular, watch out for differences between the centre and corners.



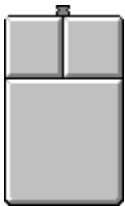
Left: Change colour

Right: Quit

## How are the focus tools used?



The focus tools display special patterns in each corner of the screen, and in the centre. The patterns are displayed in black on white, followed by the main colours on white. This is a difficult test for most monitors when close to their rated resolution. In particular, watch out for differences between the centre and corners.



Left: Change colour

Right: Quit

## Feedback to NOKIA

Dear Madam/Sir

All kinds of feedback is most welcome, so please do not hesitate to contact us by fax,

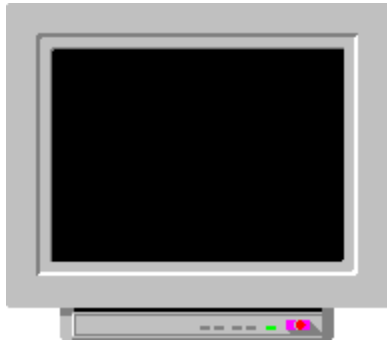
+46-8-7938441,

or by mail to the following address:

NOKIA MONITORS  
"Nokia Monitor Test V1.0"  
P.O. Box 37  
S-164 93 Kista  
SWEDEN

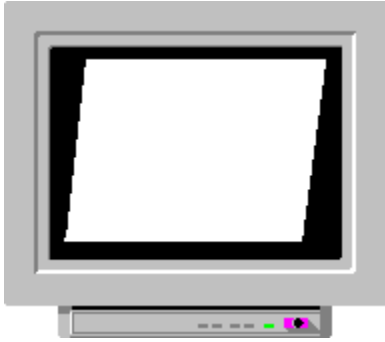
## GEOMETRY TOOLS

The geometry parameters are affected by the resolution you use on your monitor. This means that you will have to adjust your monitor for all the different resolutions you use. If your monitor has the capability to store more than one set of adjustments you shall use this program to adjust and store these adjustments for all the different resolutions you use. If your monitor can not store such adjustments you should try to use only one resolution, if possible. If this is not possible you can choose between either adjusting your monitor for your most critical or most commonly used resolution, or readjusting your monitor when you change the resolution.

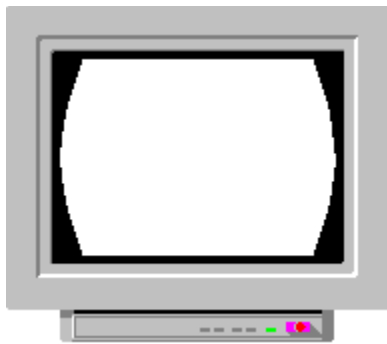


How the geometry tools are used

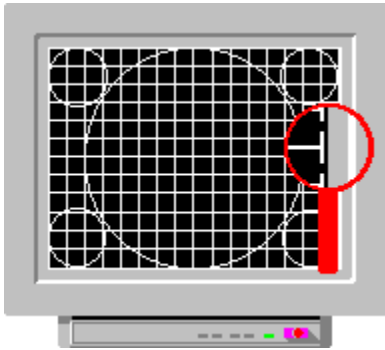
# ORTHOGONALITY or PARALLELOGRAM



# PINCUSHION or BARREL



## SIZE AND POSITION



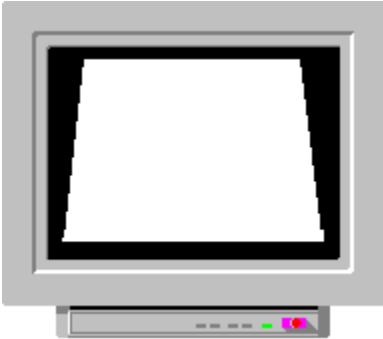
Adjust the size and position controls, so that the broken line almost disappears behind the screen bezel. If the shape of the broken line is distorted, try to adjust other parameters (trapezoid, tilt, pincushion etc.) The inner circle should be perfectly round. Measure the picture width and height. The aspect ratio should be  $4/3$  (width/height). If it is not, readjust the picture size slightly.



**TILT or ROTATION**

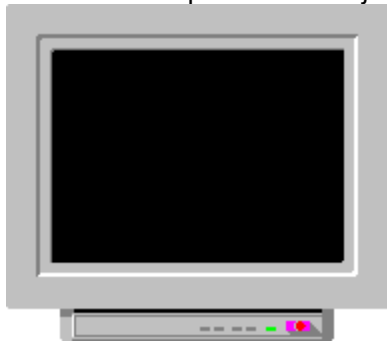


**TRAPEZOID**

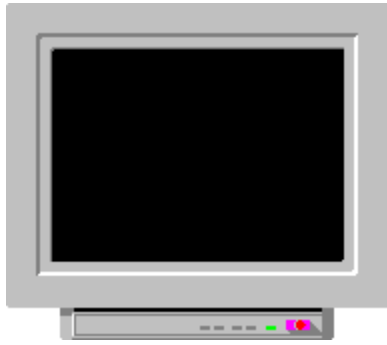


# GEOMETRY TOOLS

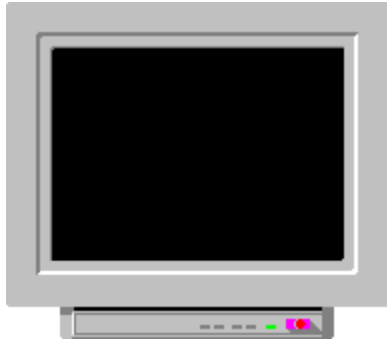
Use this test pattern to adjust and check the picture's



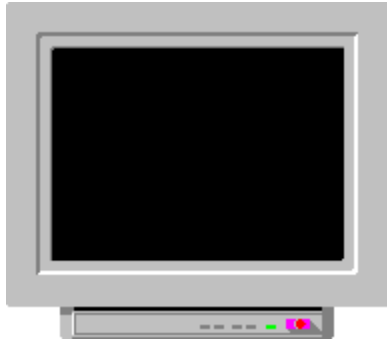
size, position



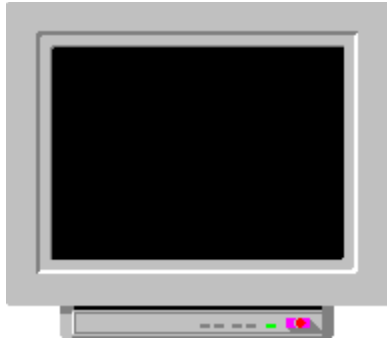
pincushion or barrel,



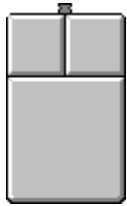
tilt or rotation



trapezoid

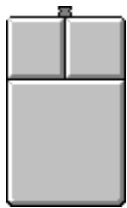
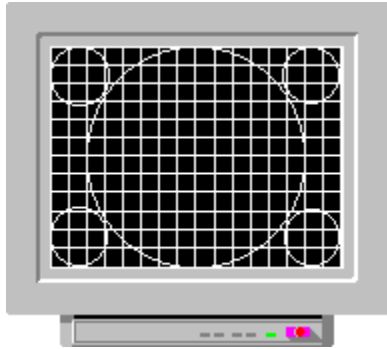


orthogonality or parallelogram



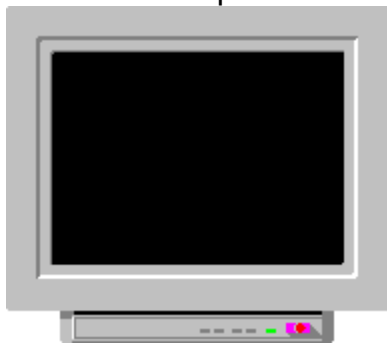
How to use the Geometry tools: Click with the left mouse button to start. ( Left: Change colours. Right: Go to the next image)

# GEOMETRY



Left: Change colour    Right: Next pattern

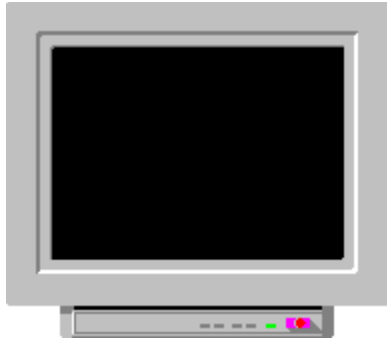
Use this test pattern to adjust and check the picture's



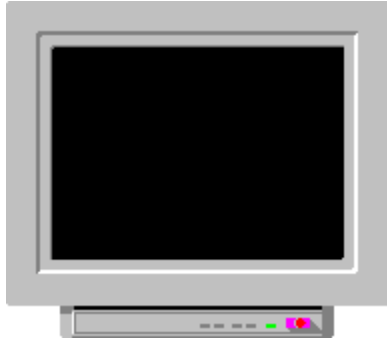
size, position



pincushion or barrel,



tilt or rotation

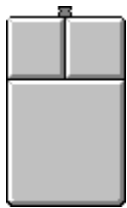
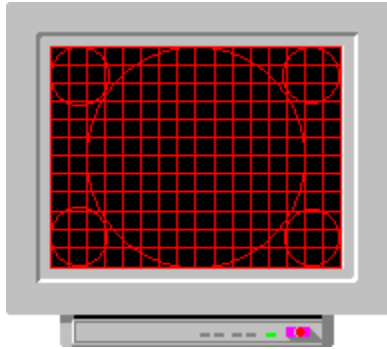


trapezoid



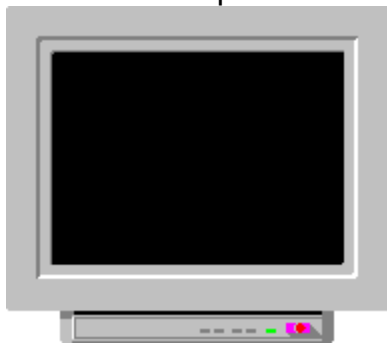
orthogonality or parallelogram

# GEOMETRY



Left: Change colour    Right: Next pattern

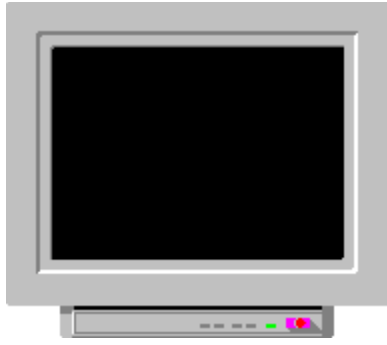
Use this test pattern to adjust and check the picture's



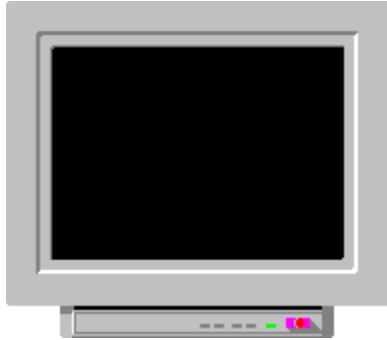
size, position



pincushion or barrel,



tilt or rotation



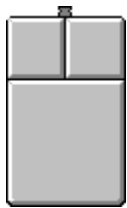
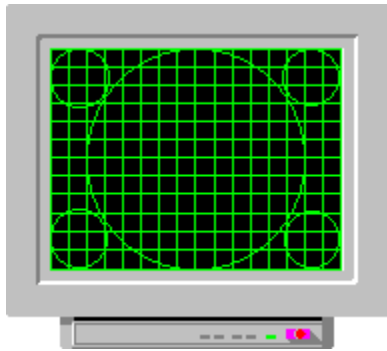
trapezoid



orthogonality or parallelogram

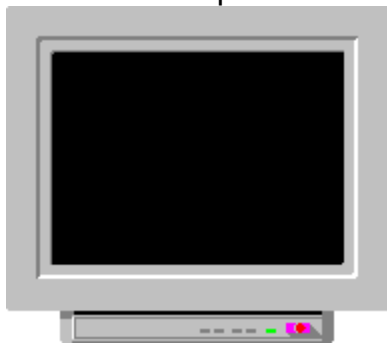


# GEOMETRY



Left: Change colour    Right: Next pattern

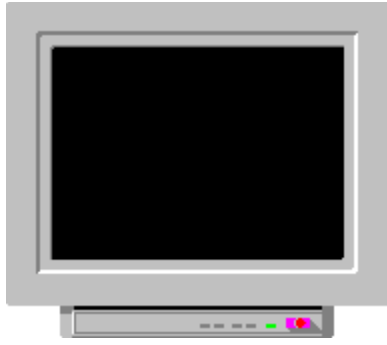
Use this test pattern to adjust and check the picture's



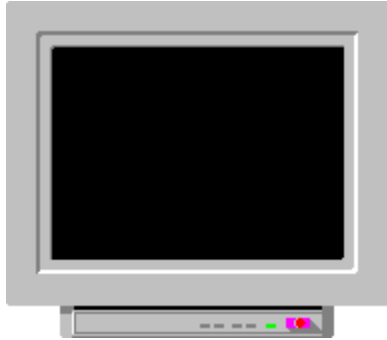
size, position



pincushion or barrel,



tilt or rotation

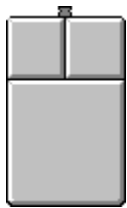
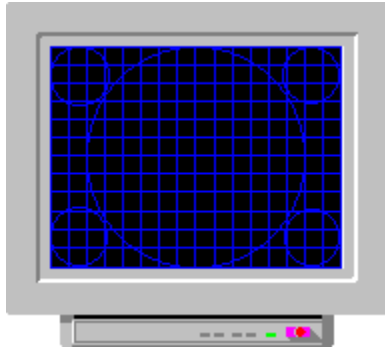


trapezoid



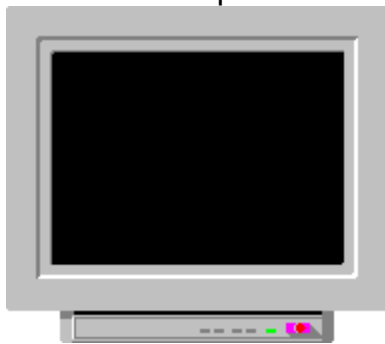
orthogonality or parallelogram

# GEOMETRY



Left: Change colour    Right: Next pattern

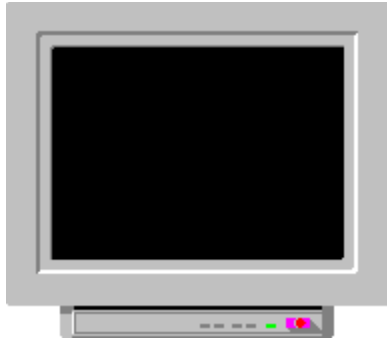
Use this test pattern to adjust and check the picture's



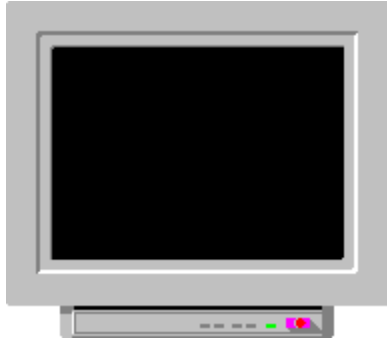
size, position



pincushion or barrel,



tilt or rotation

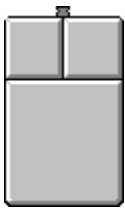
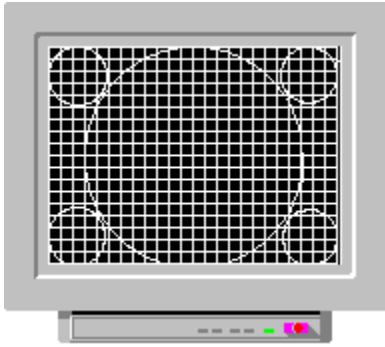


trapezoid



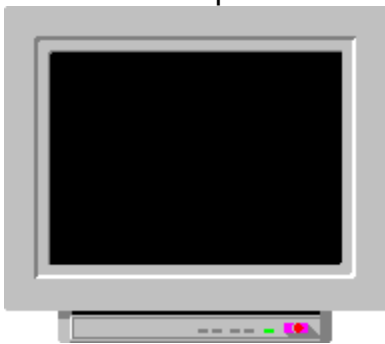
orthogonality or parallelogram

# GEOMETRY



Left: Change colour    Right: Quit

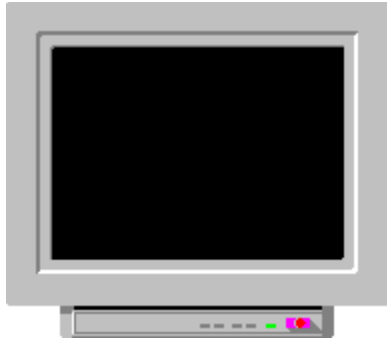
Use this test pattern to adjust and check the picture



size, position



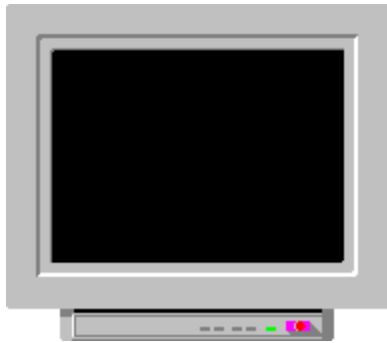
pincushion or barrel,



tilt or rotation

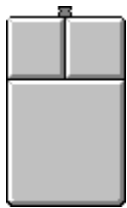
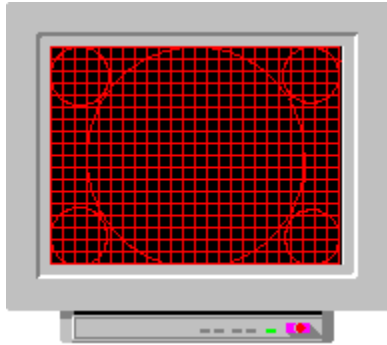


trapezoid



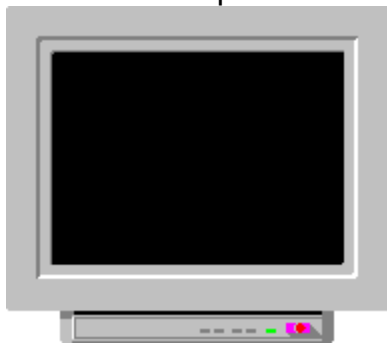
orthogonality or parallelogram

# GEOMETRY



Left: Change colour    Right: Quit

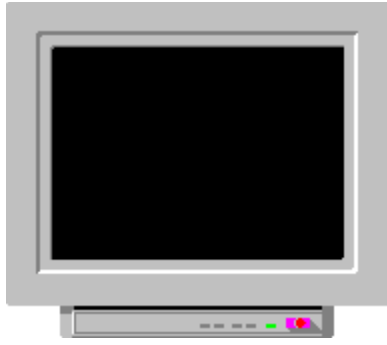
Use this test pattern to adjust and check the picture



size, position



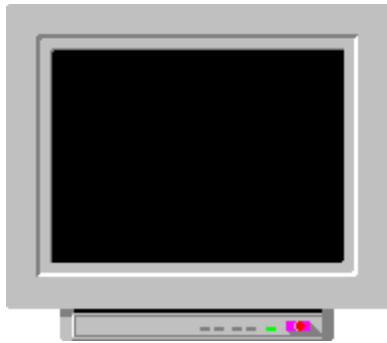
pincushion or barrel,



tilt or rotation



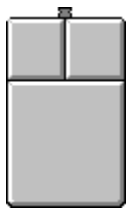
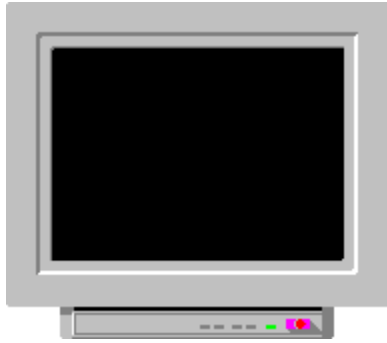
trapezoid



orthogonality or parallelogram

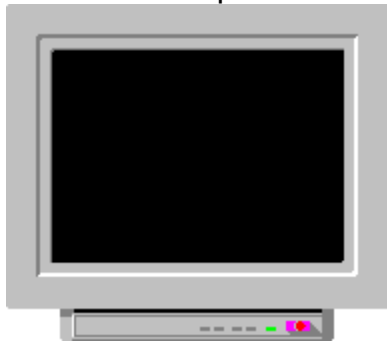


# GEOMETRY



Left: Change colour    Right: Quit

Use this test pattern to adjust and check the picture



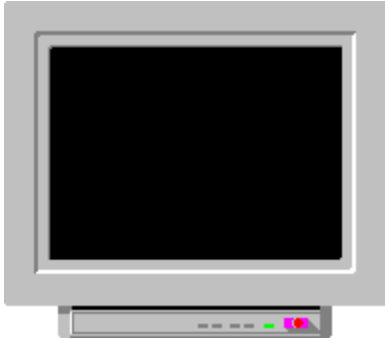
size, position



pincushion or barrel,



tilt or rotation

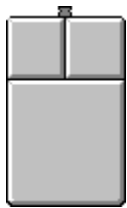
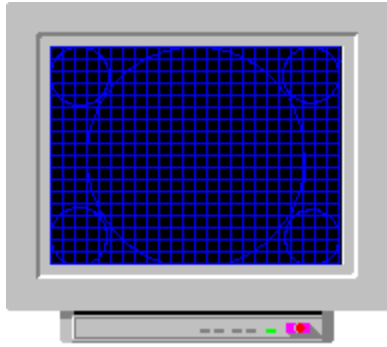


trapezoid



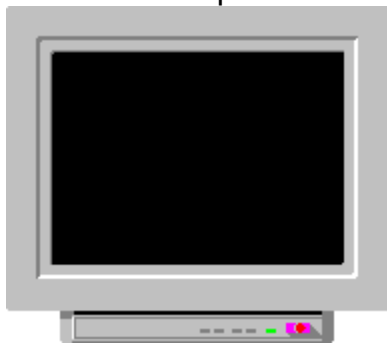
orthogonality or parallelogram

# GEOMETRY

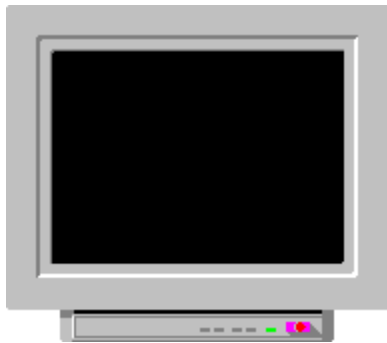


Left: Change colour    Right: Quit

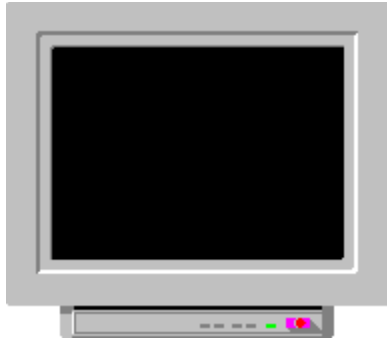
Use this test pattern to adjust and check the picture



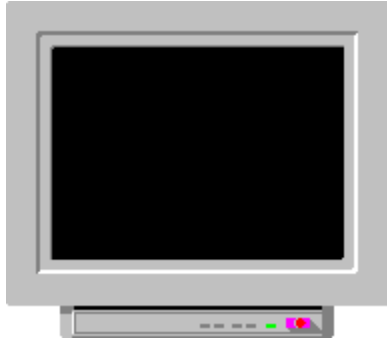
size, position



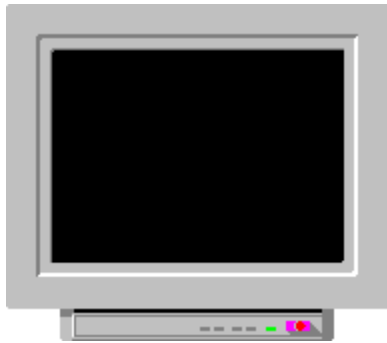
pincushion or barrel,



tilt or rotation



trapezoid

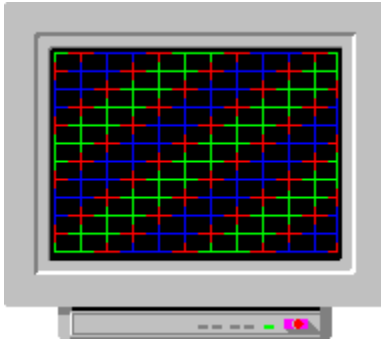


orthogonality or parallelogram

## How to start?

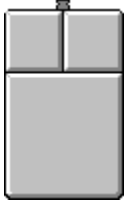
1. Use the geometry tools to adjust picture to a correct shape
2. Tune the brightness and contrast with the help of the brightness and contrast tools

## How are the convergence tools used?



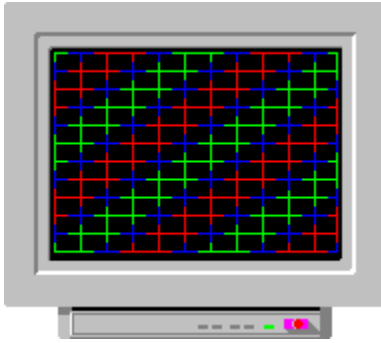
Left: Change colours

Right: Return to the start-up tool



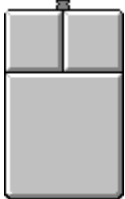
Use this test pattern to check the convergence error. See: [MISCONVERGENCE / How is it identified?](#)

## How are the convergence tools used?



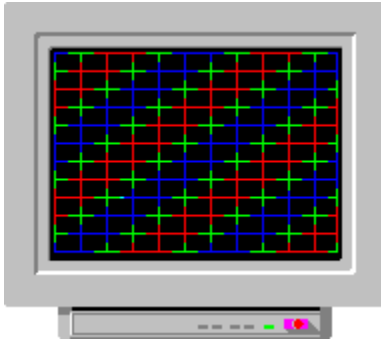
Left: Change colours

Right: Return to the start-up tool



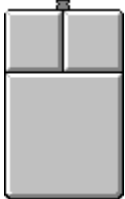
Use this test pattern to check the convergence error. See: [MISCONVERGENCE / How is it identified?](#)

## How are the convergence tools used?



Left: Change colours

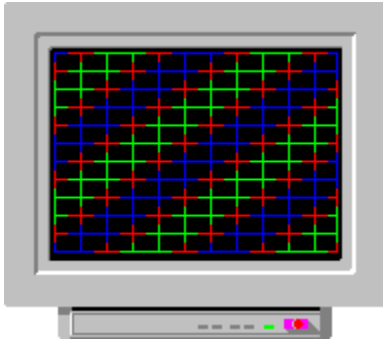
Right: Return to the start-up tool



Use this test pattern to check the convergence error. See: [MISCONVERGENCE / How is it identified?](#)

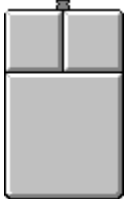


## How are the convergence tools used?



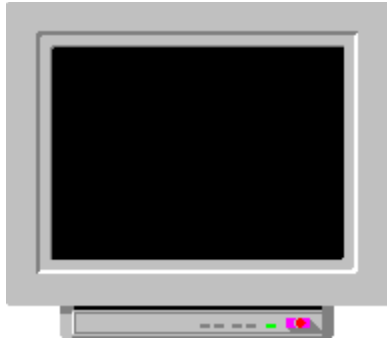
Left: Change colours

Right: Return to the start-up tool

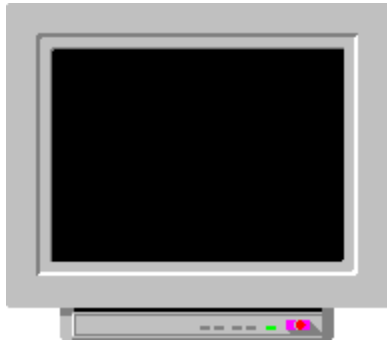


Use this test pattern to check the convergence error. See: [MISCONVERGENCE / How is it identified?](#)

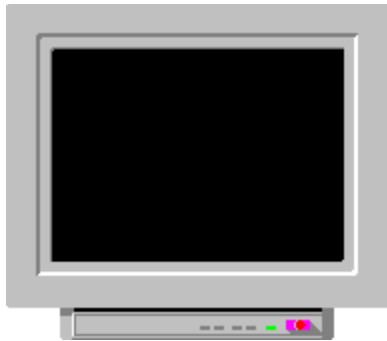
# MOIRE TOOLS



What is moiré?



How are the moiré tools used?



What can you do?

## Adjust focus

If focus adjustment is available on your monitor, defocus the image, but only slightly. Check the picture focusing by means of the focus tools and/or the readability tools.

## Change the image size

Make the picture smaller or bigger, to make moiré less noticeable.

## Change the resolution

Reduce the resolution. This always works.

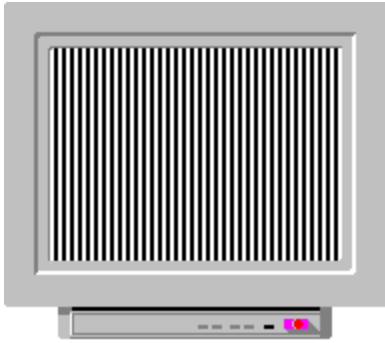
## Don` t use grey or dark grey (dim) backgrounds

Use white background colour. This will increase the beam current and defocus your picture. Check the picture focusing by means of the focus tools and/or the readability tools.

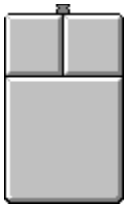
## External filters

Some external "low radiation" give rise to moiré. Check your monitor both with and without filter.

## How are the moiré tools used?



Look for waves, wisps, bundles and shimmers of intensity variations. Use all the test tools to check for moiré, as the visibility of moiré patterns varies with colours.

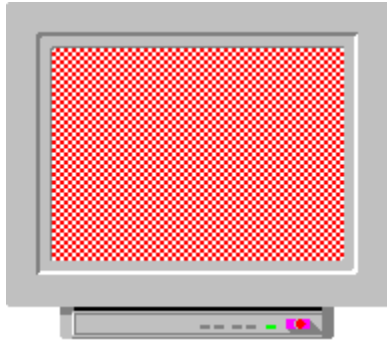


Left: Change colour

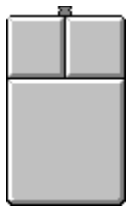
Right: Change pattern



## How are the moiré tools used?

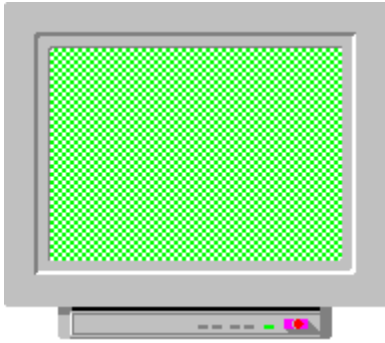


Look for waves, wisps, bundles and shimmers of intensity variations. Use all the test tools to check moiré, as the visibility of moiré patterns varies with colours.

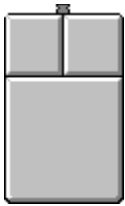


Left: Change colour      Right: Quit

## How are the moiré tools used?



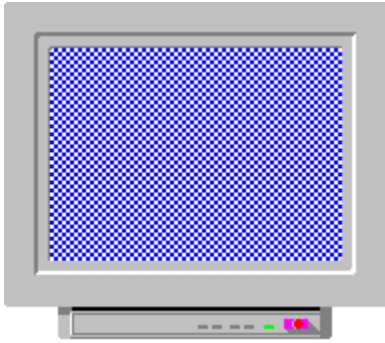
Look for waves, wisps, bundles and shimmers of intensity variations. Use all the test tools to check moiré, as the visibility of moiré patterns varies with colours.



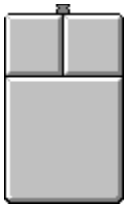
Left: Change colour

Right: Quit

## How are the moiré tools used?

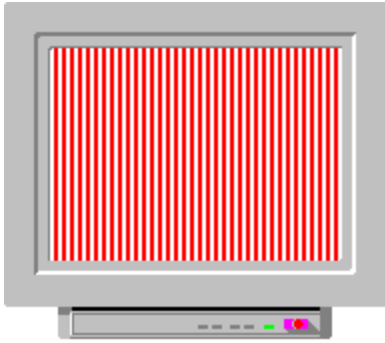


Look for waves, wisps, bundles and shimmers of intensity variations. Use all the test tools to check moiré, as the visibility of moiré patterns varies with colours.

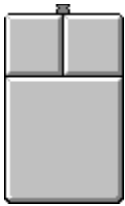


Left: Change colour      Right: Quit

## How are the moiré tools used?



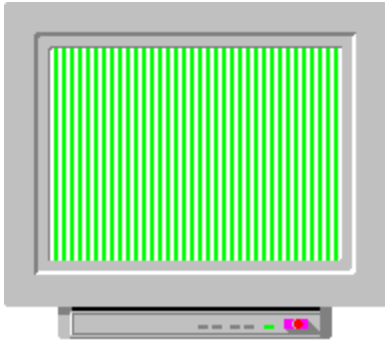
Look for waves, wisps, bundles and shimmers of intensity variations. Use all the test tools to check moiré, as the visibility of moiré patterns varies with colours.



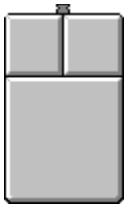
Left: Change colour

Right: Change pattern

## How are the moiré tools used?



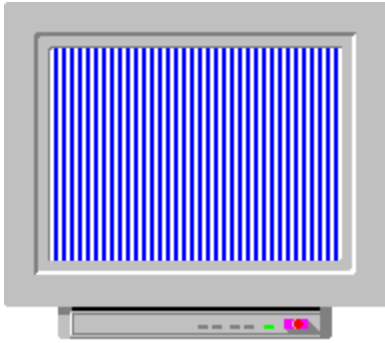
Look for waves, wisps, bundles and shimmers of intensity variations. Use all the test tools to check moiré, as the visibility of moiré patterns varies with colours.



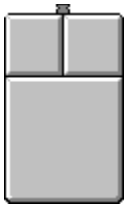
Left: Change colour

Right: Change pattern

## How are the moiré tools used?



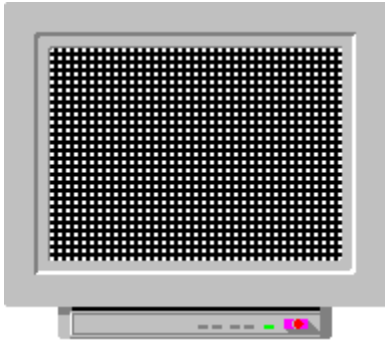
Look for waves, wisps, bundles and shimmers of intensity variations. Use all the test tools to check moiré, as the visibility of moiré patterns varies with colours.



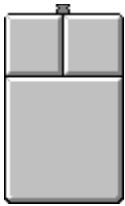
Left: Change colour

Right: Change pattern

## How are the moiré tools used?



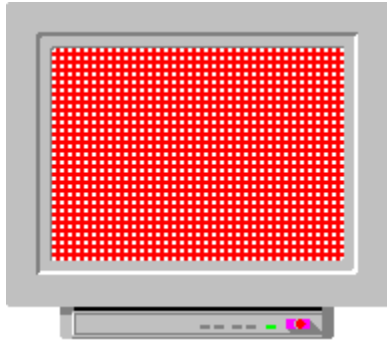
Look for waves, wisps, bundles and shimmers of intensity variations. Use all the test tools to check moiré, as the visibility of moiré patterns varies with colours.



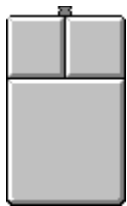
Left: Change colour

Right: Change pattern

## How are the moiré tools used?



Look for waves, wisps, bundles and shimmers of intensity variations. Use all the test tools to check moiré, as the visibility of moiré patterns varies with colours.

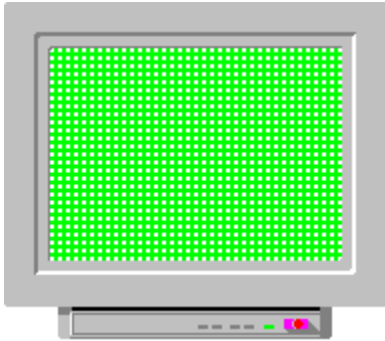


Left: Change colour

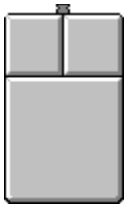
Right: Change pattern



## How are the moiré tools used?



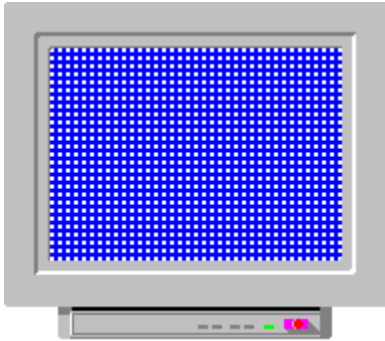
Look for waves, wisps, bundles and shimmers of intensity variations. Use all the test tools to check moiré, as the visibility of moiré patterns varies with colours.



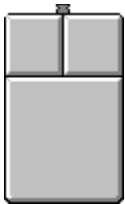
Left: Change colour

Right: Change pattern

## How are the moiré tools used?



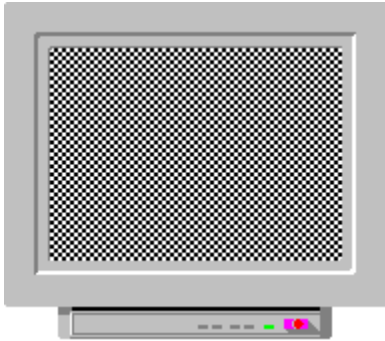
Look for waves, wisps, bundles and shimmers of intensity variations. Use all the test tools to check moiré, as the visibility of moiré patterns varies with colours.



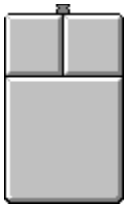
Left: Change colour

Right: Change pattern

## How are the moiré tools used?



Look for waves, wisps, bundles and shimmers of intensity variations. Use all the test tools to check moiré, as the visibility of moiré patterns varies with colours.



Left: Change colour

Right: Quit

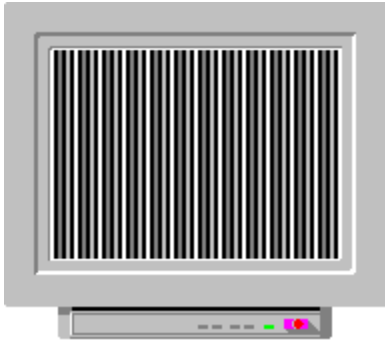
## Increase the contrast

Add contrast. This will increase the beam current and spot size, and defocus your picture. Check the picture focusing by means of the focus tools and/or the readability tools.

## What is moiré?

Moiré is a natural interference phenomenon that appears on all colour CRT monitors.

It is due to an interference between the shadow mask (or aperture grill) and the resolution used.

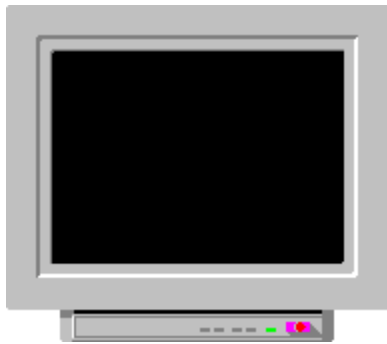


This is an example of pure video moiré. Normally you can also see some ripples, waves, and wisps of intensity fluctuations superimposed on the screen. They mostly occur in **displays that use finally focused beams.**

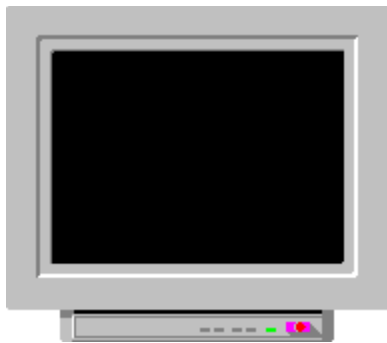
## What can you do?



Adjust focus



Increase the contrast



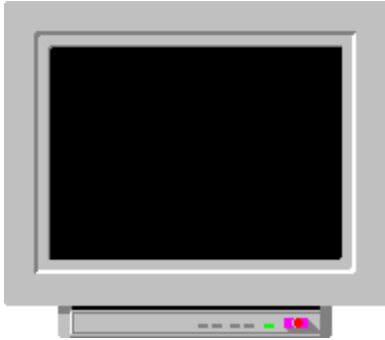
Change the image size



Change the resolution



Don't use grey or dark grey (dim) backgrounds



External filters



## **MONITOR TEST & SET-UP TOOL**

Welcome

Before you start

How to start

To use HELP: Open Toolboxes

Make your own copy to a diskette after the installation

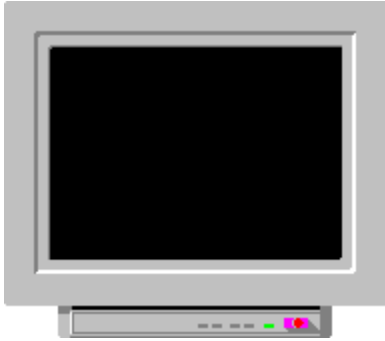
Feedback to NOKIA



## Copy the following files to a diskette:

|           |                     |
|-----------|---------------------|
| NTEST.EXE | Program file        |
| NHELP.HLP | This help file      |
| NTEST.INI | Initialisation file |

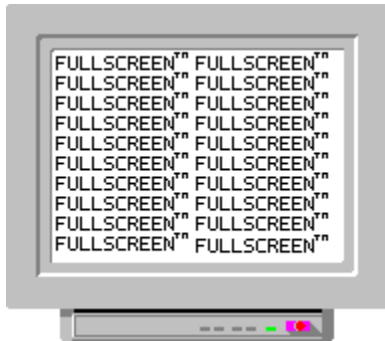
## READABILITY TOOLS



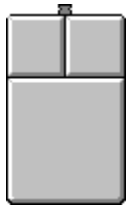
How are the readability tools used?

See also: Resolution, Convergence, Focus

## How are the readability tools used?



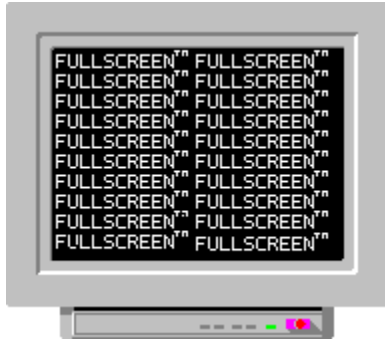
Use this pattern to check whether text is readable across the screen. The text should be readable, and all parts of each letter should be clear. If there are alignment problems you might notice colour fringing or bad focus; in any case the text will not appear sharp, possibly even unreadable.



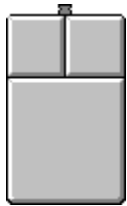
**How to use the resolution tools:** Click on the left mouse button to start. ( Left: Invert. Right: Go to the main menu)

Note: If you have too high a resolution on a small screen, it will be extremely difficult to get readable text as the alignment tolerances are too tight.

## How are the readability tools used?

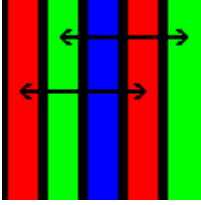


Use this pattern to check whether text is readable across the screen. The text should be readable, and all parts of each letter should be clear. If there are alignment problems you might notice colour fringing or bad focus; in any case the text will not appear sharp, possibly even unreadable.

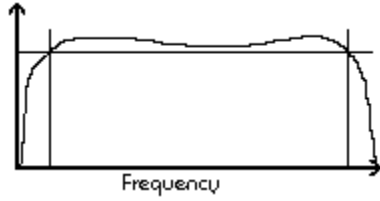


**How to use the resolution tools:** Click on the left mouse button to start. ( Left: invert. Right: Go to the main menu)

Note: If you have too high a resolution on a small screen it will be extremely difficult to get readable text as the alignment tolerances are too tight.

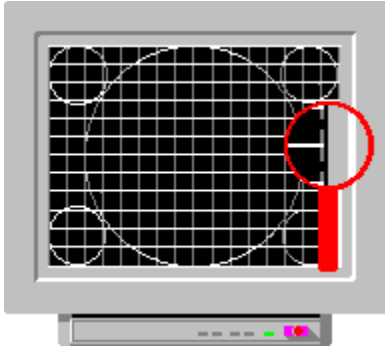


"Dot pitch" is a measure of the shortest distance between identically coloured grills. The most common dot pitches are 0.31 mm, 0.28 mm, and 0.26 mm.



The amplifier bandwidth is specified in -3dB points. Bandwidth:  $F_{\max} - F_{\min}$  (-3dB). It is however more realistic to talk about video dot frequency and rise/fall times.

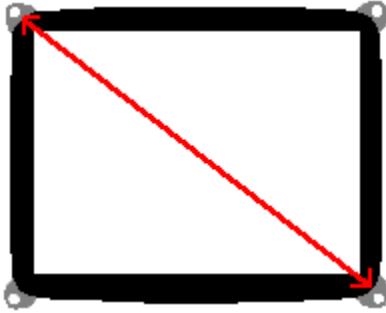
## Bandwidth, rise/fall time problem



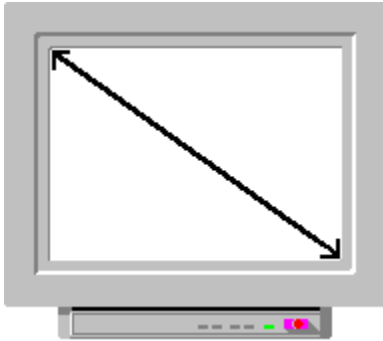
If your picture looks like this you have a problem.

1. Check all cables between the monitor and the computer.
2. You have a poor video board in the computer. This is quite a common problem for cheap video boards. Even the best monitors can not solve this problem. The correct solution is to buy a new video board. A cheaper solution is to use a lower resolution.
3. You have a poor video amplifier in your monitor, or you try to use the monitor outside of it's specified properties. The solutions are the same as above (item 2).

The most popular CRT sizes are 14", 15", 17", 20", and 21".



The CRT size is measured as the diagonal dimension of the TUBE



The visible area is always smaller than the CRT's face value. A 15" CRT, for example, gives you a visible area of 13.7" diagonally.




## Common problems

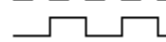


Bandwidth, rise/fall time problem.



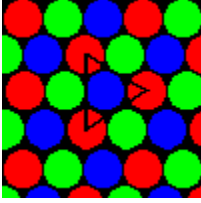
Overshooting problem.

 **Dot Frequency**

 **Video Signal**

The dot frequency is twice the video frequency.  $1/\text{PIXEL TIME} \rightarrow \text{DOT FREQUENCY}$ .

Example: 200 MHz dot frequency  $\rightarrow$  pixel time is 5 ns ( $1/200 \text{ MHz}$ )  $\rightarrow$  100 MHz video signal frequency ( $1/(5 \text{ ns} + 5 \text{ ns})$ ).



Dot pitch is a measure of the shortest distance between two dots of the same colour. The most common dot pitches are 0.31 mm, 0.28 mm, and 0.26 mm.

Low resolution.

Dot pitch 0.44 to 0.47 mm

Medium resolution.

Dot pitch 0.32 to 0.43 mm

High resolution.

Dot pitch 0.28 to 0.31 mm

Ultrahigh resolution.

Dot pitch 0.21 to 0.27 mm

# Maximum resolution

The maximum resolution depends on:



The CRT size,



The dot pitch or



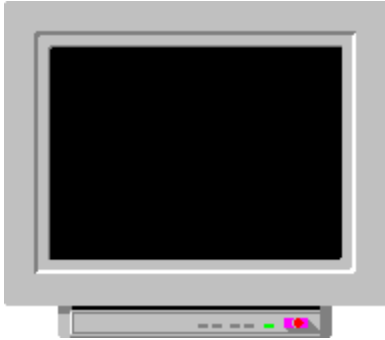
aperture grill,



The video amplifier's bandwidth

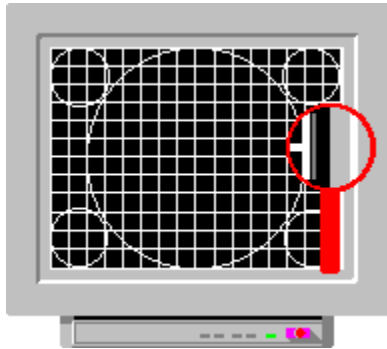


The dot frequency



The rise-fall time, and  
the video adapter card, and it is always a combination of these factors.

## Overshooting problem



If you have picture like this one you might have an "overshooting" problem, and will see "shadows" behind the white line (or black line, if you have a white background, as for example in Windows). Normally this problem is due to the video card. The manufacturer has tried to increase the output of the video card, whereupon it starts to oscillate.

1. Check all cables between the monitor and the computer.
2. You have a poor video board in the your computer, this is quite a common problem for cheap video boards. Even the best monitors can not solve this problem. The correct solution is to buy a new video board. A cheaper solution is to use a lower resolution.
3. You have a poor video amplifier in your monitor or you try to use monitor out of it's specified properties. The solutions are the a same as above (section 2).

## Recommendations

We recommend that the following maximum resolutions are used:

|     |             |  |
|-----|-------------|--|
| 15" | 800 x 600   | highly recommended                           |
|     | 1024 x 768  | recommended                                  |
|     | 1280 x 1024 | for very special applications; see dot pitch |
| 17" | 1024 x 768  | highly recommended                           |
|     | 1280 x 1024 | recommended for some applications            |
|     | 1600 x 1200 | for very special applications; see dot pitch |
| 21" | 1280 x 1024 | highly recommended                           |
|     | 1600 x 1200 | recommended                                  |

Note: Using a high resolution on a too small screen makes the characters illegible at normal viewing distances. A viewing distance closer to the monitor can cause eye-strain or musculoskeletal fatigue.

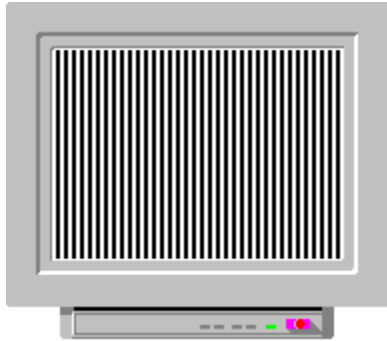
This is one most important properties of a video amplifier.  
The factor between rise/fall times and bandwidth:  
 $0.35/(\text{rise time}) \rightarrow \text{bandwidth}$ .

Example:

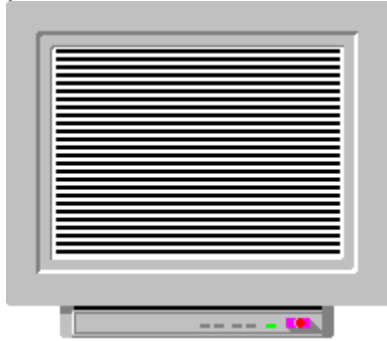
$0.35/3.5 \text{ ns} \rightarrow 100 \text{ MHz}$



## RESOLUTION / What is it?



This is a number of picture elements or pixels, that are used to produce an image on the display. The pixel resolution of the image is specified by means of (a) the number of pixels in each horizontal row, which is the same as how many vertical lines it is possible to see (if the horizontal resolution is 800 it is possible to see 400 white/black lines [1pixel/1pixel]),



and (b) the number of pixels in each vertical column on the screen, which is the same as how many horizontal lines it is possible to see (if the vertical resolution is 600 it is possible to see 300 white/black lines) [1pixel/1pixel]).

The nominally used formula is H x V. Examples:

640 x 480 -> 307 200 addressable pixels.

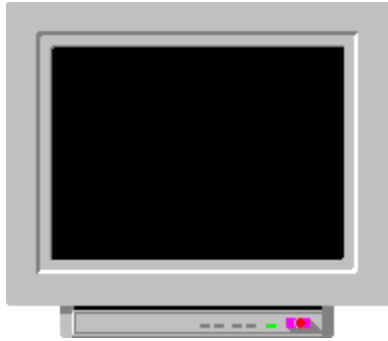
800 x 600 -> 480 000 addressable pixels.

1600 x 1200 -> 1 920 000 addressable pixels.

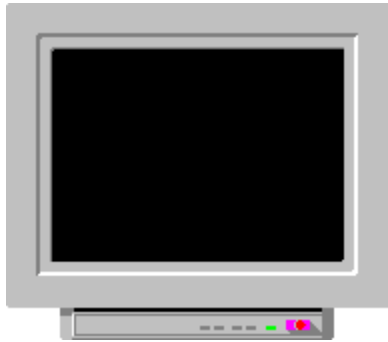
The most popular resolutions are 640x480, 800x600, 832x624, 1024x768, 1152x870, 1280x1024, and

1600x1200. See: [Theoretical pixel size.](#)

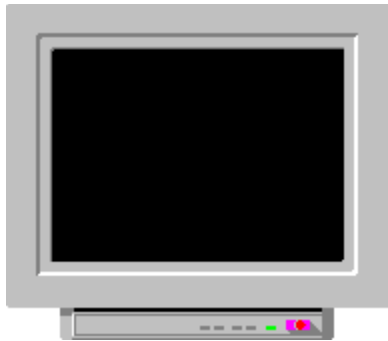
# RESOLUTION TOOLS



What is resolution ?



How are the resolution tools used?



Maximum resolution

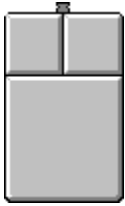


Common problems and solutions.



## Recommendations

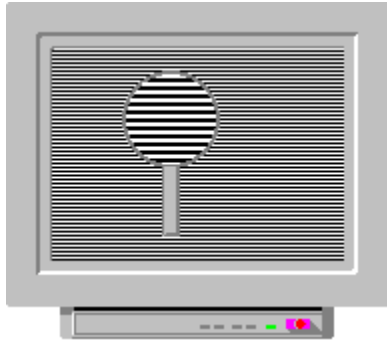
## RESOLUTION TOOLS



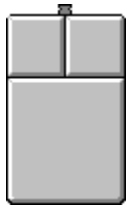
How to use the resolution tools: Click on the left mouse button to start (Left: Change resolution. Right: Go to next image)

This tool is useful for checking whether the CRT is capable of displaying finely spaced lines across the entire CRT image area. Both the horizontal and the vertical resolution can be checked.

# RESOLUTION TOOLS

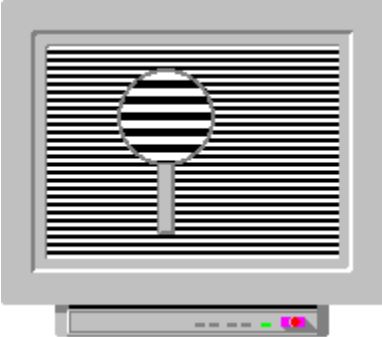


Testing vertical resolution; 1/1 pixels

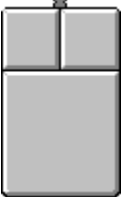


Left: Change resolution    Right: Horizontal resolution

# RESOLUTION TOOLS

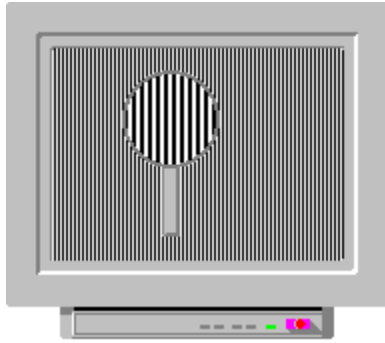


Testing vertical resolution; 2/2 pixels

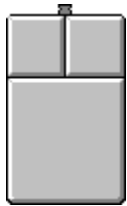


Left: Change resolution    Right: Horizontal resolution

# RESOLUTION TOOLS



Testing horizontal resolution; 1/1 pixels

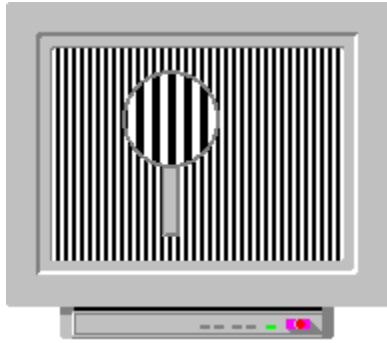


Left: Change resolution    Right: Quit

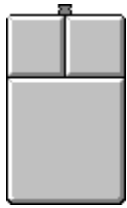
Note: This is an extreme test for CRTs running in high (800x600 +) resolution modes (especially monitors of 15" or less). Because of the way in which the electron beams scan the CRT screen, the beams must be turned completely on, and then completely off, within the span of 1 pixel. This puts a strain on both the electronics of the video adapter card and on the monitor.

If you can't see the individual white lines you might see interference patterns, which indicates that the dot pitch is probably too coarse, or you might see a grey screen, which indicates that either the video adapter or the video amplifier of the monitor is probably too slow for this combination of resolution and image size. The solution to problems of this kind is either to run your monitor at a lower resolution, or to get a monitor with a larger image area.

# RESOLUTION TOOLS



Testing horizontal resolution; 2/2 pixels



Left: Change resolution    Right: Quit



# SAFETY INSTRUCTIONS

Read these instructions in full. Follow cautions and instructions given on the monitor.

## **Do not attempt to service or open the monitor yourself.**

To prevent fire or shock hazard, do not expose this appliance to rain or moisture.

Never let objects of any kind enter into this monitor through cabinet slots, as they may then come into contact with components with dangerous voltage, which could result in a fire or electric shock.

Never spill liquid of any kind on the monitor.

Unplug the monitor for added protection, when it is left unattended and unused for a longer period of time.

Do not use any attachments not recommended by your sales representative, as they may give rise to hazards.

**If the monitor is damaged it should immediately be unplugged from the power outlet.**

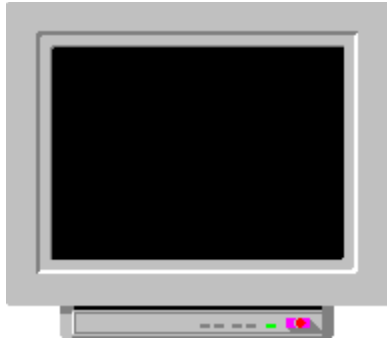
## **Connection to power system**

Do not connect the power cord of the monitor to a power outlet with a voltage or frequency that differs from that indicated on its commercial label. Always use a grounded power outlet.

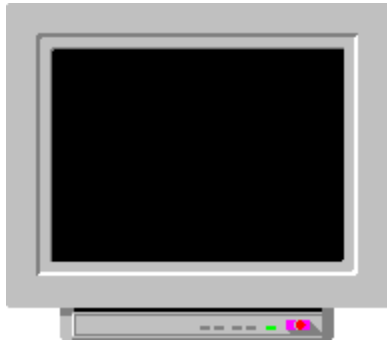
Use the attached specified power cable, which will not interfere with radio and television reception.

Do not expose the power cord to mechanical stress.

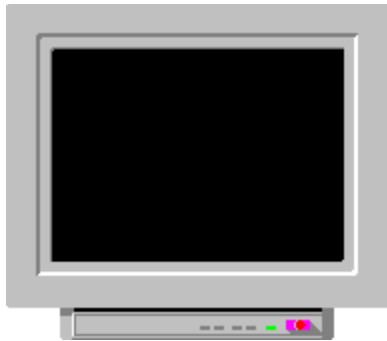
# SCREEN REGULATION



What is screen regulation?



How are the screen regulation tools used?



What can you do?



Recommendations!

## Change the intensities of the system colours

Use Windows' Control Panel to change the intensities of the system colours. (Instructions for this can be found in the Help function for Windows' Control Panel.)

## Recommendations!

If the white line moves less than is visible you have a very good monitor (screen regulation).

If the white line moves less than 1 mm your screen regulation is quite good.

If the white line moves between 1 and 2 mm your screen regulation is "fair".

If the white line moves between 3 and 5 mm your screen regulation is unsatisfactory, and if it moves more than 5 mm it is either catastrophic or your monitor is malfunctioning.

## Reduce the brightness and contrast

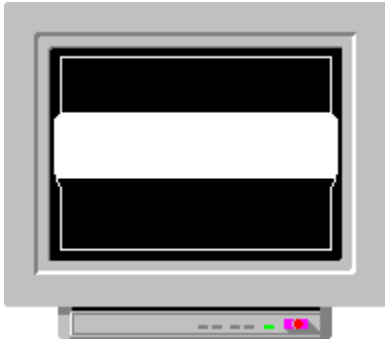
Reduce the brightness and contrast. This decreases the beam current level and reduces the effect.

## Reduce the background intensity

Use Windows' Control Panel to change background intensity, for example from white to grey.

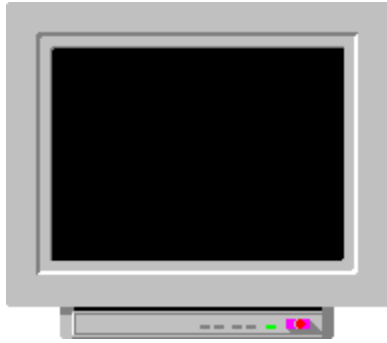
(Instructions can be found in the Help function of Windows' Control Panel.)

## What is screen regulation?



On some monitors the image expands in bright areas and contracts in dimmer areas. This happens because the monitor has a poor high-voltage regulation. This effect is more or less visible in all monitors, but normally more so in very cheap monitor models, as it is not inexpensive to design and manufacture a very good high-voltage regulation system. If your monitor has a very bad screen regulation, the picture "zooms" when you adjust the brightness control. **Examples of where this often occurs are bar graphs and Windows' title bars.**

## What can you do?



Reduce the brightness and contrast



Reduce the background intensity



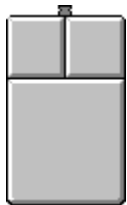
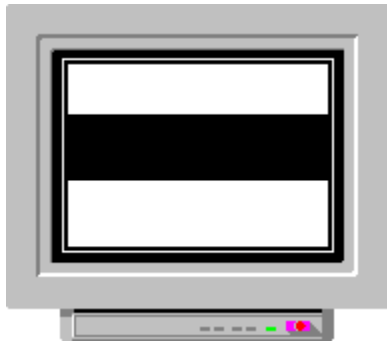
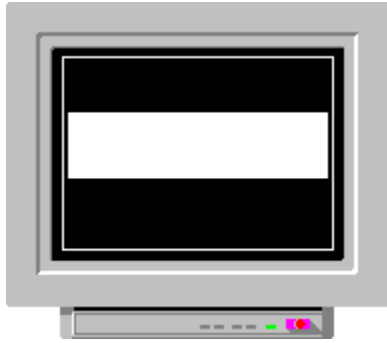
Use different system colour intensities



Use primary colours



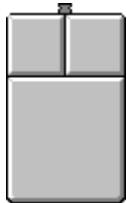
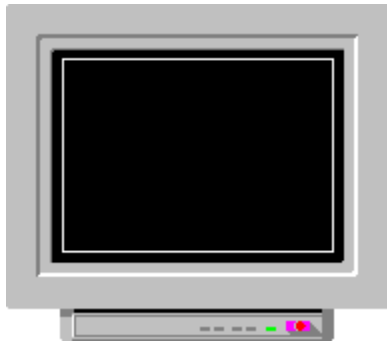
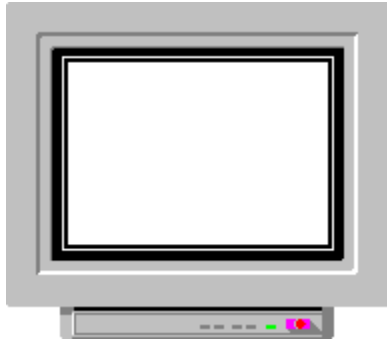
## How to use the screen regulation tools



Click on the right mouse button to go to the following picture(s).  
When the picture starts to blink, check the white lines on the left and right  
sides.

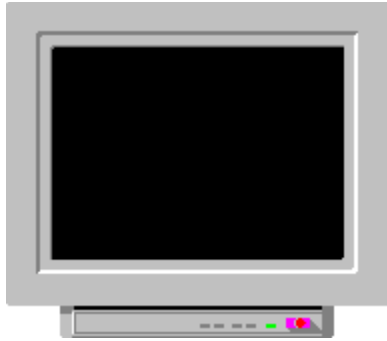
The blinking is merely used to make the effect easier to detect.

## How to use the screen regulation tools



Click on the right mouse button to end the test.  
When the picture starts to blink, check the white line on the left/right side  
and at the top/bottom.  
Blinking is merely used to make the effect easier to detect.

# START-UP TEST PATTERN



How are the start-up tools used?



Recommendations!

USE THESE ELEMENTS TO CHECK THE OVERALL LINEARITY AND CONVERGENCE.

USE THIS TO CHECK THE APPEARANCE OF THE GREY-SCALE.  
USE THIS TO ADJUST THE BRIGHTNESS AND CONTRAST OF YOUR SCREEN.

USE THIS TO CHECK THE LINEARITY AND THE FOCUS IN THE CORNER(S) .

USE THIS TO CHECK THE APPEARANCE OF THE MAIN COLOUR-SCALE.

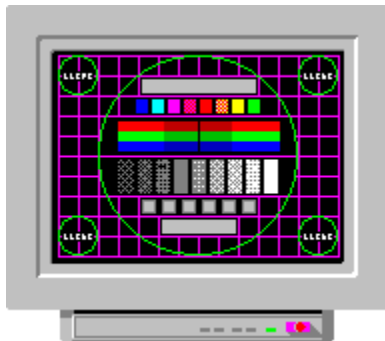
USE THESE ELEMENTS TO CHECK THE PICTURE POSITION AND SIZE.



USE THIS TO CHECK THE APPEARANCE OF THE STANDARD COLOURS.

# START-UP TEST PATTERN

How is it used?



Use this test pattern to check picture size and position, focus, and convergence, and to adjust brightness and contrast. For more detailed information, follow the instructions for the respective test patterns.

USE THESE BUTTONS TO SELECT USEFUL TEST PATTERNS FOR YOUR INTENDED PURPOSE.

HERE INFORMATION IS GIVEN ON YOUR GRAPHICS ACCELERATOR CARD, RESOLUTIONS AND COLOURS USED.

## **RECOMMENDATIONS**

USE THE START-UP TEST PATTERN REGULARLY TO CHECK THE PICTURE QUALITY OF YOUR MONITOR.

USE IT FOR EXAMPLE EVERY TIME YOU START WINDOWS.

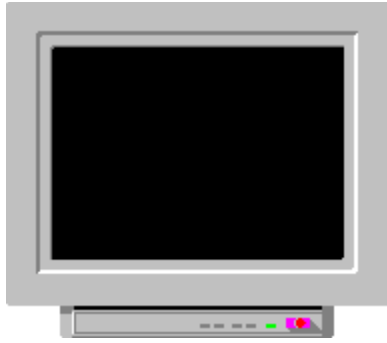
(YOU ONLY HAVE TO MOVE THE PROGRAM ICON TO WINDOWS' START-UP PROGRAM GROUP.)

IT IS HIGHLY RECOMMENDED TO USE IT AT LEAST WHEN YOU CHANGE THE RESOLUTION OR COLOURS!

FOR FINAL ADJUSTMENTS USE THE GEOMETRY AND BRIGHTNESS TEST PATTERNS OF THIS PROGRAM.

PICTURE WIDTH / RESOLUTION -> THEORETICAL PIXEL SIZE

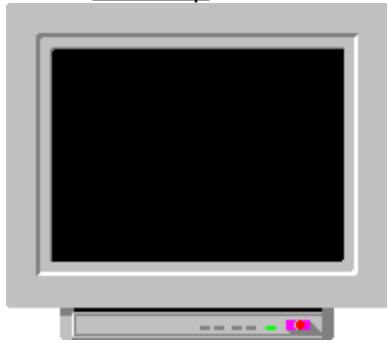
| MONITOR SIZE | RESOLUTION  | THEORETICAL PIXEL SIZE |
|--------------|-------------|------------------------|
| 21"          | 1600 x 1200 | 0.25 mm                |
|              | 1280 x 1024 | 0.31 mm                |
|              | 1152 x 870  | 0.35 mm                |
|              | 1024 x 768  | 0.39 mm                |
|              | 832 x 624   | 0.48 mm                |
|              | 800 x 600   | 0.50 mm                |
|              | 640 x 480   | 0.63 mm                |
| 17"          | 1280 x 1024 | 0.25 mm                |
|              | 1152 x 870  | 0.27 mm                |
|              | 1024 x 768  | 0.31 mm                |
|              | 832 x 624   | 0.38 mm                |
|              | 800 x 600   | 0.39 mm                |
|              | 640 x 480   | 0.49 mm                |
| 15"          | 1024 x 768  | 0.27 mm                |
|              | 832 x 624   | 0.34 mm                |
|              | 800 x 600   | 0.35 mm                |
|              | 640 x 480   | 0.44 mm                |



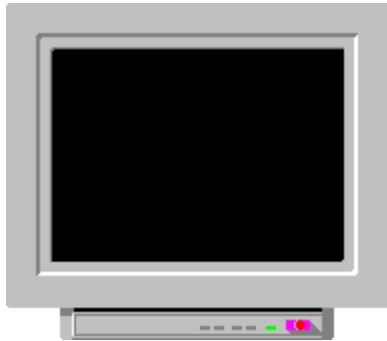
## Nokia Monitor Test



Start-up



Geometry



Brightness and contrast



Convergence



Focus



Resolution



Readability



Moiré



Colours



Screen regulation

## Use primary colours

White is made up of all the three primary colours, and will therefore load the beam current three times more often than only red, green or blue.

Secondary colours like magenta, yellow, and cyan loads the beam current twice as often as the primary colours.



# Welcome to Nokia Monitor Test

Version: 1.0

This program  
will guide you in setting the parameters, controls and adjustments of the monitor.  
will guide you on how to measure picture quality.

NOTE: This program is designed for one purpose only: TO HELP Monitor USERS.

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DPSM is a registered trademark of VESA.

## **WHY USE BRIGHTNESS AND CONTRAST CONTROL?**

There are normally two controls for setting the light output of a monitor. They are called the BRIGHTNESS and CONTRAST controls respectively.

The brightness control is used to adjust the video signal's zero-level to equal black on the monitor screen.

The contrast control is then used to set the amplification of the video signal, or in practice to set the light output on the monitor screen to a comfortable level.

The brightness control is used to adjust the low light output levels, and the contrast control to adjust the ratio between the low and high level light outputs. Both of these adjustments are influenced by the ambient light, the application (program) being used, as well as by the operator's personal preferences.



