BUROSCH

Audio-Video-Technik

Gray Bars 32 Steps

Reference Test Pattern

Technical Documentation

BUROSCH
Audio-Video-Technik

Reference Test Pattern: Gray Bars 32 Steps

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1 General Tips and Notes

Here you see all tips and notes which you implicitly have to keep in mind:

Because of an external backlight a more relaxed watching television for the human eye is possible. Thereby is to mind that the backlight has to be placed behind the display without any glares. For external backlights you can use usual illuminants with small light power.

Please let you and your eye a few minutes time to better detect potentially color differences or display problems. For it this test pattern is optimal applicable because you often don't have enough time for a cognition at quick motions.

The test patterns are optimal adapted for an aspect ratio of 16:9. For other aspect ratios (16:10, 4:3, …) please use the source signal from your corresponding transducer.
Please only use applicable test patterns which are adapted for your individual application:

- SD for resolutions up to 1,366 x 768 Pixel interlaced
- FullHD for resolutions of 1,920 x 1,080 Pixel and 1,280 x 720 Pixel

Please note that static test patterns like this one mustn't be displayed more than one hour without changing pictures of the TV-display because of possible phosphor burn-ins which causes so-called "ghosts", especially on flat screens.
The same effect of "ghosts" can also be caused by broadcasting station icons or black bars which appear when a film is reproduced in another mode than its production mode. These things also cause diverse burn-ins on a display.
Therefore we advise a not so long display of the test signal on the display unit.

Because of printer settings and for clarification of the bad image reproduction the real images will be displayed only symbolical and suggestively.

2 Company Profile

Competence and innovation are the characteristics of the company BUROSCH Audio-Video-Technik. Already in 1948 we produced radios.

Because of this long experience in the topic electronic we are the European leader in reference test signals for quality evaluation and optimizing of displays respectively nowadays.

Already in year 1994 we developed the source code for these test signals which guarantees the specification of our declaration of conformity.

A lot of static and dynamic test sequences for every application, image format and for FullHD displays are stored at our internal server to satisfy the individual requests of our customers.

Of course we also offer you various audio test sounds in different sound formats.

So we offer a lot of audio and video test sequences to a technician for evaluating all components of the playback string professionally and to optimize by the help of these signals if needed.

These sequences developed by us act in many national and international laboratories as reference for comparative product tests. These test signals are also used by leading manufacturers worldwide in development, quality controls and in services, too.

Of course we cultivate the collaboration with various research institutes and technical universities.

Mr. Prof. Dr. Ing. M. Plantholt (domain: display measurement at university of Wiesbaden, Germany) also confirms the quality of our test signals.

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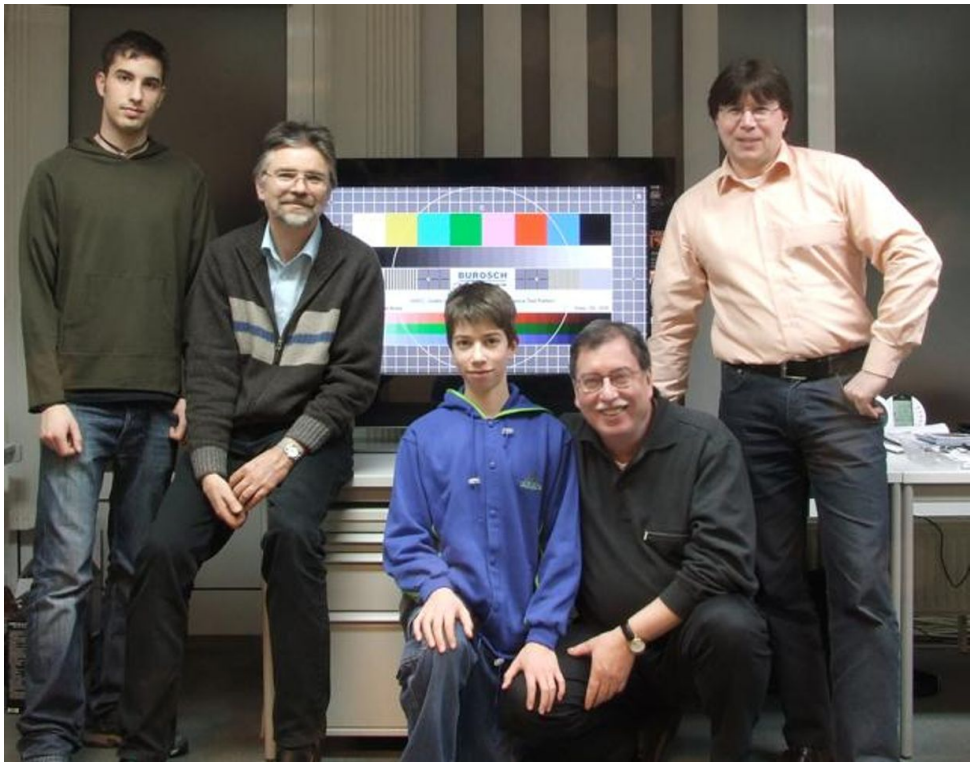
2 Company Profile

Profit by our know-how: Because of our long-time advising activity, also for famous industrial companies we are willingly at yours command for competent assistances and advices e.g. for configurations of look-up-tables over color temperature up to dynamic contrast measurements.



From left:

Steffen Burosch, Eberhard Graf, Andreas Burosch, Klaus Burosch, Paul Gaukler (Year 2007)

Presentation of the AVEC Universal Test Pattern in FullHD format on Philips 47” inch displays.

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2 Company Profile

2.1 Video Labor

By the long experience the company BUROSCH Audio-Video-Technik grown up to the Europe's leader in the area image evaluation and image optimization respectively.

Modern audio and video analyzers are used in our video labor.

The Burosch Company works only with first-class devices made by the most popular manufacturers like Sony, Hewlett Packard, Rohde & Schwarz, Tektronix, Quantum Data, Konica Minolta and many more.

Of course we work with the spectroradiometer CS-2000 from Konica Minolta already to make exact measurements, analyzes and calibrations.

Premium Broadcast Class A monitors from Sony are used in our video labor for a standard of comparison.
But in spite of grave improvements of the LCD and Plasma technique these Broadcast Class A monitors are optimal adapted for evaluation and documentation of the naturalness of colors and motion blurs.

We also arrange our knowledge to labors of famous journals for comparative product tests like Chip, c't Magazin, AVF-Bild and to professional testing laboratories like ASIG or OBL.

Stored at different mediums like CD, Video-DVD and Blu-ray Disc (BD) all test signals are available for you.

Display development departments all over the world of leading manufacturers in consumer electronics like Panasonic and in automotive industry like Daimler AG are also advised competently by us.

We also advise you willingly!
Please profit by our competence!

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2 Company Profile

2.1.1 Reference Measuring Devices

On the following pages we present our measuring devices for professional image analysis.

Professional spectroradiometers like Minolta's CS-2000 are used in the Burosch Video labor. This enables high-precision display measurements and perfect analysis. The following image shows the first-class measuring device from Minolta.

Spectroradiometer CS-2000 from KonicaMinolta

Premium measuring- and indication systems from Rohde & Schwarz, LeCroy, Tektronix and Hewlett Packard and many video display units from Sony are used in the labor of the Burosch company.

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Andreas and Klaus Burosch: Image- and Video Analysis with Video Analyzers from Rohde & Schwarz.

Klaus Burosch: Image- and Video Analysis with high-precision measuring devices from Rohde & Schwarz and many more.

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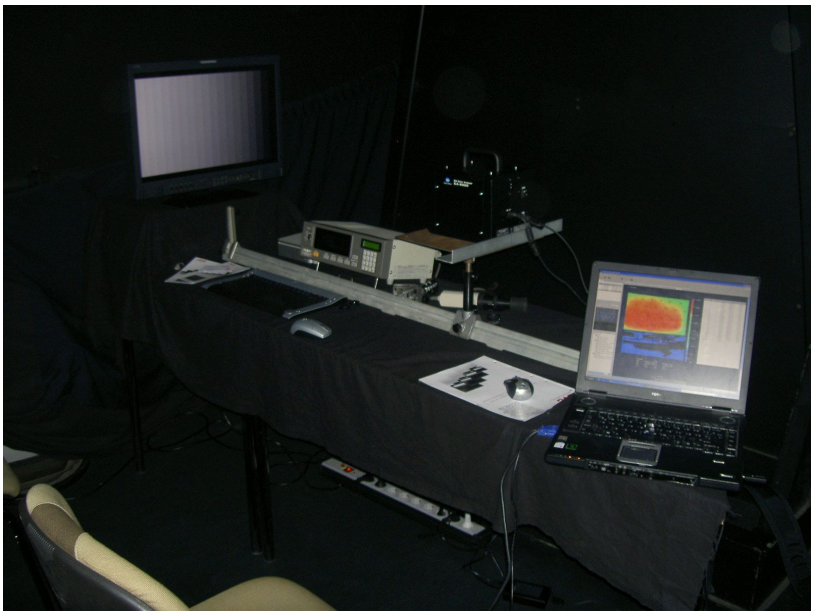
2 Company Profile



Display measurements with spectroradiometers and color analyzers from Minolta (CA-2000 und CS-2000)

Plasma Display Prototype Analysis; from left:

Mr. Wild (Department Manager HDTV Panasonic), Raphael Vogt, Klaus Burosch, Eberhard Graf, Philipp Smoldas

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2 Company Profile

2.1.2 Source Code

For being able to make a professional quality evaluation the quality of the reference signal must be known. Only if the reference and source signal respectively is known a correct image evaluation can be done.

Therefore we developed already in 1994 this source code to ensure the reconvertibleness of our reference test signals and so we guarantee the specifications of the declaration of conformity.

All of our test signals are created based on this source code and so it's an absolute reference for the technical engineer.

This source code is the basis for all further test patterns.

```
1116 for ($frame = 0; $frame < $anzframe; $frame++) {
1117     #$shift = 1.5707963267948966192313216916398*4/$anzframe*$frame;
1118     $shift = 1.5707963267948966192313216916398*4/$anzframe*$frame;
1119     $faktor = 1.5707963267948966192313216916398/$bildbreite*2*$endfreq/37.137330754352030947775628626692*(($frame/$anzframe*2)+0.5);
1120     #BUROSCH Reference Test Patten
1121     print "Frame $faktor shif $shift \n";
1122     for ($y = $topmargin; $y < $bildhoehe+$topmargin; $y++) {
1123         #print "Line $y shif $shift \n";
1124         for ($x = $leftmargin; $x < $bildbreite+$leftmargin; $x++) {
1125             $counter = 0;
1126             #my $color = Imager::Color->new(gray => ((sin($x*log($y/10+1)/50+512)+1) * 128));
1127             #my $color = Imager::Color->new(gray => ((sin($Kx*$x + $Ky*$y + $Kx2*$x*$x + $Ky2*$y*$y + $Kt*$t + $Kt2*$t*$t))*256));
1128             my $skala = $y % 50;
1129
1130
1131             #if(($x == 50) or (($skala == 0) and ($x > 9) and ($x < 91))){
1132                 #$color_wert = 0;
1133             #}else{
1134                 my $distanz = sqrt(($x-$breite/2)*($x-$breite/2) + ($y-$hoehe/2)*($y-$hoehe/2));
1135                 #$color_wert = (sin(1.70442309765071247746454176610220*0.000001*$distanz*$distanz)+1)*128;
1136                 $color_wert = (sin($faktor*$distanz*$distanz+$shift)+1)*128;
1137             #}
1138             #print "Wert = $color_wert\n";
1139
1140             $color = Imager::Color->new(gray => $color_wert);
1141
1142             if($color_wert == 0){
1143                 $counter++;
1144             }
1145             $gray -> setpixel( x => $x, y => $y, color => $color); #=
1146         }
1147         #$color_new = $gray->getpixel(x=>$x, y=>$y);
1148         #print "Zeile ",$y,":", $counter*2, "\n";
1149     }
1150     $outfilename = $bildpath."/"."ZP"." $breite $hoehe"."H $endfreq $frame.bmp";
```

BUROSCH Reference Test Pattern source code

Only if the signal source is known a competent image evaluation can be done.

Many people often do display comparisons with test patterns without knowing the signal source of them. That's why it's important to know the exact signal source and source code respectively. Correct image analysis and image evaluations can be only done by the help of this source code.

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2.2 Basic Tuning

In the speciality store the most flat screens show a good image with a sales-promotional adjustment. The customer hasn't enough time to concentrate on the real image quality because of the quick film sequences. Further the ambient lights at the display presentations in the stores are almost 10 times brighter than at home. The disillusion comes often afterwards. Because of the lower ambient light at home it is necessary to recalibrate the display when you're at home. When you place the bought display at home you see deformations, blurring or false colors mostly. Because of that the customers are often unhappy with the bought product. But mostly this isn't due to the TV-device itself. In fact the most important aspects of the image reproduction were overlooked ruthlessly or not at all attended.

Only a good interaction of the various components of the playback string makes a perfect image possible. Therefore all parameter of the signal source (e.g. DVD-Player, Blu-ray-Player or Sony Playstation 3) and of the reproduction device (TV-display) have to be checked and correct adjusted if needed.

Because of this we advise a check-up of the most important criteria like brightness, contrast, focus, color and gamma correction respectively locally in the store. The seller should afford this. Applicable for this you find the adapted test patterns on our webpage www.burosch.de depending on your later application. You can easily download these free Display Basic Tuning test patterns and burn it on a DVD.

The adjustments of your image sender and signal source respectively you must keep clearly in mind. You should check these adjustments, too. Because only if the adjustments are correctly coordinated to each other a good image and so an optimal home-cinema feeling is warranted.

Digital inputs on your TV-display like HDMI or DVI also arrange for the best image reproduction unlike analogue connections (SCART-RGB, Composite Video…).

These reference test patterns act as basis for the image evaluation and image optimizing. Technicians of famous test journals for comparative product tests e.g. Chip, c't Magazin, AVF-Bild and further more also work with our reference test patterns.

Please satisfy yourself of our reference test signals and set up your display like a technician!

On the following page you see an abridgment of the test journals Chip and c't Magazin from which you probably can learn more.

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3 Description

Here you see the test pattern in optimal display.

Reference Test Pattern Gray Bars 32 Steps in optimal display

By the help of two individual test zones the test pattern “Gray Bars 32 Steps“ is optimal adapted for check-up and calibration of the gray values reproduction and so the visual evaluation of the optimal display of brightness, contrast and the gamma.

This test pattern is separated horizontally in the middle of the image. The upper half shows 32-stepped gray bars in equal grading from completely white at the left up to maximum black on the right side.

The bottom area shows a linear ramp from maximum black on the left up to 100-percent white on the right. The border of the image consists of 50% white (middle gray).

At a correct color balance without any drifts of color dependent on brightness all the fields in the upper half are same neutral gray and the ramp in the bottom area shows a clearly linear run without any steps.

Optimal Display:

- Upper half of the image shows 32-stepped gray bars. The left field (bar) is completely white; the right one is maximum black. Grading is the same at the whole surface.
- In the bottom image area shows a clearly ramp from maximum black on the left up to completely white at the right side. There are no visible steps or color drifts.

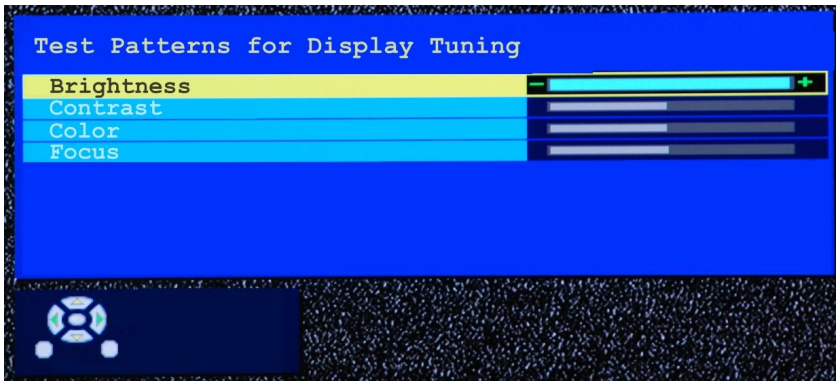
Reference Test Pattern: Gray Bars 32 Steps

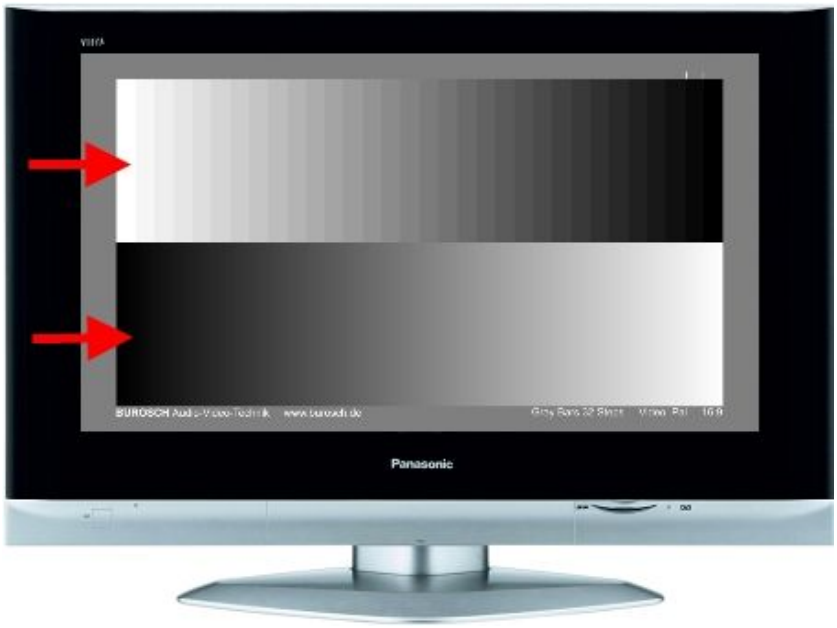
3 Description

3.1 Panasonic On-Screen Display

Representative for all on-screen displays of TV-devices we show here the Panasonic on-screen display. Please keep in mind that the construction of on-screen displays differs depending on the product.

3.1.1 Brightness





You find more detailed information about the function of the individual test zones 32-stepped Gray Bars and Gray Ramp later in this manuscript.

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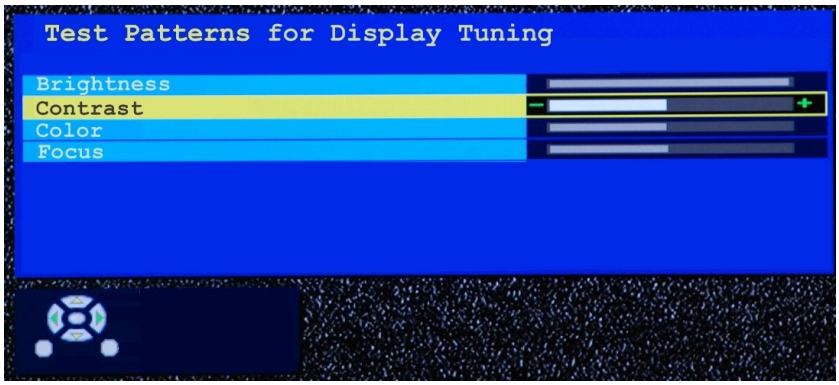
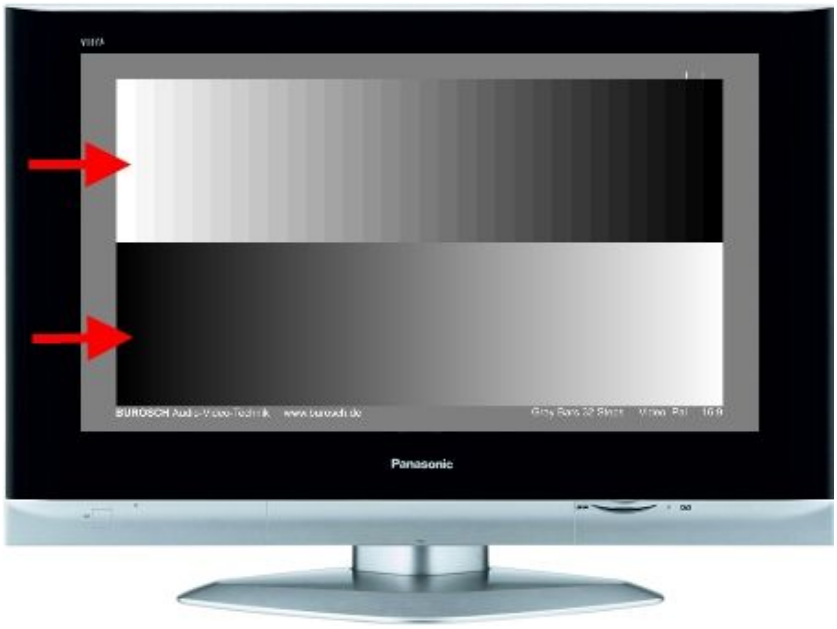
3 Description

3.1.2 Contrast





You find more detailed information about the function of the individual test zones 32-stepped Gray Bars and Gray Ramp later in this manuscript.

Reference Test Pattern: Gray Bars 32 Steps

3 Description

3.2 Overview of the test zones

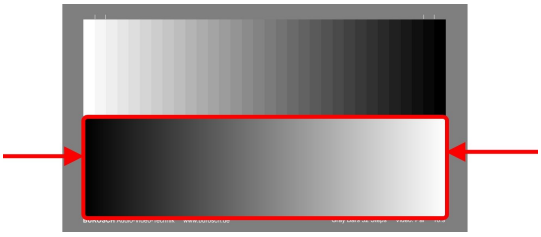
Here you see an overview of the various test zones. Detailed information you find in chapter “Individual Test Zones”.

3.2.1 Test Zone 1: 32-stepped Gray Bars

The first of the two test zones shows 32-stepped gray bars. This test zone is adapted for the optimal calibration of brightness and contrast of the display.

More detailed information for this test zone you find in chapter “Individual Test Zones“ in the sub point “32-stepped Gray Bars”.

3.2.2 Test Zone 2: Gray Ramp



This test zone shows a linear gray ramp which is optimal adapted for the uniformity and the quantification of the TV-display.

More detailed information for this test zone you find in chapter “Individual Test Zones“ in the sub point “Gray Ramp”.

Note: Please note that static test patterns like this one mustn’t be displayed more than one hour without changing pictures of the TV-display because of possible phosphor burn-ins which causes so-called “ghosts”, especially on flat screens.

The same effect of “ghosts” can also be caused by broadcasting station icons or black bars which appear when a film is reproduced in another mode than its production mode. These things also cause diverse burn-ins on a display.

Therefore we suggest a not so long display of the test signal on the display unit.

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This description applies to all products and technologies of displays like PDP (Plasma), LCD, projection or DLP.

The universal test pattern, descried in the following is excellent adapted for visual and measurement evaluation and analysis respectively.
Before using the test patterns please check that all conditions come up with the later appliance, especially check the signal path and the light conditions.

Please pay attention to a normal comfortable brightness of the room and do not arrange the display so that a light source does impact the image on the display negatively caused by possible reflections if procurable. At daylight it could distort the color and brightness sensation because of reflections or the ambient light. The best and the most enjoyable conditions for the human eye are given when the TV display is arranged in a preferably dark room with less light like in a cinema. As a result good colors and brightness differences will come into one's own.

If you modify parameters for improvement of the image quality don't forget to save the modifications so that the changes become permanent.

Please note the options of your image sender (e.g. DVD Player). Also try to get by with as few as possible of so-called image-improving features which distort the original image more than improve it.

Of course the setup in the image sender and image replication device (e.g. TV-display) must be adjusted optimally to make a perfect display possible.

Tip: Please let you and your eye a few minutes time to better detect potentially color differences or display problems. For it this test pattern is optimal applicable because you often don't have enough time for a cognition at quick motions.

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4.1 Gamma (γ)

You need a gamma correction in displayed systems to compensate the non-linear brightness sensation of the human eye. At a double brightness increase the human eye don't react it necessarily as a doubling of the brightness perception. The felt brightness sensation increases steeply in darker areas and not so steep in bright areas. The human eye has a gamma of ca. 0.3 to 0.5.

The sensation of the human vision is not linear. Electronic displays should simulate the human viewing habits. Therefore a correction is necessary because an electronic sensor like a CCD-chip or an electron ray tube work almost linearly.

To solve this problem as good as possible the gamma correction was launched:

$O = I^{\gamma}$ (O: Output signal; I: Input signal).

At the calculation of the output signal O there will be only changed the gray values, the black- and white point don't change if the input signal is in range [0.1] and set on 1 respectively. The correction function is called like the exponent gamma (γ).

At a gamma value of 1 the output signal is all in all a bit darker – brighter steps of gray bars are graded stronger than the darker ones. At a gamma of less than 1 you have a brighter output image overall – darker steps of gray bars are graded stronger than the brighter ones whereat the brightness of the brightest and darkest point (white- and black-point) won't be changed. The white point is unchanged 100% white and the black point is also still 100% black.

Manufacturer of modern displays use always a gamma value of ca. 2.2 to ensure a real brightness sensation of the human eye.

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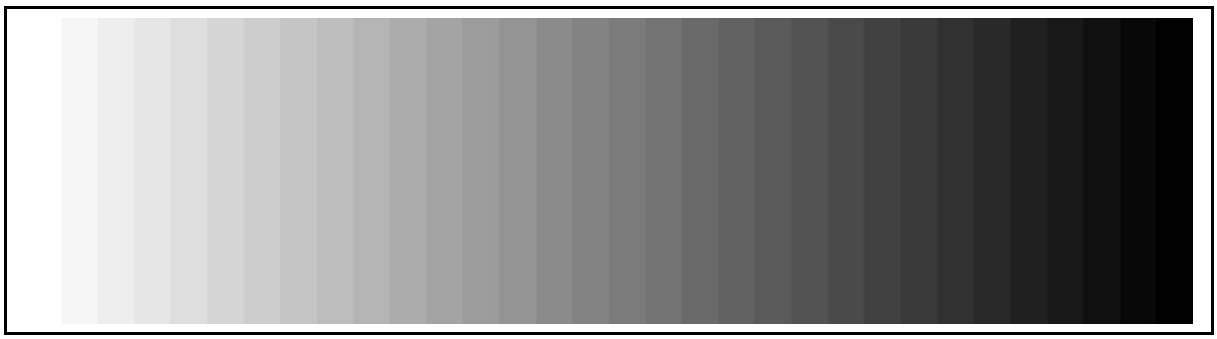
Subsequent you find a few marked and adapted examples which show you the meaning of the gamma function practically.

The original image (following image) shows 32-stepped gray bars with linear increasing brightness from left to right – the left field is completely white (100%), the right field is maximum black.



Original image

- In case of a too high adjusted gamma the brightest fields are graded stronger than the darker ones. This means you aren't able to distinguish the darker areas in the image (see following image)

Too high adjusted gamma

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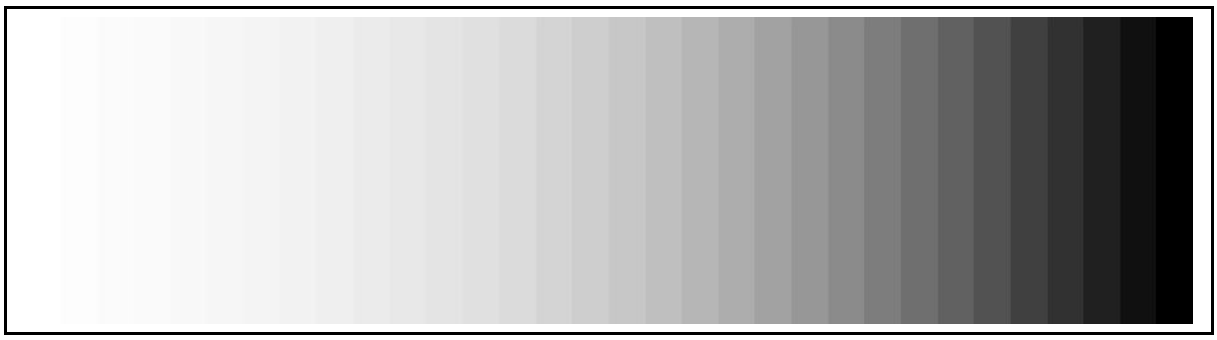
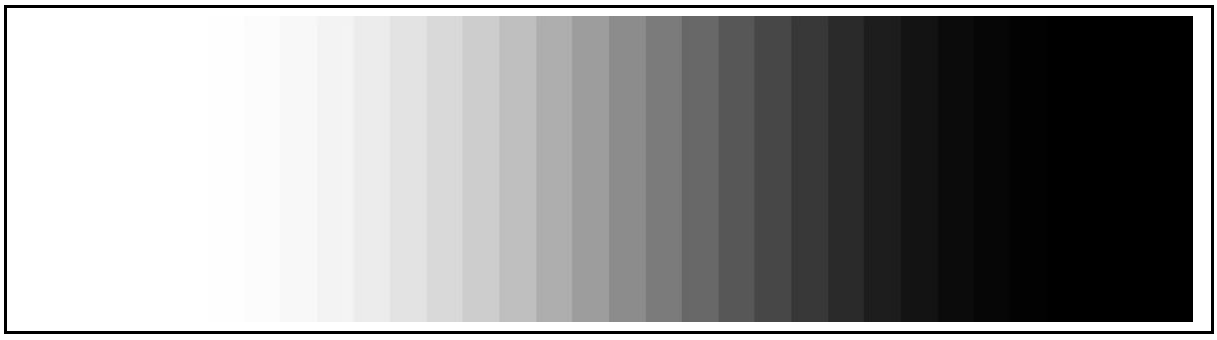
- In case of a too low adjusted gamma the darkest fields are graded stronger than the brighter ones. This means you aren't able to distinguish the bright areas in a image (see following image)



Too low adjusted gamma

- In case of a "S"-deformed gamma the middle gray fields are stronger graded than the outer fields. This means you aren't able to distinguish the brightest and darkest areas in a image (see following image)



"S"-deformed gamma

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4.2 Standard Illuminant D65 (White)

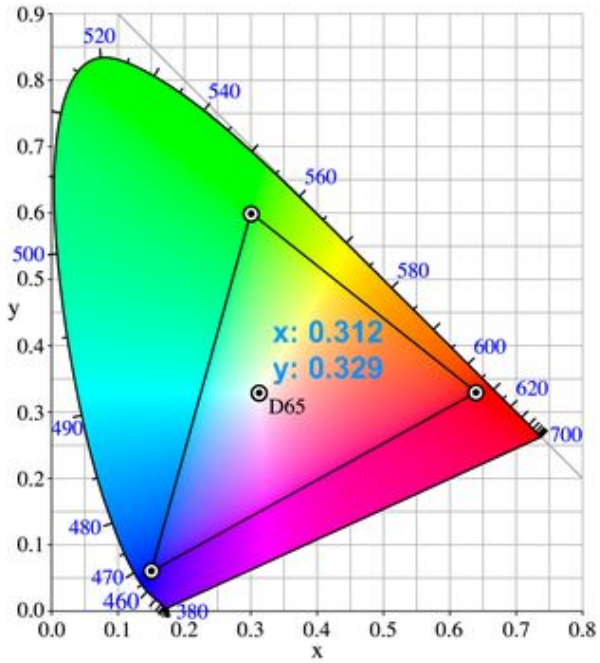
White is the only color which reflects completely and doesn't absorb any light. White contains the whole light energy within the visible spectrum. Further white is a standard for color measurements and television broadcasts which equates to the absolute reflection performance.

D65 (standardized white) is the most famous illuminant with a color temperature of 6,500 Kelvin. Color TV-devices have also this standardized color temperature for white.

D65 was defined by the CIE (International Commission on Illumination). The standardized illuminant D65 is a part of the D-illumination series which try to define the outdoor conditions on different places on the whole earth.

Depending on the color standard the white values differ marginally from each other. Therefore various graphic programs and the PAL standard define "white" in the CIE color space to the xy-coordinates 0.312/0.329 at a color temperature of 6,500 K (D65) which accords to an "average daylight". This illuminant only exists theoretically but it can be approximated.

The following diagram shows the coordinates of the standard illuminant D65 in a CIE 1931 color space.



Standard Illuminant D65 in the CIE 1931 color space

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4.3 Suitable Resolutions

This reference test pattern is optimal adapted for different resolutions. Many displays can be checked, evaluated and optimized if necessary, doesn't matter which label, image format or application the display has.

For example you can display this test pattern on small mobile phone displays, digital picture frames, navigation systems to the point of very large TV-Displays over 1.70 meter screen-size smoothly.

The following table gives an overview of the applicable resolutions:

Screen resolutions

Name	Pixel	Aspect ratio
VGA	640 x 480	1.33 : 1 = 4 : 3
SVGA	800 x 600	1.33 : 1 = 4 : 3
WVGA	853 x 480	1.77 : 1 = 16 : 9
XGA	1,024 x 768	1.33 : 1 = 4 : 3
SXGA	1,280 x 1,024	1.25 : 1
WXGA	1,280 x 768	1.66 : 1 = 15 : 9
HDTV	1,280 x 720	16 : 9
WXGA	1,280 x 800	16 : 10
WXGA	1,366 x 768	1.77 : 1 = 16 : 9
SXGA+	1,400 x 1,050	1.33 : 1 = 4 : 3
UXGA	1,600 x 1,200	1.33 : 1 = 4 : 3
Full HD	1,920 x 1,080	16 : 9

Note: The test pattern is optimal adapted for an aspect ratio of 16:9. For other aspect ratios (16:10, 4:3, …) please use the source signal from your corresponding transducer.

Please use only the particular resolution for your individual application:

- SD for resolutions up to 1,366 x 768 Pixels
- Full HD for resolutions of 1,280 x 720 Pixels and 1,920 x 1,080 Pixels

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4.4 Equation image „Jasmin und Sabrina“

Subsequent you find the description of the individual image elements and parallel the effect of possible image failures on a real image. Exemplary we use a real image portrait with different skin types for comparing.
Afterimage shows the real image in optimal, original exposition.

Real test image in optimal display

In addition to many abstract technical test images this real image shows the typical problems and its effect on real, complex images. To clarify possibly problems there are heightened cut-outs of this image.

Following aspects have to be attended of the real image:

- The whole surface of the background is neutral white
- Real skin types of the light and dark-skinned woman with clearly visible differences to each other.
- Hairs of the women show perfect and clear differences in bright and also dark parts of the image
- Real image is shown completely without any deformations or cuts

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4.5 Evaluation System

All images are evaluated based to the screen evaluation standard ITU-R BT500-11 and shown as stars. This should give you an intuition for the heaviness of the shown difference to the original image:

Excellent	Good	Fair
★★★★★	★★★★	★★★
Image is equivalent to the original	No visible differences to original image	Visible, uncritical differences to original image

Poor	Bad
★★	★
Highly visible differences to original image	Image is not equal to original, indicates a loss of information

A very good playback string with applicable connections like HDMI or DVI should reach a quality of five or four stars.

Good analogue sources like SCART-RGB or S-Video (Y/C) shouldn't reach less than 3 stars on a good display, doesn't matter which technology – CRT, LCD, Plasma, DLP or projection.

Correct wired, labeled devices should never fall to two or one star niveau at right adjustment. This is typically an unmistakable sign that there is a problem in the signal-string. It could be the configuration, calibration or other wrong adjustment or simply a defect. This needs to be checked once more.

Please keep in mind that not all TV-manufacturers allow complex calibrations on parameters like “gamma” or “color processing”. The typical parameters for calibration which should be possible at all displays are brightness, contrast, color, focus and partly the image geometry settings.

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4.6 Testbed

The optimal image reproduction on the TV-device depends on the individual settings (brightness, contrast, …) and from the correct testbed. The testbed is a really important factor which is often underestimated by many users. In this chapter the factor testbed is described.
Special attention should be paid to the following criteria:

- cabling / wiring
- ambient light
- viewing distance
- viewing angle (90° as possible)

For perfect film enjoyments please keep a preferably vertical (90°) viewing angle on the display. In case of too large difference of the viewing angle for example when you look from far right or far left it could be that brightness, contrast or color becomes falsified. Further you must pay attention to a correct presetting of the signal source (e.g. DVD Player, Sony Playstation 3,…) and your reproduction device (e.g. TV).

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4.6.1 Wiring

For a perfect image and audio signal there have to be a qualitative wiring. Because only with applicable wirings an optimal reproduction and so a perfect home cinema feeling is warranted. In this paragraph the different possibilities for wiring are presented and shortly described. At wirings you distinguish analogue from digital transfer systems.

- Analogue:

Wirings over SCART, S-Video or Component Video over Cinch plugs rank among analogue connections which reproduce a pretty poor image and audio signal respectively. Due to the high annoyances caused by bad shielded cables and/or too log cables such analogue wirings are inadvisable. The following image shows a SCART, Cinch (Component Video) and an S-Video plug successively. From these analogue connections the SCART-RGB possibility is the most reasonable and best one.

Comparison: SCART, Cinch, S-Video

- Digital:

Modern connections via digital interfaces like HDMI, DVI or LVDS make a good playback quality possible and eliminate the out-dated analogue transfer systems in the consumer electronics. The following image shows the usual digital plugs HDMI and DVI which make the best image and audio reproduction possible.

Comparison: HDMI, DVI

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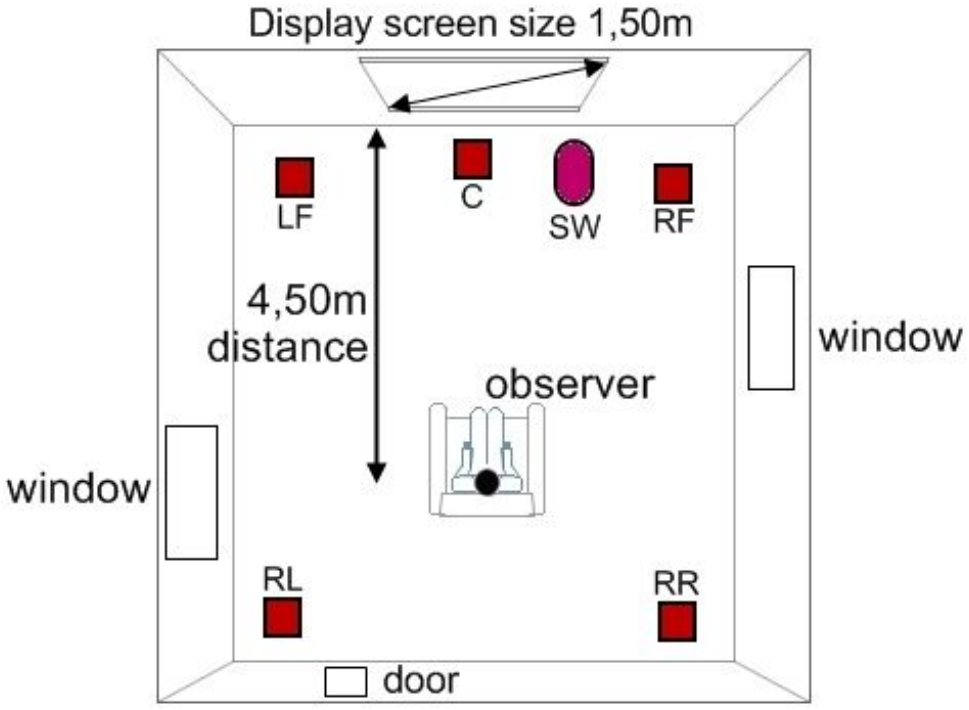
4.6.2 Ambient Light and Viewing Distance

Beside correct wirings you must also pay special attention to the positioning of the TV-display. Please place your TV-device so that various light sources like direct sunlight or the light from a bulb don't have a negative impact on the display itself by reflections if possible.

Further we advise an approximately viewing distance which depends on the size of the display. The viewing distance advised by us you can detect easily: 3 x diagonal screen size of the TV-device. This means if your TV display has a diagonal screen size of 1 meter you have to keep a distance of approximately 3 meter to ensure a sharp and high-contrast image.

The following schematically drawing shows a perfect home cinema system. Please also note the placement of the stereo or Dolby Digital 5.1 speakers.

LF (Left Front)	RL (Rear Left)
C (Center)	RR (Rear Right)
RF (Right Front)	SW: Subwoofer



Schematically drawing of an ideal home cinema system

5 Individual Test Zones

In this chapter the various test zones of the reference test pattern will be shown and described. Also you find a detailed description of possible maladjustments of the test zones in this chapter.

The reference test pattern Gray Bars 32 Steps is made up of 2 different test zones (see content on second page in this document for particular page numbers):

- 32-stepped Gray Bars
- Gray Ramp

The particular test zone is red marked for definitely clarification.

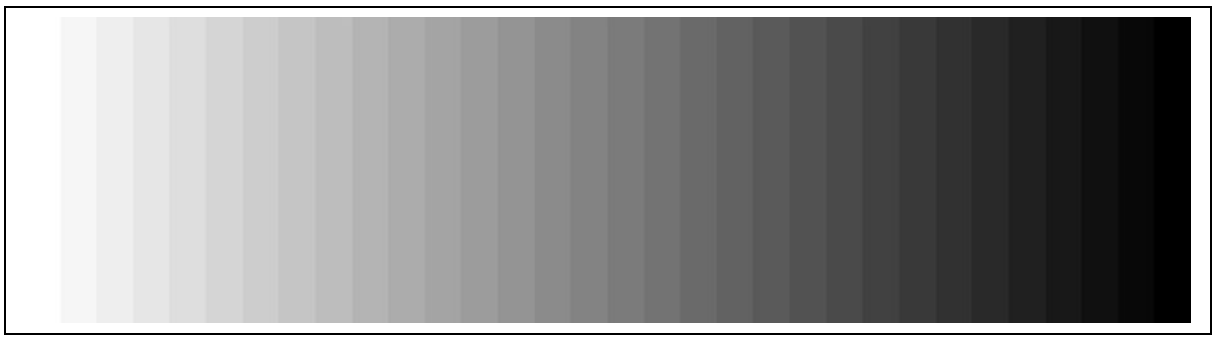
Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones

5.1 32-stepped Gray Bars

General View: 32-stepped Gray Bars

Detail View:



Detail View: 32-stepped Gray Bars

This 32-stepped Gray Bars are adapted for evaluation of the optimal brightness and contrast amount of the TV-display. All fields are same graded in the whole surface.

At a correct display you can see all 32 steps from maximum white to maximum black in the same gap. These steps are useful for calibration and the visual evaluation of the useful contrast amount and of the gamma.

At a correct color balance (color temperature) without brightness addicted drift are all fields same neutral gray.

Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones

5.1.1 Optimal Display

- Left field is maximum white (Like the illuminant D65)
- Right field is maximum black
- All steps are clearly separated to each other
- Brightness differences are the same on the whole test zone
- All steps are the same neutral gray

Detail View: optimal Display

Please note that especially the first and last two shades have to be clearly visible. Because only when white field is reproduced as D65 and the black field as pitch-black, both without color faults an image correction makes sense.

Because of its properties the human eye keeps a low profile to color faults in the first moment. The human eye quickly adapts to false colors. Due to the fact that you have to pay attention to a real color neutrality of “white D65” we advise to use a white, matt piece of paper which you simply hold beside the white step to check the neutrality this way.

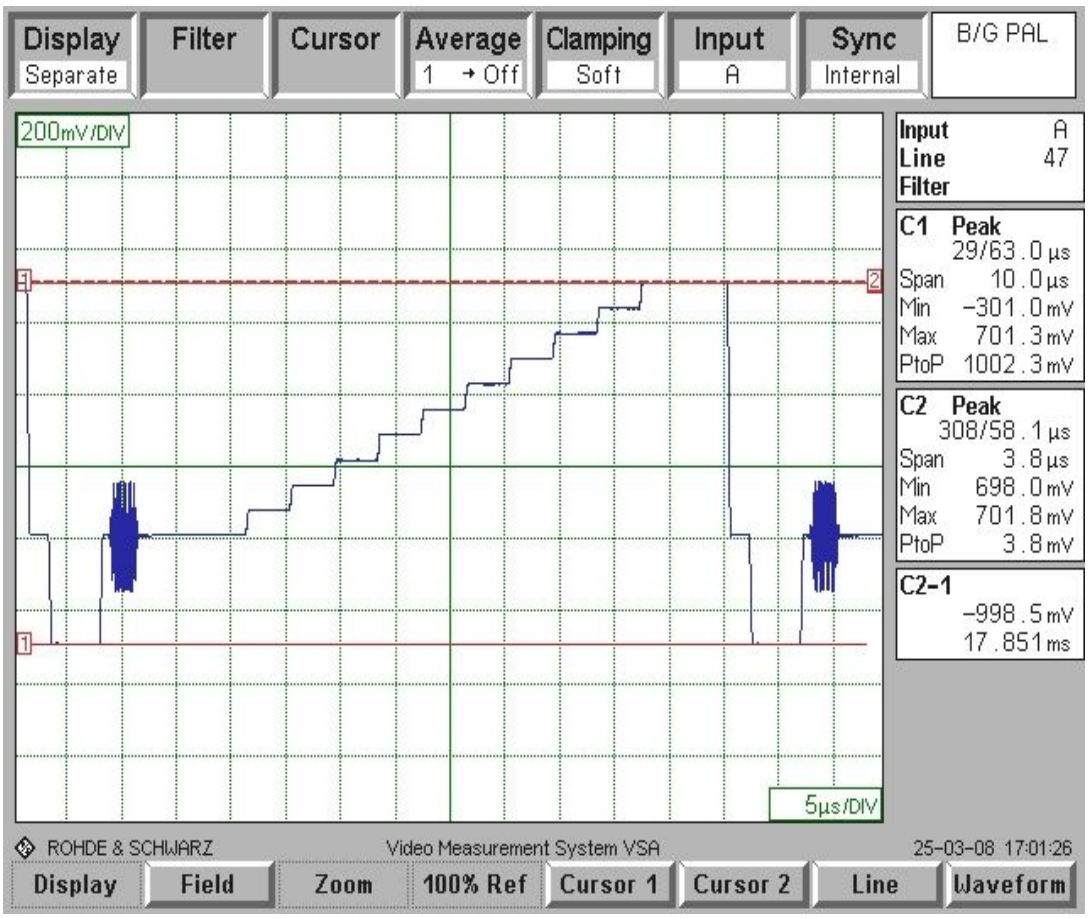
Note: Only in direct comparison e.g. with a piece of paper or different displays you are able to detect color faults in white very well!

Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones

5.1.2 Oscillogram

The following image shows an oscillogram of 10-stepped gray bars,



Oscillogram of 10-stepped Gray Bars

Gray bars are displayed as lines on the oscilloscope whose height depend on the brightness.

At a correct exposition the white level is exactly 0.7V in difference to the black level

These gray bars are used as test- and reference signal for adjustment and checkup of the brightness and contrast adjustments of various displaying systems.

Signals were measured with Rohde & Schwarz Videoanalyzer in the video labor of the Burosch Company.

Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones

5.1.3 Typical Faults

- The left fields of the gray bars don't show any differences, right field is gray instead of black – Brightness of the display adjusted too high.

The quality of this image is "poor" ★★

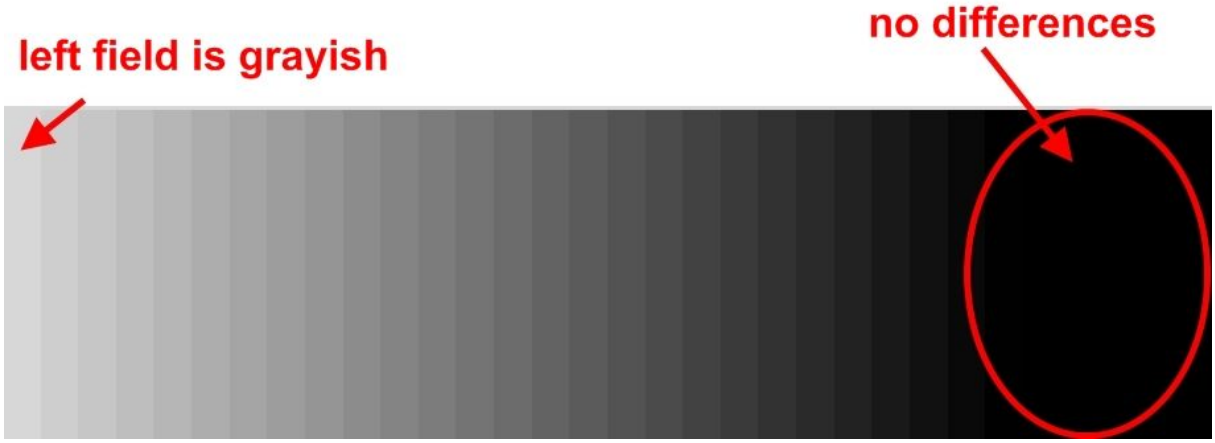
In case of a too high adjusted brightness the bright parts in the image don't show any differences. The effect of a too high brightness you see clearly on the following real image (red marked). In this example the shoulder and face area of the left woman don't show any differences in the brightness.

The quality of this image is "poor" ★★

Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones

- The right, darker fields don't show any differences. The normally white field left is darker – Brightness of the display adjusted too low.



Die The quality of this image is "poor" ★★

Too low adjusted brightness makes white areas in an image darker; see the background in the following image. Further are differences in dark areas barely detectable, like in the following real image the hairs of the right woman. You see the effect of a too low adjusted brightness now in the following real image (red arrows).

Die The quality of this image is "poor" ★★

Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones

- The left and right fields don't show any differences – contrast of the display adjusted too high

The quality of this image is "bad" ★

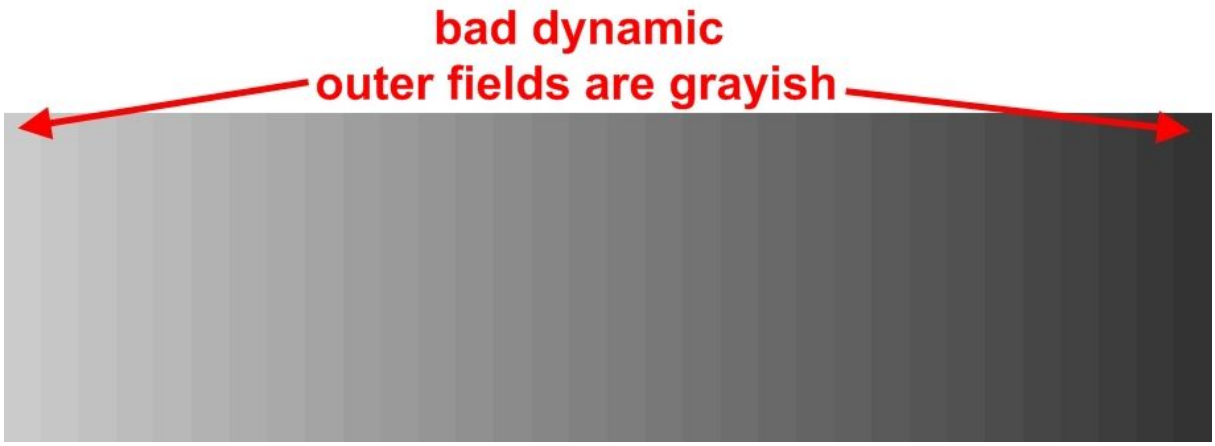
In case of a too high adjusted contrast the bright and dark parts in the image don't show any differences. You see the effect clearly on the following real image (red arrows). The shoulder and face area of the left woman and the hairs of the right woman are displayed as a bright and dark surface respectively.

The quality of this image is "bad" ★

Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones

- The grading of the fields are visible indeed but the outer fields are gray – contrast adjusted too low.



The quality of this image is “bad” ★

In case of too low adjusted contrast the image lose its necessary dynamic. Dark areas become bright and at the same time the normally bright areas become unnaturally darker. You see the effect of a bad dynamic in the following real image. Please note the grayish background and the skin colors. The light-skinned woman on the left isn’t clearly distinguishable from the darker woman by her skin teint.

The quality of this image is “bad” ★

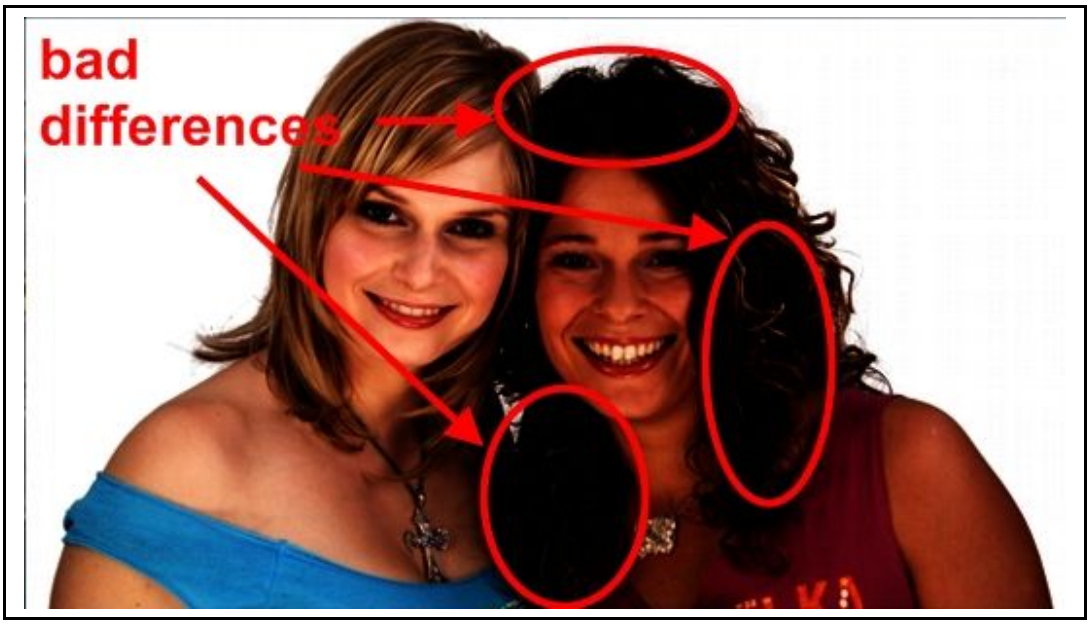
Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones

- The right fields don't show any differences but the left field is still completely white – gamma of red, green and blue adjusted too high.

The quality of this image is "poor" ★★

Too high adjusted gamma disallows differences in darker areas. But bright areas are still well distinguishable. You see this effect on the real image "Jasmin und Sabrina". Dark areas like the hairs of the right woman don't show any differences. The bright areas become a bit darker indeed because of the drift of the black value but the differences here are clearly visible and distinguishable.

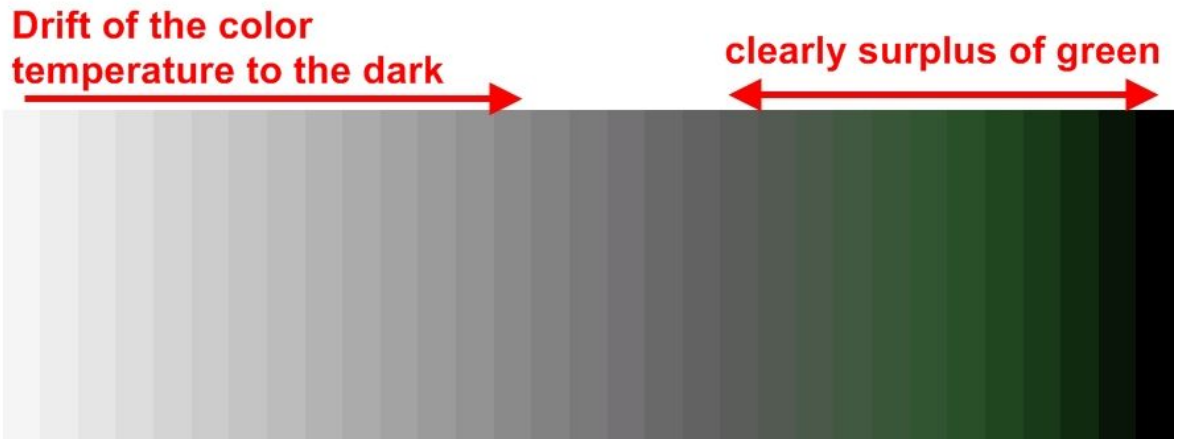


The quality of this image is "poor" ★★

Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones

- The dark fields are colored, in this example greenish – There is a drift of the color balance. Bad color processing of the display is here maybe the reason.



The quality of this image is “poor” ★★

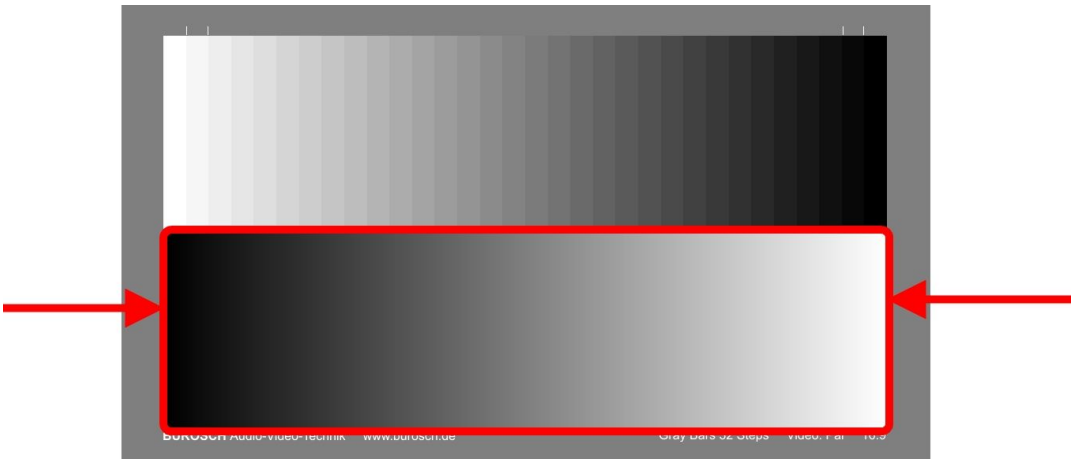
If the dark fields become colored, like in this example there is a bad color working of the display. Dark areas like in the following real image the hairs of the right woman become greenish. The following detail view of the real image clarifies the surplus of green (red arrow).

The quality of this image is “poor” ★★

Reference Test Pattern: Gray Bars 32 Steps

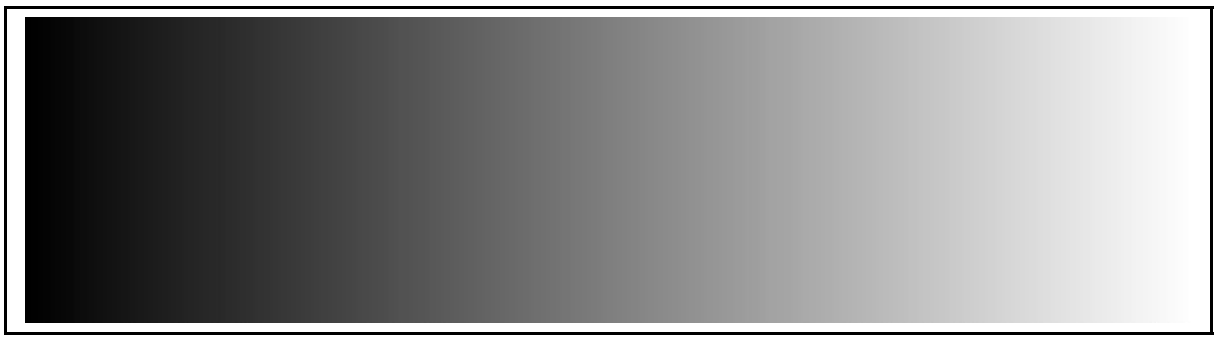
5 Individual Test Zones

5.2 Gray Ramp



General View: Gray Ramp

Detail View:



Detail View: Gray Ramp

This test zone shows a soft, linear gray ramp from maximum black on the left over many gray tones in the middle up to completely white on the right border.
At a correct display the ramp doesn't show any patterns or color faults.

5.2.1 Optimal Display

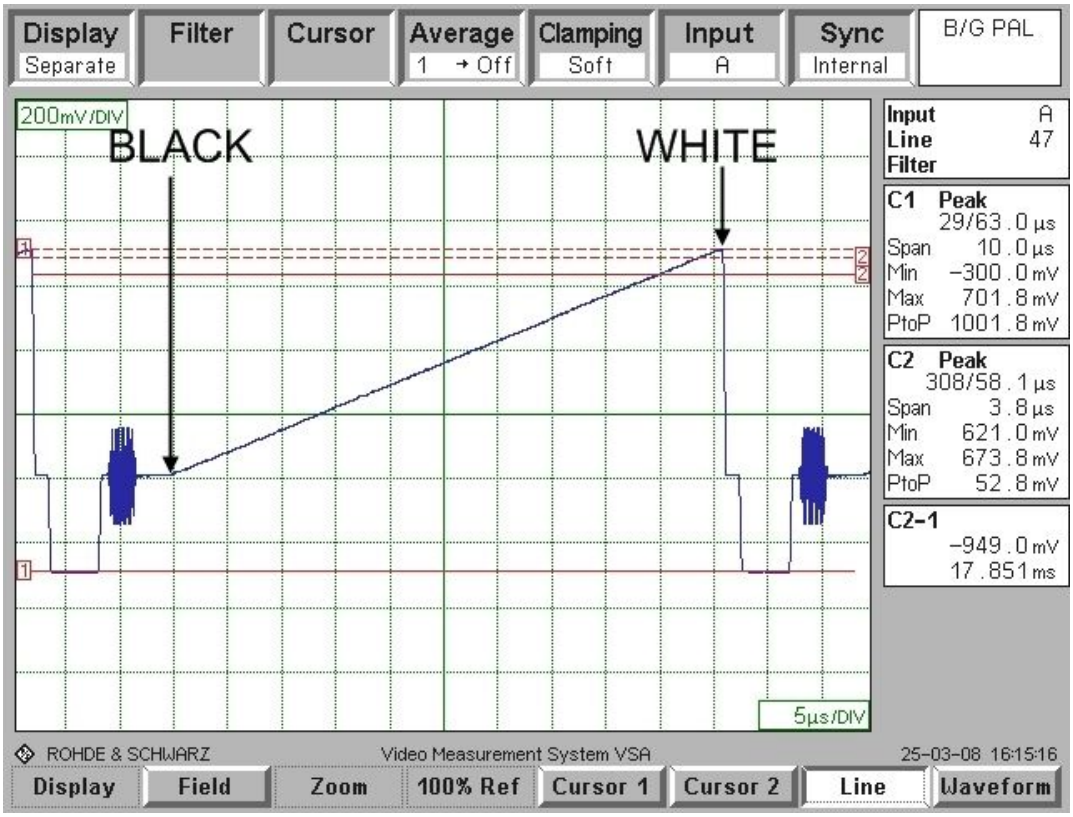
- Soft run of the ramp from black to white
- Constant and neutral gray ramp without any visible patterns or color faults

Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones

5.2.2 Oscillogram

The following image shows a perfect image from a oscilloscope from the gray ramp. Ideally the gray ramp has to look like this.



Oscillogram of a Gray Ramp

At a correct exposition the white level is exactly 0.7V in difference to the black level.

This gray ramp is used as test and reference signal for adjustment and checkup of the brightness and contrast adjustments of various displaying systems.

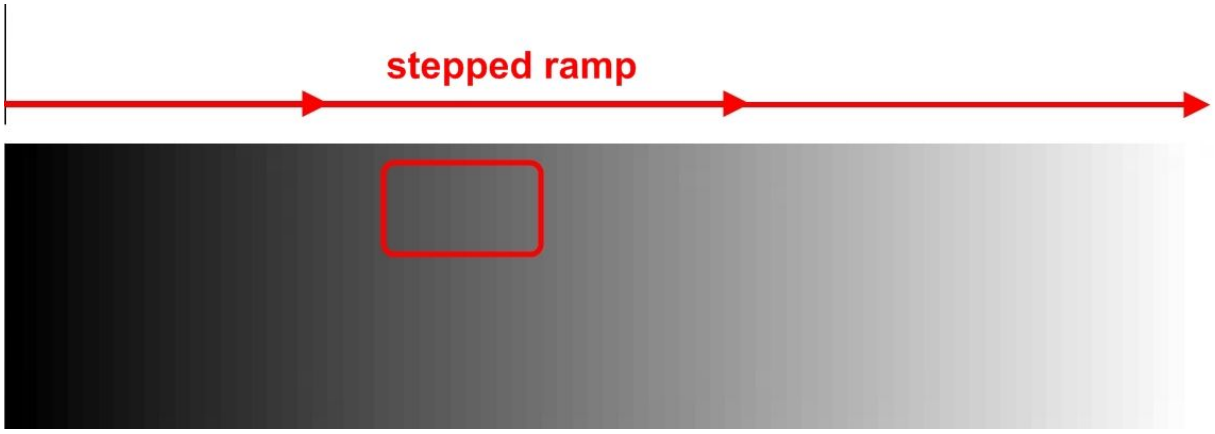
Signals were measured with Rohde & Schwarz Videoanalyzer in the video labor of the Burosch Company.

Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones

5.2.3 Typical Faults

- The neutral soft gray ramp shows stepped artifacts – bad signal processing of the display caused by qualitatively poor wiring could be here the reason.



The quality of this image is “bad” ★

You see now the red marked area zoomed up in the next detail view for clarification. This example shows stepped artifacts, such aspects point at a lacking signal processing of the display.

The quality of this image is “bad” ★

On the next page you see the effect of bad signal processing on the real image “Jasmin und Sabrina”.

Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones

On this page you see the effect of a bad signal processing.

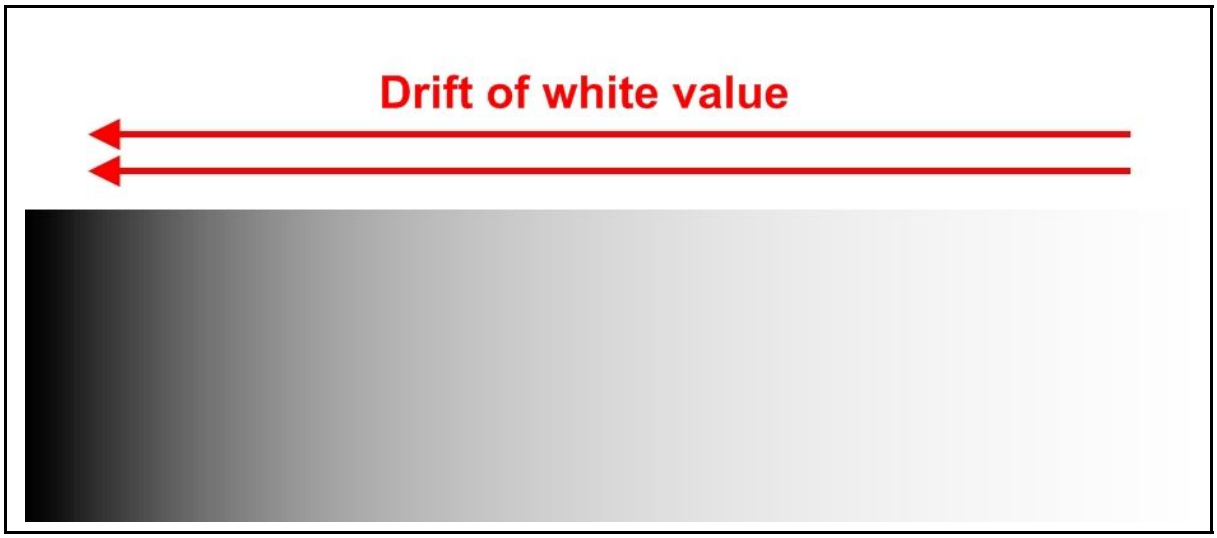
The image seems a lot blurred because of the bad signal processing of the display. Probably this problem is solved by changing cables. We suggest using digital wirings with golden connectors and for analogue mainly a cable length of maximum 1.5 meter.

The quality of this image is “bad” ★

Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones

- The ramp shows a non linear run; the white value drifts to the dark – gamma of the display is adjusted too low.



The quality of this image is “poor” ★★

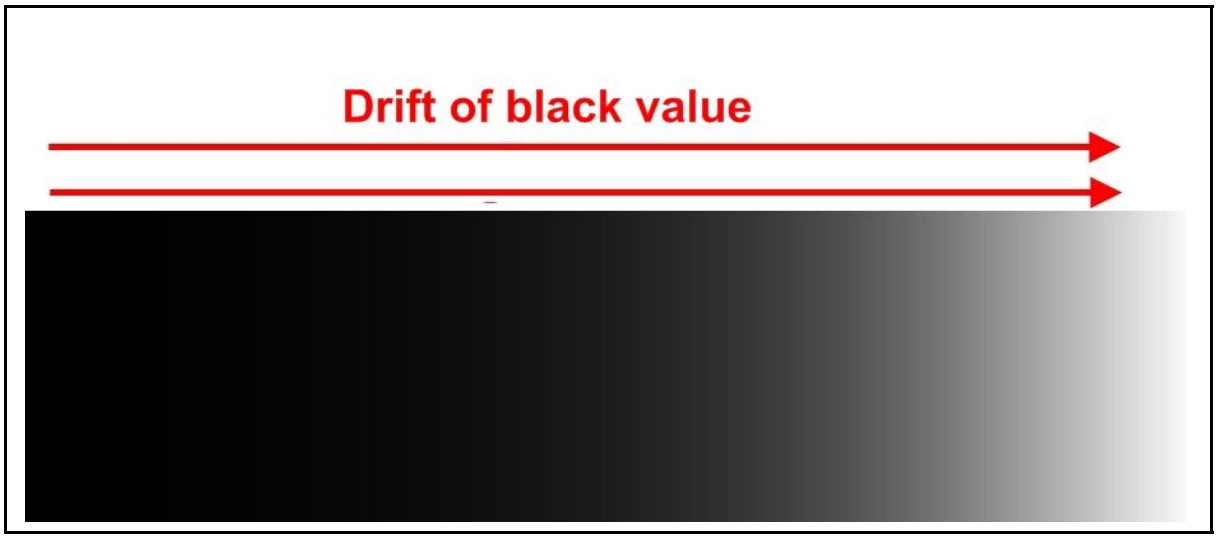
Too low adjusted gamma barely allows differences in bright areas because of the drift of white value. You see the effect clearly on the following real image. Bright areas like the shoulder and face area of the left woman don’t show any differences. Dark areas become brighter indeed because of the drift of white value but show differences anyhow.

The quality of this image is “poor” ★★

Reference Test Pattern: Gray Bars 32 Steps

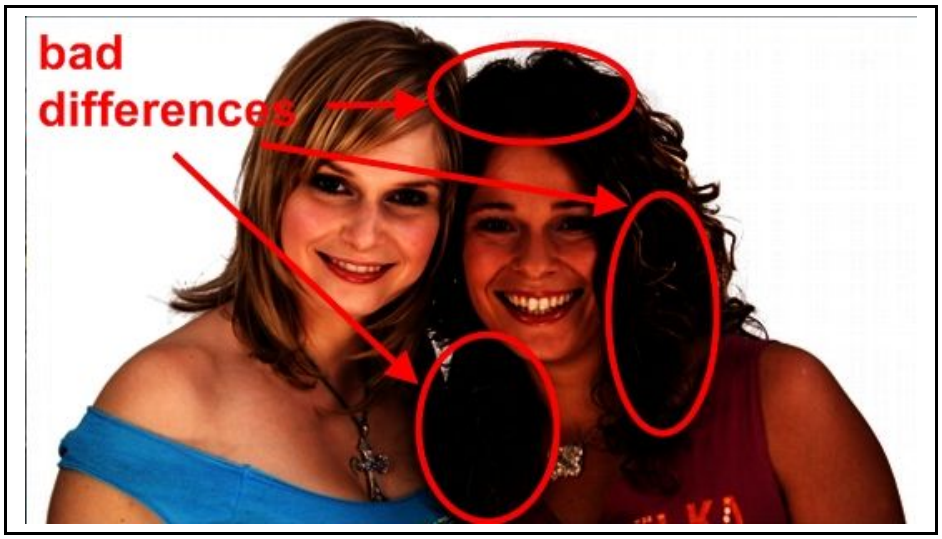
5 Individual Test Zones

- The ramp shows a non linear run, the black value drifts to the bright – gamma of the display adjusted too high.



The quality of this image is “poor” ★★

Too high adjusted gamma of the TV-display disallows differences in dark areas; but you still are able to distinguish the bright areas. You see clearly the effect on the following real image. Dark areas like the hairs of the right, darker woman don’t show any differences. Bright areas in the image become a bit darker because of the drift of black value but you are still able to distinguish the said areas.

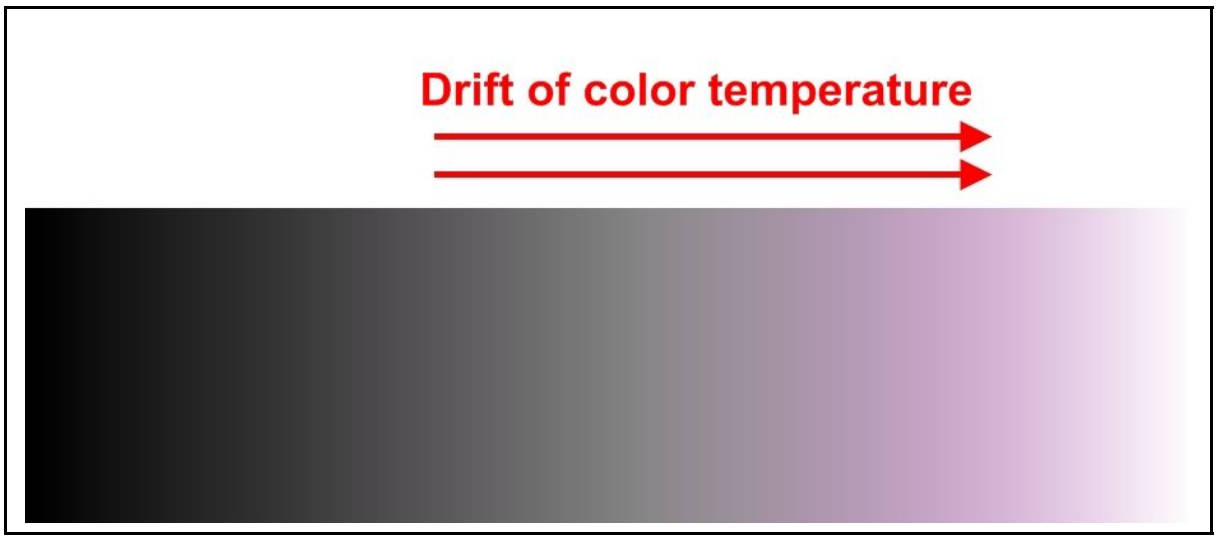


The quality of this image is “poor” ★★

Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones

- The bright areas of the ramp are colored, like in this example magenta – there is a drift of color balance to the bright. Probably a bad color processing of the displays or a bad wiring is here the reason.

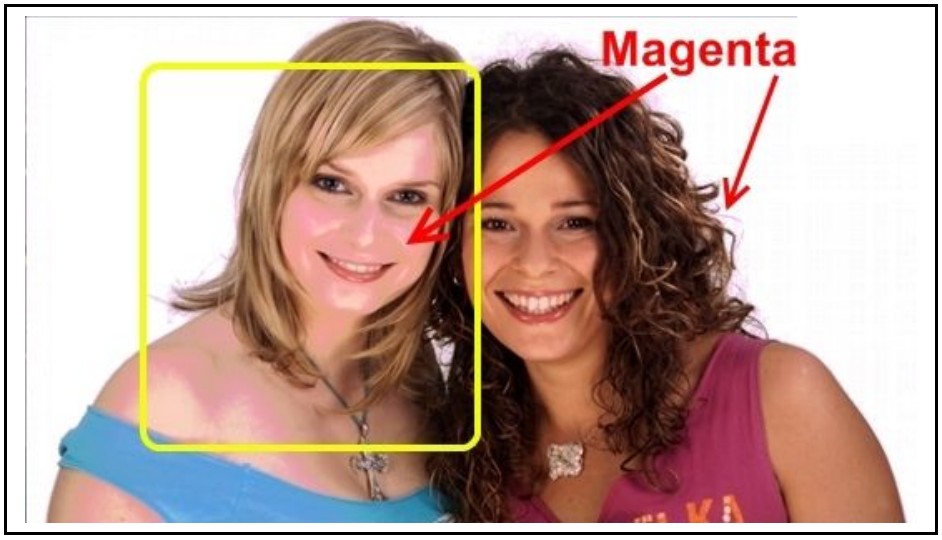


The quality of this image is “poor” ★★

In this example the color temperature drifts in the brighter areas. Further there is a surplus of magenta in the said areas of the gray ramp. You see the effect in the real image on the next page.

Reference Test Pattern: Gray Bars 32 Steps

5 Individual Test Zones



The quality of this image is “poor” ★★

The skin areas in the shoulder and face area respectively of the left woman become discolored to magenta. Further the hairs tips of the right woman also show magenta discoloring. This effect of discoloring occurs in this example only in the middle-dark areas. There can also be drifts of other colors in other brightness areas. Following detail view shows an enhancement of the yellow marked area.

The quality of this image is “poor” ★★

6 Norms / Standards

In the analogue technique there was all much regulated. Because of the change to the digital there occur a lot of error sources by the individual shifting of the aspect ratio and the resolutions (16:9, 4:3, etc.).

For a correct playback of a film or a video or even of an image there have to be a neutral transfer. You often hear the argumentation that these aren't necessary because the vision of every human is different and so an objective playback isn't possible. As a matter of principle is this argumentation right. Admittedly there is ignored that it's only possible if the signal transfer acts neutral and straight. Only when the expressed image is similar to the recorded image by the camera, the human is able to perceive what he would saw at location by his individual sensation.

The transfer itself has to behave neutrally. Big worldwide institutes look after the standards so that the neutrality is warranted.

In German speaking countries is the institute for broadcast engineering of the public broadcasting corporation of ARD, ZDF, DLR, ORF and SRG/SSR mainly responsible for the standards:

www.irt.de

For the whole European area the European Broadcast Union, EBU in Switzerland handles super ordinate to the local development institutes:

www.ebu.ch

On international floor established in 1865 in Paris the International Telecommunication Union, ITU is included:

www.itu.int

For best image evaluation and calibration you use the test pictures from this document. It works also with real, filmed motives but with reservations. The big advantage of test patterns from BUROSCH Audio-Video-Technik is the knowledge how the test patterns have to look and the knowledge how to reproduce them. Only this way the neutrality of the transmission and the playback can be measured exactly and if necessary to correct it:

www.burosch.de

Reference Test Pattern: Gray Bars 32 Steps

7 Visual Test

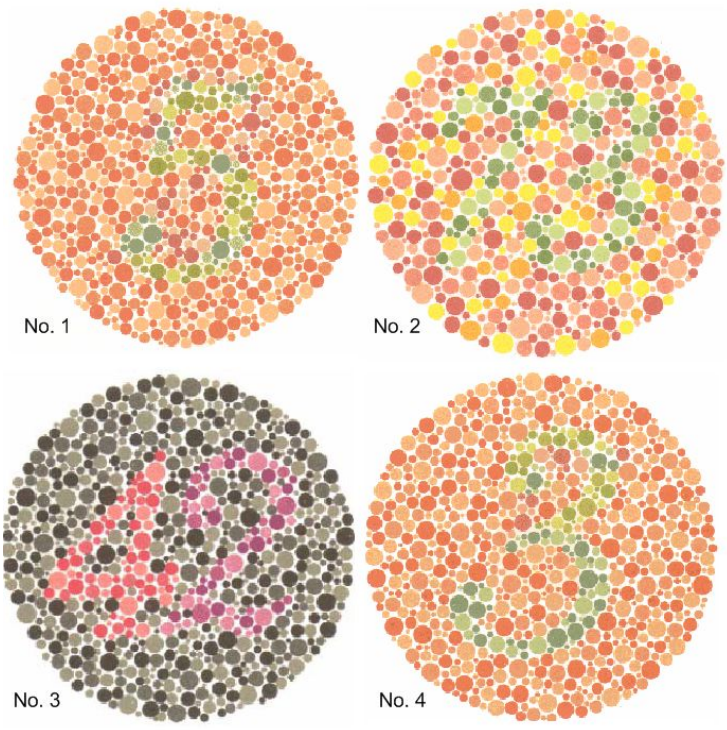
7 Visual Test

The basic prerequisite for an optimal focus and color perception is a good work of the human eye. In this chapter will be tested your vision rudely.

IMPORTANT: Because of scaling artifacts the following tests mustn't be done on your PC screen. Please pay attention to optimal printer settings therefore!

7.1 Colors

Scientifically proven are many people especially men afflicted with color blindness. This means that colors especially red and green are misinterpreted. By the help of "Ishihara Color Test Plates" this amblyopic can be easily detected. On this page you see 4 typical Ishihara Color Test Plates which prove your color perception.



Ishihara Tables

On the left you see 4 numbered Ishihara Color Test Plates for a check-up of potential red-green and yellow-blue weakness.

The numeral "5" should be clearly visible at No.1 to viewers with normal color vision. No. 2 should be visible as "73", No.3 as "42" and the last one clearly as "3".

Please check this fact on yourself.

Congenital color blindness occurs mostly at men and increase or decrease over the years.

Note: These small relative visual tests just show a trend and don't replace the way to the eye specialist!

Reference Test Pattern: Gray Bars 32 Steps

7 Visual Test

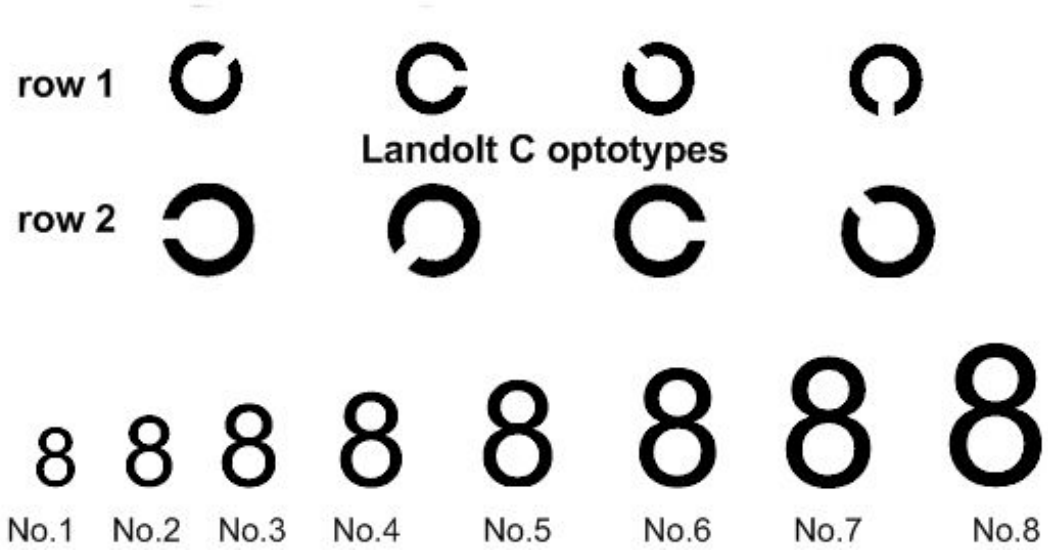
7.2 Visual Acuity

The following visual test is posing a really good challenge to your visual acuity. By the help of the following image on this page which shows two rows of Landolt C optotypes and a numbered increasing number “8” and the image on the next page which shows 3 vertical stripe patterns you can check your visual acuity very easily.

Please print the images out and hang them up at a distance of approx. 4 to 5 meter. The further the distance to the picture the better your visual acuity is.

The ring openings at least from the lower row should be clearly visible. If you don’t see any ring openings we advise a check-up at your eye specialist. The increasing “8” should be also clearly visible from 5 meter in every size. At most the smallest (No.1) could be a little tricky to identify it as an “8” from 5 meter.

This test can’t be arranged on your PC screen because the resolution can affect the perception badly.



Visual Acuity: on top Landolt C optotypes; at the bottom increasing number “8”

At optimal visual acuity all ring openings and all “8’s” are clearly detectable and readable respectively. All black contours of the Landolt C optotypes and of the increasing “8” are clearly distinguishable from the white color of the paper.

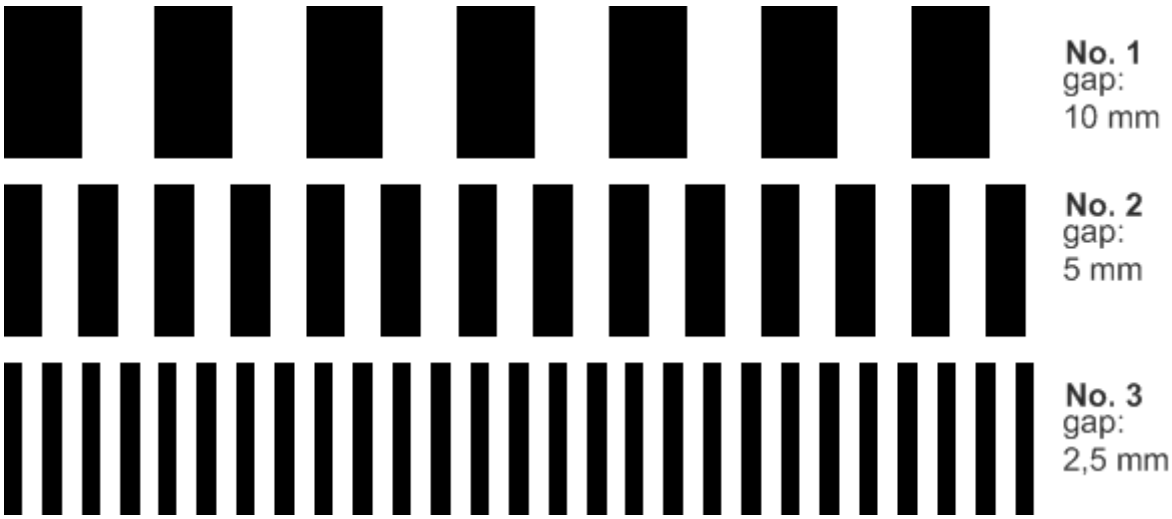
Reference Test Pattern: Gray Bars 32 Steps

7 Visual Test

The image on this page shows 3 vertical stripe patterns which are also vitally important for the visual acuity. All gaps between the stripes are over the whole horizontal direction absolutely identical.

The black and white gaps of the upper row are approx. 10 millimeter; the gaps of the middle row are approx. 5 millimeter and the gaps of the bottom horizontal row are about 2.5 millimeter.

Most important at this image are the hard and sharp outlines of the stripes. At least the upper 2 stripe patterns should be clearly visible and distinguishable at a distance of ca. 5 meter.



Visual Acuity: Stripe Pattern

If all visual tests proceeded positively you could emanate from a visual acuity of 90 to 100%.

Note: These small relative visual tests just show a trend and don't replace the way to the eye specialist!

8 Credits

Editor of this technical documentation for the reasonable application of the reference test pattern:

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Reference Test Pattern: Gray Bars 32 Steps

8 Credits

8.1 Declaration of Conformity

The compliance with specifications of the declaration of conformity of this manuscript is ensured and certified herewith by BUROSCH Audio-Video-Technik.

Compliances with the signal production and the reliability of reproducibility of the reference signal are warranted according to ISO/IEC 17000.

8.2 Copyright