

Handheld CRT Color Analyzer, PM 5639/00

PC Software CRT Color Analyzer, PM 5639/01



- Independent of phosphor type
- Unique graphic CIE chromaticity display
- Numerical read-out of xy or $u'v'$, luminance Y and correlated color temperature
- User-friendly RGB bar graph display
- Hand-held, battery operated
- Reproducible and accurate alignment of any monitor
- Traceable to international color standards
- Calibration to any white reference
- CIE 1931 standard observer response
- Automatic adaption to any field rate - also HDTV
- Uses high stability dichroic filters

PM 5639/01 CRT Color Analyzer, PC
Ensuring a high standard of picture quality has become even more important with the increasing interchange of program material from different sources such as TV studios and production houses. The PROTELEVISION CRT Color Analyzer PM 5639/00 assists in this process by meeting the demand for easy control and adjustment of the white reference on any monitor.

The PM 5639/00 consists of a color sensor which is put onto the CRT, and a display unit which can be operated by one hand, leaving the other hand free to adjust the monitor. A rechargeable battery pack is built-in, enabling you to operate the instrument anywhere. The Display Unit has a 64 by 128 dot matrix LCD display with back-lighting in order to make measurements even in dim

light possible. Two different graphical display modes have been incorporated.

The PM 5639/01 consists of a color sensor which is put onto the CRT and a software package which runs on a standard IBM compatible PC. The PC makes the system more suited for stationary operation compared to the use of the hand-held display unit.

The PM 5639 is universal and operates with all TV-systems, including HDTV.

Test Signals

The PM 5639/82 Color Alignment Generator Component and the PM 5639/83 Color Alignment Generator Composite are designed to operate automatically together with the Display Unit of the PM 5639/00. The generators may be connected to the display

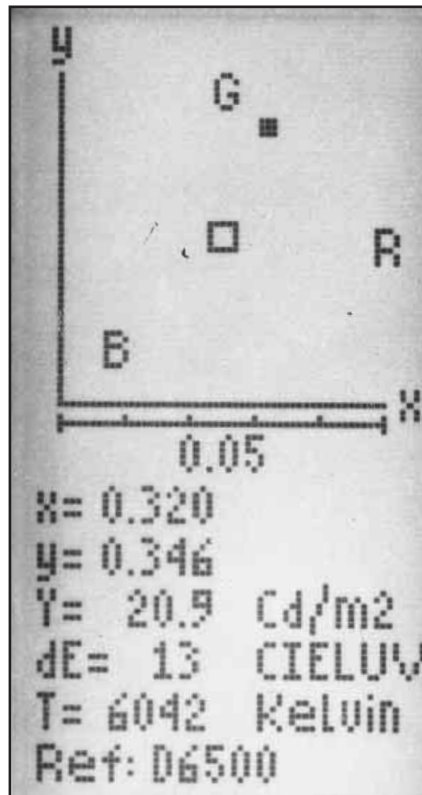
unit which thus operates as a remote control unit. The required test signals for the different calibrations of the monitor can then be recalled automatically. This is especially time saving when performing the low level and high level white balance adjustments.

The Absolute Measuring Modes: xyY and u'v'Y

Two absolute measuring modes both defined by CIE the International Commission on Illumination are realized in the PM5639. The xy system is the original CIE 1931 color measuring system. The u'v' CIE 1976 is later made as a change to the original xy system. The new system is more color uniform than the original, meaning that the system is a better description of the human color perception, related to the perception of color differences. It is possible by numeric calculation to convert between the two systems.

The two displays show the color coordinates in either an xy or an u'v' diagram, and at the same time the numerical chromaticity values together with the luminance value (Y) and the correlated color temperature. A color difference mode can be selected. In this mode the difference between the reference values and the measured values are displayed. In all modes the color error dE CIELUV is calculated as the difference between the reference and the actual color according to the CIE 1976 L*u*v* (CIELUV) color space definition. 1 CIE-LUV is very close to the smallest color difference which the human eye can distinguish.

The display, either on the Display Unit or on the PC, will show the measurement graphically in a coordinate system, where the pre-programmed color reference is shown as a small box and the measured color as a dot. The monitor is adjusted correctly when the dot falls within the box. Using the zoom function this adjustment can be done very accurately. An indication of the resolution is always given below the



The CIE xyY graphical display with the numerical values at the bottom

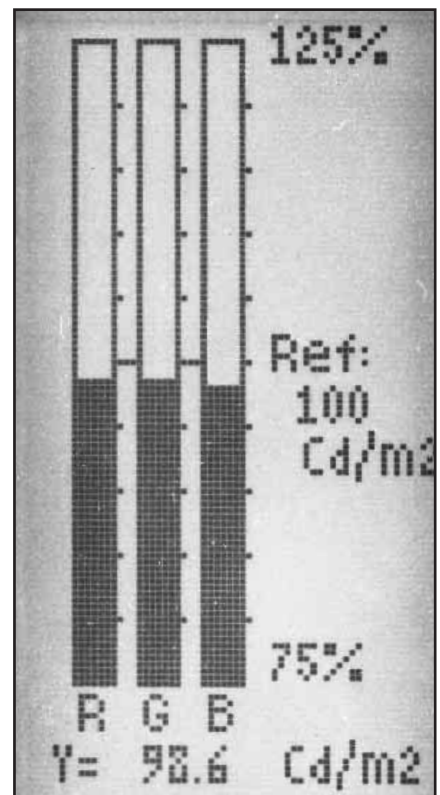
graph where a ruler corresponding to 0.05 in The luminance Y is shown in the unit selected by the user i.e. candela/m², NIT or foot-Lambert.

These displays are completely new and have been found to be very useful when an adjustment to a selected color "white" reference (eg. D6500 or 3200 K) is needed. These absolute measurements are made possible by using a new concept which relies on optical interference (dichroic) filters.

The concept makes it possible to make filters which fully equal the color response of the Standard Observer as defined by CIE. This together with a traceable calibration assure a correct white reference on any monitor independent of the actual phosphor.

RGB Measuring Mode

In the RGB measuring mode the red, green and blue values are shown as three analog bars. These bars are dis-



The RGB bar graph, showing the three primary colors and the luminance

played relative to the white reference. There are four possibilities.

- Two of the primary colors are related to the third
- All three primary colors are related to a pre-programmed white reference
- All three primary colors are related to one of the measurements stored in the memory of the color analyzer
- All three primary colors are related to an absolute reference level selected by the user

In all cases the absolute luminance value will be displayed in either Candela/m², NIT or foot-Lambert as selected by the user.

In the RGB display mode, the adjustment is carried out by bringing the amplitude of the three bars into the center of the display. It is also here possible to use a zoom function to increase the resolution and make a more accurate adjustment possible.

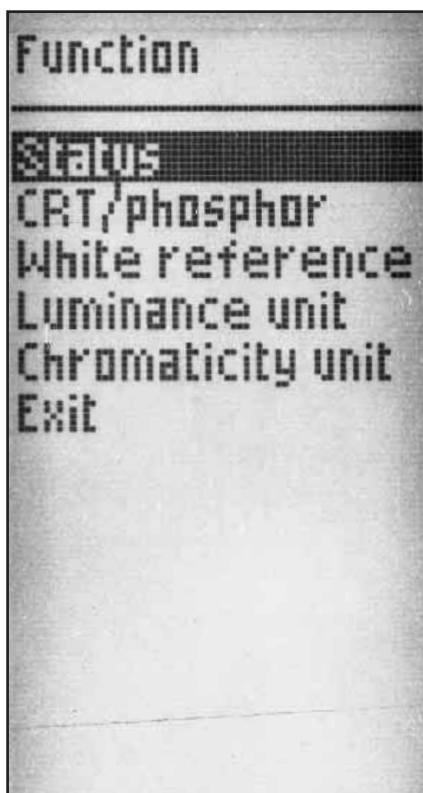
For the RGB mode to work correctly, the instrument has to know the actual phosphor. This is accomplished in a couple of minutes by use of the monitor controls and the Color Analyzer "learn" mode. The "learn" mode procedure removes the interaction (cross-talk) between phosphors when viewed by the trireceptors, and makes the instrument measure correct on the actual phosphor. The phosphor can be stored and named in the color analyzer for later use.

Operation

The instrument is extremely simple to operate. To change between the two active measuring modes xy or u'v' and RGB press either the CIE or the RGB button. The rest of the operations are performed by simple menu control. The Function key offers the possibility of selecting between a variety of different measuring facilities.

The following parameters have been factory programmed, but the user can program more himself:

- Two different standard phosphors have been preprogrammed: EBU and SMPTE "C"
- A maximum of 28 different phosphors can be stored with the "learn" facility
- The three most used references: D6500, 3200 K and 9300 K are preset from the factory. Seven different white references can be programmed into the PM5639/00 either as a measurement of the CRT, or the

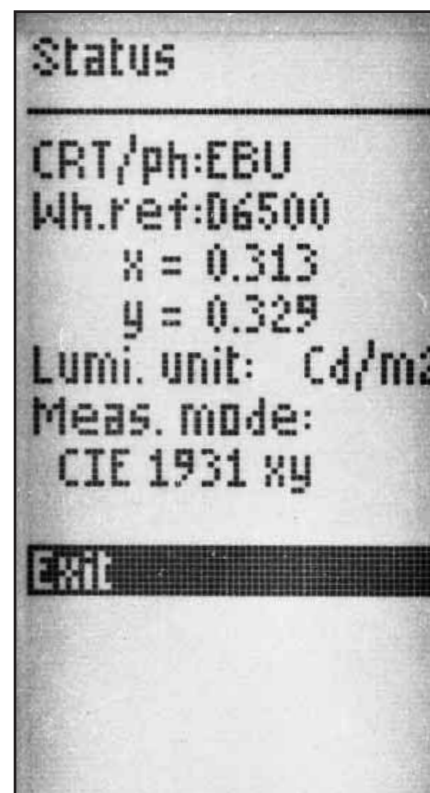


The main menu, showing the various possibilities

reference can be entered directly as x and y values

- Three different measuring units. The user can select between Candela/m², NIT or foot-Lambert

The Status display will show the parameters of the active set-up. The Reset button will quickly take the Color Analyzer into a measuring mode that has been programmed by the user as the most frequently used. It is also possible for several different users to store and name their own preferred measu-



The status display showing the active display parameters

ring set-ups. The Store button can also be used for storing a measurement which can then be recalled later or used as reference for relative RGB measurements.

A toggle function for fast switching between two measuring set-ups is included. This is very useful for switching between high and low level settings using the fixed level RGB display.

Product Data

Scan Rates

- The PM 5639/00 automatically adjusts itself to the field scanning rate including HDTV and graphical systems

Display

- Type: 64 by 128 dot matrix LCD display

with switchable back-lighting (auto switch-off function is provided)

Display Modes

- CIE xyY mode: x and y coordinates are plotted in a CIE1931 xy diagram. The x,y,Y (luminance) values, the correlated color temperature and the color error CIELUV

are shown numerically. The color error is calculated as the difference between the selected color reference and the actual color according to the definition CIE1976 L*u*v* (CIELUV) color space. 1 CIELUV is very close to the smallest color difference which the human eye can distinguish

- CIE u'v'Y mode: u' and v' coordinates are

plotted in a CIE1976 u^*v^* diagram. The u^*, v^*, Y (luminance) values and the color error CIELUV are shown numerically

- The $\partial x \partial y$ and $\partial u^* \partial v^*$ modes give readout of the difference between the measured and the reference chromaticity coordinates
- RGB mode: Red, green and blue values are shown as bar-graphs. The color balance is displayed relative to a selected parameter. The display reference may be either one of the bars, the luminance, an absolute level or relative to a previous measurement (memory location)

Measurement Range

- Luminance: 0.1 cd/m² to > 300 cd/m² (0.03 fL to > 100 fL)
- x and y values: 0.000 to 0.800
- Correlated Color Temperature: 1900 K to 12000 K

Accuracy

The following specifications apply to a measurement with an illuminant D6500, standard monitor¹⁾, luminance 10 Cd/m² (3 fL) in the

temperature range 15°C to 30°C (59°F to 86°F)

- xy coordinates: better than ± 0.002
- u^*v^* coordinates: better than ± 0.002
- Repeatability: better than ± 0.002
- Luminance (Y): better than $\pm 2\%, \pm 1$ digit
- Repeatability: better than $\pm 0.3\%, \pm 1$ digit
- RGB bars: better than $\pm 1\%$
- Repeatability: better than $\pm 1\%$
- Luminance (Y): better than $\pm 2\%, \pm 1$ digit
- Correlated color temperature: ± 50 K

¹⁾ Calibration of the standard monitor is traceable to NIST USA with respect to chromaticity and to BIPM France with respect to luminance.

Memory

- References: 10 memories for color white references
- Range for x and y: 0.2 to 0.6
- CRT-phosphors: 30 memories for different phosphors
- Set-ups: 10 memories for different measuring set-ups (display mode, CRT-phosphor type, white reference, and measuring unit)

- Measurements: 5 memories for measurements (can be recalled later, used as references for RGB measurements, or converted to white references)

Initial Programming

- Preset white references:
D6500 $x=0.313, y=0.329, u^*=0.1978, v^*=0.4683$
3200K $x=0.423, y=0.399, u^*=0.2437, v^*=0.5173$
9300K $x=0.285, y=0.293, u^*=0.1917, v^*=0.4436$
The temperatures stated are the correlated color temperatures
- Seven more white references may be named and stored by the user
- Measuring unit: cd/m² (other possibilities are fL and NIT which can be selected by the user)
- For use in the RGB mode the instrument has been taught the phosphors of two monitors. It is possible by use of the learn procedure to program additionally 28 phosphors
The two phosphors are examples of an EBU phosphor and an SMPTE "C" phosphor

General Specifications

Power Supply

- Battery operated. Interchangeable NiCd rechargeable 7.2 V battery pack. The instrument can be operated when connected to the battery charger
- Consumption:
85 mA (illumination off)
115 mA (illumination on)
- Operating time: >5 h with fully charged batteries
- Battery charging time: <14 h with instrument off
- Mains voltage:
85 V to 140 V AC or 187 V to 250 V AC
- Consumption of charger: < 6 VA
- Frequency: 48 Hz to 65 Hz

Environmental Conditions

- Operating temperatures:
10°C to 40°C (50°F to 104°F)
(non condensing)

- Storage temperature:
- 10°C to 70°C (- 22°F to 158°F)

Mechanical Data

- Color Sensor
Diameter of house: 108 mm (4.25")
Diameter of suction pad: 120 mm (4.75")
Height: 133 mm (5.25")
- Display Unit
Height: 34 mm (1.3")
Width: 75 mm (3.0")
Length: 200 mm (7.9")
- Battery Charger
Height: 86 mm (3.4")
Width: 50 mm (2.0")
Depth: 45 mm (1.8")
- Carrying Case
Height: 150 mm (5.9")

Width: 460 mm (18.1")
Depth: 310 mm (12.2")

- Weight
Color Sensor (incl. cable): 250 g (0.55 lbs)
Display Unit (incl. battery pack): 412 g (0.91 lbs)
Battery Charger: 275 g (0.61 lbs)
Total (fully packed carrying case): 4.5 kg (10 lbs)

Accessories

The PM 5639/00 package includes:

- PM 5639/90 Color Sensor
- PM 5639/80 Display Unit
- Interconnection Cable
- Rechargeable Battery Pack
- 110V AC or 230V AC Battery Charger
- Operating Manual
- Carrying Case

CRT Color Analyzer with PC Software, PM 5639/01

The PM 5639/01 CRT Color Analyzer with PC Software is used in central monitor calibration/service facilities, where a PC is used instead of the hand-held display unit. It is also useful in laboratory work, i.e. development of TVsets or color monitors. The software supplied is identical to the software included in the PM 5639/20 Industrial CRT Color Analyzer. For more details on the software, we refer to the data on PM 5639/20.

Accessories

The PM 5639/01 package includes:

- PM 5639/90 CRT Color Sensor
- Power Supply box for the sensor
- Interface Cable for use between PC and Power Supply box (sub-D connectors)
- Interface Cable for use between Power Supply box and Color Sensor (FCC68/J11 connectors)
- Mains Cable
- 5.25" IBM Compatible 1.2 MB floppy disk containing the complete software
- 3.5" IBM Compatible 1.44 MB floppy disk containing the complete software
- Carrying Case
- Instruction Manual

Ordering Information

Order Number

PM 5639/00 CRT Color Analyzer
PM 5639/01 CRT Color Analyzer, PC

When ordering please specify:

- Mains voltage:
 - 85 V to 140 V
 - 187 V to 250 V
- Mains connector type:
 - European type
 - American type
 - British type

Related Products

| | | |
|-------------|----------------|--|
| PM 5639/00 | 9449 056 39001 | CRT Color Analyzer with handheld display unit |
| PM 5639/01 | 9449 056 39011 | CRT Color Analyzer with PC software |
| PM 5639/02 | 9449 056 39021 | Auto Color Alignment System for Barco® Monitors |
| PM 5639/03 | 9449 056 39031 | Auto Color Alignment System for Sony® Monitors |
| PM 5639/10 | 9449 056 39101 | Projector color balance meter |
| PM 5639/20 | 9449 056 39201 | Industrial CRT Color Analyzer, single sensor version |
| PM 5639/21 | 9449 056 39211 | Industrial CRT Color Analyzer, double sensor version |
| PM 5639/25 | 9449 056 39251 | Miniature CRT Color Analyzer |
| PM 5639G/82 | 9449 056 39823 | Color Alignment Generator, component 625 lines |
| PM 5639M/82 | 9449 056 39828 | Color Alignment Generator, component 525 lines |
| PM 5639G/83 | 9449 056 39833 | Color Alignment Generator, composite 625 lines, PAL |
| PM 5639M/83 | 9449 056 39838 | Color Alignment Generator, composite 525 lines, NTSC |

Options

| | | |
|------------|----------------|---|
| PM 5639/61 | 9449 056 39611 | Extension kit - to upgrade PM 5639/20 to PM 5639/21 |
| PM 5639/62 | 9449 056 39621 | Extension kit - to upgrade PM 5639/00 to PM 5639/01 |
| PM 5639/63 | 9449 056 39631 | Auto Color Alignment Option for Barco® Monitors |
| PM 5639/64 | 9449 056 39641 | Auto Color Alignment Option for Sony® Monitors |
| PM 5639/80 | 9449 056 39801 | Display unit |
| PM 5639/90 | 9449 056 39901 | CRT Color sensor |
| PM 5639/91 | 9449 056 39911 | Projector triple light sensor |
| PM 5639/92 | 9449 056 39921 | Industrial CRT sensor |
| PM 5639/93 | 9449 056 39931 | Miniature CRT Color sensor |
| PM 8549/06 | 9449 085 49061 | 6 m extension cable for PM 5639 |
| PM 8549/10 | 9449 085 49101 | 10 m extension cable for PM 5639 |
| PM 8550 | 9449 085 50001 | Calibrating software for PM 5639/90 and PM 5639/92-93 |

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