



## LCD Colour Analyser, PM5639/06, handheld LCD Colour Sensor, PM5639/94

solutions in Audio & Video

- Colour balance alignment of LCD displays
- Optical system for spot measurements
- High speed operation for automatic manufacturing systems
- Communicates with standard RS-232 interface
- True CIE Standard Observer characteristics
- Numerical outputs of CIE XYZ values
- Calibration to any white reference
- Operates independent of field rate, also computer graphics and HDTV
- Calibration traceable to international standards



The PM5639 LCD Colour Analyser family has been developed for the purpose to assure the same high standard of picture quality as we have achieved with CRT colour analysers.

As flat panel display technology increases its presence on the market, from computers to the monitors on the broadcast industry, the same need for controlling colour fidelity, as for the CRT's, is necessary.

### LCD Colour Analyser, PM5639/06; handheld use

This system consists of the LCD colour sensor and a handheld display unit. A rechargeable battery in the display unit enables easy operation anywhere. The units are delivered in a suitcase.

The LCD colour sensor is designed for measurement at a certain distance from the display. Although calibrated at fixed distance it can be used at distances from a few millimetres up to some 20 cm. Only the luminance value is slightly affected of the distance.

### Test signals

When the sensor is used together with the handheld display unit, full benefits of the PM5639/82 and PM5639/83 Colour Alignment Generators can be achieved. The display unit works in this set-up as a control unit for the generator. The required test signals can then be recalled automatically.

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

Two absolute measuring modes both defined by CIE, the International Commission on Illumination, are realised in the PM5639. The xy system is the original CIE 1931 colour measuring system. The u'v' CIE 1976 is later made as a change to the original xy system. The

latter system is more colour uniform than the original, meaning that the system is a better description of the human colour perception, related to the perception of colour differences. It is possible by numeric calculation to convert from one system to the other.

The colour coordinates are shown in either an xy or an u'v' diagram, and at the same time the numerical chromaticity values are shown together with the luminance value (Y) and the correlated colour temperature. In the RGB bargraph display the difference between the reference values and the measured values are displayed. In all modes the colour error dE CIELUV is calculated as the difference between the reference and the actual colour according to the CIE 1976 L\*u\*v\* (CIELUV) colour space definition. 1 CIE-LUV is very close to the smallest colour difference, detectable by the human eye.

The display on the Display Unit, will show the measurement graphically in a coordinate system, where the pre-programmed colour reference is shown as a small box and the measured colour 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. The luminance Y is shown in the units selected by the user i.e. candela/m<sup>2</sup>, NIT or foot-Lambert.

These absolute measurements are made possible by using the concept, which relies on optical interference (dichroic) filters. With interference filters it is possible to match closely the colour response of the Standard Observer as defined by CIE. This together with a traceable calibration assures a close alignment of the white reference on any monitor independent of the monitor brand.

### RGB Measuring Mode

In the RGB measuring mode the red, green and blue values are shown as three analogue bars. These bars are displayed relative to the white reference. There are four possibilities:

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

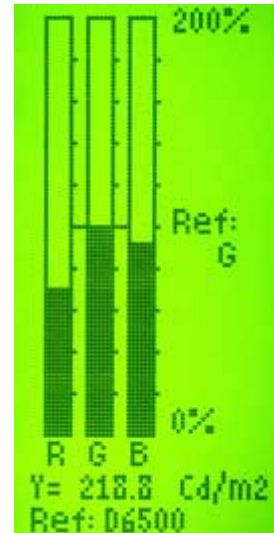
In all cases the absolute luminance value will be displayed in Candela/m<sup>2</sup>, NIT or foot-Lambert as selected by the user. In the RGB display mode, the adjustment is carried out by bringing the amplitude of the three bars into the centre of the display. It is also possible to use a zoom function to increase the resolution and make a more accurate adjustment.

For the RGB mode to work correctly, the instrument has to know the actual phosphors. This is accomplished in a couple of minutes by use of the monitor controls and the Colour Analyser "learn" mode.

The "learn" mode procedure removes the interaction (crosstalk) between phosphors when viewed by the trireceptors. The phosphors can be stored and named in the colour analyser for later use.



The CIE display showing the measurement as x,y coordinates. The solid ball is the actual measurement, while the square is the target.



The RGB display showing the relative contribution of red, green, and blue pixels. With the monitor properly aligned the bars will be on line in the middle.

The following parameters have been factory programmed. The user can program more himself: Two different standard phosphors have been pre-programmed: 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.

Different white references can be programmed into Display unit or PC either as a measurement of the CRT, or the reference can be entered directly as x and y values.

- Three different measuring units. The user can select between Candela/m<sup>2</sup>, NIT or foot-Lambert.

## LCD Colour Analyser PM5639/06 with display unit

### Handheld LCD Colour Analyser

This stand-alone system consists of the LCD Colour Sensor, Display Unit plus necessary accessories. For the basic measurement specification, refer to chapter below.

#### 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 and shown numerically together with the correlated colour temperature and the colour error in CIELUV.
- CIE u'v'Y mode: u' and v' coordinates are plotted in a CIE1976 u'v' diagram and shown numerically together with the colour error in CIELUV.

The x'y' and u'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 colour balance is displayed relative to a selected reference:
  - one of the bars,
  - the luminance,
  - an absolute level
  - relative to a previous measurement (memory location)

#### Memory Positions

White references:

- 10 memories for white references
- Range for x and y: 0.2 to 0.6

Colour pixels:

- 30 memories for different colour pixels
- Set-ups:
- 10 memories for different measuring set-ups.

#### Factory Programming

White references:

- D6500 (x=0.313, y=0.329)
- 3200K (x=0.423, y=0.399)
- 9300K (x=0.285, y=0.293)

Other white references may be stored by using the "Learn white reference" function. The numbers, as measurements, can also be input directly into the file.

#### Power Supply

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

#### Accessories

The PM5639/06 package includes:

- PM5639/94 LCD Colour Sensor
- PM5639/80 Display Unit
- Interconnection Cable
- Rechargeable Battery Pack
- 110V AC or 230V AC Battery Charger
- Operating Manual
- Carrying Case

## Colour Sensor PM5639/94

### Measurement Range

Luminance 0.5 to 1000 Cd/m<sup>2</sup> (0.15 to 300 FtL)

x and y values 0.000 to 0.800

Correlated Colour Temperature:

1900 K CCT to 12.000 K CCT

Angle of aperture: ±10°

Measuring distance: calibrated at 130mm.

Luminance within ±2 Cd/m<sup>2</sup> in range 5 to 200 mm

### Accuracy

The following specifications apply to a measurement with an illuminant D6500 standard monitor<sup>1)</sup> at a luminance level of 80 Cd/m<sup>2</sup> (23.3 Ft.) and at a distance of 130 mm and at an ambient temperature of 15°C to 30°C (59°F to 86°F)

- Chromaticity (measured on white): Accuracy: ±0.002 Repeatability: ±0.002
- Luminance Accuracy at reference distance: ±2% ±1 digit Repeatability: ±0.3% ±1 digit
- XYZ/RGB bars: ±1% Repeatability: ±1% Luminance(Y): ±2% ±1 digit
- Measuring rate: When used with the display software: 3 and 10 measurements/second. When used with the communication modules: up to 15 measurements/second programmable
- Correlated colour temperature: ±50 K CCT

### Scan Rates

The PM5639/94 automatically adjusts itself to the field-scanning rate including HDTV and graphical systems

### Accessories:

The PM5639/94 is delivered without any accessories but the Operating Manual.

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

## General Specifications

### Environmental condition

- Operating temperature: 10°C to 40°C (50°F to 104°F) (non-condensing)
- Storage temperature: -10°C to 70°C (-14°F to 158°F) (non-condensing)

- Vibration: IEC 68-2-6 F; 5-50-200 Hz 0.7 mm<sub>pp</sub> 50 m/s<sup>2</sup>;
- 1 octave/min; 3x30 min
- Bump: IEC 68-2-29 part 2; 350 m/s 1000 bumps in 3 directions
- Repetitive bump: 120 m/s<sup>2</sup>

### Mechanical data Colour Sensor

- Diameter of sensor: 40 mm (1.6")
- Length: 300 mm (11.8")
- Weight: 270 g (0.6 lb)

## Accessories

### Accessories: PM5639/06

The PM5639/06 LCD Colour Analyser package includes:

- PM5639/94 LCD Colour Sensor
- PM5639/80 Display Unit with Rechargeable Battery Pack
- Interconnection Cable between sensor and display unit.
- 110V AC or 230V AC Battery Charger
- Operating Manual
- Carrying Case

### Accessories: PM5639/94

The PM5639/94 is delivered with:

- Operating manual

## Optional Accessories

### PM5639/82 and /83

The optional PM5639/82 Colour Alignment Generator Component and the PM5639/83 Colour Alignment Generator Composite are designed to operate automatically together with the Display Unit of the PM5639/00 and the PM5639/06.

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.

## Ordering Information

### Configured Systems

- PM5639/06 LCD Colour Analyser with PM5639/94 Colour Sensor and PM5639/80 Display Unit and with interface cable packed in a carrying case.
- PM5639/26 LCD Colour Sensor with power supply, PC software (DOS), and interface cables

### Single Items

- PM5639/94 LCD Colour Sensor Unit
- PM5639/80 Display Unit for colour sensor
- PM8563 Interface Cable from PM5639/94 LCD Colour Sensor to PM5639/80 Display Unit

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