

# TOP 200/150

Telescopic Optical Probes for radiance and  
luminance measurements



We bring quality to light.



### Key features at a glance

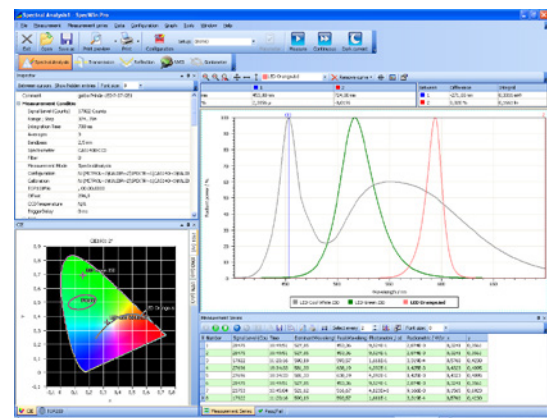
- ▲ Perfectly round and sharp measuring spot with optimized Pritchard style optical system
- ▲ Convenient focusing by internal view-finder camera
- ▲ Large number of lenses for wide range of measuring-spot sizes and distances to test samples
- ▲ The software allows up to different measuring-spot sizes to be selected
- ▲ Flexible fiber connection with patented mode

# 01 \ \ TOP 200 – Telescopic optical probe for radiance and luminance

In combination with a spectrometer, the TOP 200 Telescopic Optical Probe permits precise spot measurements of radiance and luminance, as well as the chromaticity of displays, panel graphics and other light sources. A multimode fiber is used to guide the light radiation from the TOP 200 to the spectrometer.

The patented mode mixer from Instrument Systems delivers uniform light transmission into the fiber and hence reproducible measurements even if the position of the fiber is changed.

The TOP 200 can be operated with all spectroradiometers in the CAS 140D Series as well as the DTS 500 Display Test System from Instrument Systems with SpecWin Pro software. Remote control for the TOP 200 is provided via a USB port.



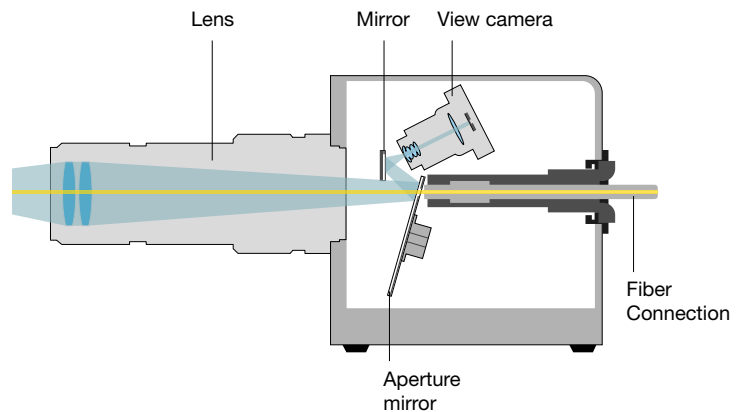
▲ Analysis of an LED with SpecWin Pro software

# 02 \\ Mode of functioning

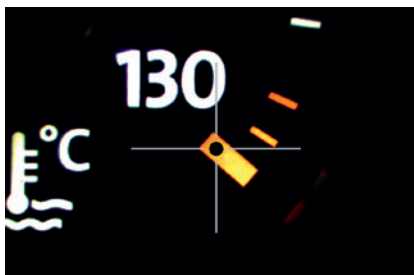
## Optimized Pritchard style optical system

An innovative optical concept was implemented in the TOP 200. The aperture mirror is inclined at an angle of 15° to the plane of the image and this creates a sharply defined measuring spot.

The standard inclination angle of 45° used in competing products leads to unfocused edges because parts of the measuring spot are significantly displaced from the plane of the image. The holes drilled in the aperture mirror of the TOP 200 are also designed to be slightly elliptical in order to compensate for the 15° angle and guarantee a perfectly round measuring spot.



▲ Mode of functioning of telescope optic with Pritchard style optical system

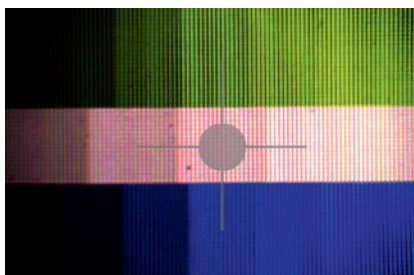


▲ Perfectly sharp and round measuring spot with the TOP 200

## View-finder camera

The TOP 200 used an internal view-finder camera with 2560 x 1920 pixel resolution. It permits exceptionally convenient control and focusing of the desired measuring spot. The entire field of view of the view-finder camera is some 20 times bigger than the measuring spot in aperture position 2. The image generated by the view-finder camera is automatically stored in the measurement file and printed out in the reports. The position and size of the measuring spot is thereby explicitly documented.

When the aperture is closed, the measuring location of the sample is visible, and software superimposes a reticle to mark the position of the measuring spot. As soon as the aperture port has been selected, the physical measuring spot, i.e. the aperture port is visible as a black circle.



▲ View-finder image with closed aperture and visible measuring location

# 03 \ Features

## A large number of lenses

A large number of lenses can be flange-mounted securely and quickly on the TOP 200 using the F-mount bayonet connector from Nikon. This system covers a large range of different measuring-spot diameters and object distances.

Most lenses are suitable for the visible and near infrared spectral range. A special high resolution lens (TOP100-322) with a focal length of 105 mm and close-up lenses with 2-fold or 4-fold distance reduction can be supplied for measurements in the UV/VIS range. A collision guard for operation with the DTS 500 positioning system system is available.

| Lens   |          | 50 mm focal length           |        |       | HRL 90 |
|--|----------|------------------------------|--------|-------|--------|
| Measuring distance*                          |          | 228 mm                       | 500 mm | 1 m   | 230 mm |
| Aperture                                     | Diameter | Measuring-spot diameter [mm] |        |       |        |
| 1  | 0.125 mm | 0.44                         | 1.11   | 2.34  | 0.075  |
| 2  | 0.25 mm  | 0.89                         | 2.22   | 4.67  | 0.15   |
| 3  | 0.5 mm   | 1.77                         | 4.44   | 9.34  | 0.3    |
| 4  | 0.8 mm   | 2.84                         | 7.1    | 13.94 | 0.5    |
| Field of view of the view-finder camera [mm] |          |                              |        |       |        |
| Width [mm]                                   |          | 20.2                         | 54     | 116   | 3.7    |
| Height [mm]                                  |          | 12.9                         | 35     | 74    | 2.3    |

\* Distance between test sample and TOP 200 front panel

## Choice of measuring-spot sizes

The size of the measuring spot depends on the lens used, the aperture port selected, and the distance to the sample.

If the HRL 90 high-resolution lens is used, measuring-spot sizes as low as 0.075 mm are achieved allowing even very small features of panel graphics in the passenger cell of a car or an aircraft cockpit to be analyzed with sufficient resolution.

## Patented mode mixer

The light radiation is launched into the spectrometer via an optical fiber that uncouples the aperture size from the entrance slit and hence the spectral resolution of the spectrometer. Spectroradiometers without optical fiber coupling are significantly flawed because the spectral resolution changes with the diameter of the measuring spot.

The patented mode mixer compensates for changes in position and hence changes in transmission properties of the multimode fiber. The measuring error with mode mixer is less than 1 % compared with up to 20 % without mode mixer. The mode mixer also offers another significant advantage because mixing the light results in polarization scrambling which reduces the polarization error to approximately 0.4 %. LCD displays can therefore be measured very accurately.

## LED spot light

Locating the desired measuring point and focusing on it is often very difficult with unilluminated test samples in a dark room. This is why an LED spot light is supplied as standard with each TOP 200. The LED spot light can be connected to the TOP 200 as necessary and the flexible swan-neck attachment guarantees convenient and reliable illumination of the test sample at distances up to half a meter.

Test equipment with TOP 200 & CAS 140D for NVIS display measurement



## 04 \ \ TOP 150 – Model with single aperture for production applications

The TOP 150 features only one single aperture (instead of 4) and is used large-scale in production testing, e.g. of flat panel displays. It is specialized for radiance and luminance with excellent long-term stability.

TOP 150 with mode mixer



## 05 \ \ TOP 200 – NVIS measurement of displays and panel graphics

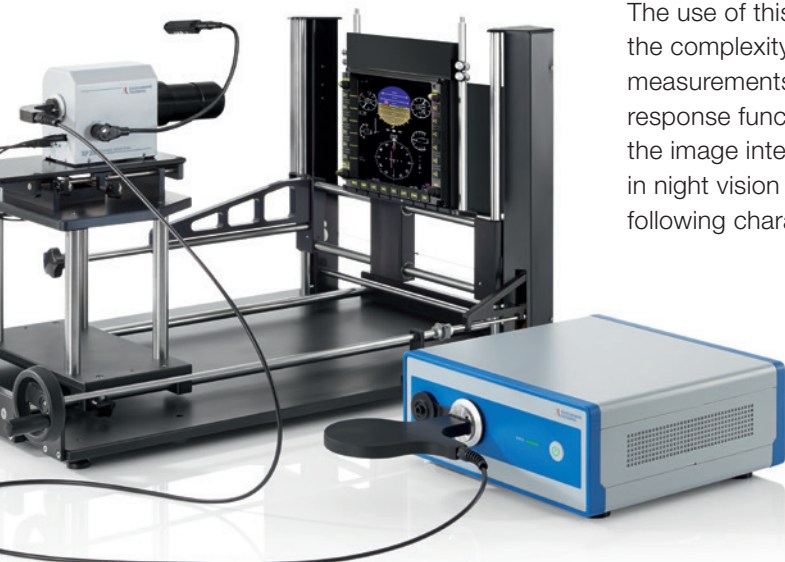
For NVIS measurements, it is critical that the extremely high-intensity differences between the visible and near infrared spectral ranges are measured correctly (typically 380 to 930 nm). This applies to large displays, small switches, and symbol measurement according to e.g. MIL-STD-3009, MIL-L-85762A, MIL-DTL-7788G (former MIL-P-7788F), JSSG-2010-5, ARP 5825, RAE WP 6, and others.

The NVIS display test system DTS 140D NVIS combines the advantages of the high-end array spectroradiometer CAS 140D (with further stray light suppression and automatic adjustment of measurement sensitivity) and the telescopic optical probe TOP 200 with built-in viewer camera. The TOP 200 guarantees a perfectly round and sharp measuring spot with an optimized Pritchard style optical system (with spot diameter from 75 micron up to inches).

The use of this test system solves the complexity of NVIS radiance measurements: 1) The spectral response functions rendered by the image intensifier, which is used in night vision goggles, has the following characteristics

(NVIS A/B/C): Optical radiation in the spectral range from approx. 650 to 930 nm is amplified by five orders of magnitude and converted to visible light. Thus, the radiance of the display in that spectral region must be extremely low compared to the visible spectrum in order to avoid blinding/shutter. 2) The NVIS radiance readings have to be scaled to the luminance of the same sample.

The CAS 140D meets all requirements for radiance and color accuracy that acquire the radiation spectrum from 380 to 930 nm. Luminance and NVIS radiance are calculated from the spectroradiometric data, enabling proper weighting and scaling. Different integration functions can easily be implemented by the user in the software (e.g. future goggle response curves or other standards). The article reviews the features of the NVIS display test system and discusses its measurement performance in specific applications.



## 06 \\ Our test laboratories – accredited quality

Instrument Systems offers systems for measurements of spectral radiance and spectral irradiance, for which our in-house, ISO 17025 accredited test laboratory confirms the metrological traceability by provided test report. These systems are therefore ideally suited for

measurements in the accredited scope of ISO 17025 and other international standards that require proof of metrological traceability. This enables our customers to demonstrate the quality of measurements to any third party.

All standards used are directly traceable to the reference standard of the national laboratories PTB (Germany) or NIST (USA). The test certificates included with our measuring instruments depict details of the traceability chain.

## 07 \\ Service and support

We at Instrument Systems are setting a benchmark not only with our products. Our services secure the long-term value of your investment and guarantee optimum productivity over the entire period of use.

### **Our service offerings include the following:**

- ▲ Engineering services
- ▲ Technical advice, also post-sales
- ▲ Re-calibration with certificate
- ▲ Instrument repair and hardware upgrade
- ▲ Software updates

## 08 \\ Technical specifications

| Model                             | TOP 200   | TOP 150                     |
|-----------------------------------|---|-----------------------------|
| Spectral range                    | Determined by the lens (see ordering information) |                             |
| View-finder camera                | 2560 x 1920 pixel, RGB                            | 752 x 480 pixel, RGB        |
| Aperture diameter                 | 0.125 / 0.25 / 0.5 / 0.8 mm                       | customer specific           |
| Dimensions basic unit (L x H x W) | 141.5 mm x 136 mm x 98.3 mm                       | 131.5 mm x 113 mm x 89.3 mm |
| Weight                            | 2.2 kg  | 1.5 kg                      |
| Power supply                      | 100 VAC to 240 VAC, 50/60 Hz                      | 4.75 to 5.25 V via USB 2.0  |
| PC connection                     | USB 2.0   |                             |
| Operating temperature range       | +10 °C to +35 °C                                  |                             |
| Relative humidity                 | < 70 % non-condensing                             |                             |
| Base plate                        | ¼-20 UNC, 4 x M6                                  |                             |

## 09 \\ Ordering information

| Order number   | Description   |
|--|---|
| <b>TOP 200 / TOP 150 basic unit and optical fibers with mode mixer</b>                           |   |
| TOP200-100-3   | Basic unit with Pritchard-style optics, motorized wheel with 4 apertures, and view-finder camera with 2560 x 1920 pixels; (without fiber, without lens)                       |
| TOP200-104   | Adapter for connecting a fiber bundle to the TOP 200  |
| TOP200-105   | Adapter for connecting an SMA fiber bundle to the TOP 200   |
| TOP200-203   | Fiber guide with integrated mode mixing (D50, 90° version) and PLG adapter; fiber length 2.3 m wavelength range 300 to 2200 nm; supports accessory recognition with CAS 140D  |
| TOP200-204   | Fiber guide with integrated mode mixing (D50, 90° version) and PLG adapter; fiber length 2.3 m wavelength range 190 to 1350 nm; supports accessory recognition with CAS 140D  |
| TOP200-212   | Fiber guide with integrated mode mixing (D50, 90° version) and PLG adapter; fiber length 3.5 m; wavelength range 300 to 2200 nm; supports accessory recognition with CAS 140D |
| TOP150-100   | Basic unit with Pritchard-style optics, single aperture, and view-finder camera with 752 x 480 pixels; (without fiber, without lens)  |
| TOP150-110   | Basic unit with Pritchard-style optics, single aperture, and without view-finder camera; (without fiber, without lens)  |
| TOP150-226   | Fiber guide with integrated mode mixing (D50, 90° version) and PLG adapter; fiber length 2.3 m; wavelength range 300 to 2200 nm; supports accessory recognition with CAS 140D |
| TOP150-228   | Fiber guide with integrated mode mixing (D50, 90° version) and PLG adapter; fiber length 3.5 m; wavelength range 300 to 2200 nm; supports accessory recognition with CAS 140D |
| <b>TOP 200 / TOP 150 lenses and close-up lenses for visible and near infrared spectral range</b> |   |
| TOP100-307-1   | 25 mm fixed focal length; F/2.6; 370 to 1100 nm; fixed working distance   |
| TOP100-307-2   | 25 mm fixed focal length; F/2.6; 370 to 1100 nm; variable working distance  |
| TOP100-317-1   | 50 mm fixed focal length; F/2.8; 370 to 1100 nm; fixed working distance   |
| TOP100-317-2   | 50 mm fixed focal length; F/2.8; 370 to 1100 nm; variable working distance  |
| TOP100-319   | High-resolution objective lens, 90 mm focal length; 370 to 1100 nm  |
| TOP100-322   | Objective lens, 105 mm focal length, F/4.0; 200 to 800 nm   |
| <b>TOP 200 / TOP 150 accessories</b>   |   |
| TOP100-400   | Tripod stand with tilting head for TOP 150/200  |

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KONICA MINOLTA Group

**Instrument Systems GmbH**

Kastenbauerstr. 2

81677 Munich, Germany

ph: +49 (0)89 45 49 43-58

fax: +49 (0)89 45 49 43-11

info@instrumentsystems.com

www.instrumentsystems.com

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