Instrument Systems
KONICA MINOLTA Group

# DSP 200

DSP 200 photometer for goniophotometric measurements


We bring quality to light.


**Product highlights at a glance**

- Class L photometers conforming to DIN 5032-7 (2017), CIE 69, CIE 121 and EN 13032-1
- Wide measuring range of 0.1 mlx (display resolution) to 200 klx for all standard light sources, including PWM LED
- Consistent display of measurements (device display, connected system components and software)
- Excellent stability and lowest noise level due to detector cooling
- System integration via CAN bus, integrated color display with touchscreen

# 01 \\ DSP 200 – For ultra-fast measurement of spatial light distribution with the goniophotometer

The DSP 200 photometer establishes a benchmark with regard to precision, linearity, measurement speed, and has an impressively broad range of possible applications in various different measurement distances, depending on the sample and application. It satisfies the requirements of accuracy class L according to DIN 5032-7 (2017) and EN 13032-1 for laboratory measurement of the photometric data of lamps and luminaries. It distinguishes itself in particular through its ability to measure modern specimens with pulse-width modulated LEDs and LED modules, as well as samples with traditional light sources such as incandescent, halogen, fluorescent and discharge lamps. This is made possible by a unique combination of high-precision analog technology and state-of-the-art digital signal processing.

A cooled silicon photoelement adjusted to the brightness sensitivity of the human eye is used as a detector, achieving outstanding stability and precision.

An extensive range of accessories is available for the DSP 200. For example, it incorporates stray light tubes adjusted to the measurement distance and sample size, stands, ceiling mounts and optical benches.

# 02 \\ Mode of functioning

The exceptionally fast internal sampling rate enables precise measurement of the light distribution of pulse-width modulated light sources with different frequency, even with extremely short duty cycles. This is due to a high-speed digital signal processor that guarantees excellent stability and repeatability.

Eight measuring ranges with automatic, signal form-dependent switching provide for excellent measurement resolution and dynamic range. The reading is conveniently displayed directly in lux or candela without the need to include a range exponent. The photometer features a wide measuring range of 0.1 mlx to 200 klx, covering all known goniophotometric applications.

The DSP 200 photometer is linked by CAN-bus to the AMS or LGS controller. Up to eight preamplifiers can thus be connected for the integration of several measuring receivers in a lighting laboratory. The AMS / LGS controller also functions as a photometric display unit with the option of switching between the individual photometers or displaying readings in different units of measurement such as cd or lx. The photometer is calibrated in the ISO 17025 accredited test lab at Instrument Systems and is traceable to national luminous intensity standards (e.g. PTB).

## Measurement of pulse-width modulated light sources

To dim the LED or LED module, e.g. for realizing various functions such as brake and position light with one and the same light source, luminaries are often operated with pulse width modulation. Typical frequencies range from 80 Hz to 1 kHz. Some extremely short duty cycles are used here. The DSP 200 photometer was optimized for this particular, commonly used application. The measured signal passes through a digital filter that – depending on the type of light source used – eliminates any modulations and interferences from the signal. The filter characteristics are optimally adapted to the different signal sources. The extremely fast digital signal processor guarantees excellent stability and repeatability.


Tube / stand with DSP 200.

# 03 \\ Fast “on-the-fly” measurements

The DSP 200 photometer is most commonly used for fast “on-the-fly” grid and slice measurements with the goniophotometers of the Optronik line AMS 200, 3000 and 5000, as well as our goniophotometers LGS 350, 650 and 1000. The fast data transmission rate enables the scanning of even high-resolution grids within the shortest of times for graphic representation as an isocandela diagram or as a test report using the LightCon or SpecWin Pro control software.

The location-dependent luminous intensity of the sample is measured strictly position-synchronous while the goniometer is in motion. The automatic measuring range switchover remains active, in order to map the different intensities of the sample with the best-possible dynamic range.

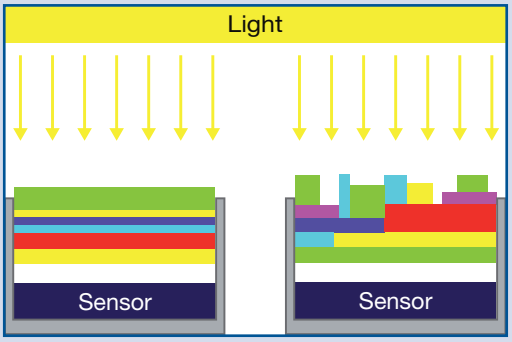
AMS 5000.

# 04 \\ Integrated photometer head

Photometer head DSP 200: V($\lambda$)-filter.

The integrated photometer head has a silicon photodiode precisely corrected to V($\lambda$) with a light-sensitive surface of 6 x 6 mm². On account of this small light-sensor active surface, excellent spatial resolution is achieved compared to conventional photometers, making it particularly suitable for light sources with sharp gradients and new applications such as glare-free headlights, pixel headlights and scans along the cut-off line. The in-built detector cooling to 3 °C guarantees the best possible suppression of dark current influence and other disruptions. Full filtering ensures that the influence of non-uniform illumination of the light-sensitive surface (error index $f_9$ according to DIN 5032-7) is kept at a technical minimum. With other detector designs this may easily be in the double-digit percentage range. The V($\lambda$) correction satisfies the requirements of DIN 5032-7 and EN 13032-1 ($f_1' \leq 1.5$ %) and is typically approx. 0.9 to 1.4 %. Each photometer is supplied with an individual test report on spectral sensitivity.

## $f_9$ – non-uniform illumination of the photometer head




Various methods of spectral measurement.

Current standards such as EN 13032-1 (2004) and DIN 5032-7 (2017) allow for a characteristic that is crucial to the accuracy of photometric measurements of standard photometer heads, the so-called $f_9$, the influence of non-uniform illumination of a photometer head. For test objects with sharp gradients, e.g. automobile headlights and, in particular, modern ADB and pixel headlights, decisive advantages are offered by photometers with full filtering, by which the spectral sensitivity is virtually constant over the entire light entry surface.

Although other filter methods achieve a similarly good spectral alignment with the brightness sensitivity of the human eye, in the case of non-uniform illumination the $f_9$ parameter may reach a double-digit percentage figure and the $f_1$ spectral correction may get out of hand. With full filtering, today's manufacturing processes enable extremely good spectral alignment, so that this satisfies the stringent requirements of the applicable standards for laboratory luxmeters in every respect.

# 05 \\ Software for different applications

Automotive, traffic or general lighting: Instrument Systems has the optimum, flexible solution for a variety of applications.

### LightCon software for conformity in the development of external vehicle lighting

LightCon was specially developed for fast photometric measurement of external vehicle lighting and industries with similar requirements, such as airfield lighting or variable message signs and retroreflection.

The software supports:

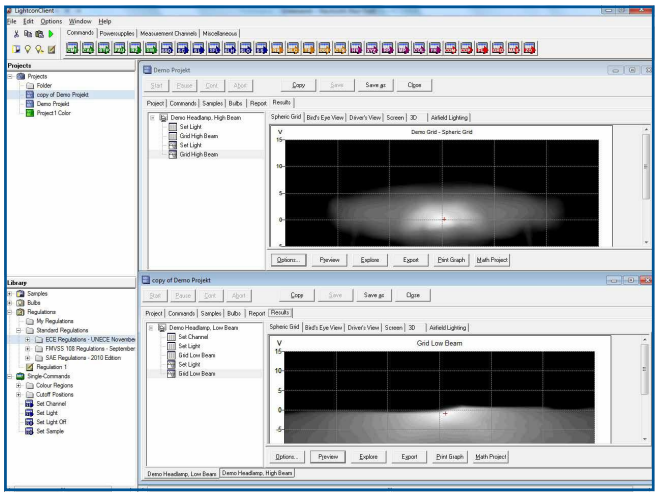
- All AMS goniophotometers of the Optronik line
- The assigned measuring receivers with DSP 200 photometer, DSP 10 photometer and type CM 10 tristimulus colorimeter
- Spectroradiometers such as the CAS 140CT or CAS 140D (for color coordinate measurement)
- Retroreflectometers of the RMS 1200 series
- Luminance measurement of license plate illumination
- Control and measurement of electrical operating parameters of the samples via SNT 10 power sources
- Control of frequency and duty cycle for pulse width modulated light sources.

The software is characterized by clear, modular and intuitive design that enables the user to quickly become familiar with the operation of a complex goniophotometer system after only a short training period.

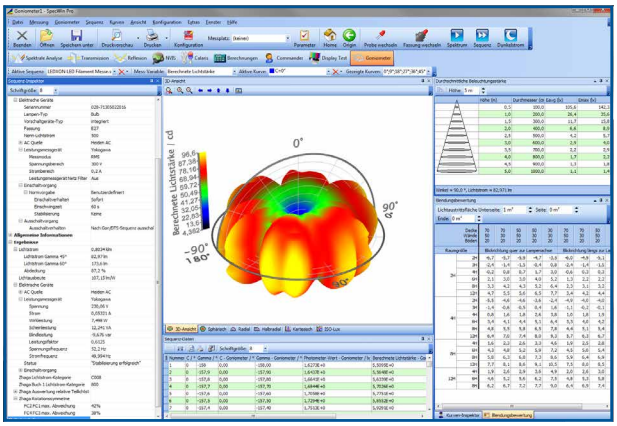
Lamps and test objects can be stored and managed in a structure definable by the user himself. The software contains a complete regulation database acc. to UN-ECE, SAE and FMVSS108, ICAO and FAA standards that are regularly updated by Instrument Systems. Regulations are also freely editable, and there is an option of defining manufacturer's limits, in addition to standard limits. Light distributions can be graphically represented as isocandela diagrams in the form of spherical scan grids, wall projections, driver's and bird's-eye views. They can be superimposed and processed via export in CSV, KRS or IES format and compared and exchanged with all common simulation and ray tracing programs.

## SpecWin Pro for SSL and general lighting

In an extension module for the DSP 200 / DSP 10 photometer and LGS goniophotometer, SpecWin Pro supports the measurement of spatial radiation properties of lamps, luminaries and modules from the field of solid state lighting and general lighting as well as the control and measurement of electrical operating data via DC or AC sources. The use of the DSP 200 / DSP 10 photometer permits extremely fast "on-the-fly" collection of photometric data in candela or lux, the luminous flux integration and graphic presentation of the light distribution curve as an isocandela diagram in the $\gamma$- / C-coordinate system in polar or Cartesian form.
The software furthermore enables the assignment of luminaries to energy efficiency classes of the European Union and provides all standard export formats for illumination planning such as IES or EULUMDAT.



LightCon.



SpecWin Pro.

## Size of the light entry surface

In times of glare-free headlights with millions of pixels, high resolution measuring grids are becoming increasingly necessary. A small light-sensitive surface of the detector is thus of vital importance. While many conventional photometers have a relatively large light entry surface with diffusor, which is big enough to receive a sufficient photocurrent signal for measuring lower luminous intensity, the DSP 200 offers excellent spatial resolution with a light entry surface of only 6 x 6 mm. Thanks to full filtering, there is no need for a diffusor. With state-of-the-art amplifier technology and low noise levels, lower luminous intensities and extremely high signal levels can be measured with hitherto unparalleled spatial resolution.

# 06 \\ Technical specifications according to DIN 5032-8 (2017)

| | | |
|---|---|---|
| **1. Instrument** | | |
| 1.1 Manufacturer and brand name | Instrument Systems Optische Messtechnik GmbH | |
| 1.2 Type and sales designation | System photometer DSP 200 | |
| **2. Application** | System photometer for laboratory application | |
| 2.1 Indoor | Instrument designed for interior space | |
| 2.2 Outdoor | n.a. | |
| 2.3 Specific application area | Precision measurement of illuminance, luminous intensity and luminous intensity distribution with a goniophotometer | |
| **3. Class index** | L according to DIN 5032 part 7, EN-DIN 13032-1 | |
| **4. Measurement range** | | |
| 4.1 Smallest reading | 0.1 mlx | |
| 4.2 Highest reading | 200 klx | |
| 4.3 Number of ranges | 8 | |
| **5. Photometer head** | | |
| 5.1 Type of light sensitive receiver | Silicon photo diode with V($\lambda$) spectral adaptation (full filtering) and Peltier cooling | |
| 5.2 Assignment to the display unit | Integrated display unit and additional measurand output at goniophotometer control unit | |
| 5.3 Spatial evaluation | No correction | |
| 5.4 Thermostatic stabilization | Integrated | |
| 5.5 Light sensitive surface | 5.8 x 5.8 mm | |
| 5.6 Special feature | Individual test report for V($\lambda$)-adaptation in steps of 5 nm from 380 to 780 nm | |
| **6. Display unit** | | |
| 6.1 Transducer | Precision operational amplifier | |
| 6.2 Integration time | PWM Mode $t_{max} \leq 20$ ms | Fast mode $t_{max} \leq 4$ ms |
| 6.3 Display | LC Display, direct indication of the calibrated measurement value in lx or cd | |
| 6.4 Automatic range selection | Auto-adaptive range selection | |
| 6.5 Digital data interface | CAN, RS232, USB, LAN | |
| 6.6 Analogue output | n.a. | |
| 6.7 Electrical operating mode | Suitable for continuous duty | |
| 6.8 Attenuator / Multiplicator | Individual multiplicators for measurement distances | |
| 6.9 Special features | Supports rapid grid measurements with goniophotometer, triggered synchronously to goniometer position, display with touchscreen | |
| **7. Maximum parameters and additional characteristics according to DIN EN 13032-1 and DIN 5032-7** | | |
| 7.1 Uncertainty of standard | $U_{cal}$ | ≤ 0.8 % |
| 7.2 V($\lambda$)-adaptation | $f_1'$ | ≤ 1.4 % (typ. ≈ 0.9 - 1.4 %) |
| 7.3 UV-response | u | ≤ 0.1 % |
| 7.4 IR-response | r | ≤ 0.1 % |
| 7.5 Spatial evaluation | $f_2$ | No cosine correction |
| 7.6 Linearity | $f_3$ | ≤ 0.1 % |
| 7.7 Display unit | $f_4$ | ≤ 0.2 % |
| 7.8 Fatigue | $f_5$ | ≤ 0.1 % measured at 5000 lx |
| 7.9 Temperature coefficient | $f_6$ | ≤ 0.002 % / K |
| 7.10 Modulated light | $f_7$<br>$f_7$ $(f_u)^d$<br>$f_7$ $(f_o)^d$ | ≤ 0.1 %<br>-- [1]<br>≤ 2 % |
| 7.11 Range change | $f_{11}$ | $f_{11} \leq 0.05$ % |
| 7.12 Total parameter [2] | $f_{ges}$ | ≤ 3 % |
| 7.13 Non-uniform illumination | $f_9$ | ≤ 3 % |

| | | |
|---|---|---|
| **8. Calibration interval** | Recommended calibration interval 1 year or according to quality management requirements of the user | |
| **9. Electrical supply** | Power supply via CAN-Bus connection by the AMS / LGS Controller | |
| 9.1 Nominal voltage | 24 V DC | |
| 9.2 Nominal power consumption | 6 W | |
| 9.3 Nominal frequency | n.a. | |
| **10. Dimension** | | |
| 10.1 Instrument (L x W x D) | 215 mm x 112 mm x 118 mm (over all), 215 mm x 112 mm x 60 mm (only housing) | |
| 10.2 Photometer head | Tube flange: Ø 50 x L 34 mm | |
| 10.3 Length of the connecting cable | Up to 50 m (CAN-system cable) | |
| **11. Weight** | 1050 g with integrated detector | |
| **12. Evironmental conditions** | Operating temperature<br>Storage temperature<br>Relative humidity<br>Operating altitude | +5 °C ... +40 °C<br>-5 °C ... +40 °C<br>0...70 % rF, non condensing<br>< 2000 m |
| **13. Compliance / product safety** | CE (2014/30/EU, 2011/65/EU, 2012/19/EU), FCC, KC | |

[1] DSP 200 is a fast photometer designed for fast goniophotometric measurement so that this value is irrelevant for its evaluation.
[2] Calculation of total parameter $f_{ges} = U_{cal} + f_1 + u + r + f_3 + f_4 + f_5 + f_6 + f_7 + f_{11}$



Instrument Systems
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

Kaiserin-Augusta-Allee 16-24
10553 Berlin, Germany
ph: +49 (0)30 34 99 41-0
fax: +49 (0)30 34 55 054
info_berlin@instrumentsystems.com
www.instrumentsystems.com/optronik

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