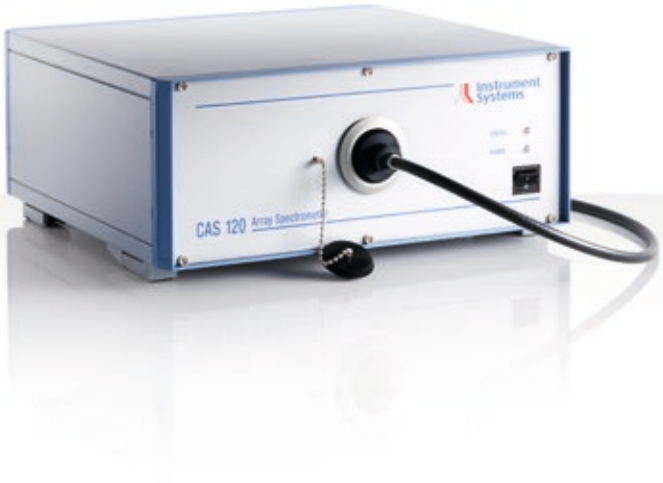
We bring quality to light.

CAS 120
CCD Array Spectrometer

Instrument Systems

KONICA MINOLTA Group



The features at a glance

- Precision spectrograph with integrated density filter wheel (OD 1 – 4)
- Shutter for automatic dark current correction
- 2048 x 14 pixels back-illuminated CCD detector, 16 bit ADC
- Short integration times of 4 ms
- USB interface
- Hardware I/O trigger

The powerful optical spectrometer: accurate, fast and versatile

The new high-performance CAS 120 makes it even more feasible to deploy the proven metrology from Instrument Systems even in price-sensitive applications, such as LED production testing or quality assurance.

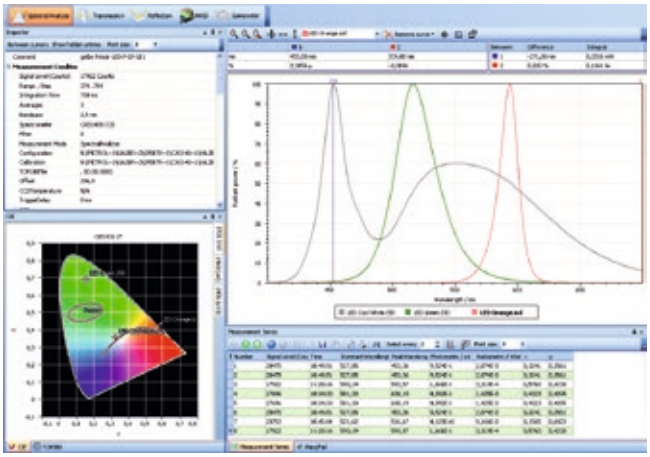
Unique technical innovations integrated in the CAS 120 result in a higher level of dependability and speed. These benefits are achieved alongside reduced cost even under the demanding conditions experienced in 24/7 production environments. The spectrometer also complies with the exacting requirements of accuracy and versatility without compromise. The CAS 120 is equipped with a USB interface and hardware trigger, and is available as a VIS (360 – 830 nm) or UV-VIS (200 – 800 nm) model.

Solutions for laboratory and production

Like all spectrometers from Instrument Systems, the CAS 120 can be combined with any of a large number of adapters and other accessories using fiber-optic cables to permit a wide range of different tasks for one spectrometer. This enables the CAS 120 to be deployed efficiently in production, quality assurance, as well as in research and development. The integrated density filter wheel and the dark-current shutter also facilitate fully automated measurements over an extremely broad signal range.

Versatile software support

Instrument Systems supplies a DLL and a LabVIEW® driver for use in production environments and at automated measurement stations. Calculation of all photometric, radiometric and colorimetric quantities is included in the software packages. This permits fast and easy integration within existing production facilities. Integration is even easier when using the LED Tester software which provides all important functions for the definition of test sequences and binning of LEDs.



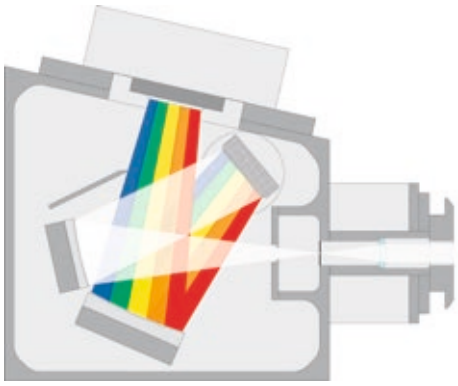
SpecWin Pro spectral analysis software

SpecWin Pro and SpecWin Light spectral software packages have been developed for a wide range of interactive

semi-automatic and even fully automatic laboratory applications. Each package features comprehensive functions for analysis and documentation of test results.

The proven optical setup

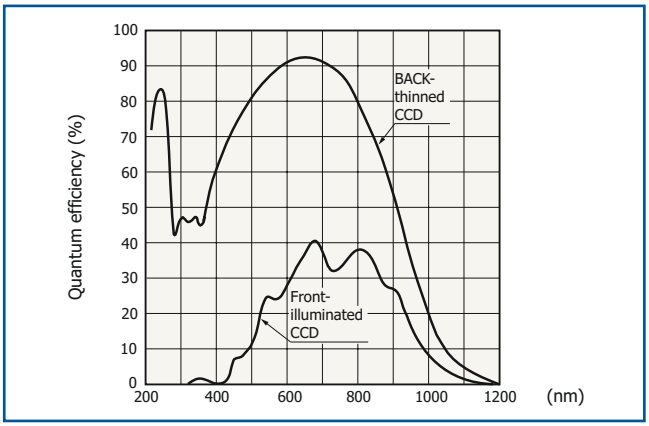
A Crossed Czerny Turner Spectrograph with integrated density filter wheel and dark current shutter forms the core of the CAS 120. It guarantees maximum optical precision with exceptionally good straylight rejection and a high level of optical precision.



Optical setup of the CAS 120 with optimized Crossed Czerny Turner Spectrograph

Back-illuminated CCD detector

A back-thinned CCD area sensor with 2048 x 14 pixels is used in the CAS 120. This sensor offers a high level of measuring sensitivity and large dynamic range. An optical concentrator made up of a cylindrical lens enhances the sensitivity of the spectrometer to values which are comparable with larger, more expensive detectors. Hardware binning of the 14 vertical pixels has improved the signal-to-noise ratio beyond the levels achieved with smaller CCD spectrometers. The low number of pixels in the sensor combined with the fast A/D converter results in particularly short measuring times of only 4 ms.

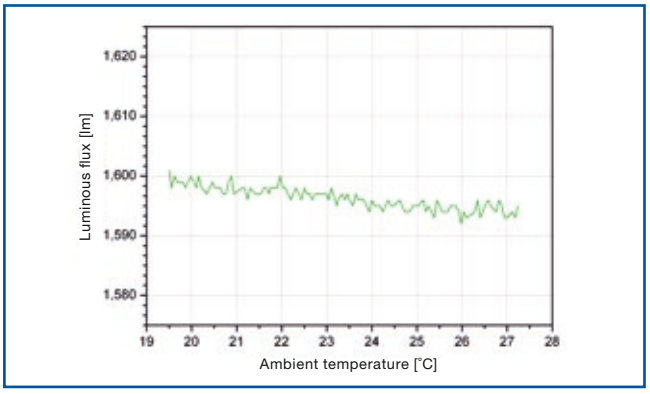


Spectral sensitivity functions for back-thinned CCD and front-illuminated CCD

Back-thinned CCD detectors also feature a significantly better signal sensitivity in the short-wave spectral range (blue response) than in conventional front-illuminated CCDs which are used in low-cost spectrometers. This is a particular advantage when measuring blue and white LEDs (see the Instrument Systems Handbook of LED Metrology for more information on stray light).

Stable even without cooling

Cooling of the CCD detector defines a key cost factor for high-end array spectrometers. However, cooling of the CCD detector has been deliberately omitted in the CAS 120. Instead, the temperature of the CCD detector is recorded each time a spectrum is measured and built-in algorithms automatically compensate the measurement data for thermal variations in the detector. This guarantees stable and reliable measurement results without expensive cooling and temperature stabilization of the detector.



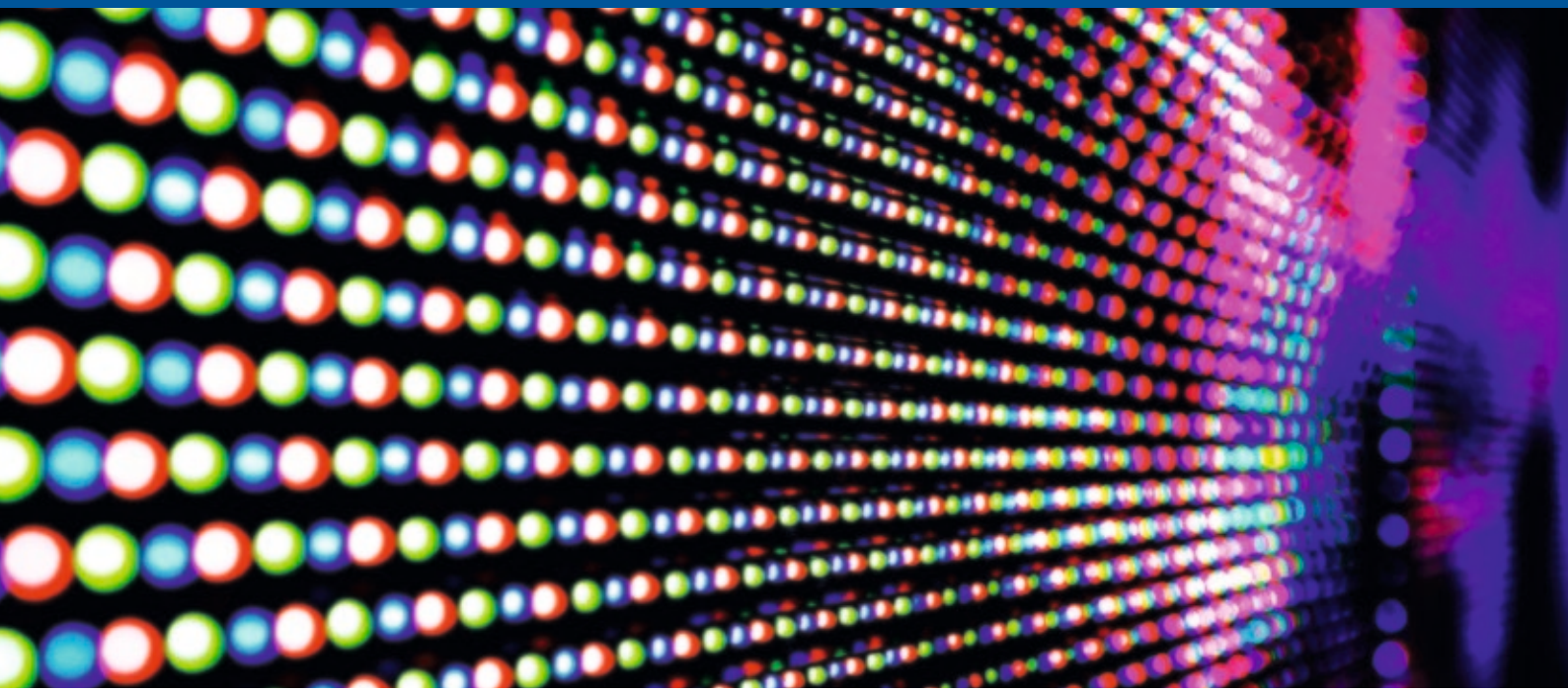
Stability of photometric measurements

Reliable and robust

The new filter wheel design operates without any mechanical position switches. Instead, a more reliable configuration with an electronic angle sensor is used to identify the exact filter positions. Optical density filters on the filter wheel are used to expand the total dynamic range of the CAS 120 to an impressive 8 decades without manual intervention. As with all Instrument Systems spectrometers, the density filters are spectrally calibrated to ensure high spectral accuracy in all modes of operation. The filter wheel also incorporates the function of the mechanical dark-current shutter which provides fully automated dark-current calibration of the CCD detector.

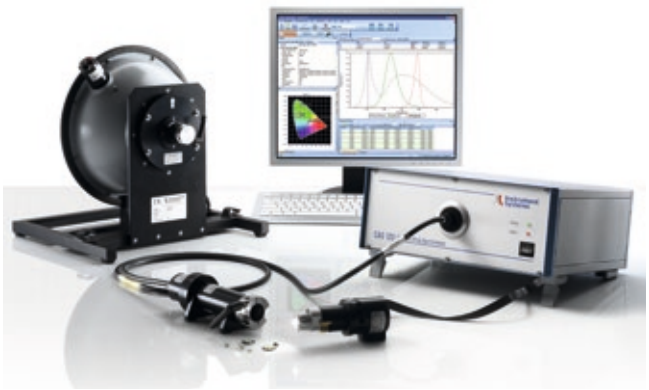
USB interface and hardware I/O trigger

The CAS 120 is equipped with a reliable, screw-fit USB interface and a separate TTL trigger I/O interface. The hardware trigger is necessary to enable precise timing and synchronization with other instruments like current sources. Minimizing synchronization errors and delays is especially critical for wafer probing and LED sorting. Trigger cables are available for direct connection of standard current sources to the CAS 120.



Diverse applications: From lab to LED production

The CAS 120 is ideal for all measurement applications of LEDs, OLEDs and solid-state lighting products. Firstly, the comprehensive range of accessories transforms the setup of the spectrometer into a universal lab workstation.



Laboratory test setup for LEDs

Secondly, the robust design, the short measuring times and attractive pricing make the CAS 120 ideal for use in cost sensitive production environments. The wafer with processed LED chips provides the opportunity to determine the properties of the future LED for the first time. In particular, this is crucially important when manufacturing white LEDs where tight production tolerances and a high yield for the final white LEDs can only be guaranteed by precise testing for the optical and electrical parameters of the blue LED chips used.

Measurement of luminous intensity

The measurement adapters of the LED 4xx series permit luminous intensity measurements in conformity with CIE standards to be carried out in the laboratory and in the back-end-of-line processes. Instrument Systems has developed the EKT-10x fiber-optic measurement adapters for use in the front-end-of-line processes. This probe can be operated under a microscope and permits fast configuration of the wafer and continuous positional control during testing. The probe's high light throughput also facilitates very short measuring times even with low-power LED chips.

LED25-430 adapter for averaged LED intensity measurements in conformity with CIE 127

Measurement of luminous flux

The integrating spheres with a proven track record from Instrument Systems are used for taking precise measurements of total luminous flux. Spheres with diameters ranging from 75 to 1900 mm permit all measurements in the laboratory and in the production of LEDs, LED modules and complete lamps and luminaires. For production applications Instrument Systems also works directly with the manufacturers of wafer probers and LED handlers, in order to achieve optimum integration of the optical test system in the existing machine design.

ISP 150L Integrating Sphere for production applications

All results in a single measurement

The spectral measuring principle empowers the CAS 120 to determine photometric and all colorimetric and spectral parameters in a single measurement:

- Luminous flux [lm] or luminous intensity [cd]
- Color coordinates [x,y,z] and color temperature [K]
- Color rendering index (CRI)
- Dominant, centroid and peak wavelength [nm]
- Peak width at half-height FWHM [nm]

A very high level of accuracy for the test results is always guaranteed with factory calibration of the spectrometer combined with corresponding measurement adapters in the ISO 17025 certified calibration laboratories operated by Instrument Systems.

The LED Tester

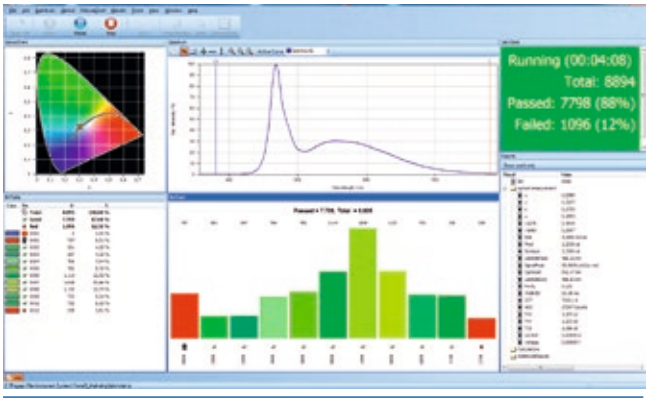
The LED Tester is a turnkey system to facilitate fast and easy integration in a wide range of different production settings when manufacturing LEDs. The modular setup means that the LED Tester can be matched to specific requirements. The CAS 120 is integrated seamlessly into the system and is particularly effective for applications where ease of deployment, cost and testing speeds are a top priority.

The LSM 350 4-quadrant source and measure unit has been developed to supply electrical current to LEDs and to obtain electrical measurements. This instrument delivers especially fast measuring sequences for testing multi-chip LEDs (e.g. RGB). Additionally, the popular series 2400 and 2600 sourcemeters from Keithley can also be used in the LED Tester.

LED Tester

The Tester software supports sorting and binning of packaged LEDs, or mapping of devices on a wafer. The software permits an arbitrarily configurable sequence of optical and electrical measurements. Flexible binning definitions allow the sorting criteria to be any single metric or a combination of any electrical and optical parameters. Electrical and optical testing of up to 8 different chips in a single package is supported.

A hardware interface provides fast exchange of binning results with the machine. This interface can generally be used with all the standard LED handlers or wafer probers without any need for additional programming resources. The LED Tester also offers a COM Client based software interface which allows easy access to all test procedures.



LED Tester software

Technical specifications

Model	UV/VIS	VIS
Spectral range	200 – 800 nm	360 – 830 nm
Detector	Back-thinned CCD	Back-thinned CCD
Number of pixels (vertically binned)	2048 x 14	2048 x 14
Spectral resolution *1	2.7 nm	2.2 nm
Datapoint interval	0.35 nm	0.3 nm
Wavelength accuracy *2	+/- 0.3 nm	+/- 0.3 nm
Integration time	4 msec – 20 sec	4 msec – 20 sec
Linearity	+/- 0.6%	+/- 0.6%
Straylight		
Broadband for Illuminant A radiation *3	7×10^{-4}	5×10^{-4}
for LED *4	5×10^{-4}	5×10^{-4}
with laser *4	1×10^{-4}	1×10^{-4}
LED measurements		
Measuring range luminous intensity *5	1 mcd – 5 kcd	1 mcd – 5 kcd
Measuring range luminous flux *6	1 mlm – 3.3 klm	1 mlm – 3.3 klm
Measurement uncertainty luminous intensity *7	+/- 4%	+/- 4%
Measurement uncertainty luminous flux *7	+/- 4%	+/- 4%
Measurement uncertainty dominant wavelength *7	+/- 0.5 nm	+/- 0.5 nm
Measurement uncertainty color coordinates *7	+/- 0.002	+/- 0.002
Spectroradiometry		
Sensitivity range for irradiance *8	5×10^{-8} – 5×10^{2} W/m^{2}nm	3×10^{-8} – 3×10^{2} W/m^{2}nm
Signal sensitivity at 1s integration time *8	8×10^{-7} W/m^{2}nm	5×10^{-7} W/m^{2}nm
Spectroradiometric accuracy *7	+/- 4%	+/- 4%
Measurement accuracy for color coordinates at Illuminant A *7	+/- 0.002	+/- 0.002
Reproducibility of color coordinate measurement at Illuminant A *7	+/- 0.0002	+/- 0.0002
Spectrophotometry		
Baseline noise *9	+/- 400 counts, or +/- 2.5%	
Photometric transmission measurement accuracy	+/- 1%T	
Baseline drift *10	0.3%/h	
Spectrograph		
Focal length, f number, grating	approx. 120 mm, f/3.5, plane reflection grating	
Slit	Models UV/VIS and VIS : standard: 100 µm; optional: 50 µm	
Filter wheel / Shutter	Standard for all models; density filter OD 1 – 4; model UV/VIS with UV density filters; position monitoring with encoder	
Electrical data		
AD converter	16 bit resolution	
PC interface	USB 2.0	
Triggering	Input: TLL ascending slope; output: 2 TTL outputs (software controlled), one TTL flash pulse	
Miscellaneous		
Dimensions (H, W, D)	147 x 343 x 317 mm^3	
Power supply	Wide-range input 100 VAC to 240 VAC 50/60 Hz	
Power consumption	max. 35 VA	
Ambient temperature	15 – 35°C; relative humidity 70% max., non-condensing	
Weight	approx. 7 kg	
Valid standards	In conformity with EN 61010-1:2002-08 (safety requirements governing electrical equipment for measurement, control and laboratory use)	

Ordering information

Order number	Description
CAS120-151	Model VIS; 360 to 830 nm; 2048 pixels back-illuminated CCD detector; 2.2 nm spectral resolution (100 µm slit)
CAS120-152	Model UV-VIS; 200 to 800 nm; 2048 pixels back-illuminated CCD detector; 2.7 nm spectral resolution (100 µm slit)
CAS120-330	50 µm slit (instead of standard 100 µm slit)
Measurement adapters for production applications	
LED-433-15	Luminous intensity measurement adapter for LEDs I_{LED-B} (0.01 sr); incl. OFG-414 and PLG-410; 380 to 1600 nm; shortened version
LED-434-15	Luminous intensity measurement adapter for LEDs I_{LED-B} (0.01 sr); incl. OFG-424 and PLG-420; 190 to 1350 nm; shortened version
EKT-101	External optical probe Fiber bundle with 90° beam deflection; 280 to 2500 nm
EKT-102	External optical probe Fiber bundle with 90° beam deflection; 190 to 1350 nm
ISP100-130	ISP100 Integrating Sphere Integrating sphere with 100 mm diameter, fiber bundle connector; 240 to 2600 nm; version for handling machine or prober
ISP100-140	ISP100 Integrating Sphere Protective glass cover for measuring port of the ISP100-130
Measurement adapters for laboratory applications	
LED25-430	Averaged LED Intensity probe, complete for I_{LED-B} (100 mm) and LED test sockets with 25 mm diam; incl. LED25-100, LED25-230, OFG-424 and PLG-420; 220 to 1350 nm
LED-436-15	Luminous intensity measurement adapter for LEDs; I_{LED-B} (0.01 sr); incl. OFG-414 and PLG 410; 380 – 1600 nm; with clamp for LED test socket
LED-437-15	Luminous intensity measurement adapter for LEDs; I_{LED-B} (0.01 sr); incl. OFG-424 and PLG 420; 190 – 1350 nm; with clamp for LED test socket
ISP150L-250	150 mm integrating sphere, complete for luminous flux measurements at LEDs; adapter plate for 25 mm LED test sockets; auxiliary light source; incl. OFG-414 and PLG-410; 380 – 1600 nm
ISP150L-251	150 mm integrating sphere, complete for luminous flux measurements at LEDs; adapter plate for 25 mm LED test sockets; auxiliary light source; incl. OFG-424 and PLG-420; 240 – 1350 nm
Calibrations	
CAL-120	Calibration of radiant intensity and luminous intensity; wavelength range VIS
CAL-121	Calibration of radiant intensity and luminous intensity; wavelength range UV and VIS
CAL-140	Calibration of luminous flux; absolute value with reference LED at the measuring port of the sphere; wavelength range VIS
CAL-141	Calibration of luminous flux; absolute value with reference LED at the measuring port of the sphere; wavelength range UV and VIS
Software	
SW-120	SpecWin Light spectral software for Windows XP/7; only for MAS40/LED Station, CAS140B/CT and CAS120
SW-130	SpecWin Pro spectral software for Windows XP/7; supports MAS40, CAS140B/CT, CAS120, SPECTRO 320, DTS 500, LEDGON
SW-231	DLL driver program for CAS140B/CT and CAS120; runs on Windows XP/7
SW-233	LabVIEW® driver software; also requires SW-231

*1 Approximate values for 100 µm standard slit. Other values for optional 50 µm slit.
*2 Applies to Penray lamp or laser.
*3 Measured at 400 nm in combination with a GG455 long-pass filter relative to peak intensity of unweighted spectral data.
*4 Measured at 150 nm gap left of the peak wavelength, relative to peak intensity of unweighted spectral data.
*5 Applies for a signal/noise ratio of 10:1, for yellow LED with 585 nm and with LED-436 Adapter. The values are a factor of 20 to 100 higher for white LEDs.
*6 Applies for a signal/noise ratio of 10:1, for yellow LED with 585 nm and with ISP250 Integrating Sphere. The values are a factor of 20 to 100 higher for white LEDs.
*7 Immediately after calibration relative to the calibration standard and without density filter. Indicated errors refer to the twofold standard deviation.
*8 Measured with EOP-120 External Optical Probe and OFG-414 Fiber Bundle, at 600 nm wavelength and signal/noise ratio of 10:1, including the density filters and without averaging.
*9 Signal level for shortest integration time and at 30,000 counts.
*10 Applies for 30 minutes with LS100-130 after 1 hour warm-up time.

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