

# CAS 140CT IR Series

Array spectrometer for high accuracy  
infrared light measurement



We bring quality to light.



#### Key features at a glance

- ▲ Two model variants to cover wavelength from 780 nm – 2150 nm
- ▲ High-performance InGaAs linear image sensor with wide dynamic range
- ▲ Spectrograph design optimized for NIR/SWIR wavelength applications and high-sensitivity performance
- ▲ Thermoelectric cooling down to -20 °C for low dark current and enhanced stability
- ▲ Extensive range of accessories for different measurement challenges

## 01 \\ CAS 140CT IR series – Benchmark for accuracy

The CAS 140CT IR series of spectroradiometers from Instrument Systems are high-performance array spectrometers that have been optimized in order to fulfill the requirements for wavelength measurement in the near-infrared (NIR) to short-wave infrared (SWIR) spectral range.

With the cooled InGaAs or extended InGaAs line sensors of the CAS 140CT IR series a wavelength range of 780 nm to 2150 nm can be covered with two model variants.

The model IR1 covers a range from 780 nm to 1650 nm, the model IR2 from 1500 nm to 2150 nm. All instruments in the series feature thermoelectric cooling of the sensors to a temperature of -10 °C (model IR1) or -20 °C (model IR2). This ensures low noise and excellent long-term stability.

At the heart of the CAS 140CT is a crossed Czerny-Turner spectrograph. The entire optical setup is optimized for the infrared wavelength range and guarantees a high optical throughput together with high signal dynamics and low stray light. The integrated neutral density filter wheel extends the measurable intensity range. This enables either extremely low or high light intensities to be measured without manual intervention in the measurement setup.

An additional shutter with position detection permits automatic dark current measurement. In particular, this is to the benefit of critical measurement tasks and complex production processes.

The CAS 140CT IR1 model additionally has a high-gain option for significantly expanding the sensitivity range to low power applications.

A wide selection of measurement adapters can be easily connected via optical fibers. In this way, the spectrometer can be upgraded to a complete system for a wide range of spectroradiometric measurement tasks.

The instruments are equipped as a standard with a USB interface. The accessory recognition (Ident key) integrated into a CAS 140CT IR series enables safe operation with several measurement adapters. For this purpose, the code stored in the Ident key of the measurement adapter is compared with the currently selected calibration file.

The CAS 140CT IR series from Instrument Systems offers a unique combination of high measurement accuracy with ruggedness and reliability. Even in continuous operation in the production environment, the CAS 140CT IR is a guarantee for precise readings and long-term stability.

## 02 \ \ Extended wavelength range

Special applications require that a wide wavelength range from UV to infrared can be covered within a single measurement. With the two CAS 140CT IR-models a spectral range of 780 – 1650 nm (IR1) or 1500 – 2150 nm (IR2) can be analyzed. Using the CAS 140D a spectral range from 200 nm to 1100 nm can be covered. A parallel measurement can be performed with instruments of the CAS 140D series in order to simultaneously record the UV and VIS range.

### MultiCAS add-on

The MultiCAS add-on for the software application SpecWin Pro permits the combination of CAS 140D and CAS 140CT spectrometers to a cluster, e.g. in order to cover a wavelength range of 200 nm – 2150 nm in one measurement procedure.

The additional MultiCAS hardware trigger box ensures that the spectrometers are activated synchronously. The software application SpecWin Pro automatically combines the individual spectra into a total spectrum. An additional step within the factory calibration of the complete setup guarantees precise measurement results.

Example MultiCAS measurement setup showing two CAS 140D, one CAS 140CT and the MultiCAS hardware trigger box.



## 03 \ \ Software solutions for analysis and documentation

A broad pallet of software solutions is available for controlling the models of the CAS 140CT IR series and analyzing readings. All programs provide highly reliable routines that have been validated by experts for radiometric, photometric and colorimetric calculations.

### SpecWin Pro and SpecWin Light with an extended range of functions

The SpecWin Pro and SpecWin Light software programs are available for the diverse laboratory tasks. SpecWin Light embraces all the basic functions for measurement analysis and documentation.

SpecWin Pro additionally offers plug-in modules for a greatly extended range of functions. These include, e.g. the integration and control of different types of source-measure-units from e.g. Keithley or Vektrex or the storage and analysis of a sequence of fast measurements in burst mode.

For easy and intuitive operation, SpecWin Pro and SpecWin Light have application-specific modules with specific user interfaces. The Reflectance/Transmittance module enables fast measurement of reflective

or transmissive properties. With the Goniometer module a goniometer system, e.g. LEDGON can be controlled. The Commander module is a programming interface where measurement sequences can be created by just a few clicks.



SpecWin Pro spectral analysis software.

## Software development kit with DLL and LabVIEW driver

A software development kit (SDK) is available for custom programming or integration into production sequences. In addition to a DLL library, the SDK incorporates valuable sample programs and programming aids. The DLL already

contains all colorimetric calculations, for easy integration in customized measurement systems and evaluation of readings. In addition, a driver for programming measurement processes in LabVIEW is available for laboratory use of the CAS 140CT.

## MultiTrack

To store a sequence of very fast measurements in burst mode as described above, the MultiTrack add-on for SpecWin Pro has been developed to extend the software features.

# 04 \\ Solutions for further spectral measurement tasks

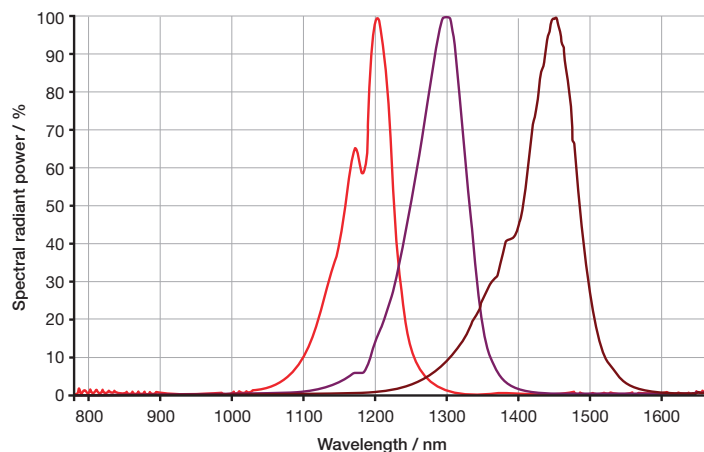
CAS 140CT IR series spectrometers are ideally suited for all requirements in spectral measurement.

The versatile fiber connector, a broad range of accessories and balanced software functions enable a wide range of system solutions that cover all regular measurement tasks.

## Spectroradiometry

The optical probes of the EOP series are exceptionally well-suited to the precise measurement of spectroradiometric magnitudes. They can be easily connected via optical fiber to the to the CAS 140CT IR for reliable measurement of irradiance. The PLG-series optical adapter ensure a reliable and reproducible mechanical connection of the optical fiber to the spectrometer. Variations in the measurement results can thus be minimized if the accessories have to be changed frequently.

Instrument Systems offers optical probes with primarily directional response characteristics and high light throughput, or models with excellent cosine correction but lower light throughput.



▲ Normalized spectra of different IR-LEDs with peak wavelengths at 1200, 1300, and 1450 nm measured with CAS 140CT and integrating spheres at Instrument Systems.

## SWIR measurements

Short wavelength infrared light (SWIR) is usually defined as light with a wavelength between 0.9  $\mu\text{m}$  and 1.7  $\mu\text{m}$ , sometimes also as the spectrum between 0.7  $\mu\text{m}$  and 2.5  $\mu\text{m}$ . The number of applications with sources in this wavelength range has increased considerably in recent years. It enables numerous applications that would be difficult or impossible with visible light. SWIR is used as the light source in various applications such as wearable devices, food analysis, drug discovery and healthcare.

The industry is continuously working on increasing the optical output power and efficiency of SWIR LEDs to enable further fields of applications. With the CAS 140CT IR series models IR1 and IR2, Instrument Systems offers two spectrometers to cover the full SWIR spectral range. A broad range of accessories is additionally available for multiple measurement tasks. The high-sensitivity option facilitates measurement of low optical power light sources.

## Transmission and reflection measurements

Due to high stability and stray light suppression, the CAS 140CT IR is also optimally suited to transmission and reflection measurements. Combined with the appropriate measurement adapter, the CAS 140CT IR is the ideal measurement system for the respective application. In addition to measurement tasks in the range of directional transmission, such as the examination of optical filters and lenses, it permits the examination of the diffuse transmission and reflection of scattering samples and solar cells.

ACS-570 series of LED calibration standards. The compact power supply and TEC-control unit ACU ensures fast temperature regulation, as well as high stability of the supply current.

## Calibration equipment

Instrument Systems offers a broad range of calibration equipment – ranging from single LED calibration standards up to complete calibration laboratories. Calibration equipment simplifies the monitoring and auditing of measurement devices. If

needed, a special calibration module in SpecWin Pro can recalibrate the measurement setup. Our ISO 17025 accredited test laboratories ensure highest accuracy and direct traceability to the reference standards of national institutes.



# 05 \ \ Our test laboratories – Accredited quality

As a leading manufacturer of light measurement equipment we strive to ensure that you are able to place the greatest possible trust in our instruments. Our customers enjoy significantly greater certainty and guaranteed comparability of readings with the accreditation of our test labs according to DIN EN ISO / IEC 17025 with flexible scope of application of category III. This enables our

customers to demonstrate the quality of measurements to any third party and ensures a long-term investment. Besides test procedures for photometric quantities, the company's test labs are also accredited to ISO 11664 for the measurement of colorimetric quantities.

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.



EOP optical probes with different light throughput and angular response characteristic.



# 06 \ 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

# 07 \ Technical specifications

Model	IR1	IR1 High-Gain	IR2
Spectral range	780 – 1650 nm	780 – 1700 nm	1500 – 2150 nm
Detector	InGaAs	InGaAs	ext. InGaAs
Pixel number	512	512	256
Cooling	-10 °C	-10 °C	-20 °C
Spectral resolution <sup>0)</sup>	9 nm	9 nm	23 nm
Data point interval	2.1 nm	2.1 nm	4.1 nm
Wavelength accuracy <sup>1)</sup>	±0.5 nm	±0.5 nm	±1.5 nm
Integration time	10 ms – 65 s	10 ms – 65 s	10 ms – 200 ms
Shortest duration SOT to EOT	-	19 ms	-
Dynamic range <sup>2)</sup>	-	10000 : 1	-
Non-linearity	1 %	1%	1%
<b>Stray light</b>			
Broadband for Illuminant A <sup>3)</sup>	1·10 <sup>-3</sup>	1·10 <sup>-3</sup>	1·10 <sup>-3</sup>
For LED <sup>4)</sup>	1·10 <sup>-3</sup>	5·10 <sup>-4</sup>	-
For Laser <sup>5)</sup>	-	3·10 <sup>-4</sup>	-
<b>Sensitivity</b>			
Measuring range irradiance <sup>6)</sup>	3·10 <sup>-6</sup> – 3·10 <sup>+4</sup> W/ m <sup>2</sup> nm	2·10 <sup>-7</sup> – 2·10 <sup>+4</sup> W/m <sup>2</sup> nm	3·10 <sup>-5</sup> – 0.6 W/m <sup>2</sup> nm
Measuring range radiant flux <sup>7)</sup>	-	1·10 <sup>-6</sup> – 7·10 <sup>+4</sup> W	-
<b>Spectrophotometry</b>			
Baseline noise <sup>8)</sup>	±0.2 % (±25 cts)	±0.05 %	±0.2 % (±25 cts)
Transmission measuring accuracy <sup>9)</sup>	±1 % T	±1 % T	±1 % T
Baseline drift <sup>10)</sup>	0.15 %/h	0.1 cts/h	0.15 %/h
<b>Spectrograph</b>			
Focal length, grating	Approx. 120 mm, f/3.5, plane ruled grating		
Slit	Standard: 100 µm; optional: 50 µm		Standard: 250 µm
Filter wheel	Density filters OD 1 to OD 4		
<b>Electrical data</b>			
AD converter	15-bit resolution		
PC interface	USB 2.0		
Triggering	1 TTL input with ascending slope; 2 software-controlled TTL outputs; 1 TTL output with flash pulse		

Model	IR1	IR1 High-Gain	IR2
<b>Spectrophotometry</b>			
Dimensions (H, W, D)	192 mm x 330 mm x 348 mm		
Power supply	Wide-range input 100-240 VAC 50/60 Hz		
Power consumption	Max. 50 VA		
Ambient temperature	15 – 35 °C; relative humidity 0 – 70 %, non-condensing		
Weight	Approx. 10 kg		
Applicable standards	In conformity with EN 60721-4-7 Class 7M2, EN 60721-4-7 Class 2M2, EN 61326:2004-05 and EN 61010-2002-08		
<b>Measurement uncertainty</b>			
<b>Accuracy <sup>1), 11)</sup></b>			
Radiant Flux	5.0 %	5.0 %	-
Irradiance	5.0 %	5.0 %	-
<b>Instrument precision <sup>1)</sup></b>			
Radiometric integral	0.2%	0.2%	-

<sup>0)</sup> Approximate values for 100 µm (IR1) and 250 µm (IR2) standard slit.

<sup>1)</sup> For IR1 High-Gain, only valid for the spectral range 780 nm – 1650 nm.

<sup>2)</sup> For a single acquisition with 10ms integration time.

<sup>3)</sup> Measured with long pass filter FELH1100 at 900nm, relative to peak intensity of unweighted spectral data.

<sup>4)</sup> Measured 400 nm left to the peak wavelength, relative to peak intensity of unweighted spectral data.

<sup>5)</sup> Measured 150 nm left to the peak wavelength, relative to peak intensity of unweighted spectral data.

<sup>6)</sup> Measured with optical probe EOP-120 and OFG-414 fiber bundle at 1200 nm and signal/noise ratio of 10:1, without averaging.

<sup>7)</sup> Applies to a signal-to-noise ratio of 10:1. Measured with integrating sphere ISP 150L.

<sup>8)</sup> With shortest integration time, without averaging and with 50 % modulation. This value improves with appropriate averaging (e.g. 9-fold averaging results in a 3-fold reduction of noise).

<sup>9)</sup> Applies to optimum spectral range; with 10 % transmission and immediately after recording an averaged baseline.

<sup>10)</sup> Typical value. Applies with LS100-130 light source after 1-hour warm-up.

<sup>11)</sup> Expanded measurement uncertainty (k=2), immediately after calibration, determined for spectra of LED type ACS570-44 at 1300 nm.

## 08 \ Ordering information

Order number	Description				
Spectrometer	Model	Detector	Spectral range	Spectral resolution	Data point interval
CAS140CT-171	IR1	InGaAs diode array	780 – 1650 nm	9 nm	2.1 nm
CAS140CT-171H	IR1 High-Gain	InGaAs diode array	780 – 1700 nm	9 nm	2.1 nm
CAS140CT-175	IR2	Extended InGaAs diode array	1500 – 2150 nm	15 nm	3 nm
<b>Options</b>					
ACS-010	Accessory identification (Ident-Key)				
<b>Software</b>					
SW-120	SpecWin Light spectral software for Windows. Features emission-, transmission-, reflexion- and LED/display-measurements				
SW-130	SpecWin Pro spectral software for Windows. Including all modules and measurement modes				
SW-135	SpecWin Pro/Light language pack for Chinese (traditional und simplified) and Japanese				
SW-136	Calaris calibration software for array spectrometers; plug-in for SpecWin Pro				
SW-140	SpecWin Pro plug-in for Keithley 24xx/26xx sourcemeter				
SW-141	SpecWin Light plug-in for Keithley 24xx/26xx sourcemeter				
SW-150	SpecWin Pro plug-in for AC-sources and powermeter				
SW-160	SpecWin Pro MultiTrack plug-in for fast acquisition of spectra				
SW-180	SpecWin Pro plug-in for Keithley digital multimeter DMM6500/7510/7512				
SW-231	Software development kit (SDK); DLL software for customized programs				
SW-233	LabVIEW driver software; requires SW-231				

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