SEEK THERMAL MOSAIC CORE S309SP PERFORMANCE ANALYSIS

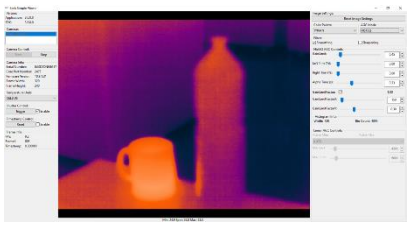
Performance Report - September 2021

Seek Thermal Mosaic Core S309SP: testing the actual performance of a user-friendly and easy-to-integrate device!

REPORT CONTENT

- Piséo's opinion of the Seek Thermal Mosaic Core S309SP
- An overview of the thermal camera market and Company Profile of Seek Thermal
- In-depth analysis of the user functions of the camera core
- Accurate characterization and analysis of the measured performance parameters of the embedded microbolometric sensor
- Thorough analysis of the measured thermometric performance and optical architecture of the camera
- Wide and deep analysis of the sensor correction functions and algorithms
- An analysis of the image process flow from sensor to image, as well as an assessment of image quality
- A performance comparison with other products.

Development kit used for testing purpose
Source: Seek Thermal



Seek Thermal Viewer UI functionalities
Source: Piséo

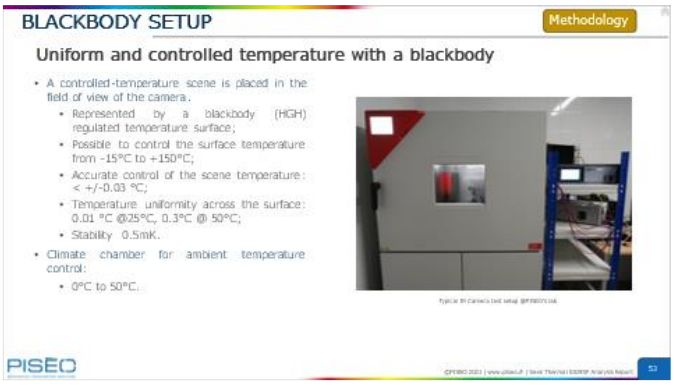
ESTABLISHING AN INTERNATIONAL PERFORMANCE TESTING STANDARD

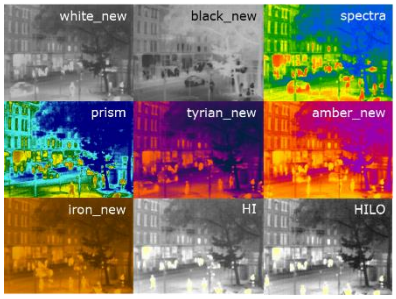
In order to characterize the performance of the camera core, Piséo's experts use their own test protocols, software, and lab equipment, which includes a calibrated HGH black body and climate chamber able to perform tests at ambient temperatures ranging from -20°C (-4°F) up to 100°C (212°F).

There is currently no international standard protocol for thermal camera performance testing available. After performing our own characterization tests on many devices, analyzing manufacturers' datasheets and discussing the reasons for the discrepancies between our test results and their published values, it became clear to us that the performance values published were all based on different test protocols. It is, therefore, quite impossible for the purchaser to use the datasheets to select a thermal camera or core based on comparable performance values between products. Therefore, we aim to publish such data based on a fully transparent and consistent testing protocol whatever the product tested. By doing so, we provide the market with independent, unbiased test results that de facto establish an international performance testing standard for thermal cameras, cores, and sensors. This report contains for the first time a table highlighting the comparison of the main performance indicators between products. using Piséo's own testing protocol. Manufacturers, integrators and end-users, if you also want to get your thermal camera tested, feel free to drop us a message!

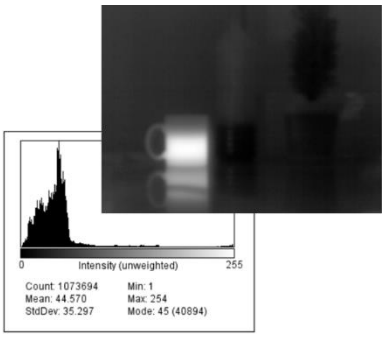
Camera performances comparisons

CHARACTERISTICS		IRAY T3S	FLIR BOSON 640	SEEK THERMAL S309SP
Sensor characteristics	Pixel resolution	384 x 288	640 x 512	320 x 240
	Pixel pitch	17 µm	12 µm	12µm
	Frame rate	60 Hz	9 Hz	9 Hz
Sensor performance at 25°C ambient temperature	Signal output resolution			
	NETD (claimed)			
	NETD (measured)			
	Resp (DN/K)			
	Scene dynamic (Kelvin)			
	# of bad pixels			
	Operability (%)			
	RFPN (DN)			
	RFPN impact on read temperature (°C)			
Temperature sensing	Functionality available			
	Accuracy (claimed) (°C)			
	Accuracy (measured) (°C)			
Correction algorithms and image processing	Non-uniformity and signal quality correction			
	Deviance on uniform image			
	Image processing	Equalizer, Sharpener, ACE. Configuration and parameters fixed.	Equalizer (two modes), Sharpener, Soft sharpener, ACE. Many parameters selectable by developers	AGC, 3 selectable algorithms Smoothing Sharpening
	SDK	Not available	Available	Available
	Calibration	Not possible	Possible, through SDK	Possible, through AGC settings

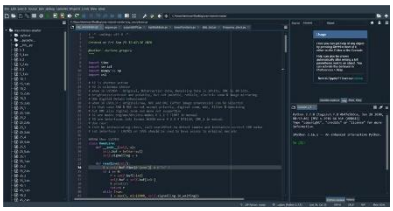




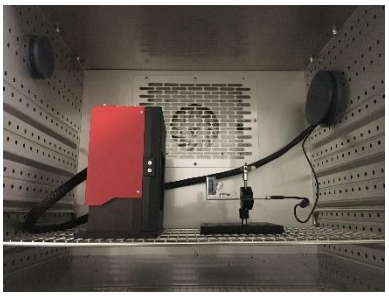
Seek Thermal Mosaic Core S309SP color map
Source: Piséo



Seek Thermal Mosaic Core S309SP AGC Algorithm analysis
Source: Piséo



Piséo's image processing proprietary software



Seek Thermal Mosaic Core S309SP being tested in Piséo's climate chamber
Source: Piséo

KEY FEATURES

Carried out by a team of experienced optical and system engineers, this technical report relies on robust and comprehensive test protocols and thorough analyses of the test results. The outcome of this process is a set of typical performance indicators, such as responsivity, NETD, scene dynamic, operability…, leading to functionality assessment and image quality appreciation. Together, they make it possible for Piséo to develop its own benchmark procedure for thermal cameras, enabling them to test the various cameras independently.

The Piséo team outlines its observations on the Seek Thermal Mosaic Core S309SP: the product appears to be very easy to handle and test, thanks to its design and the available tools as provided by the manufacturer. However, the sensor does not appear as best-in-class compared to what can be currently found for such commercialized camera cores.

Added value of the Seek Thermal Camera:

- An easy-to-use SDK and user-friendly GUI.
- Infinite focus that avoids the need for focus control.
- The compactness of the module and the electronic processor.
- Easy-to-control image processing algorithm.
- Temperature measuring functions and 32-bit temperature map.

What should be improved:

- Performance below state-of-the art: NETD, optical resolution.
- Warm-up time before NETD value stabilizes.
- Presumed older generation sensor.
- No option to capture images directly from the associated software/interface (SeekViewer).

This report does not include:

- Optical detection performance, described by the Johnson criteria.
- The MRTD to assess the image quality depending on the use case.

DISCRIMINATING PRODUCTS IN A BOOMING MARKET

Fueled by multiple drivers, including the need to measure the temperature of a large number of people due to COVID-19 as well as general surveillance, the market for infra-red thermal imaging cameras and modules is expanding rapidly. In fact, our partner Yole Développement (Yole) expects an 8% compound annual growth rate from 2019 to 2025 ($CAGR_{2019-2025}$). Many new players, especially from Asia, have already started to disrupt the market. In order to make appropriate choices, therefore, users, integrators, and sensor manufacturers need to be able to discriminate between products based on accurate and independent assessments of their performance and features (benchmarks).

Currently, no international performance testing standards have been published. This situation leaves purchasers of such systems with supplied datasheet values that may not always be right or may only provide partial information. This is where Piséo fills the gap, with its independent evaluations and testing of thermal cameras.

This Thermal Mosaic Core S309SP performance analysis is the third report we have published that shows the actual performance of commercialized products. More will come in the near future enabling fair performance comparisons.

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AUTHORS

Dr Olivier Andrieu – Innovation Leader and System Architect - Piséo

Olivier ANDRIEU is in charge of technical expertise and innovation projects at Piséo. He holds a degree in Engineering and a Ph.D. in physics. His career has allowed him to carry out various responsibilities in innovation in the automotive sector in connection with sensors and battery management systems as well as within Philips Lighting where he acted as a system architect. Dr Andrieu has supervised the design of numerous commercialized photonic systems for different sectors. He has also performed many technical analyses of photonic systems and has published several reports in collaboration with Yole Développement's teams.

Grégory Duchêne - Sr Optical Designer, Illumination, Detection and Imaging Systems - Piséo

Grégory Duchêne is in charge of advanced optical systems studies and analyses at Piséo. He holds an engineering degree from the Institut d'Optique Graduate School (IOGS). He has completed with success the optical design of many innovative photonic systems for Piséos' customers. Further to his strong optical design skills Grégory has deep know-how of optical metrology of illumination and imaging systems. Grégory Duchêne is our Zemax expert and also teaches optical system design at IOGS.

Lionel Artinyan – Photonic Systems Test Engineer - Piséo

Lionel Artinyan holds a degree from the ENSSAT Graduate School and has a strong background in photonic component and system characterization. At Piséo he oversees custom test bench engineering and test realization. He has participated in the design of many different test benches that include optical devices and control programs. Lionel has tested with success many systems that integrate pulsed light sources such as xenon lamps, LED's, and laser diodes, as well as imaging sensors.

RELATED REPORTS

- iRAY T3S Thermal Camera Performance Analysis *by Piséo*
- FLIR Boson Thermal Camera Performance Analysis by Piséo
- Thermal Imagers and Detectors 2020 *by Yole Développement*
- Guide Infrared's 17µm Microbolometer Module *by System Plus Consulting*
- iRay Technology 12µm and 17µm Thermal Sensors *by System Plus Consulting*

More information and details about our offers and bundled opportunities on www.i-micronews.com

ABOUT PISÉO

Piséo is a French independent Innovation Center that helps industrial companies to innovate by providing analysis, design, realization and characterization services for illumination, detection, and imaging systems.

Created in 2011 under the leadership of Yole Développement, its main shareholder, the company has successfully carried out 200+ customer projects and 4000+ characterization tests in its accredited lab. Active in many application fields, such as personal devices, domestic appliances, defense, and security, automotive and transportation, general lighting, healthcare and well-being, Piséo has about 150 regular customers, including global leaders and high-tech start-ups.

Application and technical analyses

- Reverse engineering of photonic components and systems
- Performance analysis reports of components and systems
- Application and technical reports of photonic components and systems
- Benchmarking of component and system performance and construction
- Regulatory and normative intelligence
- Technology intelligence
- Patent intelligence
- Photobiological and laser risk assessment

System design and Realization

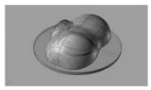
- Application requirements of photonic systems (UV, VIS, IR)
- Concept generation
- Feasibility studies
- Optical, mechanical, electronic and software design
- Simulations
- Thermal management
- System integration
- Prototyping, pre-series and small volume production with partners
- Redesign to cost, to quality
- Design for reliability

Test lab

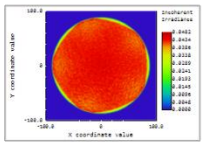
- Photometric and colorimetric measurements (accredited)
- Spectral and radiometric measurements (UV, VIS, IR)
- Photobiological risk assessment (accredited)
- Luminance and color maps of displays, light panels, etc.…
- Electrical measurements
- Temperature measurements
- Characterization of cameras, modules and imaging sensors (VIS, IR): NUC, NETD, responsiveness, MTF …)

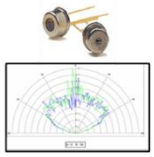
Piséo can test any sensor/module/camera or help you with similar systems' benchmarks.
All you have to do is contact us!

Examples of completed projects and services:

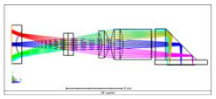
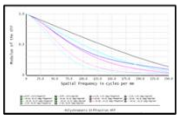


Freeform optic design and realization for streetlighting



UV-C illuminator design and realization



VCSEL based system design and realization

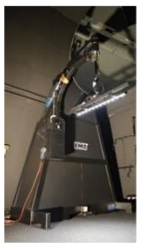


Imaging optical system design and realization



IR camera performance analysis



UV measurements and photobiological risk assessment


Goniophotometry

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