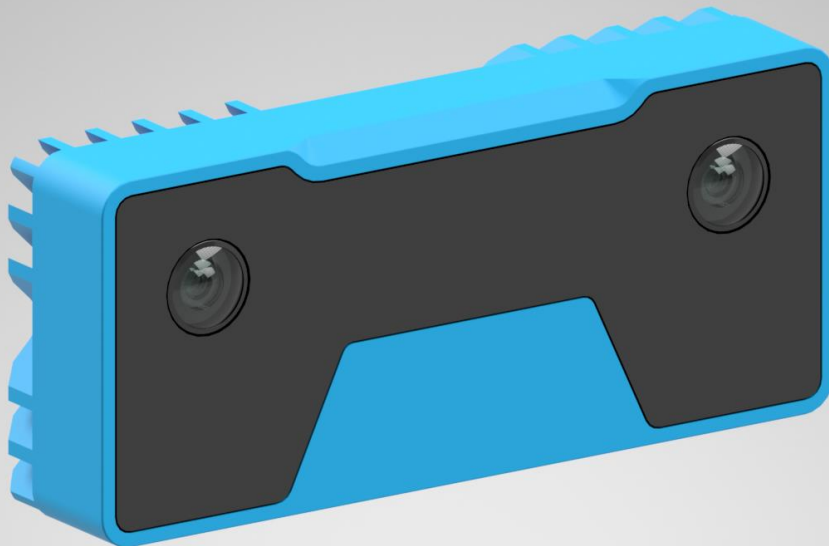# HemiStereo® NX

World's Most Powerful, Most Affordable AI-enabled Stereo Vision Camera

HS-NX Rev 1.0

DATASHEET

3D Vision Performance

	Optical Configuration	
	Fisheye Stereo Vision HS-NX-180_	**Wide-Angle Stereo Vision** HS-NX-90_
Sensing Technology	HemiStereo® - binocular stereo vision technology for extreme wide-angle depth sensing using Deep Neural Network based stereo correspondence matching	
Lenses	High-resolution all-glass lenses	
	2.0 mm Fisheye Aperture: F/2.2 Filter: 650nm IR-cut filter (ICF)	2.7 mm Low-Distortion Wide-Angle Aperture: F/2.8 Filter: 650nm IR-cut filter (ICF)
Field of View	180° × 145° (V × H)	85° × 67° (V × H)
Image Sensor	Sony IMX477 12.48 MP Stacked Back-Side Illuminated, Type 1/2.3", 1.55µm pixel, Rolling Shutter*	
Image Resolution	4032 × 3040	
Depth Resolution	Up to 4096 × 3072[†]	
Base Length	142.0 mm	
Axial Depth Precision[‡]	±0.1 mm @ 0.5 m ±0.3 mm @ 1.0 m ±1.3 mm @ 2.0 m ±8.2 mm @ 5.0 m ±32.7 mm @ 10.0 m	±0.06 mm @ 0.5 m ±0.25 mm @ 1.0 m ±1.0 mm @ 2.0 m ±6.3 mm @ 5.0 m ±25.3 mm @ 10.0 m
Intended Range	0.5 m – 10 m	1.0 m – 20 m

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* Rolling shutter readout times: 30 ms (full readout mode) / 15 ms (binned 2K mode)

† On the model with NVIDIA® Jetson Nano™ (HS-NX-___N) depth resolution is limited to 2048 × 2048 in SGM mode, due to RAM limitations.

‡ These axial precision values are result of calculation of the theoretical maximum based on the given stereo camera setup. Practical values may be affected by image noise, ambient illumination and surface texture.

Note: Parameters may be used for reference only. All features and specifications are subject to change without notice.

Edge Compute Capability

	Edge Compute Configuration			
	NVIDIA® Jetson Xavier NX™		NVIDIA® Jetson Nano™	
CPU Complex	6-core NVIDIA® Carmel ARMv8.2 64-bit CPU Max. Operating Frequency: **1.90 GHz**		4-core ARM® Cortex® -A57 MPCore CPU Max. Operating Frequency: **1.43 GHz**	
GPU	384-core NVIDIA® **Volta**™ GPU with 48 Tensor cores | Max. Frequency: **1100 MHz**		128-cores NVIDIA® **Maxwell**™ GPU | Max. Frequency: **921 MHz**	
RAM	**8 GB** 128-bit LPDDR4x DRAM Maximum Memory Bus Frequency: 1600MHz		**4 GB** 4ch x 16-bit LPDDR4 DRAM Maximum Memory Bus Frequency: 1600MHz	
Interfaces	– Gigabit Ethernet, RJ-45 – HDMI and DisplayPort Connector – **4x USB 3.1 Type-A** – 1x USB 2.0 Micro-B – GPIO, I2C, I2S, SPI, UART (internal) – M.2 Key-E + **M.2 Key M** (internal)		– Gigabit Ethernet, RJ-45 – HDMI and DisplayPort Connector – **4x USB 3.0 Type-A** – 1x USB 2.0 Micro-B – GPIO, I2C, I2S, SPI, UART (internal) – M.2 Key-E (internal)	
Module TDP	10W − 15W		5W − 10W	
Depth Pixel Data Rate§	Mode**	Data Rate	Mode	Data Rate
	BM (64 Disp)	140.6 Mio. px/s	BM (128 Disp)	8.4 Mio. px/s
	SGM (64 Disp)	10.1 Mio. px/s	SGM (64 Disp)	2.3 Mio. px/s
	SGM (128 Disp)	6.6 Mio. px/s	SGM (128 Disp)	1.5 Mio. px/s
Depth Frame Rate (@ Selected Resolution Settings)	Resolution	BM (64 Disp) / SGM (64 Disp)	Resolution	BM (64 Disp) / SGM (64 Disp)
	4096 × 3072	11.2 FPS / 0.5 FPS	4096 × 3072	-†† / -
	2048 × 1536	28.0 FPS / 4.5 FPS	2048 × 1536	4.4 FPS / 0.9 FPS
	1024 × 768	28.0 FPS / 14.0 FPS	1024 × 768	10.3 FPS / 3.2 FPS
	512 × 396	28.0 FPS / 28.0 FPS	512 × 396	17.0 FPS / 8.6 FPS

§ Depth pixel data rate is defined by building the product of resolution in pixels with the measured frame rate. The presented value is an average of several resolutions that are not limited by imager framerate of 28 FPS. This metric may be used as performance indicator for real-world depth data rate. Actual performance may differ due to GPU scaling effects for certain resolutions.

** Modes: BM = Block-Matching \| SGM = Semi-Global-Matching \| Disp = Max. number of disparities.

†† Not available on the model with NVIDIA® Jetson Nano™ (HS-NX-___N). Depth resolution is limited to 2048 × 2048 in SGM mode.

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Operating Conditions

	Power Requirements	
	NVIDIA® Jetson Xavier NX™	NVIDIA® Jetson Nano™
Operating Voltage	10.0 V – 19.0V DC (19V power supply included)	4.75 – 5.25V DC (5V power supply included)
Physical Connectors	2.5 × 5.5 × 9.5 mm DC barrel jack	USB 2.0 Micro-B (up to 2A) 2.1 × 5.5 × 9.5 mm DC barrel jack
Max. Power Consumption	20 W	15 W
	Environmental Requirements	
Temperature Range	-20 °C – 50 °C	
Dust and Moisture	Case provides some level of protection against splashing water and dust. Jetson Developer Kit IO Interface remains sensitive to ingress of water and dust. (no IP rating)	
Cooling	Passively cooled withing operating range by full metal body machined from Aluminum.	
Illumination	Some form of external light source is required.	
	Physical Information	
Dimensions	200 mm × 87 mm × 42 mm (W × L × H)	
Weight	0.85 kg	
Mounting Options	1× 1/4-20 UNC standard tripod mount 2× M4×0.7-6H blind tapped holes	

Figure: Rear view showing heatsink for passive cooling.

Software

All HemiStereo NX sensor units ship with a pre-loaded and calibrated version of the HemiStereo Core software which is responsible for calculating precise, wide-angle RGB-D data. By default, this application starts on boot of the sensor. With the HemiStereo Viewer software you can access 3d and image data remotely from your computer, configure the sensor or record sequences.
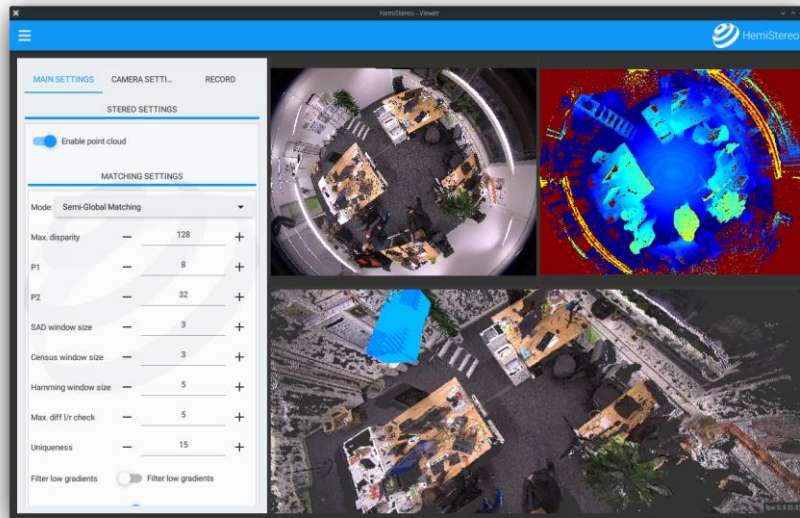

Figure: Screenshot of HemiStereo Viewer

For the development of new visual AI applications, HemiStereo NX is compatible with a wide selection of software frameworks, interfaces and programming languages. With full root access to the integrated Jetson computer you can build and run any system of your choice.
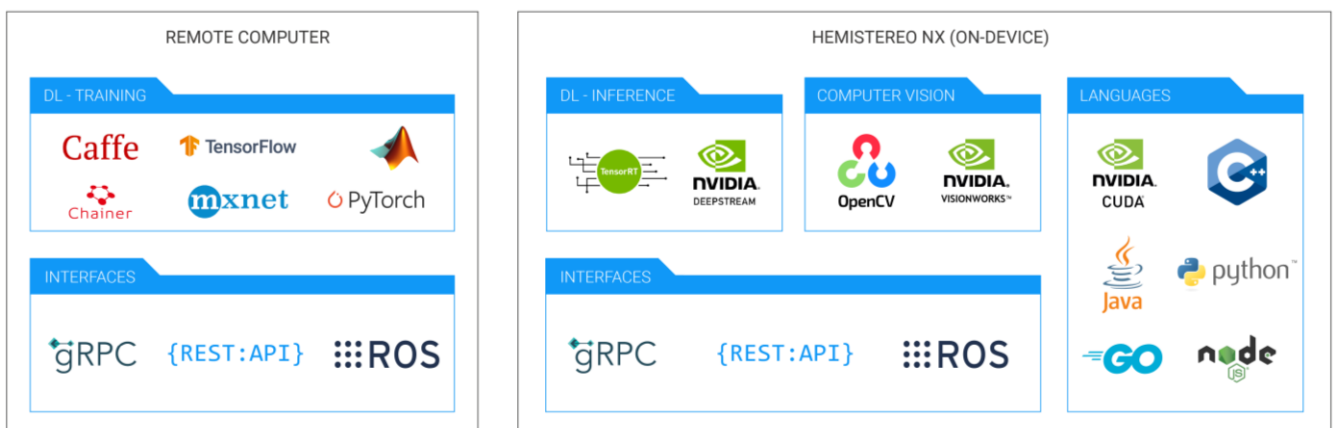
HemiStereo® NX Software Ecosystem

Figure: Overview of Compatible Interfaces, Languages and Frameworks

Application vs. Recommended Model

		Optical Configuration	
		Fisheye Stereo Vision HS-NX-180_	Wide-Angle Stereo Vision HS-NX-90_
Edge Compute Configuration	Jetson Xavier NX HS-NX-___X	AGV and Robot Navigation Indoor / Outdoor Mapping (Real-time) Collision Warning (Manned Vehicles)	Optical Inspection Long-Range Navigation and Mapping Pick-and-Place
	Jetson Nano HS-NX-___N	People Counting (Low Ceiling) Access Control Indoor / Outdoor Mapping (Offline)	People Counting (High Ceiling) Storage Area Fill Level Monitoring Shelf Inspection

Model Numbers

HemiStereo NX is currently available in four configurations based on its optical and compute configurations. All configurations come pre-build and pre-calibrated. You can select the model that fits your application the best. Please refer to the model numbers below.

HS-NX-180N   Fisheye Stereo Vision + NVIDIA® Jetson Nano™ Developer Kit

HS-NX-180X   Fisheye Stereo Vision + NVIDIA® Jetson Xavier NX™ Developer Kit

HS-NX-90N   Wide-Angle Stereo Vision + NVIDIA® Jetson Nano™ Developer Kit

HS-NX-90X   Wide-Angle Stereo Vision + NVIDIA® Jetson Xavier NX™ Developer Kit

Acknowledgements

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