

Nexalus SoloFlux



Executive Summary

In this paper, we introduce the Nexalus SoloFlux, our revolutionary single-slot GPU cooling coldplate featuring our patented¹ Nexalus jet impingement technology, marking a significant advancement in GPU cooling solutions.

Compact enough to fit within a single-slot footprint, this cutting edge technology is engineered to seamlessly cool the most powerful GPUs on the market, with thermal design powers (TDPs) exceeding 450W, delivering unrivalled performance and efficiency.

First of its kind, Nexalus SoloFlux is currently tailored to accommodate various models of GeForce RTX 4090 GPUs, with the potential to be adapted for compatibility with other state -of-the-art GPUs such as the Intel GAUDI 3, Nvidia H100, and the forthcoming Nvidia H200.

Extensive testing affirms the outstanding cooling performance of the Nexalus SoloFlux. This solution is optimal for advanced high-performance computing and AI applications, enabling the use of modern systems to their maximum capacity. For instance, Figure 1 shows a fully populated motherboard featuring 5 GPUs. Furthermore, in a recent application, the Nexalus SoloFlux was utilized to integrate as many as 7 GeForce RTX 4090 GPUs into a single 4U server, alongside a Nexalus cooled Sapphire Rapids CPU. This exceptional configuration enables efficient cooling of a system that exceeds an impressive 4 kW of computational power.



Figure 1: Fully populated ASUS Pro WS W790-ACE board with 5 GeForce RTX 4090 GPUs featuring the Nexalus SoloFlux.

¹ Nexalus liquid cooled solutions are described in one or more of our granted or pending patent applications



Single Slot GPU Cold Plate

The Nexalus SoloFlux stands as a groundbreaking advancement in thermal management technology, revolutionizing the landscape of high-performance computing and AI with its innovative features and efficiency. Designed to address the evolving demands of modern GPUs, the Nexalus SoloFlux introduces several features that set it apart from conventional cooling solutions:

Jet Impingement Technology in a Single Slot Footprint

For the first time, the Nexalus SoloFlux integrates jet impingement technology within a single-slot footprint, i.e. 20 mm, marking a significant milestone in GPU cooling solutions. This design allows for maximum heat dissipation in a compact form factor, catering to the space constraints and high density demands of modern computing systems without compromising on performance.

• Optimized Design for Enhanced Cooling Performance

At the heart of the Nexalus SoloFlux lies a sophisticated design tailored to maximize cooling efficiency across the entire GPU board. The main block comprises three essential components (Figure 2); a copper nickel-plated cold plate - strategically positioned to interface directly with the GPU core, an intermediate plate - serving as a cold plate for other critical components such as VRAM, capacitors and mosfets, and at the same time incorporating a microjet showerhead, and a top plate that seals the liquid cooling channels. Additionally, a backplate provides structural support and further enhances heat dissipation.

Central to Nexalus SoloFlux superior cooling performance is the use of impinging liquid jets that allow extremely high heat transfer coefficients and targeted cooling. The shape and pattern of the showerhead nozzles, coupled with precision-engineered features in the copper cold plate, have been selected after thorough investigation and optimization to maximize heat transfer specifically on the GPU core, ensuring optimal thermal management under demanding workloads.

• Outstanding Versatility and Compatibility

Nexalus SoloFlux is specifically engineered to accommodate a wide array of Nvidia 4090 GPUs, including the INNO3D GeForce RTX 4090, Palit GeForce RTX 4090, and Gainward GeForce RTX 4090 models. Its innovative design ensures seamless integration with these GPUs, allowing consistent and reliable performance across the various configurations.

Nexalus SoloFlux facilitates installation with its port configuration, featuring two inlet and two outlet ports with G1/4 threads. This design allows the use of an alternating port configuration, facilitating side-by-side installation of multiple GPUs while eliminating the need for smaller-than-single-slot specialized fittings. This ensures compatibility with a broad selection of fittings accessible on the market (Figure 3).





Figure 3: Example of single slot spacing side-by-side installation with quick connect fittings.



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Performance Evaluation

The cooling performance of the Nexalus SoloFlux was evaluated across varying conditions using the following set up:

- inlet water temperature was maintained at 20°C with a chiller throughout the testing process
- flow rates ranging from 1 to 4.8 L/min were applied to simulate different cooling scenarios
- two stress tests (LuxMark and FurMark) were conducted to assess GPU performance under different loads.

The test data gathered include the inlet and outlet water temperatures, GPU power consumption, and GPU temperatures. Data points were collected at steady-state temperatures, typically after approximately 10 minutes of testing.

Figure 4 shows the GPU temperature across the tested flow rates for the LuxMark (278W) and FurMark (445W) stress tests. Particularly noteworthy is the scenario where the GPU power peaked at 445W:

- the GPU temperature was kept as low as 36°C when the flow rate was 4.8 L/min (pump power=21.6W).
- even in scenarios with minimal flow rates of 1 L/min (pump power=1.1W), the GPU temperature remained at only 44.9°C.

These results highlight the exceptional cooling efficacy of the Nexalus SoloFlux, along with its ability to maintain GPU temperatures within optimal limits, effectively reducing concerns such as thermal throttling, reduced clock speeds and stability issues. This makes it an ideal choice for high-performance computing environments, where sustained operations at peak performance are essential.



Figure 4: GPU temperature for 20 ${}^\circ\!\!\!{\rm C}$ inlet water across different flow rates



Technical Specifications and Drawings

COMPATIBILITY

- Gainward GeForce RTX™ 4090
- INNO3D[®] GeForce RTX[™] 4090
- Palit GeForce RTX™ 4090







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