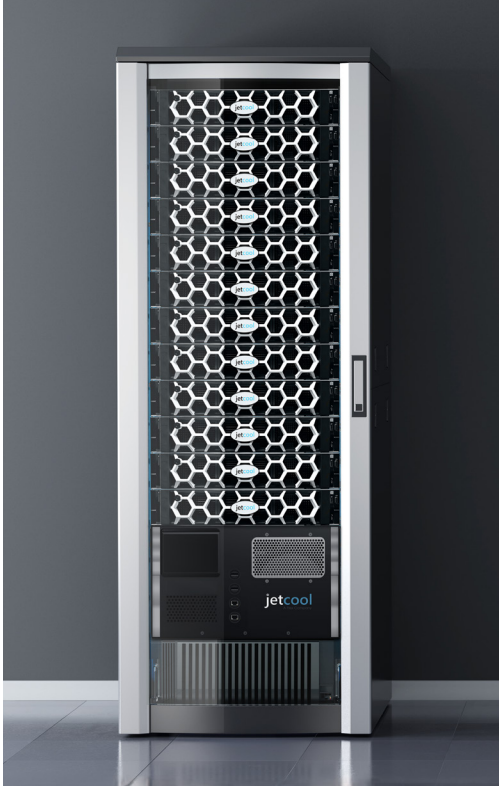
EBOOK

JetCool SmartSense CDU

Scalable Cooling for the AI Era

High-performance workloads drive need for liquid cooling in data centers



As computing demands surge due to generative artificial intelligence (GenAI), high-performance computing (HPC), and cloud workloads, traditional air cooling in data centers is increasingly unable to meet the thermal and efficiency requirements of accelerated computing. Modern processors and AI Accelerators generate significantly more heat, especially as rack densities surpass 100 kW per rack. The adoption of next-generation GPUs, such as the NVIDIA Blackwell B200 Tensor Core GPU with a thermal design power of 1,200 W, requires liquid cooling to keep these GPUs within safe operating temperatures.

This is particularly true in large-scale AI server deployments, where thermal and energy demands are pushing existing infrastructure to its limits. For example, the NVIDIA NVL72 rack system, which is based on the B200 GPU, requires 120 kW per rack today, with a roadmap for 600 kW in 2027[1]. Liquid cooling, with its far superior thermal conductivity, can efficiently remove heat from high-density racks, making it a preferred choice in many AI data centers.

Coolant distribution units are a key component in your liquid cooling strategy

Coolant Distribution Units (CDUs) are essential in modern data centers, especially those deploying direct-to-chip liquid cooling solutions, as well as in environments supporting AI and HPC workloads.

A CDU is a specialized device used in liquid cooling systems to manage and regulate the flow of coolant to critical components such as servers, processors, and other heat-generating equipment. CDUs significantly improve data center efficiency by serving as the central hub for liquid cooling systems, delivering precise, reliable, and energy-efficient thermal management for high-density IT environments.

What to consider when evaluating a CDU in your high-density rack deployments

When considering a CDU, the performance can be evaluated using several key metrics, which determine their effectiveness, reliability, and suitability for specific cooling requirements. Some key performance metrics to consider include:

Cooling capacity (kW): The maximum heat load a CDU can remove, typically specified at a certain approach temperature difference (ATD). For example, at an ATD of 7°C, the cooling capacity of the SmartSense CDU reaches 300 kW.

Approach temperature difference (ATD): The difference between the supply temperature of the technology cooling system (TCS) and the inlet temperature of the facility water system (FWS).

Flow rate (LPM): The volume of coolant circulated per minute through the primary (facility) and secondary (IT) loops. Higher flow rates support greater heat loads and more demanding cooling scenarios, with high-performance CDUs offering 1 LPM/kW or greater. The most efficient performance is achieved when TCS and FWS flow rates are close to each other.

Pressure head (psi): The delivered pressure at the flow rate required. It is important for CDU pumps to generate sufficient pressure to overcome the pressure drop of the manifolds and cooling modules attached to the TCS. High-performance CDUs offer secondary pressure heads above 20 psi, supporting dense and complex cooling networks.

1. https://www.tomshardware.com/pc-components/gpus/nvidia-shows-off-rubin-ultra-with-600-000-watt-kyber-racks-and-infrastructure-coming-in-2027

Cooling load density (kW/RU): The cooling capacity per rack unit (RU) reflects how much heat can be removed relative to the CDU's physical size. This is crucial for space-constrained data centers.

Temperature range: The operational temperature window for the coolant, often spanning from 10°C to 70°C. Wider temperature ranges enable greater versatility, allowing flexibility for different IT and facility requirements.

Designed for the next generation of AI data centers

JetCool's SmartSense CDU is a liquid-to-liquid cooling solution specifically designed to meet the needs of today's accelerated computing, as well as the next generation of AI data centers. Delivering up to 300 kW of cooling capacity in a compact 6U form factor, the SmartSense CDU scales from single-rack deployments to support multiple racks with a single CDU. Designed for in-rack and in-row configurations, it enables plug-and-play integration with facility water loops and supports elevated return temperatures up to 70°C, reducing dependence on mechanical chillers and enabling year-round "free cooling" in most environments.

Given the performance metrics outlined above, the SmartSense CDU supports up to 300 kW cooling capacity in Boost Mode, or up to 160 kW in a fully redundant operating mode. Redundant Mode ensures continuous and reliable operation, even in the event of a pump failure.

PERFORMANCE METRICS	BOOST MODE*	REDUNDANT MODE
Cooling capacity	300 kW	160 kW
Approach temperature difference (ATD)	7°C	4°C
Flow rate	400 LPM	280 LPM
Pressure head	22 psi	28 psi
Cooling load density	50 kW/RU	26 kW/RU
Operating temperature range	10°C to 70°C	10°C to 70°C

*Boost Mode is defined as the SmartSense CDU operating with all pumps running.

How to decide if a CDU is right for your workload

Let's consider a planned deployment of NVIDIA DGX B200 racks as an example. Operating the DGX B200 requires approximately 14.3 kW of power. In a typical data center configuration, this translates to around 60 kW of rack power when factoring in additional system components and potential peak usage scenarios.

One consideration is the ratio of flow rate to cooling capacity; this ratio should be above 1.0, at a minimum. The typical and widely recommended ratio for liquid cooling systems, especially in data center CDUs, is **1.2 to 1.5 liters per minute per kilowatt (LPM/kW) of cooling capacity.** The effectiveness of higher flow rates depends on the cold plate and heat exchanger design. If these components are not optimized for higher flow, the benefit to cooling capacity may be limited.

60 kW of rack power would require a total flow rate of **90 LPM**, with a **LPM/kW ratio of 1.5**

- **Rack heat load** = 60 kW
- **Ratio of flow rate to cooling capacity** = 1.5
- **ATD =** 4°C
- **Total flow rate =** 60 kW x 1.5 = 90 LPM

Cooling a 60 kW per rack heat load

In summary, increasing the flow rate in a CDU enhances its cooling capacity by enabling more efficient heat transfer from IT equipment. However, the relationship is not linear; beyond a certain point, higher flow rates provide less additional cooling benefit and may increase energy consumption or stress on system components. The optimal flow rate should be matched to the heat load and cooling system design for best performance.

PERFORMANCE METRICS	EXAMPLE CUSTOMER RACK REQUIREMENTS	SMARTSENSE CDU CAPACITY
Rack heat load	60 kW	160 kw total
Ratio of flow rate to cooling capacity	1.5 LPM	1.7 LPM
Flow rate	90 LPM / rack	280 LPM
Approach temperature difference (ATD)	4° C (target)	4° C (performance)
Operating temperature range	10° C to 70° C	10° C to 70° C

Other considerations for reliable and efficient data center liquid cooling

The SmartSense CDU supports a wide fluid temperature range of 10°C to 70°C, enabling compatibility with traditional and warm-water cooling loops. This flexibility allows data center operators to leverage ambient or facility water sources for free cooling in a wider range of climates — reducing or eliminating the need for mechanical chillers and lowering operational costs. The unit's approach temperature of just 2°C to 7°C enables precise temperature control and efficient heat transfer, helping maintain optimal chip performance under sustained high workloads.

In terms of efficiency, the SmartSense CDU delivers impressive results. Data centers now have the opportunity to achieve exceptionally low facility-level power usage effectiveness (PUE) with our SmartSense CDU serving as an integral component. By optimizing power consumption and streamlining heat rejection processes, SmartSense CDU enhances overall cooling system efficiency. When combined with high-efficiency cooling equipment, such as advanced dry coolers, data centers can reach remarkably low cooling PUE values, potentially as low as 1.03. This synergy minimizes energy usage, aligns with sustainability goals, and significantly reduces operational costs, making the SmartSense CDU a key player in driving improved facility-level PUE and enabling more effective, sustainable operations.

The SmartSense CDU supports standard communication protocols, including TCP/IP, Redfish, SSH, and Webserver interfaces. These options allow for seamless integration with existing facility management systems, remote monitoring, and real-time telemetry, making SmartSense easy to deploy and manage across large-scale infrastructure environments.

Designed to pair with JetCool SmartPlate™ cold plates

While many CDUs struggle to support the higher flow rates required for the next generation of AI accelerators and accelerated computing, SmartSense enables them. Its high flow rates and high temperature tolerance unlock the full performance of JetCool SmartPlate cold plates. Together, they create an advanced cooling ecosystem that delivers:

- Lower thermal resistance and improved hot spot management
- Better GPU utilization by avoiding throttling
- Compatibility with processors exceeding 3,000 W thermal design power (TDP)
- A scalable and retrofittable liquid cooling platform

This synergy allows data center operators to move confidently into the AI era without worrying about redesigning infrastructure with every new generation of chips.

Reliability and operational efficiency at scale

SmartSense combines cutting-edge performance with practical, operator-focused design.

Versatile form factor: 6U design compatible with 42+-inch (1070 mm) deep racks in 19-inch and ORv3 configurations

Industrialized construction: Engineered for mission-critical uptime, including redundant pumps

Patented technology: With additional patents pending, SmartSense reflects JetCool's continuous innovation

Integrated sensors and telemetry: Simplifies monitoring and performance optimization

Operators benefit from reduced cooling complexity, improved energy efficiency, and significantly lower TCO.

Backed by Flex manufacturing, supply chain, and scale

SmartSense is manufactured by Flex, enabling global production capability, stringent quality assurance, and a resilient supply chain. This partnership enables:

Commissioning and system validation: Flex enables all SmartSense CDU units are properly installed and integrated across your environment, with configuration checks and system-level validation to ensure operational integrity from day one.

Component availability and rapid fulfillment: Flex's global logistics infrastructure and critical spare parts are readily available, enabling faster repairs and minimizing service interruptions.

Ongoing maintenance with integrated telemetry: SmartSense supports proactive service strategies using sensor-driven diagnostics and system data capture to guide long-term support and performance optimization.

Coolant health and lifecycle stewardship: Flex delivers advanced fluid management services, including regular sampling, analysis, and treatment guidance to maintain coolant performance, extend equipment life, and support sustainability initiatives.

Remote and on-site incident response: Whether planning scheduled maintenance or responding to the unexpected, Flex delivers rapid technical support — remotely or on site — to keep high-density workloads online and operational.

The shift to high-power AI workloads is here, and it comes with the need for secure, scalable, and integrated infrastructure solutions

Flex and JetCool deliver more than just advanced technology — they provide a foundation of trust through supply chain security, global manufacturing reach, and full-stack integration.

From cold plates to CDUs, JetCool and Flex now offer a fully integrated liquid cooling solution backed by lifecycle services that enable every system is properly installed, maintained, and supported for long-term success. With Flex's global footprint and deep expertise in vertical integration, customers benefit from faster deployment, streamlined service, and peace of mind.

Whether you're building at the edge or scaling to multi-megawatt campuses, JetCool and Flex deliver the hardware, services, and support required to operate reliably and efficiently — anywhere in the world.

For more information and pricing, contact us at hello@jetcool.com | (978) 449-4600 | jetcool.com

Learn more how Flex and Jetcool can help modernize your cooling strategy

For more information, visit **flex.com/connect**

Flex (Reg. No. 199002645H) is the manufacturing partner of choice that helps a diverse customer base design and build products that improve the world. Through the collective strength of a global workforce across 30 countries and responsible, sustainable operations, Flex delivers technology innovation, supply chain, and manufacturing solutions to various industries and end markets.