

# Pushing Operational Limits and Efficiencies with Liquid Immersion Cooling

*Density-optimized GPU-accelerated servers from AMAX and immersion cooling racks from GRC offers first-rate performance in computing power and overall energy efficiency*

As hardware density and costs continue to rise, liquid cooling is transforming the datacenter industry, pushing the operational limits of both CPU- and GPU-based servers while roughly halving the construction costs of traditional datacenters. Already used for geoscience and other high-demand applications, experts agree that immersion is the future of cooling technology,<sup>1</sup> and will scale to support the datacenter technologies of tomorrow.

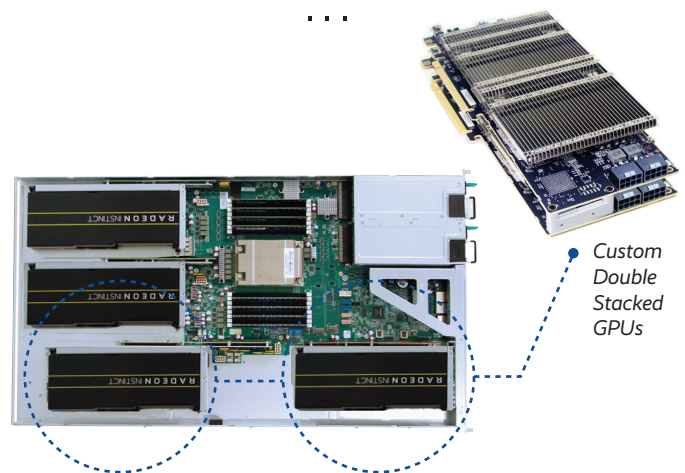
According to Uptime Institute, the average cost of building a data center is currently \$11.50 per Watt of critical (IT) load plus \$300 per square foot for site preparation. That means a 100% increase in power consumption would mean an additional \$11.5 million per Megawatt and three times the space requirement to manage density for air cooling at \$300 per square foot.<sup>2</sup> Rack-based immersion cooling solutions support breakthrough growth and cost-saving potential, delivering across-the-board improvements in rack density, cooling capacity, datacenter layout, and location options.

Meanwhile, conventional cooling is incapable of handling high-density computing required for emerging applications. Datacenter sites already require significant CAPEX to have electric utilities deliver additional power as they scale, relocate, or push to the cloud as well; conventional cooling cannot deliver the energy efficiency required to contain these costs. In time, enterprises may find conventional cooling is unable to provide the reliability and uptime required to meet the business needs of the future. Immersion cooling is a system of cooling CPUs and GPUs where the coolant is in direct contact with the processing units itself. Most of the contributors to internal thermal

resistance are eliminated. Direct liquid immersion cooling offers a high heat transfer coefficient that reduces the temperature rise of the processors surface above the liquid coolant temperature.

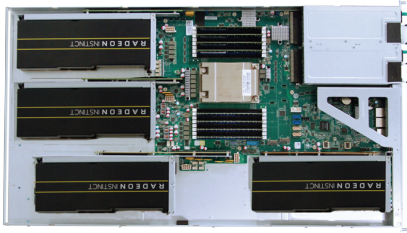
## *Immersion is the Future of Liquid Cooling*

Among the four primary liquid cooling technologies available—single phase, two phase, core plate, and rear-door heat exchange—single-phase immersion cooling delivers the most optimized performance per-watt-per dollar, with outstanding density, superior bandwidth, lower data center TCO, optimized compute, memory, and significant reduction in cooling datacenter energy consumption.



**BrainMax™ ICG-160**

**1U 6x GPU Density Optimized Server for Immersion Cooling**



# BrainMax™ ICG-160



- Supports up to 6 x single-wide or 4 x double-wide GPU cards in a 1U immersion cooling chassis
- Supports one AMD EPYC™ 7002 series processor family

## Features

- Onboard dual-port 10GBase-T networking
- Heatsink optimization
- Fanless
- Adapted power supply
- Optimized design for thermal efficiency
- Air-to-immersion subsystems compatibility

## Specifications

<b>Processor</b>	<ul style="list-style-type: none"> <li>• Single AMD EPYC™ 7002 series processor, 7nm, Socket SP3, up to 64 cores, 128 threads</li> </ul>
<b>Memory</b>	<ul style="list-style-type: none"> <li>• 16 x DDR4 DIMM slots</li> <li>• Up to 2,048GB RDIMM/ 1,024GB LRDIMM/ 2,048GB LRDIMM 3DS</li> <li>• Memory speed up to 3200 MHz</li> </ul>
<b>Graphics Processing Unit (GPU):</b>	<ul style="list-style-type: none"> <li>• Up to 6 x single-wide or 4 x double-wide GPU cards in a 1U immersion cooling chassis</li> </ul>
<b>Expansion Slots</b>	<ul style="list-style-type: none"> <li>• 6 x PCIe Gen 3 x16 slots for GPUs</li> <li>• 1 x FH/HL PCIe Gen 3 x16</li> </ul>
<b>Network Controller</b>	<ul style="list-style-type: none"> <li>• 2 x 10GBASE-T ports</li> <li>• 1 x 10/100/1000 management LAN</li> </ul>
<b>Storage</b>	<ul style="list-style-type: none"> <li>• 2 x hot-swap 2.5" SATA Drive Bays</li> <li>• 2 x SATA 6G SATADOM ports</li> <li>• 2 x NVME/SATA M.2</li> </ul>
<b>Chassis</b>	<ul style="list-style-type: none"> <li>• 1U rack-optimized chassis</li> <li>• Modified power supply: 1600 watt redundant, 80 PLUS Platinum</li> </ul>
<b>Supported Immersion Cooling Rack: GRC Chassis</b>	<ul style="list-style-type: none"> <li>• Power dissipation per rack: 25kW - 100kW</li> <li>• Number of U per rack: 42U – 52U</li> </ul> <p><i>Immersion Cooling Rack includes:</i></p> <ul style="list-style-type: none"> <li>• Rack(s) filled with liquid immersion coolant</li> <li>• Coolant distribution unit (CDU)</li> <li>• Monitoring and alerts application</li> <li>• Mirrored System, with 2N redundant pumps</li> <li>• Integrated cable management</li> <li>• Rack-mounted service rails for easy server maintenance and hot swaps</li> </ul>
<b>Immersion Cooling Solution Value Proposition:</b>	<ul style="list-style-type: none"> <li>• Cut cooling energy by up to 95%</li> <li>• Attain an mPUE &lt;1.05</li> <li>• Lower upfront costs 50%</li> <li>• Reduce server power draw 10-20%</li> <li>• Cool up to 200 kW in a single rack</li> <li>• Enables high-density data center layouts</li> <li>• CPU/GPU-agnostic</li> <li>• Fast deployment: 8-12 weeks</li> <li>• Enables Scaling in 1 to 4 rack increments</li> </ul>

<sup>1</sup> Marc Bhuyan, Google Machine Learning Infrastructure Project Manager. BisNow Conference, December 2018. Published: <https://www.bisnow.com/silicon-valley/news/data-center/new-cooling-computer-technologies-could-mean-savings-for-data-centers-96080>

<sup>2</sup> Pitt Turner IV, P.E. with Kenneth G. Brill. Cost Model: Dollars per kW plus Dollars per Square Foot of Computer Floor. Uptime Institute, 2015.