

Lenovo ThinkStation P520c

Version: 5 | 03/08/2022

Downloads

Hardware Maintenance Manual	P520c HMM
Drivers & Software	P520c Drivers & Software
Available Whitepapers	RTX GPU Support Matrix P520/520c Power Configurator P520/520c Memory Configurations Intel VROC Support

SECTION I: Platform Overview

Description	MAINSTREAM WORKSTATION ON A BUDGET Closing the gap in price and performance between entry-level and high-end workstations. The ThinkStation® P520c offers a higher CPU performance and memory capacity than any entry-level workstation in the market.
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CPU

Processor Support	Xeon Scalable Processors
Socket Type	Socket-R4 (LGA 2066)

Operating Systems

Preloaded	Windows 10 Pro 64-bit for Workstations Ubuntu 16.04 LTS (configuration specific)
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	Ubuntu 18.04 LTS (configuration specific)
Supported	Windows 7 Pro 64-bit (via Windows 10 Pro Downgrade Rights) Red Hat Enterprise Linux 7.3 Ubuntu 16.04 LTS Ubuntu 18.04 LTS

Memory

Slots	Up to 4 DIMMs
Channels	Supports up to 4 DIMM Sockets, 4 Channels
Type	288-Pin, 1866/2133/2400/2666MHz/2933MHz ECC RDIMM
ECC Support	Yes
Speed	Up to 2933MHz
Max DIMM Size	64GB DDR4 ECC RDIMM
Max System Memory	256GB

Storage

Total Bays/Size	2 x 3.5"
SATA	4 x SATA Connectors, Gen 3
PCIe	2 x M.2 PCIe Connectors Onboard 3 Additional M.2 NVMe Drives Supported by Single Adapters
SAS	Supported via Optional Adapter
eSATA	1 x eSATA Connector, Gen 3
Disclaimers	Additional parts/enclosures may be required for some configurations

Video

Integrated Graphics	Not Available
Discrete Graphics	PCIe Add-In-Card, Details in Section Below
Multi-GPU Support	Yes
Type	PCIe Add-In-Card
Bus Interface	PCIe x16

Slots

Slot 1	PCIe 3.0 x16, Full Height, Full Length, 75W, With Latch
Slot 2	PCIe 3.0 x8, Full Height, Full Length, 50W, Open Ended

Slot 3	PCIe 3.0 x16, Full Height, Full Length, 75W, With Latch
Slot 4	PCIe 3.0 x4, Full Height, Half Length, 25W, Open Ended (PCH)

Front I/O

USB	2 x USB 3.1 Gen 1 Type-A 5Gb/s
Audio	1 x Combo Audio/Microphone Jack (3.5mm)
Media Card Reader	Front 9-in-1 Media Card Reader Standard (USB 2.0) Optional: Front 15-in-1 Media Card Reader (requires Flex module)
Flex Module	Flex Module: Supports Two 5.25" Flex Bays With Several Options Integrated <ul style="list-style-type: none"> • Up to Two Half Height Optical Drives • Up to Two 5.25" Slim ODD cages • Up to One Front Access Storage Enclosure • Up to One Flex Module for One or More of the Following Options: 9.0mm Optical/ 15-in-1 USB 3.1 Gen 1 Reader/Front eSATA/Dual Port Front Thunderbolt/Front USB 3.1 Gen 1 Type-C/4-Digit Diagnostic Display Note: 1. Only one can be supported from 15-in-1 reader, Thunderbolt, and 4-Digit display 2. Up to two ports are supported from 1394, eSATA, and USB Type-C
Disclaimers	Note: Actual USB throughput will vary depending on the type and quantity of USB devices used.

Rear I/O

USB	"2 x USB 2.0 Type-A 480Mb/s 4 x USB 3.1 Gen 1 Type-A 5Gb/s"
Audio	3 x Rear (Line Out, Line In, MIC); Retaskable to 5.1 1 x Front Stereo+MIC Headset
DisplayPort	As Supported by GPU
HDMI	As Supported by GPU
DVI	As Supported by GPU
VirtualLink	As Supported by GPU
VGA Port	As Supported by GPU
Serial Port	Optional 1 x Rear Port
Ethernet	1 x 1GbE - RJ45
PS/2	2 x PS/2
IEEE 1394	Not Available
eSATA	Optional PCIe Bracket
Parallel Port	Not Available
Optional USB Adapter	Dual Type-C Ports USB 3.1 Dual Type-A Ports USB 2.0
Optional Network Adapter	Intel I210-T1 Single Port Gigabit Ethernet Adapter Intel I350-T2 Dual Port Gigabit Ethernet Adapter Intel I350-T4 Quad Port Gigabit Ethernet Adapter PCI-E 1 x WFi Card With BT HP External Antenna Kit (8265 AC)

Disclaimers

Note: Actual USB throughput will vary depending on the type and quantity of USB devices used.

Ethernet

Vendor	Intel Jacksonville I219LM
Speeds	10/100/1000Mbps
Functions	PXE, ASF, WOL, Jumbo Frames, Teaming
Connectors	1 x RJ45

Audio

Vendor	Realtek
Type	HD (5.1)
Internal Speaker	Yes
Connectors	3 x Rear 3.5mm Jacks (Line In, Line Out, Microphone In)
Chipset	ALC662
Number of Channels	6 Channels
Number of Bits/Audio Resolution	6 Channel DAC supports 16/20/24 bit PCM Stereo ADC supports 16/20 bit PCM

Thermal

Temp Sensors	Ambient Sensor VR1 Sensor VR2 Sensor PCIe Sensor MB Sensor
Fans	1 x CPU Fans 1 x Rear Fan 1 x Front Fans 1 x Power Supply Fan (internal) 2 x ODD Bay Fans (optional)

Power Specifications

Power Supply	500W
Power Efficiency	92% Efficient @ 50% Load
Main	C14
Operating Voltage Range	100 - 240V
Rated Voltage Range	90-264VAC

Rated Line Frequency	47Hz / 63Hz
Operating Line Frequency Range	50Hz / 60Hz
Rated Input Current	9A-15A
Graphics	1 x 8 pin (6+2)
Power Supply Fan	Yes
ENERGY STAR® Qualified (config dependent)	Yes
80 PLUS Compliant	Yes
Built-in Self Test (BIST) LED	Yes
Aux Power Drop	Yes

BIOS

Vendor	AMI
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Chassis Information

Color	Graphite Black
PSU	500W, Autosensing, 92% PSU, 80 PLUS Platinum Qualified
Thermal Solutions	Two System Fans Standard (1 front, 1 rear), One Fan per CPU, One PSU Fan
Dimensions	175mm/6.89" W x 426mm/16.77" D x 375.5mm/14.78" H
Weight	14.5kg / 31.97lbs

Packaging Dimensions

Height (mm/in)	525mm / 20.67"
Width (mm/in)	292mm / 11.49"
Depth (mm)	501mm / 19.72"

Security & Serviceability

TPM	Infineon SLB9665TT TPM 2.0
Asset ID	Yes, 1024 x 8bit
vPro	Intel vPro for WS (AMT 9.x)
Cable Lock Support	Yes, Optional Kensington Cable Lock
Serial, Parallel, USB, Audio,	Yes

Network, Enable/Disable Port Control	
Power-On Password	Yes
Setup Password	Yes
NIC LEDs (integrated)	Yes
Access Panel Key Lock	Unique Key Lock Kit - Optional Common Key Lock Kit - Optional
Boot Sequence Control	Yes
Padlock Support	Not Supported
Boot without keyboard and/or mouse	Yes
Access Panel	Tool-less Side Cover Removal
Optical Drive	Tool-less
Hard Drives	Tool-less
Expansion Cards	Tool-less
Processor Socket	Tool-less
Color coded User Touch Points	Yes
Color-coordinated Cables and Connectors	Yes
Memory	Tool-less
System Board	Retained With Screws
Restore CD/DVD/USB Set	Not Included, Restore Media Available via Lenovo Customer Support Center

Operating Environment

Air Temperature	Operating: 10°C to 35°C (50°F to 95°F)
Storage	Storage: -40°C to 60°C (-40°F to 140°F) in Original Shipping Carton Storage: -10°C to 60°C (14°F to 140°F) Without Carton
Humidity	Relative Humidity Operating: 10% to 80% (non-condensing) Relative Humidity Storage/Transit: 10% to 90% (non-condensing) Wet Bulb Temperature Operating: 25°C (77°F) max Wet Bulb Temperature Non-operating: 40°C (104°F) max
Altitude	Operating: -15.2m to 3048m (-50ft to 10000ft) Storage: -15.2m to 10668m (-50ft to 35000ft)
Vibration	Package Vibration: Random, 1.04G at 2-200 Hz, 15 Minutes XYZ 6 faces Operating Vibration: Random, 0.27G at 5-500 Hz, 30 Minutes Per Surface (X,Y,Z) Non-Operating Vibration: Random, 1.04G at 2-200 Hz, 15 Minutes Per Surface (±X, ±Y, ±Z)
Shock	Operation Shock: 3ms (15G) for 4 Axis (+X, -X, +Y, -Y) 3ms (30G) for 2 Axis (+Z, -Z), Half-sine Wave, Each Side Will do One Time Rack Operation Shock: 5ms (15G) for 6 Axis (+X, -X, +Y, -Y, +Z, -Z), Half-sine Wave, Each Side Will do One Time Non-operating Shock: Trapezoidal Wave, 50G, 9ms, 6 Sides (+X, -X, +Y, -Y, +Z, -Z), Filter 300Hz, Each Side Shock One Time

SECTION II: Platform Detail

Board Size	10" x 9.6" (254mm x 244mm)
Layout	Custom ATX

Motherboard Core

Processor Support	Xeon Scalable Processors
Socket Type	Socket-R4 (LGA 2011)
Memory Support	DDR4 up to 2933MHz RDIMM Memory
Voltage Regulator	Intel VR13 - 165W TDP Capable
Chipset (PCH)	Intel C422 Chipset
Flash	32MB
Super I/O	Nuvoton NCT6685
Clock	Intel Native isCLK
Audio	Realtek ALC662 Codec
Ethernet	Intel Jacksonville I219LM
SAS	Optional via Broadcom Adapter

Supported Components

Processor Level	Skylake
Processor	Intel Xeon Cascade Lake W-2223 Intel Xeon Skylake W-2195 Intel Xeon Skylake W-2175 Intel Xeon Skylake W-2155 Intel Xeon Skylake W-2145 Intel Xeon Skylake W-2135 Intel Xeon Skylake W-2133 Intel Xeon Skylake W-2125 Intel Xeon Skylake W-2123 Intel Xeon Skylake W-2104 Intel Xeon Skylake W-2102
Memory Type	RDIMMs - 2933MHz RDIMMs - 2666MHz
Memory	8GB DDR4 ECC RDIMM PC4-2933-R 16GB DDR4 ECC RDIMM PC4-2933-R 32GB DDR4 ECC RDIMM PC4-2933-R 64GB DDR4 ECC RDIMM PC4-2933-R 8GB DDR4 ECC RDIMM PC4-2666 16GB DDR4 ECC RDIMM PC4-2666 32GB DDR4 ECC RDIMM PC4-2666

Storage

3.5" SATA Hard Disk Drive (HDD)	1TB SATA HDD 7200rpm, 6Gb/s, 3.5" 2TB SATA HDD 7200rpm, 6Gb/s, 3.5" 4TB SATA HDD 7200rpm, 6Gb/s, 3.5" (enterprise class)
2.5" SATA Hard Disk Drive (HDD)	500GB 2.5" SATA HDD 7200rpm (FIPS certified)
2.5" SATA Solid State Drive (SSD)	256GB SATA SSD, 6Gb/s, TLC, 2.5", OPAL 512GB SATA SSD, 6Gb/s, TLC, 2.5" OPAL 512GB SATA SSD, 6Gb/s, TLC, 2.5", Non-OPAL 1024GB SATA SSD, 6Gb/s, TLC, 2.5" OPAL 2048GB SATA SSD, 6Gb/s, TLC, 2.5" OPAL
M.2 PCIe Solid State Drive (SSD)	256GB M.2 PCIe SSD, Gen 3 x4, NVMe, OPAL 512GB M.2 PCIe SSD, Gen 3 x4, NVMe, OPAL 1024GB M.2 PCIe SSD, Gen 3 x4, NVMe, OPAL 2048GB M.2 PCIe SSD, Gen 3 x4, NVMe, OPAL

RAID

RAID Levels and Requirements	M.2 RAID via Intel VROC SATA RAID via Onboard Intel Controller or Broadcom Adapter SAS RAID via Broadcom Adapter
Notes	Supported RAID levels for a system will vary from the stated capabilities of the RAID controller due to dependencies on the number and capacity of physical disks in the system and on customer requirements for performance, fault tolerance, or data redundancy. Max supported RAID 0/1/5/10.
Optional Hard Disk Drive Controllers	Broadcom 9460-16i ROC PCIe Adapter, Supports 0/1/5/10 Broadcom 9440-8i IOC PCIe Adapter, Supports 0/1/5/10
Intel VROC	Intel Virtual RAID On CPU (VROC) - Basic, Supports 0/1/10 Intel Virtual RAID On CPU (VROC) - Premium, Supports 0/1/5/10

Optical Drive/Removable Media

DVD-ROM Drive	DVD-ROM Drive - 16x/48x Slim SATA DVD-ROM
DVD Burner/CD-RW Drive	DVD Burner/CD-RW Rambo Drive Slim ODD DVD Burner/CD-RW
Blu-Ray Burner Drive	Blu-Ray Burner Drive w/AACS encryption Slim Blu-Ray ODD DVD Burner
Media Card Reader Specifications	Front 9-in-1 USB 2.0 Media Card Reader Standard Optional Front 15-in-1 Media Card Reader (requires Flex module)

Keyboard and Pointing Devices

Keyboard	Traditional USB Keyboard Traditional PS/2 Keyboard Smart Card USB Keyboard Calliope USB Keyboard
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Pointing Devices	Calliope USB Mouse Lenovo USB Laser Mouse Fingerprint USB Mouse PS/2 Optical Mouse
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Expansion Bays

5.25" External Access Bays	<p>Two 5.25" Flex Bays, Supports the Following:</p> <ul style="list-style-type: none"> • Up to Two Half Height Optical Drives • Up to Two 5.25" Slim ODD Cages, Each Supports One 9.0mm Optical Drive • Up to One 5.25" Slim ODD and HDD Cage for One 9.0mm Optical Drive Plus One 3.5" or 2.5" SATA Disk • Up to One Front Access Storage Enclosure for One 3.5" or 2.5" SATA Disk • Up to One Flex Module for One or More of the Following Options: 9.0mm Optical/15-in-1 USB 3.1 Gen 1 Reader/Front eSATA/Front Thunderbolt/Front USB 3.1 Gen 1 Type-C <p>Note: 1. Only one can be supported from the following: 15-in-1 memory card reader, dual Thunderbolt ports</p> <p>Note: 2. Up to two ports are supported from 1394, eSATA, and USB Type-C</p>
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PCIe Adapters

Network	Intel I210-T1 Single Port Gigabit Ethernet Adapter Intel I350-T2 Dual Port Gigabit Ethernet Adapter Bitland BN8E88 1000M PCIe ASF FH Aquantia 5G Ethernet Adapter (single port) Aquantia 10G Ethernet Adapter (single port)
Thunderbolt	Front Thunderbolt Card Kit - Supports Two Optional Thunderbolt Ports (USB Type-C) on Flex Module, One of Two Ports Supports Video Out Rear Thunderbolt PCIe Adapter
WiFi Cards	Intel PCIe WiFi Card With BT External Antenna Kit (9560 AC)
PCIe to M.2 Adapter Card	PCIe x4 to M.2 Adapter (for NVMe SSD)

SECTION III: Supported Component Detail

CPU Specifications

CPU	Intel Xeon W-2223	Intel Xeon W-2195	Intel Xeon W-2175	Intel Xeon W-2155	Intel Xeon W-2145
# of Cores	4	18	14	10	8
# of Threads	8	36	28	20	16
Processor Base Frequency	3.60GHz	2.3GHz	2.5GHz	3.3GHz	3.7GHz

Max Turbo Frequency	3.90GHz	4.3GHz	4.3GHz	4.5GHz	4.5Ghz
Cache	8.25MB	24.75MB	19MB	13.75MB	11MB
TDP	120W	140W	140W	140W	140W
Intel ARK Spec Link	Intel Xeon W-2223	Intel Xeon W-2195	Intel Xeon W-2175	Intel Xeon W-2155	Intel Xeon W-2145

CPU Specifications

CPU	Intel Xeon W-2135	Intel Xeon W-2133	Intel Xeon W-2125	Intel Xeon W-2123	Intel Xeon W-2104
# of Cores	6	6	4	4	4
# of Threads	12	12	8	8	4
Processor Base Frequency	3.7GHz	3.60GHz	4Ghz	3.6GHz	3.2GHz
Max Turbo Frequency	4.5GHz	3.90GHz	4.5Ghz	3.9GHz	Not Available
Cache	8.25MB	8.25MB	8.25MB	8.25MB	8.25MB
TDP	140W	140W	120W	120W	120W
Intel ARK Spec Link	Intel Xeon W-2135	Intel Xeon W-2133	Intel Xeon W-2125	Intel Xeon W-2123	Intel Xeon W-2104

CPU Specifications

CPU	Intel Xeon W-2102
# of Cores	4
# of Threads	4
Processor Base Frequency	2.9GHz
Max Turbo Frequency	Not Available
Cache	8.25MB
TDP	120W
Intel ARK Spec Link	Intel Xeon W-2102

HDD Specifications

Drive	500GB SATA - 7200rpm, 6Gb/s, 2.5"	1TB SATA - 7200rpm, 6Gb/s, 3.5"	2TB SATA - 7200rpm, 6Gb/s, 3.5"	4TB SATA - 7200rpm, 6Gb/s, 3.5"
3.5" SATA Hard Disk Drive (HDD)	Not Available	Yes	Yes	Yes
2.5" SATA Hard Disk Drive (HDD)	Yes	Not Available	Not Available	Not Available
Connector	SATA	SATA	SATA	SATA

Transfer Rate (Gb/sec)	160MB/s OD Read	Average Data Rate, Read/Write 156MB/s	Average Data Rate, Read/Write 156MB/s	Sustained Data Transfer Rate 216-226MB/s
Spindle Speed (RPM)	7,200	7,200	7,200	7,200
Power Off to Spindle Stop (sec)	NA	NA	NA	NA
DC Power to Drive Ready (sec)	3.5	<10.0	<17.0	<17.0
Average Latency (msec)	4.2	4.16	4.16	4.16
Input (VDC)	5	5	5	5
Typical (Watts)	1.9	6.19	6.7	7.35
Idle (Watts)	0.7	4.6	4.5	5.45
Physical Dimensions	69.85mm x 100.34mm x 7mm	101.6mm x 146.99mm x 19.88mm	101.6mm x 146.99mm x 26.1mm	101.85mm x 147mm x 26.1mm
Weight (grams)	90	420	535	680
Operating (C) Ambient	0 to 60	0 to 60	0 to 60	5 to 60
Operating (C) Base Casting	60	60	60	60
Non-Operating (C) Ambient	(-40 to 70)	(-40 to 70)	(-40 to 70)	(-40 to 70)
Gradient (C per Hour)	20	20	20	20
Operating (Gs @ 2ms)	400	70	80	Read 70 Gs / Write 40 Gs
Non-Operating (Gs @ 2ms)	1000	350	300	300
After Market Option	Yes - PN			

Solid State Storage Specifications

Drive	512GB 2.5" SATA SSD	1TB 2.5" SATA SSD	2TB 2.5" SATA SSD	256GB NVMe M.2 SSD TLC	512GB NVMe M.2 SSD TLC
Dimensions Millimeters (W x D x H)	70 x 100 x 7.0	70 x 100 x 7.0	70 x 100 x 7.0	22 x 80 x 2.3	22 x 80 x 2.3
Interface Type	SATA-III	SATA-III	SATA-III	PCIe Gen 3 x4 NVMe	PCIe Gen 3 x4 NVMe
Power Active (AVG)	1.9W	2.2W	6W	5W	5W
Power Idle	50mW	50mW	50mW	50mW	50mW
Typical Sequential Read	540MB/s	540MB/s	530MB/s	3000MB/s	3200MB/s
Typical Sequential Write	500MB/s	500MB/s	500MB/s	1300MB/s	1600MB/s
Typical Random Read (4GB Span)	75K IOPS	75K IOPS	75K IOPS	205K IOPS	340K IOPS
Typical Random Write (4GB Span)	84K IOPS.	84K IOPS.	84K IOPS.	260K IOPS.	275K IOPS.
Operating Temperature Range	0 to 55°C	0 to 55°C	0 to 55°C	0 to 55°C	0 to 55°C
Endurance Rating (Lifetime)	150TB	300TB	600TB	85TB	150TB

Writes)					
Mean Time Between Failures (MTBF)	2.0M POH	2.0M POH	2.0M POH	2.0M POH	2.0M POH
Hardware Encryption	AES 256-bit	AES 256-bit	AES 256-bit	AES 256-bit	AES 256-bit

Solid State Storage Specifications

Drive	1024GB NVMe M.2 SSD TLC	2048GB NVMe M.2 SSD TLC
Dimensions Millimeters (W x D x H)	22 x 80 x 2.3	22 x 80 x 2.3
Interface Type	PCIe Gen 3 x4 NVMe	PCIe Gen 3 x4 NVMe
Power Active (AVG)	5W	5W
Power Idle	50mW	50mW
Typical Sequential Read	3200MB/s	3500MB/s
Typical Sequential Write	1600MB/s	3000MB/s
Typical Random Read (4GB Span)	340K IOPS	600K IOPS
Typical Random Write (4GB Span)	275K IOPS.	500K IOPS.
Operating Temperature Range	0 to 55°C	0 to 55°C
Endurance Rating (Lifetime Writes)	300TB	600TB
Mean Time Between Failures (MTBF)	2.0M POH	2.0M POH
Hardware Encryption	AES 256-bit	AES 256-bit

Discrete Graphics Adapter

Adapter	NVIDIA P400	NVIDIA P620	NVIDIA P1000	NVIDIA P2000	NVIDIA T400	NVIDIA T600
Bus Interface	PCIe 3.0 x16	PCIe 3.0 x16	PCIe 3.0 x16	PCIe 3.0 x16	PCIe 3.0 x16	PCIe 3.0 x16
Display Interface	3 x mDP 1.4	4 x mDP 1.4	4 x mDP 1.4	4 x DP 1.4	3 x mDP 1.4	4 x mDP 1.4
Graphics Chipset	Pascal	Pascal	Pascal	Pascal	Turing	Turing
Memory Clock Frequency (MHz)	1003MHz	1252MHz	1253MHz	1752MHz		
Memory Size	2GB GDDR5	2GB GDDR5	4GB GDDR5	5GB GDDR5	2GB GDDR6	4GB GDDR6
Memory Interface	64-bit	128-bit	128-bit	160-bit	64-bit	128-bit
Memory Bandwidth	Up to 32GB/s	Up to 80GB/s	Up to 82GB/s	Up to 140GB/s	80GB/s	160GB/s
GPU Cores	CUDA	CUDA	CUDA	CUDA	CUDA	CUDA

	Cores: 256	Cores: 512	Cores: 640	Cores: 1024	Cores: 384	Cores: 640
GPU Core Frequency (MHz)	1228MHz		1266MHz		1076MHz	
Maximum Power Consumption	30W	40W	47W	75W	30W	40W
Supported Resolutions and Max Refresh Rates (Hz) (Note: Analog and/or Digital)	3 x 4096x2160 @ 60Hz 1 x 5120x2880 @ 60Hz	4 x 4096x2160 @ 60Hz 4 x 5120x2880 @ 60Hz	4 x 4096x2160 @ 60Hz 4 x 5120x2880 @ 60Hz	4 x 4096x2160 @ 60Hz 4 x 5120x2880 @ 60Hz	4 x 4096x2160 @ 120Hz 4 x 5120x2880 @ 60Hz	
Thermal Solution	Ultra-quiet Active Fansink	Ultra-quiet Active Fansink	Ultra-quiet Active Fansink	Ultra-quiet Active Fansink	Active	Active
Dimension	2.713" H x 5.7" L Single Slot, Low Profile	2.713" H x 5.7" L Single Slot, Low Profile	2.713" H x 5.7" L Single Slot, Low Profile	4.4" H x 7.9" L Single Slot	2.7" H x 6.1" L Single Slot	2.7" H x 6.1" L Single Slot
Advanced Display	Not Available	Not Available	Not Available	Not Available	-	-
SLI/NVLink Support	Not Available	Not Available	Not Available	Not Available	-	-
Disclaimers	GPUs with long extenders are supported through manufacture configure only; standalone option additions are not supported	-	-	-	-	-

Discrete Graphics Adapter

Adapter	NVIDIA T1000	Quadro RTX 5000	Quadro RTX 6000	NVIDIA RTX A2000	NVIDIA RTX A4000	NVIDIA RTX A5000
Bus Interface	PCIe 3.0 x16	PCIe 3.0 x16	PCIe 3.0 x16	PCIe 4.0 x16	PCIe 4.0 x16	PCIe 4.0 x16
Display Interface	4 x mDP 1.4	4 x DP 1.4 1 x VirtualLink	4 x DP 1.4 1 x VirtualLink	4 x DP 1.4a	4 x DP 1.4a	4 x DP 1.4a
Graphics Chipset	Turing	Turing	Turing	Ampere	Ampere	Ampere
Memory Clock Frequency (MHz)	1750MHz			1750MHz		
Memory Size	4GB GDDR6	16GB GDDR6	24GB GDDR6	6GB/12GB GDDR6	16GB GDDR6	24GB GDDR6
Memory Interface	128-bit	256-bit	384-bit	192-bit	256-bit	384-bit
Memory Bandwidth	160GB/s	Up to	Up to	288GB/s	448 GB/s	Up to

		448GB/s	672GB/s			768GB/s
GPU Cores	CUDA Cores: 896	CUDA Cores: 3072 Tensor Cores: 384 RT Cores: 48	CUDA Cores: 4608 Tensor Cores: 576 RT Cores: 72	CUDA Cores: 3328 Tensor Cores: 104 RT Cores: 26	CUDA Cores: 6411 Tensor Cores: 192 RT Cores: 48	CUDA Cores: 8,192 Tensor Cores: 256 RT Cores: 64
GPU Core Frequency (MHz)	1620MHz	1440MHz	-	-	-	-
Maximum Power Consumption	50W	Total board power: 265W Total graphics power: 230W	Total board power: 295W Total graphics power: 260W	70W	140W	230W
Supported Resolutions and Max Refresh Rates (Hz) (Note: Analog and/or Digital)	4 x 4096x2160 @ 120Hz 4 x 5120x2880 @ 60Hz 2 x 7680x4320 @ 60Hz	4 x 4096x2160 @ 120Hz 4 x 5120x2880 @ 60Hz 2 x 7680x4320 @ 60Hz	4 x 4096x2160 @ 120Hz 4 x 5120x2880 @ 60Hz 2 x 7680x4320 @ 60Hz	4 x 4096x2160 @ 120Hz 4 x 5120x2880 @ 60Hz 2 x 7680x4320 @ 60Hz	4 x 4096x2160 @ 120Hz 4 x 5120x2880 @ 60Hz 2 x 7680x4320 @ 60Hz	4 x 4096x2160 @ 120Hz 4 x 5120x2880 @ 60Hz 2 x 7680x4320 @ 60Hz
Thermal Solution	Active	Ultra-quiet Active Fansink	Ultra-quiet Active Fansink	Active	Active	Active
Dimension	2.7" H x 6.1" L Single Slot	4.4" H x 10.5" L Dual Slot, Full Height	4.4" H x 10.5" L Dual Slot, Full Height	2.7" H x 6.6" L, Dual slot	4.4" H x 9.5" L Single Slot	4.4" H x 10.5" L Dual Slot, Full Height
Advanced Display	SYNC 2	SYNC 2	-	-	-	-
SLI/NVLink Support	NVLink	NVLink	-	-	-	-

Discrete Graphics Adapter

Adapter	RTX A5000
Bus Interface	PCIe 4.0 x16
Display Interface	4 x DP 1.4a
Graphics Chipset	Ampere
Memory Size	24GB GDDR6
Memory Interface	384-bit
Memory Bandwidth	Up to 768GB/s
GPU Cores	CUDA Cores: 8,192 Tensor Cores: 256 RT Cores: 64
Maximum Power Consumption	230W
Supported Resolutions and	4 x 4096x2160 @ 120Hz

Max Refresh Rates (Hz) (Note: Analog and/or Digital)	4 x 5120x2880 @ 60Hz 2 x 7680x4320 @ 60Hz
Thermal Solution	Active
Dimension	4.4" H x 10.5" L Dual Slot, Full Height

Intel® Ethernet Specifications

Card	Intel I210-T1 Single Port Gigabit Ethernet Adapter (Springville)	Intel I350-T2 Dual Port Gigabit Ethernet Adapter (Stony Lake T2)	Intel I350-T4 Quad Port Gigabit Ethernet Adapter (Stony Lake T4)	Intel X540- T2 Dual Port Copper 10Gb Ethernet Adapter	Intel X710- DA2 Dual Port Fiber 10Gb Ethernet Adapter
Supplier PN	I210T1, MM# 941033	I350T2G1P2 0, MM# 928941	I350T4G1P2 0, MM# 928942	MM#928955	MM# 952103
Data Rates Supported	10/100/1000 Mbps copper	10/100/1000 Mbps (Copper), 1000Mbps (Fiber)	10/100/1000 Mbps (Copper), 1000Mbps (Fiber)	100/1000Mb ps and 10Gbps Copper	1GbE/10GbE Optical fiber 10GbE Direct Attach (DAC)
Controller Details	Intel® Ethernet Controller I210	Intel Ethernet Controller I350	Intel Ethernet Controller I351	Intel Ethernet Controller X540	Intel Ethernet Controller X710-AM2
Controller Bus Architecture	PCIe 2.1 (5GT/s)	PCIe 2.1 (5GT/s)	PCIe 2.1 (5GT/s)	PCIe 2.1 (5GT/s)	PCIe 3.0 (8GT/s)
Data Transfer Mode	Ethernet	Ethernet	Ethernet	Ethernet	Ethernet
Power Consumption	0.81W	Copper: I350-T2 V2= 4.4W Fiber: I350-F2= 5.5W	Copper: I350T4V2= 5W LC-Fiber: I350F4= 6W	X540-T2: 10Gps= 17.4W 1Gbps= 9.5W 100Mbps=6. 6W X540-T1: 10Gbps=10.8 W 1Gbps= 7.7W 100Mbps= 6.4W	Dual-port 10GBASE- SR= 4.3W typ/4.8W max Dual-port 1000BASE- SX= 4W typ/4.3W max Dual-port 10GBASE- LR= 4.5W typ/ 5.1W max Dual-port Direct Attach (Twinax)= 3.3W typ/3.7W max
IEEE Standards Compliance	IEEE 802.3/10BA SE-T, 100BASE- TX, 1000BASE-T	IEEE 802.3/10BA SE-T, 100BASE- TX, 1000BASE-T	IEEE 802.3/10BA SE-T, 100BASE- TX, 1000BASE-T	IEEE 802.3 100/1000/10 GBASE-T	IEEE 802.3 1/10/10GBAS E-SR/LR, SFF-8431 10GSFP+DA C
Boot ROM Support	PXE boot, Intel iSCSI	PXE boot, Intel iSCSI	PXE boot, Intel iSCSI	PXE boot, Intel iSCSI	PXE boot, Intel iSCSI

	Remote Boot for Windows, Linux and Vmware, Intel BootAgent Software via PXE or BootP, WDMS or UEFI	Remote Boot for Windows, Linux and Vmware, Intel BootAgent Software via PXE or BootP, WDMS or UEFI	Remote Boot for Windows, Linux and Vmware, Intel BootAgent Software via PXE or BootP, WDMS or UEFI	Remote Boot for Windows, Linux and Vmware, Intel BootAgent Software via PXE or BootP, WDMS or UEFI	Remote Boot for Windows, Linux and Vmware, Intel BootAgent Software via PXE or BootP, WDMS or UEFI
Network Transfer Mode (Full/Half Duplex)	Supported	Supported	Supported	Supported	Supported
Network Transfer Rate	1,000Mbps Full Duplex	1,000Mbps Full Duplex	1,000Mbps Full Duplex	1,000Mbps Full Duplex	1,000Mbps Full Duplex
Operating System Driver Support	Windows 7/8/10, Linux, Free BSD, XEN,Vmware	Windows 7/8/10, Linux, Free BSD, XEN,Vmware	Windows 7/8/10, Linux, Free BSD, XEN,Vmware	Windows 7/8/10, Windows ServerLinux, FreeBSD	Windows 2008, 2012; RHEL 6.5/7.0, FreeBSD 9/10, Vmware ESXi 5.x
Manageability	Supported	Supported	Supported	Supported	Supported
Manageability Capabilities Alerting	Supported	Supported	Supported	Supported	Supported
TDP	Firmware Based Thermal Management	Firmware Based Thermal Management	Firmware Based Thermal Management	Firmware Based Thermal Management	Not Available
Operating Temperature Range	0°C to 55°C (32°F to 131°F)	0°C to 55°C (32°F to 131°F)	0°C to 55°C (32°F to 131°F)	0°C to 55°C (32°F to 131°F)	0°C to 55°C (32°F to 131°F)
# of Ports	1	2	4	2	2
Data Rate Per Port	10/100/1000 Mbps (copper)	10/100/1000 Mbps (copper), 1000Mbps (fiber)	10/100/1000 Mbps (copper), 1000Mbps (fiber)	100/1,000Mbps, 10Gbps	1Gbps, 10Gbps
System Interface Type	PCIe Gen 2.1	PCIe Gen 2.1	PCIe Gen 2.1	PCIe Gen 2.1	PCIe 3.0
NC Sideband Interface	Not Available	Not Available	Not Available	Not Available	Yes
Jumbo Frames Supported	Yes	Yes	Yes	Yes	Yes
1000Base-T	Yes	Yes	Yes	Yes	Yes
IEEE 1588	Supported	Supported	Supported	Not Available	Supported
Supported Under vPro	Not Available	Not Available	Not Available	Not Available	Not Available

Intel® Ethernet Specifications

Card	Intel Ethernet SFP+ SR Optics Module	Intel Dual Band Wireless-AC 7260 ASM	Intel Winstorm Peak 8265 2x2 AC+BT 4.2 Vpro M.2 Combo
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Supplier PN	MM#: 941243	7260HMWDTX.R, MM# 936170	MM#: 946658
Data Rates Supported	Not Available	Intel Dual Band Wireless-AC 7260	Intel Dual Band Wireless-AC 8265
Controller Details	Not Available	Intel Dual Band Wireless-AC 7260, Dual Band, 2x2, WiFi+BT	Intel Dual Band Wireless-AC 8265, 2x2, WiFi+BT, MU- MIMO
Controller Bus Architecture	Not Available	PCIe M.2	PCIe M.2
Data Transfer Mode	Not Available	WiFi (802.11ac), 2.4GHz, 5GHz	WiFi (802.11ac), 2.4GHz, 5GHz
Power Consumption	Not Available	Not Available	Not Available
IEEE Standards Compliance	Not Available	IEEE 802.11abgn, 802.11ac, 802.11d, 802.11e, 802.11i, 802.11h, 802.11w	IEEE 802.11abgn, 802.11ac, 802.11d, 802.11e, 802.11i, 802.11h, 802.11w, 802.11r, 802.11k, 802.11v(pending)
Boot ROM Support	Not Available	Not Available	Not Available
Network Transfer Mode (Full/Half Duplex)	Not Available	Not Available	Not Available
Network Transfer Rate	Not Available	300/867Mbps	867Mbps
Operating System Driver Support	Not Available	Windows 10, 32-bit*, Windows 10, 64-bit*, Windows 8.1, 32-bit*, Windows 8.1, 64-bit*, Windows 8, 32-bit*, Windows 8, 64-bit*, Windows 7, 32-bit*, Windows 7, 64-bit*, Linux*	Windows 10, 64-bit*, Windows 8.1, 64-bit*, Windows 7, 32-bit*, Windows 7, 64-bit*, Linux*
Manageability	Not Available	Not Available	Not Available
Manageability Capabilities Alerting	Not Available	Not Available	Not Available
TDP	Not Available	Not Available	Not Available
Operating Temperature Range	Not Available	0°C to 80°C (32°F to 176°F)	0°C to 80°C (32°F to 176°F)
# of Ports	Not Available	Not Available	Not Available
Data Rate Per Port	Not Available	Not Available	Not Available
System Interface Type	Not Available	PCIe M.2	PCIe M.2
NC Sideband Interface	Not Available	Not Available	Not Available
Jumbo Frames Supported	Not Available	Not Available	Not Available
1000Base-T	Not Available	Not Available	Not Available
IEEE 1588	Not Available	Not Available	Not Available
Supported Under vPro	Not Available	Supported	Supported

Ethernet

Model	i210-T1	Dual Port	Dual Port	Dual Port	X710-DA2
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		Copper= I350-T2V2 Dual Port LC-Fiber= I350-F2	Copper= I350-T4 V2 Dual Port LC-Fiber= I350-F4	Copper= X540-T2	
Connector	RJ-45 Copper	2 x Ports RJ-45 Copper or 2 x ports LC-Fiber	4 x Ports RJ-45 Copper or 4 x Ports LC-Fiber	2 x Ports RJ-45 Copper	2 x SFPs Receptable
Website	i210 T1	i350 T2/F2	i350 T4/F4	x540 T2	x710 DA2
Auto-Negotiation	IEEE* 802.3* Auto-negotiaton	IEEE* 802.3* Auto-negotiaton	IEEE* 802.3* Auto-negotiaton	IEEE* 802.3* Auto-negotiaton	IEEE* 802.3* Auto-negotiaton
Intel® vPro™	Not Available	Not Available	Not Available	Not Available	Not Available
Intel® Standard Manageability	Supported	Supported	Supported	Supported	Supported
Power Optimizer Platform Low-power Management Systems	Supported	Supported	Supported	Supported	Supported
Energy Efficient Ethernet	Supported	Supported	Supported	Not Available	Supported
TCP/UDP Checksum and Segmentation Offload (IPv4 and IPv6)	Supported	Supported	Supported	Supported	Supported
Receive Side Scaling	Supported	Supported	Supported	Supported	Supported
Dual Tx and Rx Queues	Yes	Yes	Yes	Yes	Yes
Jumbo Frames (up to 9KB)	Supported	Supported	Supported	Not Available	Supported
Teaming	Not Available	Supported	Supported	Supported	Supported
Wake from Deep Sx	Supported	Supported	Supported	Not Available	Not Available
Server Operating System Support	Windows Server 2008, 2012, 2016, 2019 Linux (RHEL/SLES), Free BSD, Xen, Vmware	Windows Server 2008, 2012, 2016, 2019 Linux (RHEL/SLES), Free BSD, Xen, Vmware	Windows Server 2008, 2012, 2016, 2019 Linux (RHEL/SLES), Free BSD, Xen, Vmware	Windows Server 2003, 2008; RHEL 4, Linux/SLES 11, Vmware	Windows 2008, 2012; RHEL 6.5/7.0, FreeBSD 9/10, Vmware ESXi 5.x
Network Proxy/ARP Support	Supported	Supported	Supported	Supported	Supported

Ethernet

Model	AC 7260 NGW	AC 8265 NGW
Connector	2 x Antennas	2 x Antennas
Website	7260 NGW	8265 NGW
Auto-Negotiation	Not Available	Not Available
Intel® vPro™	Supported	Supported

Intel® Standard Manageability	Not Available	Not Available
Power Optimizer Platform Low-power Management Systems	Supported	Supported
Energy Efficient Ethernet	Not Available	Not Available
TCP/UDP Checksum and Segmentation Offload (IPv4 and IPv6)	Not Available	Not Available
Receive Side Scaling	Not Available	Not Available
Dual Tx and Rx Queues	Not Available	Not Available
Jumbo Frames (up to 9KB)	Not Available	Not Available
Teaming	Not Available	Not Available
Wake from Deep Sx	Not Available	Not Available
Server Operating System Support	Not Available	Not Available
Network Proxy/ARP Support	Not Available	Not Available

SECTION IV: BIOS / Certifications / Standards / Environmental

BIOS Specifications

WMI Support	Compliant With Microsoft WBEM and the DMTF Common Information Model
ROM-Based Setup Utility (F1)	System Configuration Setup Program (text only interface) Available at Power-on With F1 Key
Bootblock Recovery	Recovers System BIOS if the Flash ROM Becomes Corrupted
Replicated Setup	Saves System Configuration Settings to a File That Can Then be Used to Replicate the Settings to Other Systems
Boot Control	Boot Control Available Through ROM-based Setup Utility or With F12 Key at Power-on
Memory Change Alert	Power-on Error Message in the Event of a Decrease in System Memory
Thermal Alert	Power-on Error message in the Event of a Fan Failure
Asset Tag	Supports Ability to Set SMBIOS Type 2 Baseboard Asset Tag Field
System/Emergency ROM Flash Recovery with Video	Supports Process to Recover the System BIOS if the Flash ROM Becomes Corrupted
Remote Wakeup/Remote Shutdown	System Admin Can Power On/Off a Client Computer from a Remote Location to Provide Maintenance
Quick Resume Time	Supports Low Power S3 (suspend to RAM) and Prompt Resume Times
ROM Revision Level	System UEFI (BIOS) Version Reported in SMBIOS Type 0 Structure and

	in BIOS Setup
Keyboard-less Operation	System Can be Booted Without a Keyboard
Per-port Control	Allows I/O Ports to be Individually Enabled/Disabled Through ROM-based Setup or WMI Interface
Adaptive Cooling	Offers Multiple Settings for Fan Control Ranging Between Better Performance and Better Acoustics
Security	User and Administrator Passwords Can Protect Boot and ROM-based Setup <ul style="list-style-type: none"> - Support Electronic Lock - Chassis Intrusion Detection - UEFI Secure Boot Support - HDD Password Can Protect HDD Data - Windows UEFI Firmware Update Support - Device Guard Support - Optional Access Panel Lock, Kensington Lock, and Pad Lock
Intel(R) AMT (includes ASF 2.0)	Allows System to be Supported from a Remote Location
Intel(R) TXT	Intel(R) Trusted Execution Technology Provides a Security Foundation to Build Protections Against Software Based Attacks
Memory Modes	Supports Mirroring, Lock Step, and Sparing Memory Modes
Windows 10 Ready	Supports Windows 10 Requirements for Secure Flash, UEFI v 2.6 Device Guard Support Spec

Industry Standard Specification Support

UEFI	Unified Extensible Firmware Interface v2.7
ACPI (Advanced Configuration and power Management Interface)	Advanced Configuration and Power Interface v6.1
ASF 2.0	DMTF Alert Standard Format Specification v2.0
ATA (IDE)	AT Attachment 6 with Packet Interface (ATA/ATAPI-6)
CD Boot	EI Torito Bootable CD-Rom Format Specification, v1.0
EHCI	Enhanced Host Controller Interface for Universal Serial Bus, Revision v1.0
PCI	NA (No PCI slot)
PCI Express	PCI Express Base Specification v3.0
SATA	Serial ATA Revision 3.0 Specification
TPM	Trusted Computing Group TPM Specification v2.0
UHCI	Universal Host Controller Interface Design Guide, Revision v1.1
USB	Universal Serial Bus Revision v1.1 Universal Serial Bus v2.0 Universal Serial Bus v3.0
SMBIOS	DMTF System Management Spec v3.2.1
XHCI	XHCI SPEC Revision v1.2

Social and Environmental Responsibility

Quality Control	Lenovo is a member of an eco declaration system that enforces regular independent quality control
Hazardous Substances and Preparation	<ul style="list-style-type: none"> • Products do not contain more than; 0.1% lead, 0.01% cadmium, 0.1% mercury, 0.1% hexavalent chromium, 0.1% polybrominated biphenyls (PBB) or 0.1% polybrominated diphenyl ethers (PBDE). (See legal reference and Note B1) • Products do not contain Asbestos • Products do not contain Ozone Depleting Substances: Chlorofluorocarbons (CFC), hydrobromofluorocarbons (HBFC), hydrochlorofluorocarbons (HCFC), Halons, carbontetrachloride, 1,1,1-trichloroethane, methyl bromide • Products do not contain more than; 0.005% polychlorinated biphenyl (PCB), 0.005% polychlorinated terphenyl (PCT) in preparation • Products do not contain more than 0.1% short chain chloroparaffins (SCCP) with 10-13 carbon atoms in the chain containing at least 48% per mass of chlorine in the SCCP • Parts with direct and prolonged skin contact do not release nickel in concentrations above 0.5 microgram/cm²/week REACH Article 33 information about substances in articles is available at: http://www.lenovo.com/social_responsibility/us/en/ThinkGreen_products.html#environment
Batteries	Not Available
Safety, EMC Connection to the Telephone Network and Labeling	Not Applicable, no Connection to a Telephone Network

Acoustic Noise Emissions Declaration

Safety, EMC Connection to the Telephone Network and Labeling

System Software Manager	Lenovo ThinkStation Supports Software Management Tools by Lenovo Vantage
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Regulations & Standards

EMC & Safety	FCC DoC for North America VCCI Certification for Japan BSMI Certification for Taiwan EU/EFTA CE Mark & DoC UL/CUL(P920,P720,P520,P520c), cTUVus(P330) UL-GS(P920,P720,P520,P520c), TUV-GS(P330) IEC60950-1 CB Report/Certificate Saudi Arabia SASO Kuwait KUCAS China CCC Mark Hong Kong SAR (CB report) Singapore PSB South Africa SABS Russia-EAC Morocco-CM Mexico-NOM Kazakhstan-EAC Belarus-EAC
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Serbia KVALITET
 Ukraine UKrCEPRO
 India-BIS
 USA Chemical Emission Test

Environmentals

Energy Star	ENERGY STAR® v7.0
EPEAT	EPEAT Certification Available on Select Models
ErP Lot-3 2013	Yes
Hazardous Substances	<ul style="list-style-type: none"> • Products do not contain more than; 0.1% lead, 0.01% cadmium, 0.1% mercury, 0.1% hexavalent chromium, 0.1% polybrominated biphenyls (PBB) or 0.1% polybrominated diphenol ethers (PBDE) • Products do not contain Asbestos • Products do not contain Ozone Depleting Substances: Chlorofluorocarbons (CFC), hydrobromofluorocarbons (HBFC), hydrochlorofluorocarbons (HCFC), Halons, carbontetrachloride, 1,1,1-trichloroethane, methyl bromide • Products do not contain more than; 0.005% polychlorinated biphenyl (PCB), 0.005% polychlorinated terphenyl (PCT) in preparation • Products do not contain more than 0.1% short chain chloroparaffins (SCCP) with 10-13 carbon atoms in the chain containing at least 48% per mass of chlorine in the SCCP • Parts with direct and prolonged skin contact do not release nickel in concentrations above 0.5 microgram/cm₂/week