

Lenovo P5

Version: 3.0 | 07/18/2023

Downloads

Hardware Maintenance Manual	P5 HMM
Drivers & Software	P5 Drivers & Software
Available Whitepapers	Power Configurator Memory Configurator Storage Configurator Windows 11 Installation Windows 10 Installation Red Hat Enterprise Linux 9 Installation Ubuntu Linux 22.04 LTS Installation

SECTION I: Platform Overview

Description	Engineered for ultimate versatility, the Lenovo ThinkStation P5 is the all-around industry workhorse for professionals that demand scalable, future-proof solutions. Featuring an all-new Aston Martin inspired chassis design, the latest Intel® Xeon® W processors, and support for up to two NVIDIA RTX™ A6000 graphics cards, you can rely on the P5 to pack enough punch for any workflow, even in mission-critical environments.
-------------	--

CPU

Processor Support	4th Generation Intel Xeon Scalable Processors
Socket Type	Socket-E (LGA-4677)
Disclaimers	

Operating Systems

Preloaded	Windows 11 Pro 64-bit for Workstation Windows 10 Pro 64-bit for Workstation Windows 10 IOT Ubuntu 22.04 LTS (configuration specific)
Supported	Windows 10 Enterprise Edition Red Hat Enterprise Linux 9.x Ubuntu 22.04 LTS
Disclaimers	

Memory

Slots	Up to 8 DIMMS
Channels	Processor Supports up to 8 DIMMs, 4 Channels
Type	DDR5, 288-Pin, ECC RDIMM
ECC Support	Yes
Speed	Up to 4800MHz
Max DIMM Size	64GB DDR5 ECC RDIMM
Max System Memory	512GB
Disclaimers	*Memory speed is dependent on the CPU

Storage

Total Bays/Size	3
SATA	3 x SATA 3.0 Connectors
PCIe (M.2)	2 x M.2 NVMe 2280/22110 PCIe Connectors Onboard Up to 1 x M.2 NVMe 2280 Flex Bay Drive
Disclaimers	*See Storage Whitepaper for details on the available usage options.

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
Disclaimers	

Slots

Slot 1	PCIe 5.0 x16, Full Height, Full Length, 75W
Slot 2	PCIe 4.0 x4, Full Height, Full Length, 25W, Open Ended
Slot 3	PCIe 5.0 x16, Full Height, Full Length, 75W
Slot 4	PCIe 4.0 x4, Full Height, Full Length, 25W, Open Ended
Slot 5	PCIe 4.0 x8, Full Height, Full Length, 25W, Open Ended
Slot 6	PCIe 4.0 x4, Full Height, Full Length, 25W, Open Ended
Disclaimers	

Front I/O

USB	1 x USB-A 3.2 Gen 2 (10Gbps) 1 x USB-A 3.2 Gen 2 (10Gbps) (with Always On Charging) 2 x USB-C 3.2 Gen 2 (10Gbps)
Audio	1 x 3.5mm Global Headset Jack (Headphone + Mic in)
Media Card Reader	15-in-1 Media Card Reader
Flex Bay	Front access drive bay
Disclaimers	Note: Actual USB throughout will vary depending on the type and quantity of USB devices used.

Rear I/O

USB	2 x USB-A 2.0 (480Mbps) 4 x USB-A 3.2 Gen 1 (10Gbps) 1 x USB-C 3.2 Gen 2x2 (20Gbps)
Audio	2 x Rear (Line Out, Line In retasked as Mic)
DisplayPort	As Supported by GPU
HDMI	As Supported by GPU
Serial Port	Optional 1x Rear Port
Ethernet	1 x 1GbE - RJ45
PS/2	Optional PS/2 (2 port) PCIe adapter
Optional Network Adapter	Bitland RTL8168H 1000M PCIe Ethernet Adapter Intel I210-T1 Single Port Gigabit PCIe Ethernet Adapter Intel I350-T2 Dual Port Gigabit PCIe Ethernet Adapter Intel I350-T4 Quad Port Gigabit PCIe Ethernet Adapter Intel AX211 WIFI (via onboard M.2) with Internal Antennas
Disclaimers	Note: Actual USB throughout will vary depending on the type and quantity of USB devices used.

Ethernet

Vendor	Intel 1GbE I219 (Vpro, AMT)
Speeds	10/100/1000Mbps
Functions	PXE, ASF, WOL, Jumbo Frames, Teaming
Connectors	1 x RJ45
Disclaimers	Note: Network speeds listed are theoretical.

Audio

Vendor	Realtek
Type	HD (2.0)
Internal Speaker	1 x 1.5 watt 4 ohm
Connectors	2 x Rear 3.5mm Jacks (Line Out, Line In retasked as Mic) 1 x Front 3.5mm Global Headset Jack (Headphone + Mic in)
Chipset	Realtek ALC897Q (rear) Realtec ALC4032 (front)
Number of Channels	Rear Audio: 2 Channels Front Audio: 2 Channels
Number of Bits/Audio Resolution	Rear Codec: 10 Channel DAC Supports 16/20/24-bit PCM 2 Stereo ADC Supports 16/20/24-bit PCM Front Codec: One stereo DAC supports 8/16/22.05/24/32/44.1/48/96/176.4/192KHz Sample Rate, 16/24-bit One stereo ADC supports 8/16/22.05/24/32/44.1/48/96KHz Sample Rate, 16/24-bit
Disclaimers	*Note: Audio Codec ALC897Q can support 7.1 channel, but motherboard only has 2 rear jacks – MIC in and Line out, only 2 channel for Line out.

Thermal

Temp Sensors	Ambient Cabled Sensor – Thermistor, MB Header cabled to chassis front bezel PCIe Zone 1 Sensor – Thermistor PCIe Zone 2 Sensor – Thermistor PCIe Zone 3 Sensor – Thermistor M.2 Zone 1 Sensor – Thermistor M.2 Zone 2 Sensor – Thermistor VCORE Thermal Sensor – Thermistor HDD Bay – Thermistor Flex Bay Sensor – 1 I2C Temp Sensor, placed at Flex Bay
Fans	1 x Front Fan (FRONT_FAN) – 4-pin header with 3-pin key 1 x Rear Fan (REAR_FAN) – 4-pin header with 3-pin key 1 x CPU 1 Fan (CPU_FAN) – 4-pin header with 3-pin key 2 x DDR5 Fan (DUCT_FANX) – 4-pin header with 3-pin key 1 x HDD Optional Fan (HDD_FAN) – 4-pin header with 3-pin key 1 x Flex Bay Optional Fan (FLEX_BAY_FAN) – 4-pin header with 4-pin key PSU1 Fans – provided by PSU vendor

Power Specifications

Power Supply	750 watts / 1000 watts
Power Efficiency	92% Efficient @ 50% Load
Main	C14 socket to std C13 line cord
Operating Voltage Range	100 - 240V (autosensing)
Rated Voltage Range	90-264VAC
Rated Line Frequency	47Hz / 63Hz
Operating Line Frequency Range	50Hz / 60Hz
Rated Input Current	750W 10A 1000W 6A-12A
Graphics	Up to 4 x 8-pin (6+2) PCIe*
Power Supply Fan	Yes
ENERGY STAR® Qualified (config dependent)	Yes
80 PLUS Compliant	Yes
Built-in Self Test (BIST) LED	Yes
Disclaimers	*Quantity of Graphics power cables is configuration dependent *See Power Configuration Whitepaper for additional details.

BIOS

Vendor	AMI
Disclaimers	

Chassis Information

Color	Storm Gray
PSU	Standard: 750W, Autosensing, 92% PSU, 80 PLUS Platinum Qualified Optional: 1000W, Autosensing, 92% PSU, 80 PLUS Platinum Qualified
Thermal Solutions	1 Rear Fan 1 Front Fan 1 CPU Fan 1 Fan HDD Bay (Optional) 1 Fan Flex Bay (Optional) 2 Memory Fans 2 PSU Fans
Dimensions	440mm/17.3" H (without feet) 446mm/17.6" H (with feet)

	453.9mm/17.9" D 165mm/6.5" W
Weight	19kg /41.9lbs
Disclaimers	

Packaging Dimensions

Height (mm/in)	600mm / 23.62"
Width (mm/in)	295mm / 11.61"
Depth (mm)	571mm / 22.48"
Weight (kgs/lbs)	21.5kg /47.4lbs
Disclaimers	

Security & Serviceability

TPM	Infineon SPI TPM SLB9672 TPM 2.0
Asset ID	Yes, 1024 x 8bit
vPro	Yes
Cable Lock Support	Yes, Optional Kensington Cable Lock
Serial, Parallel, USB, Audio, Network, Enable/Disable Port Control	Yes
Power-On Password	Yes
Setup Password	Yes
NIC LEDs (integrated)	Yes
Access Panel Key Lock	Common or Random Key Lock Kit - Optional
Boot Sequence Control	Yes
Padlock Support	Yes
Boot Without Keyboard and/or Mouse	Yes
Access Panel	Tool-less Side Cover Removal
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 Phillips Head Screws

Restore CD/DVD/USB Set	Not Included, Restore Media Available via Lenovo Download Recovery Service or available through Lenovo Support.
Disclaimers	*Note: CPU Heatsink assembly requires a T30 bit.

Operating Environment

Air Temperature	Operating: 10 ⁰ C to 35 ⁰ C (50 ⁰ F to 95 ⁰ F)
Storage	Storage: -40 ⁰ C to 60 ⁰ C (-40 ⁰ F to 140 ⁰ F) in Original Shipping Carton Storage: -10 ⁰ C to 60 ⁰ C (14 ⁰ F to 140 ⁰ 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 ⁰ C (77 ⁰ F) max Wet Bulb Temperature Non-operating: 40 ⁰ C (104 ⁰ F) max
Altitude	Upper limits decrease 1°C (1.8°F) per 300 m (1000 ft) above sea level
Vibration	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	Operating: X,Y axis: +- 15G/3ms Z axis: +- 30G/3ms Operating (Rack mounted): X,Y,Z axis: +- 15G/3ms Non-operating target: Trapezoidal shock, 35g average, 11ms
Disclaimers	

SECTION II: Platform Detail

Board Size	11.94" x 9.88" (303.3mm x 251mm)
Layout	Lenovo Custom Extended ATX
Disclaimers	

Motherboard Core

Processor Support	Intel(R) – Xeon(R) W-2400 Series Processors
Socket Type	Socket E (LGA 4677)
Memory Support	Max 8 DDR5 RDIMMs up to 4800MHz
Voltage Regulator	Intel VR14.0 – 250W TDP Capable
Chipset (PCH)	Intel Alder Lake S PCH W790
Flash	2 x 64Mb
Super I/O	One MEC1723 (176pin)

Clock	External Clock
Audio	Rear Codec: Realtek ALC897Q (Rear I/O) Front Codec: Realtek ALC4032 (FPIO)
Ethernet	Intel 1Gb I219
Disclaimers	

Supported Components

Processor Level	Intel(R) – Xeon(R) W-2400 Series Processors
Processor	Intel Xeon W7-2495X Intel Xeon W7-2475X Intel Xeon W5-2465X Intel Xeon W5-2455X Intel Xeon W5-2445 Intel Xeon W3-2435 Intel Xeon W3-2425 Intel Xeon W3-2423
Memory Type	RDIMMs – 4800MHz, CPU Dependent
Memory	16GB DDR5 ECC RDIMM PC5-4800 32GB DDR5 ECC RDIMM PC5-4800 64GB DDR5 ECC RDIMM PC5-4800
Disclaimers	Additional CPU SKUs Certified

Storage

3.5" SATA Hard Disk Drive (HDD)	2TB SATA – 7200rpm, 6Gb/s, 3.5" 6TB SATA – 7200rpm, 6Gb/s, Enterprise, 3.5" 12TB SATA – 7200rpm, 6Gb/s, Enterprise, 3.5"
2.5" SAS Hard Disk Drive (HDD)	
2.5" SATA Hard Disk Drive (HDD)	
2.5" SATA Solid State Drive (SSD)	
M.2 PCIe Solid State Drive (SSD)	512GB M.2 PCIe – SSD, 2280, Gen4 (x4), NVMe, TLC, OPAL2.0 1024GB M.2 PCIe – SSD, 2280, Gen4 (x4), NVMe, TLC, OPAL2.0 2048GB M.2 PCIe – SSD, 2280, Gen4 (x4), NVMe, TLC, OPAL2.0 4096GB M.2 PCIe – SSD, 2280, Gen4 (x4), NVMe, TLC, OPAL2.0
U.2 PCIe Solid State Drive (SSD)	
PCIe Add-in-Card Solid State Drive (SSD)	
Intel Optane Storage Technology	
Disclaimers	Additional Storage Devices Certified

RAID

RAID Requirements	M.2 and SATA RAID via Intel VROC Controller
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	
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
Disclaimers	*NOTE: Some features available after launch

Optical Drive/Removable Media

Disclaimers	
-------------	--

Keyboard and Pointing Devices

Keyboard	USB Traditional Keyboard PS/2 Traditional Keyboard Smart Card Keyboard USB Calliope Keyboard
Pointing Devices	USB Fingerprint Mouse USB Calliope Mouse PS/2 Black Optical Mouse
Disclaimers	

Expansion Bays

5.25" External Access Bays	Front access drive bay
Disclaimers	

PCIe Adapters

Network	Bitland RTL8168H 1000M PCIE Ethernet 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 Intel X550-T2 Dual Port Copper 10Gb Ethernet Adapter Intel X710-DA2 Dual Port 10G Ethernet Converged Network Adapter
Thunderbolt	

USB	
WiFi Cards	Intel PCIe WiFi Card With BT Internal Antenna Kit (AX211)
PS/2	PS/2 (2 Port) PCIe adapter
Com port	Serial COM port cable with 5V transceiver
PCIe to M.2 Adapter Card	ThinkStation Quad AIC Gen 3 M.2 Adapter
Disclaimers	Note: The Intel X710 requires SFP+ modules for operation

SECTION III: Supported Component Detail

CPU Specifications

CPU	Intel Xeon Platinum 8280	Intel Xeon Platinum 8160T	Intel Xeon Gold 6254	Intel Xeon Gold 6154	Intel Xeon Gold 6242	Intel Xeon Gold 6142	Intel Xeon Gold 6136	Intel Xeon Gold 6238T	Intel Xeon Gold 6234	Intel Xeon Gold 6134	Intel Xeon Gold 6230	Intel Xeon Gold 6128	Intel Xeon Gold 5222	Intel Xeon Gold 5122	Intel Xeon Gold 5120T	Intel Xeon Gold 5218	Intel Xeon Gold 5118	Intel Xeon Gold 5115	Intel Xeon Silver 4216	Intel Xeon Silver 4116	Intel Xeon Silver 4215	Intel Xeon Silver 4115
# of Cores	28	24	18	18	16	16	12	22	8	8	20	6	4	4	14	16	12	10	16	12	10	8
# of Threads	56	48	36	36	32	32	24	44	16	16	40	12	8	8	28	32	24	20	32	24	16	20
Processor Base Frequency	2.7 GHz	2.1 GHz	3.1 GHz	3 GHz	2.8 GHz	2.6 GHz	3 GHz	1.9 GHz	3.3 GHz	3.2 GHz	2.1 GHz	3.4 GHz	3.8 GHz	3.6 GHz	2.2 GHz	2.3 GHz	2.3 GHz	2.4 GHz	2.1 GHz	2.1 GHz	2.5 GHz	2.2 GHz
Max Turbo Frequency	4 GHz	3.7 GHz	4 GHz	3.7 GHz	3.9 GHz	3.7 GHz	3.7 GHz	3.7 GHz	4 GHz	3.7 GHz	3.9 GHz	3.7 GHz	3.9 GHz	3.7 GHz	3.2 GHz	3.9 GHz	3.2 GHz	3.2 GHz	3.2 GHz	3 GHz	3.5 GHz	3.2 GHz

Cache	38.5 MB	33 MB L3	24.75 MB	24.75 MB L3	22 MB	22 MB L3	24.75 MB L3	30.25 MB	24.75 MB	24.75 MB L3	27.5 MB	19.25 MB L3	16.5 MB	16.5 MB L3	19.25 MB L3	22 MB	16.5 MB L3	13.75 MB L3	22 MB	16.5 MB L3	1
TDP	205 W	150 W	200 W	200 W	150 W	150 W	150 W	125 W	130 W	130 W	125 W	115 W	105 W	105 W	105 W	125 W	105 W	85 W			
Intel ARK Spec Link	Intel Xeon PLATINUM 8280	Intel Xeon PLATINUM 8160T	Intel Xeon GOLD 6254	Intel Xeon GOLD 6154	Intel Xeon GOLD 6242	Intel Xeon GOLD 6142	Intel Xeon GOLD 6136	Intel Xeon GOLD 6238T	Intel Xeon GOLD 6234	Intel Xeon GOLD 6134	Intel Xeon GOLD 6230	Intel Xeon GOLD 6128	Intel Xeon GOLD 5222	Intel Xeon GOLD 5122	Intel Xeon GOLD 5120T	Intel Xeon GOLD 5218	Intel Xeon GOLD 5118	Intel Xeon SILVER 4216	Intel Xeon SILVER 4116	Intel Xeon SILVER 4215	
Disclaimers																					

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"	6TB SATA - 7200rpm, 6Gb/s, 3.5"
3.5" SATA Hard Disk Drive (HDD)	Not Available	Yes	Yes	Yes	Yes
2.5" SATA Hard Disk Drive (HDD)	Yes	Not Available	Not Available	Not Available	Not Available
Connector	SATA	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	Sustained data transfer rate 216 - 226MB/s
Spindle Speed (RPM)	7,200	7,200	7,200	7,200	7,200
DC Power to Drive Ready (sec)	3.5	<10.0	<17.0	<17.0	<17.0
Average Latency (msec)	4.2	4.16	4.16	4.16	4.16
Input (VDC)	5	5	5	5	5
Typical (Watts)	1.9	6.19	6.7	7.35	8.13
Idle (Watts)	0.7	4.6	4.5	5.45	6.21

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	101.85mm x 147mm x 26.1mm
Weight (grams)	90	420	535	680	705
Operating (C) Ambient	0 to 60	0 to 60	0 to 60	5 to 60	5 to 60
Operating (C) Base Casting	60	60	60	60	60
Non-Operating (C) Ambient	(-40 to 70)	(-40 to 70)	(-40 to 70)	(-40 to 70)	(-40 to 70)
Gradient (C per Hour)	20	20	20	20	20
Operating (Gs @ 2ms)	400	70	80	Read 70 Gs / Write 40 Gs	Read 70 Gs / Write 40 Gs
Non-Operating (Gs @ 2ms)	1000	350	300	300	250
Disclaimers					

Solid State Storage Specifications

Drive	256GB 2.5" SATA SSD	512GB 2.5" SATA SSD	1TB 2.5" SATA SSD	2TB 2.5" SATA SSD	256GB NVM e M.2 SSD TLC	512GB NVM e M.2 SSD TLC	1024GB NVM e M.2 SSD TLC	2048GB NVM e M.2 SSD TLC	480GB AIC Optane™ SSD	1.5TB U.2 Optane™ SSD
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	70 x 100 x 7.0	22 x 80 x 2.3	22 x 80 x 2.3	22 x 80 x 2.3	22 x 80 x 2.3	20 x 168 x 104	70 x 100 x 15
Interface Type	SATA -III	SATA -III	SATA -III	SATA -III	PCIe Gen 3.0 x4 NVM e	PCIe Gen 3.0 x4 NVM e	PCIe Gen 3.0 x4 NVM e	PCIe Gen 3.0 x4 NVM e	PCIe Gen 3.0 x4 NVM e	PCIe Gen 3.0 x4 NVM e
Power Active (AVG)	1.8W	1.9W	2.2W	6W	5W	5W	5W	5W	18W	18W
Power Idle	50mW	50mW	50mW	50mW	50mW	50mW	50mW	50mW	7W	7W
Typical Sequential Read	540 MB/s	540 MB/s	540 MB/s	530 MB/s	300 OMB /s	3200 MB/s	3200 MB/s	3500 MB/s	2700 MB/s	2700 MB/s
Typical Sequential Write	500 MB/s	500 MB/s	500 MB/s	500 MB/s	1300 MB/s	1600 MB/s	1600 MB/s	300 OMB /s	2200 MB/s	2200 MB/s
Operating Temperature Range	0 to 55°C	0 to 55°C	0 to 55°C	0 to 55°C	0 to 55°C	0 to 55°C	0 to 55°C	0 to 55°C	0 to 85°C	0 to 85°C
Endurance Rating (Lifetime Writes)	85TB	150TB	300TB	600TB	85TB	150TB	300TB	600TB	8.76 PB	27.3PB
Mean Time Between Failures (MTBF)	2.0M POH	2.0M POH	2.0M POH	2.0M POH	2.0M POH	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	AES 256 bit	AES 256 bit	AES 256 bit	No	No
Disclaimers	SSD performance measured with Crystal Disk Mark version									

	6.0.2 with the default 1000 MB data set. Sequential measurements are with 1 Thread, Queue-Depth 32. Random measurements are with 4 threads and queue-depth 32.		
--	--	--	--

HDD Controllers

PCI Bus	PCH Integrated
PCI Modes	SATA 3.0
RAID Levels	0/1/5/10
Data Transfer Rates	6Gb/s
Internal Connectors	2 x MiniSAS HD (2 ports each) + 3 x SATA
Disclaimers	

Optical Drive Specifications

Relative Humidity	
Maximum Wet Bulb Temperature	
Disclaimers	

Integrated Graphics Adapter

Disclaimers	
-------------	--

Discrete Graphics Adapter

Adapter	Qu ad ro P4 00	Qu ad ro P6 20	Qu ad ro P1 00 0	Qu ad ro P2 20 0	T4 00	T6 00	T1 00 0	Qu ad ro RT X 40 00	Qu ad ro RT X 50 00	Qu ad ro RT X 60 00	Qu ad ro RT X 80 00	RT X A4 00 0	RT X A5 00 0	RT X A6 00 0	Qu ad ro GV 10 0
Bus Interface	PC le 3. 0 x1 6	PC le 3. 0 x1 6	PC le 3. 0 x1 6	PC le 3. 0 x1 6	PC le 3. 0 x1 6	PC le 3. 0 x1 6	PC le 3. 0 x1 6	PC le 3. 0 x1 6	PC le 3. 0 x1 6	PC le 3. 0 x1 6	PC le 3. 0 x1 6	PC le 4. 0 x1 6	PC le 4. 0 x1 6	PC le 4. 0 x1 6	PC le 3. 0 x1 6

Display Interface	3 x m DP 1.4	4 x m DP 1.4	4 x m DP 1.4	4 x DP 1.4	3 x m DP 1.4	4 x m DP 1.4	4 x m DP 1.4	3 x DP 1.4 1 x VirtualLink	4 x DP 1.4 1 x VirtualLink	4 x DP 1.4 1 x VirtualLink	4 x DP 1.4 1 x VirtualLink	4 x DP 1.4 a	4 x DP 1.4 a	4 x DP 1.4 a	4 x DP 1.4
Graphics Chipset	Pascal	Pascal	Pascal	Pascal	Turing	Turing	Turing	Turing	Turing	Turing	Turing	Amperre	Amperre	Amperre	Volta
Memory Clock Frequency (MHz)	1003 MHz	1252 MHz	1253 MHz	1251 MHz	1625 MHz	1750 MHz	1750 MHz	1750 MHz	1750 MHz	2000 MHz	858 MHz				
Memory Size	2GB GDDR5	2GB GDDR5	4GB GDDR5	5GB GDDR5X	2GB GDDR6	4GB GDDR6	4GB GDDR6	8GB GDDR6	16GB GDDR6	24GB GDDR6	48GB GDDR6	16GB GDDR6	24GB GDDR6	48GB GDDR6	32GB HBM2
Memory Interface	64-bit	128-bit	128-bit	160-bit	64-bit	128-bit	128-bit	256-bit	256-bit	384-bit	384-bit	256-bit	384-bit	384-bit	4096-bit
Memory Bandwidth	Up to 32 GB/s	Up to 80 GB/s	Up to 82 GB/s	Up to 20 GB/s	80 GB/s	160 GB/s	160 GB/s	Up to 416 GB/s	Up to 448 GB/s	Up to 672 GB/s	Up to 672 GB/s	448 GB/s	Up to 768 GB/s	Up to 768 GB/s	Up to 870 GB/s
GPU Cores	CUDA Cores : 256	CUDA Cores : 512	CUDA Cores : 640	CUDA Cores : 1280	CUDA Cores : 384	CUDA Cores : 640	CUDA Cores : 896	CUDA Cores : 2304 Tensor Cores : 288 RT Cores : 36	CUDA Cores : 3072 Tensor Cores : 384 RT Cores : 48	CUDA Cores : 4608 Tensor Cores : 576 RT Cores : 72	CUDA Cores : 4608 Tensor Cores : 576 RT Cores : 72	CUDA Cores : 6411 Tensor Cores : 192 RT Cores : 48	CUDA Cores : 8,192 Tensor Cores : 256 RT Cores : 64	CUDA Cores : 10,752 Tensor Cores : 336 RT Cores : 84	CUDA Cores : 5120 Tensor Cores : 640
GPU Core Frequency (MHz)	1228MHz	1266MHz	1266MHz	1266MHz	1000 MHz	1005 MHz	1005 MHz	1620 MHz	1440 MHz	1440 MHz	1395MHz	1132MHz			
Maximum Power Consumption	30 W	40 W	47 W	75 W	30 W	40 W	50 W	Total board power: 160 W To	Total board power: 265 W To	Total board power: 295 W To	Total board power: 295 W To	140 W	230 W	300 W	250 W

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	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
Supplier PN	I210T1, MM# 941033	I350T2 G1P20, MM# 928941	I350T4 G1P20, MM# 928942	MM#9 28955	MM# 952103	MM#: 941243	7260H MWDTX.R, MM# 936170	MM#: 946658
Data Rates Supported	10/100/1000 Mbps copper	10/100/1000 Mbps (Copper), 1000Mbps (Fiber)	10/100/1000 Mbps (Copper), 1000Mbps (Fiber)	100/1000Mbps and 10Gbps Copper	1GbE/10GbE Optical fiber 10GbE Direct Attach (DAC)	Not Available	Intel Dual Band Wireless-AC 7260	Intel Dual Band Wireless-AC 8265
Controller Details	Intel® Ethernet Controller I210	Intel Ethernet Controller I350	Intel Ethernet Controller I351	Intel Ethernet Controller X540	Intel Ethernet Controller X710-AM2	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	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)	Not Available	PCIe M.2	PCIe M.2
Data Transfer Mode	Ethernet	Ethernet	Ethernet	Ethernet	Ethernet	Not Available	WiFi (802.11ac), 2.4GHz, 5GHz	WiFi (802.11ac), 2.4GHz, 5GHz
Power Consumption	0.81W	Copper: I350-T2 V2= 4.4W Fiber: I350-F2= 5.5W	Copper: I350T4 V2= 5W Fiber: I350F4 = 6W	X540-T2: 10Gps= 17.4W 1Gbps= 9.5W 100Mbps= 6.6W X540-T1: 10Gbps= 10.8W 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-SR= 4.3W typ/4.8W max	Not Available	Not Available	Not Available

					SE-LR= 4.5W typ/ 5.1W max Dual-port Direct Attach (Twina x)= 3.3W typ/3.7 W max			
IEEE Standards Compliance	IEEE 802.3/10BASE-T, 100BASE-TX, 1000BASE-T	IEEE 802.3/10BASE-T, 100BASE-TX, 1000BASE-T	IEEE 802.3/10BASE-T, 100BASE-TX, 1000BASE-T	IEEE 802.3 100/1000/10GBASE-T	IEEE 802.3 1/10/10GBASE-SR/LR, SFF-8431 10GSFP+DAC	Not Available	IEEE 802.11a bgn, 802.11ac, 802.11d, 802.11e, 802.11i, 802.11h, 802.11w	IEEE 802.11a bgn, 802.11ac, 802.11d, 802.11e, 802.11i, 802.11h, 802.11w, 802.11r, 802.11k, 802.11v (pending)
Boot ROM Support	PXE boot, Intel iSCSI Remote Boot for Windows, Linux and VMware, Intel BootAgent Software via PXE or BootP, WDMS or UEFI	PXE boot, Intel iSCSI Remote Boot for Windows, Linux and VMware, Intel BootAgent Software via PXE or BootP, WDMS or UEFI	PXE boot, Intel iSCSI Remote Boot for Windows, Linux and VMware, Intel BootAgent Software via PXE or BootP, WDMS or UEFI	PXE boot, Intel iSCSI Remote Boot for Windows, Linux and VMware, Intel BootAgent Software via PXE or BootP, WDMS or UEFI	PXE boot, Intel iSCSI Remote Boot for Windows, Linux and VMware, Intel BootAgent Software via PXE or BootP, WDMS or UEFI	Not Available	Not Available	Not Available
Network Transfer Mode (Full/Half Duplex)	Supported	Supported	Supported	Supported	Supported	Not Available	Not Available	Not Available
Network Transfer Rate	1,000Mbps Full Duplex	1,000Mbps Full Duplex	1,000Mbps Full Duplex	1,000Mbps Full Duplex	1,000Mbps Full Duplex	Not Available	300/867Mbps	867Mbps
Operating System Driver Support	Windows 7/8/10, Linux, FreeBSD, XEN, VMware	Windows 7/8/10, Linux, FreeBSD, XEN, VMware	Windows 7/8/10, Linux, FreeBSD, XEN, VMware	Windows 7/8/10, Linux, Windows Server Linux,	Windows 2008, 2012; RHEL 6.5/7.0, FreeBSD 9/10,	Not Available	Windows 10, 32-bit*, Windows 10, 64-bit*, Windows	Windows 10, 64-bit*, Windows 8.1, 64-bit*,

				FreeBS D	Vmwar e ESXi 5.x		ws 8.1, 32-bit*, Windo ws 8.1, 64- bit*, Windo ws 8, 32-bit*, Windo ws 8, 64- bit*, Windo ws 7, 32-bit*, Windo ws 7, 64- bit*, Linux*	Windo ws 7, 32-bit*, Windo ws 7, 64- bit*, Linux*
Manageability	Support ed	Support ed	Support ed	Support ed	Support ed	Not Availab le	Not Availab le	Not Availab le
Manageability Capabilities Alerting	Support ed	Support ed	Support ed	Support ed	Support ed	Not Availab le	Not Availab le	Not Availab le
TDP	Firmw are Based Therm al Manag ement	Firmw are Based Therm al Manag ement	Firmw are Based Therm al Manag ement	Firmw are Based Therm al Manag ement	Not Availab le	Not Availab le	Not Availab le	Not Availab le
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)	Not Availab le	0°C to 80°C (32°F to 176°F)	0°C to 80°C (32°F to 176°F)
# of Ports	1	2	4	2	2	Not Availab le	Not Availab le	Not Availab le
Data Rate Per Port	10/100 /1000 Mbps (coppe r)	10/100 /1000 Mbps (coppe r), 1000M bps (fiber)	10/100 /1000 Mbps (coppe r), 1000M bps (fiber)	100/1,0 00Mbps , 10Gbp s	1Gbps, 10Gbp s	Not Availab le	Not Availab le	Not Availab le
System Interface Type	PCIe Gen 2.1	PCIe Gen 2.1	PCIe Gen 2.1	PCIe Gen 2.1	PCIe 3.0	Not Availab le	PCIe M.2	PCIe M.2
NC Sideband Interface	Not Availab le	Not Availab le	Not Availab le	Not Availab le	Yes	Not Availab le	Not Availab le	Not Availab le
Jumbo Frames Supported	Yes	Yes	Yes	Yes	Yes	Not Availab le	Not Availab le	Not Availab le
1000Base-T	Yes	Yes	Yes	Yes	Not Availab le	Not Availab le	Not Availab le	Not Availab le
IEEE 1588	Support ed	Support ed	Support ed	Not Availab	Support ed	Not Availab	Not Availab	Not Availab

				le		le	le	le
Supported Under vPro	Not Available	Not Available	Not Available	Not Available	Not Available	Not Available	Supported	Supported
Disclaimers								

Ethernet

Model	i210-T1	Dual Port Copper = I350-T2V2 Dual Port LC-Fiber= I350-F2	Dual Port Copper = I350-T4 V2 Dual Port LC-Fiber= I350-F4	Dual Port Copper = X540-T2	X710-DA2	AC 7260 NGW	AC 8265 NGW
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 Receptacle	2 x Antennas	2 x Antennas
Website	i210 T1	i350 T2/F2	i350 T4/F4	x540 T2	x710 DA2	7260 NGW	8265 NGW
Auto-Negotiation	IEEE* 802.3* Auto-negotiation	IEEE* 802.3* Auto-negotiation	IEEE* 802.3* Auto-negotiation	IEEE* 802.3* Auto-negotiation	IEEE* 802.3* Auto-negotiation	Not Available	Not Available
Intel® vPro™	Not Available	Not Available	Not Available	Not Available	Not Available	Supported	Supported
Intel® Standard Manageability	Supported	Supported	Supported	Supported	Supported	Not Available	Not Available
Power Optimizer Platform Low-power Management Systems	Supported	Supported	Supported	Supported	Supported	Supported	Supported
Energy Efficient Ethernet	Supported	Supported	Supported	Not Available	Supported	Not Available	Not Available
TCP/UDP Checksum and Segmentation Offload (IPv4 and IPv6)	Supported	Supported	Supported	Supported	Supported	Not Available	Not Available
Receive Side Scaling	Supported	Supported	Supported	Supported	Supported	Not Available	Not Available
Dual Tx and Rx Queues	Yes	Yes	Yes	Yes	Yes	Not Available	Not Available
Jumbo Frames (up to 9KB)	Supported	Supported	Supported	Not Available	Supported	Not Available	Not Available
Teaming	Supported	Supported	Supported	Supported	Supported	Not Available	Not Available

						e	e
Wake from Deep Sx	Support ed	Support ed	Support ed	Not Availabl e	Not Availabl e	Not Availabl e	Not Availabl e
Server Operating System Support	Window s Server 2008, 2012, 2016. 2019 Linux (RHEL/ SLES), Free BSD, Xen, Vmware	Window s Server 2008, 2012, 2016. 2019 Linux (RHEL/ SLES), Free BSD, Xen, Vmware	Window s Server 2008, 2012, 2016. 2019 Linux (RHEL/ SLES), Free BSD, Xen, Vmware	Window s Server 2003, 2008; RHEL 4, Linux/S LES 11, Vmware	Window s 2008, 2012; RHEL 6.5/7.0, FreeBS D 9/10, Vmware ESXi 5.x	Not Availabl e	Not Availabl e
Network Proxy/ARP Support	Support ed	Support ed	Support ed	Support ed	Support ed	Not Availabl e	Not Availabl e
Disclaimers							
Media Card Reader							
Description	9-in-1 (USB 2.0)						
Disclaimers							

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 - 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	• 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
-------------------------	--

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
Serbia KVALITET
Ukraine UKrCEPRO
India-BIS
USA Chemical Emission Test

Environmentals

Energy Star	ENERGY STAR® v7.0
EPEAT	EPEAT® Silver Certification Available on Select Models
Greenguard	Greenguard
RoHS	RoHS Compliant
ErP Lot-3 2013	Yes
Hazardous Substances	• 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
TCO Certification	9.0
Disclaimers	EPEAT registered where applicable. EPEAT registration varies by country. See www.epeat.net for registration status by country.