THINKSTATION P320 TOWER & SFF

SD Card Slot
Power Button
Audio/Mic Jack
2x USB3.0 Ports

VGA Connector
Serial Connector

2x Display Ports

4x USB3.0 Ports
2x USB2.0 Ports
Ethernet Port
Audio Ports

PCI-E Slots

Power Button

2x USB3.0 Ports
Audio/Mic Jack

SD Card Slot

VGA Connector
Serial Connector

2x Display Ports

4x USB3.0 Ports
2x USB2.0 Ports
1Gb Ethernet Port
Audio Ports

PCI-E Slots

Section I: System Overview
System Overview

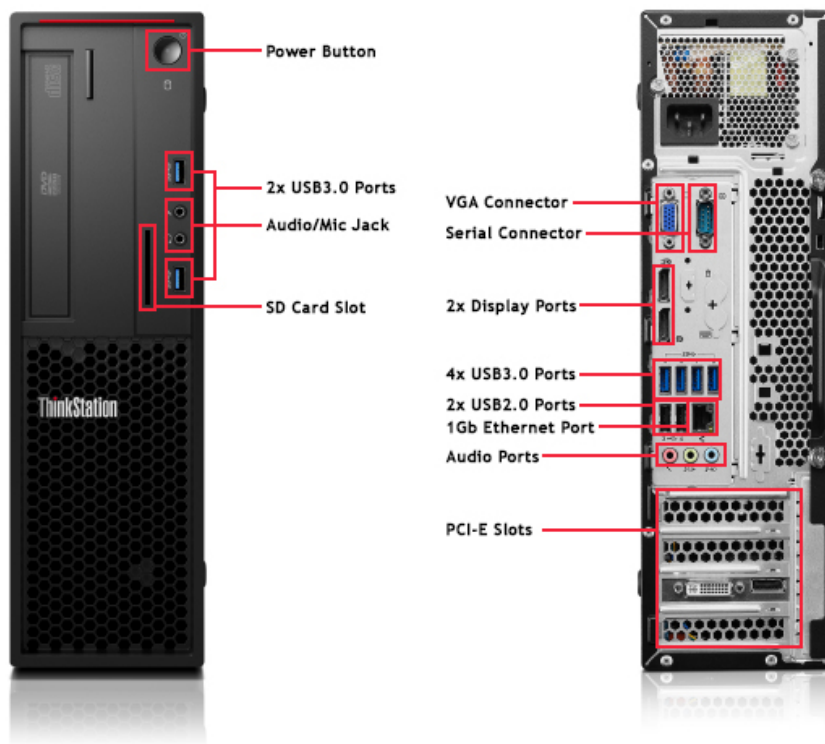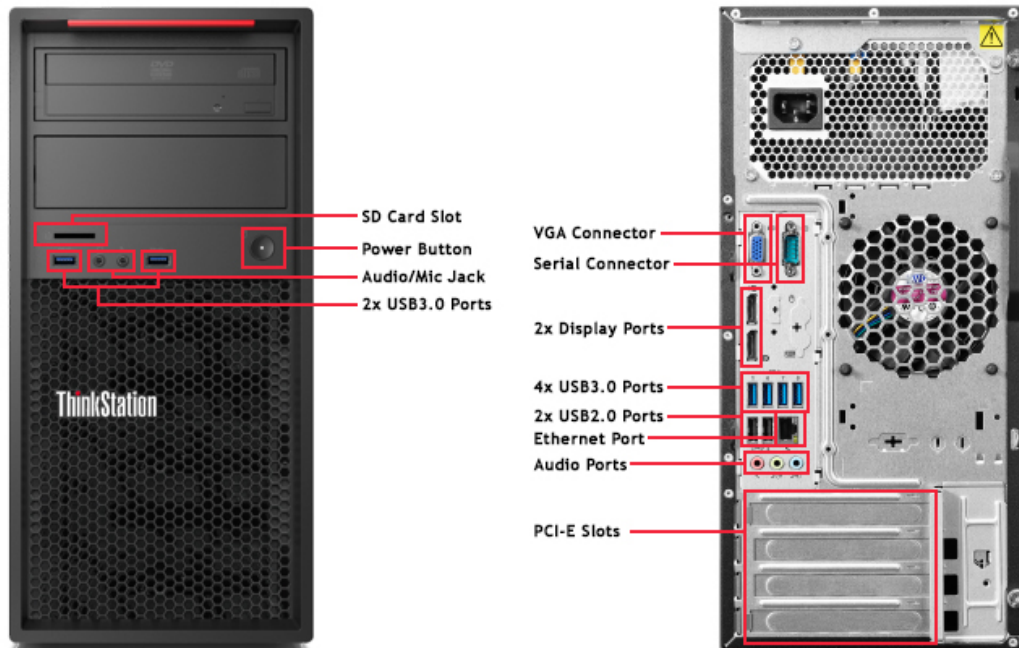**P320 Tower**

The single-processor P320 workstation uses a Micro Advanced Technology Extended (MATX) motherboard, both 250 watt (W), and an optional 400 watt (W) power supply unit (PSU). The motherboard chipset consists of the Intel® 2400-MHz PCH supporting error-correcting code (ECC) Double Data Rate 4 (DDR4). Maximum memory supported is 64GB for UDIMMs. The processor socket is an Intel® LGA1150 GA-C2 level with support for dual core, quad core, processors from the Intel® Xeon line (E3-1200v6 family of processors) as well as Core i processors (i3, i5, i7).

P320 SFF

The single-processor P320 workstation uses a Micro Advanced Technology Extended (MATX) motherboard, with a 210 watt(W) power supply unit (PSU). The motherboard chipset consists of the Intel® 2400-MHz PCH supporting error-correcting code (ECC) Double Data Rate 4 (DDR4). Maximum memory supported is 64GB for UDIMMs. The processor socket is an Intel® LGA1150 GA-C2 level with support for dual core, quad core, processors from the Intel® Xeon line (E3-1200v6 family of processors) as well as Core i (i3, i5, i7).

Operating Systems

P320 Tower

Preloaded

Genuine Windows 10® Professional 64-bit
Genuine Windows 10DG to 7® Professional 64-bit

Supported

Red Hat Enterprise Linux

P320 SFF

Preloaded

Genuine Windows 10® Professional 64-bit
Genuine Windows 10DG to 7® Professional 64-bit

Supported

Red Hat Enterprise Linux

Motherboard – P320

Form Factor	P320 Tower	P320 SFF
Board Size	248mm*248mm	248mm*248mm

Motherboard Core

Processor Support	Intel® Xeon™ E3-1200v6/v5	Intel® Xeon™ E3-1200v6/v5
	Intel® i7™ Quad Core	Intel® i7™ Quad Core
	Intel® i5™ Quad Core	Intel® i5™ Quad Core
	Intel® i3™ Dual Core	Intel® i3™ Dual Core
Socket Type	LGA1151	LGA1151
Memory Support	2400 MHz	2400 MHz
QPI (GTPS)	up to 9.6GT/s	up to 9.6GT/s
Voltage Regulator	80W TDP	80W TDP
Chipset (PCH)	Intel C236	Intel C236
Flash	16MB	16MB
HW Monitor	–	–
Super I/O	Nuvoton NCT6685D	Nuvoton NCT6685D
Clock	Greenlow Native isCLK(Intel C236)	Greenlow Native isCLK(Intel C236)
Audio	ALC662VD-GR	ALC662VD-GR
Ethernet	Intel I219-LM	Intel I219-LM

Memory

Slots	4	4
Channels	2	2
Type	UDIMM	UDIMM
ECC Support	Yes (with Xeon Processor)	Yes (with Xeon Processor)
Speed	2400 MHz	2400 MHz
Max DIMM Size	16GB	16GB
Max System Memory	64GB	64GB

Ethernet

Vendor	Intel	Intel
Count	1	1
EEPROM	None	None

Speeds	10/100/1000 Mbps	10/100/1000 Mbps
Functions	PXE, WOL,AMT	PXE, WOL,AMT
Connectors	(1) x RJ45 on Rear I/O	(1) x RJ45 on Rear I/O

Audio

Type	Integrated Audio	Integrated Audio
Chipset	ALC662VD-GR	ALC662VD-GR
Stereo Conversion	24-bit DAC and 24-bit ADC	24-bit DAC and 24-bit ADC
High Definition Stereo Support	v	v
Number of Channels	2 channels (5.1 via Driver Selection)	2 channels (5.1 via Driver Selection)
Number of Bits/Audio Resolution	6 channels of DAC support 16/20/24-bit PCM format for 5.1 audio solution 2 stereo ADC support 16/20-bit PCM format	6 channels of DAC support 16/20/24-bit PCM format for 5.1 audio solution 2 stereo ADC support 16/20-bit PCM format
Sampling Rate (recording/playback)	Support 44.1K/48K/96K sample rate	Support 44.1K/48K/96K sample rate
Signal to Noise Ratio	DAC SNR>98dBFSA, ADC SNR>90dBFSA	DAC SNR>98dBFSA, ADC SNR>90dBFSA
Wavetable Voices	32-voice wavetable(For XP only)	32-voice wavetable(For XP only)
Analog Audio	v	v
Dolby Digital	None	None
THX	None	None
Digital Out (S/PDIF)	None	None
Speaker Power Rating	Int Speaker (1.5W) / Ext 2.0 Speaker (4W)	Int Speaker (1W) / Ext 2.0 Speaker (4W)

Video

Onboard	Supported (On some Processors)	Supported (On some Processors)
Type	Integrated (Some Processors)	Integrated (Some Processors)
Bus Interface	Processor onboard	Processor onboard
Display Interface	VGA/DP/DP	VGA/DP/DP
Video Resolution (max)	DP: 4096×2304@60Hz	DP: 4096×2304@60Hz
Graphics Cover Name	Intel HD Graphics 530	Intel HD Graphics 530

Storage

Floppy	None	None
IDE	None	None
SATA	(5) x SATA Connectors, Gen. 3 (1) x eSATA Connector, Gen. 3	(5) x SATA Connectors, Gen. 3 (1) x eSATA Connector, Gen. 3
	SATA RAID 0,1,5,10 supported natively via Intel Controller	SATA RAID 0,1,5 supported natively via Intel Controller
eSATA	(1) x eSATA Connector, Gen. 3	(1) x eSATA Connector, Gen. 3

Slots

PCI	No	No
Available Slots	No	No
PIN Count	No	No
Data Bus Width	No	No
Voltage	No	No
PCI Express x1	2pcs	2pcs
Available Slots	1 Full High	1 Low Profile
PIN Count	36 pins connectors	36 pins connectors
Data Bus Width	500MB/s per Direction; duplex 16GB/s	500MB/s per Direction; duplex 16GB/s
Voltage	12V	12V
Power (Max)	25W	25W

PCI Express x4	Yes	Yes
Available Slots	1 Full Height	1 Half High
PIN Count	164 pins connectors	164 pins connectors
Data Bus Width	8GB/s per Direction ; duplex 1GB/s	8GB/s per Direction ; duplex 1GB/s
Voltage	12V	12V
Power (Max)	75W	45W
PCI Express x16	Yes	Yes
Available Slots	1 Full High	1 Half High
PIN Count	164 pins connectors	164 pins connectors
Data Bus Width	8GB/s per Direction; duplex 16GB/s	8GB/s per Direction; duplex 16GB/s
Voltage	12V	12V
Power (Max)	75W	45W

I/O

Front

High Speed USB 3.0	2	2
Internal High Speed USB 2.0	0	0
Microphone	1	1
Headphone	1	1

Back

High Speed USB 2.0	2	2
High Speed USB 3.0	4	4
1 standard serial, 1 optional via punching out	Yes	Yes
Optional parallel	Yes(header on MB)	No
2 PS/2	Yes(header on MB)	optional, via punching out
integrated VGA port	1	1
integrated Display port	2	2
RJ45	1	1
RJ11 (on selected models)	0	0
IEEE 1394 (on selected models)	0	0
Audio Line in	1	1
Audio line out	1	1
Mic In	1	1
eSATA	1 optional E-SATA	1 optional E-SATA

Thermal

Temp Sensors	Ambient Cable Thermal Sensor	Ambient Cable Thermal Sensor
	VR Temperature Sensor	VR Temperature Sensor
	PSU Thermal Sensor(inside)	PSU Thermal Sensor(inside)
Fans	Rear SYSTEM Fan x1 4-pin header with 4-pin key	Rear SYSTEM Fan x1 4-pin header with 4-pin key
	Front Fan 4-pin header with 4 pin key	Front Fan 4-pin header with 4 pin key
	ODD bay Fan 4-pin header with 3-pin key	ODD bay Fan 4-pin header with 3-pin key
	PSU Fan Main PSU power connector	PSU Fan Main PSU power connector
	CPU Fan Header x1 4-pin header with 4-pin key	CPU Fan Header x1 4-pin header with 4-pin key

Power Connectors

Main	(1) 10-Pin (2×5) ATX Standard	(1) 10-Pin (2×5) ATX Standard
Memory & CPU	4-Pin	4-Pin
Graphics	6-Pin (400W) (None for 250W)	None

Security

TPM	TPM 1.2	TPM 1.2
Asset ID	Rohm BUL08-1FJ-W/FVJ-W/NXP PCA24S08AD	Rohm BUL08-1FJ-W/FVJ-W/NXP PCA24S08AD
vPro	E3 12xx v6/v5 yes	E3 12xx v6/v5 yes

BIOS

Vendor	AMI	AMI

Chassis Information

	P320 Tower	P320 SFF
Format	25L Rack Mountable Tower	12L Rack Mountable Tower
Dimensions	425mm H x 175mm W x 431mm D	338mm H x 102mm W x 375mm D
Weight	TWR(13kg(net weight)+1.3kg(carton+p.47kg(plastic)+0.9375kg(wood) = 15.7075 kg)	SFF(7.9kg(net weight)+1.05kg(carton+0.36kg(plastic)+0.9375kg(wood) = 10.2475 kg)
Packaging Parameters without External Speaker		
Height (mm)	510	505
Height (inch)	20.08	19.88
Width (mm)	310	215
Width (inch)	12.2	8.46
Depth (mm)	540	530
Depth (inch)	21.26	20.87
Weight (kgs)	14	9.23
Weight (lbs)	30.86	20.34
Color	Raven Black paint	Raven Black paint
PSU	250 watt 85% efficient tool-less power supply 400 watt 92% efficient tool-less power supply	210 watt 85% efficient tool-less power supply 210 watt 92% efficient tool-less power supply
Thermal Solutions	Rear Fan Standard – Optional Front fan required for some configurations	Rear Fan Standard – Optional Front fan required for some configurations

Security & Serviceability

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	Tool-less
Green Color Power LED on Front of Computer	Yes
Restore CD/DVD Set	Restore system to original factory shipping image – Can be obtained via Lenovo Support
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
Security Chip	Yes
Access Panel Key Lock	Optional
Boot Sequence Control	Yes
Padlock Support	Yes, loop in rear for optional padlock, prevents side panel removal
Boot without keyboard and/or mouse	Yes

Operating Environment

Air Temperature	• Operating: 10˚C to 35˚C (50˚F to 95˚F)
	• 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	Operating 20% ~ 80% (non-condensing)
	Non-Operating 20% ~ 90%(non-condensing)
	• Wet Bulb Temperature Operating: 25˚C max
Altitude	Operating: -15.2 m to 3048 m (-50 ft to 10 000 ft)
Vibration	With Packaging 1.04 G at 2 to 200 Hz at 1 octave/min
	Operating: 0.27 G at 5 to 500 Hz at 0.5 octave/min,Ramdom(without LCD panel)
	Non- operatig 1.04 G at 2 to 200 Hz at 1 octave/min
Shock	Without Package: Bottom half-sine pulse with a change in velocity of 37.4 cm/sec (14.7 inches/sec)
	Operating: 45-G faired square wave with a velocity change of 441 cm/sec (173.7 inches/sec)

Regulations and Standards
EMC & Safety

FCC DoC for North America	Yes
VCCI certification for Japan	Yes
BSMI certification for Taiwan	Yes
EU/EFTA CE Mark & DoC	Yes
UL/CUL	Yes
TUV-GS	Yes
IEC60950-1 CB Report/Certificate	Yes
Saudi Arabia ICCP(SASO)	Yes
China CCC Mark	Yes
Hong Kong SAR (CB report)	Yes
Argentina S-mark	Yes
Singapore – PSB	Yes
South Africa – SABS	Yes
Russia-GOST/EAC	Yes
Mexico-NOM	Yes
Kazakhstan -GOST-K /EAC	Yes
Belarus-certificate/EAC	Yes
Croatia-certificate/CE	Yes
Serbia – KVALITET	Yes
Ukraine – UKrCEPRO	Yes
Energy Star 6.1	Yes
PERD(Product Environmental Review Database	Yes
China RoHS	Yes

EU RoHS	Yes
EU WEEE	Yes
Japan J-Moss	Yes
California RoHS	Yes
USA Chemical Emission Test	Yes
New York RoHS	Yes
Japan Energy Saving	Yes

Environmentals

Energy Star	Energy Star Program Requirements for Computers: Version 6.1 (select models)
EPEAT	EPEAT™ Gold rating (select models)
ErP Lot-3 2013	ErP Lot-3 2013 (Enabled via system setup. Default on for systems shipped to EMEA.)
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), hydrochlorofluorcarbons (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.

Section II: Supported Components
Processor

KabyLake Xeon E3

E3-1280 v6 (3.9GHz / 4C / 8M / 2400 / 72W / Turbo / HT / GT0 / No iGFx)

E3-1275 v6 (3.8GHz / 4C / 8M / 2400 / 73W / Turbo / HT / GT2)

E3-1270 v6 (3.8GHz / 4C / 8M / 2400 / 72W / Turbo / HT / GT0 / No iGFx)

E3-1245 v6 (3.7GHz / 4C / 8M / 2400 / 73W / Turbo / HT / GT2)

E3-1240 v6 (3.7GHz / 4C / 8M / 2400 / 72W / Turbo / HT / GT0 / No iGFx)

E3-1230 v6 (3.5GHz / 4C / 8M / 2400 / 72W / Turbo / HT / GT0 / No iGFx)

E3-1225 v6 (3.3GHz / 4C / 8M / 2400 / 73W / Turbo / HT / GT2)

E3-1220 v6 (3.0GHz / 4C / 8M / 2400 / 72W / Turbo / GT0 / No iGFx)

KabyLake-Core

i7-7700K (4.2GHz / 4c / 8M / 2400 / 95W / GT2) (Tower only)

i7-7700 (3.6GHz / 4c / 8M / 2400 / 65W / GT2)

i5-7600 (3.5GHz / 4c / 6M / 2400 / 65W / GT2)

i5-7500 (3.4GHz / 4c / 6M / 2400 / 65W / GT2)

i5-7400 (3.0GHz / 4c / 6M / 2400 / 65W / GT2)

i3-7300 (4.0GHz / 2c /4M / 2400 / 51W / GT2)

i3-7100 (3.9GHz / 2c / 3M/ 2400 / 51W / GT2)

SkyLake Xeon E3

E3-1245 v5 (3.5GHz / 4C / 8M / 2133 / 80W / Turbo / HT / GT2)

E3-1240 v5 (3.5GHz / 4C / 8M / 2133 / 80W / Turbo / HT / GT0 / No iGFx)

E3-1230 v5 (3.4GHz / 4C / 8M / 2133 / 80W / Turbo / HT / GT0 / No iGFx)

E3-1225 v5 (3.3GHz / 4C / 8M / 2133 / 80W / Turbo / GT2)

E3-1220 v5 (3.0GHz / 4C / 8M / 2133 / 80W / Turbo / GT0 / No iGFx)

SkyLake Core

i7-6700 (3.4GHz / 4c / 8M / 2133 / 65W / GT2)

i5-6500 (3.2GHz / 4c / 6M / 2133 / 65W / GT2)

i5-6400 (2.7GHz / 4c / 6M / 2133 / 65W / GT2)

i3-6100 (3.7GHz / 2C / 3M / 2133 / 51W / GT2)

Multi core technologies are designed to improve performance of multithreaded software products and hardware-aware multitasking operating systems and may require appropriate operating system software for full benefits; check with software provider to determine suitability; not all customers or software applications will necessarily benefit from use of these technologies.

64-bit computing on Intel® 64 architecture requires a computer system with a processor, chipset, BIOS, operating system, device drivers, and applications enabled for Intel® 64 architecture. Processors will not operate (including 32-bit operation) without an Intel® 64 architecture-enabled BIOS. Performance will vary depending on your hardware and software configurations

Memory

UDIMMs – 2400MHz

4GB PC4-2400MHz DDR4 non-ECC-UDIMM

8GB PC4-2400MHz DDR4 non-ECC-UDIMM

16GB PC4-2400MHz DDR4 non-ECC-UDIMM

8GB PC4-2400MHz DDR4 ECC-UDIMM

16GB PC4-2400MHz DDR4 ECC-UDIMM

Storage

3.5" SATA Hard Disk Drive (HDD)

1TB SATA – 7200 rpm, 6 Gb/s, 64MB cache, 3.5"

2TB SATA – 7200 rpm, 6 Gb/s, 64MB cache, 3.5"

3.5" Enterprise SASA Hard Disk Drive (HDD)

4TB SATA – 7200rpm, 128MB cache, 3.5"

2.5" SATA Solid State Drive (SSD)

256GB SATA SSD, 6Gb/s, ,2.5" OPAL

512GB SATA SSD, 6Gb/s, 2.5" Non-OPAL

512GB SATA SSD, 6Gb/s, 2.5" OPAL

1 TB SATA SSD , 6Gb/s, , 2.5" OPAL

2 TB SATA SSD , 6Gb/s, , 2.5" OPAL

M.2 (NGFF) PCIe Solid State Drive (SSD)

256 GB M.2 PCIe – Solid State Drive (SSD), Gen3x4, OPAL NVMe

256 GB M.2 PCIe – Solid State Drive (SSD), Gen3x4, OPAL NVMe, Intel

512 GB M.2 PCIe – Solid State Drive (SSD), Gen3x4, NVMe

512 GB M.2 PCIe – Solid State Drive (SSD), Gen3x4, OPAL NVMe, Intel

1TB M.2 PCIe – Solid State Drive (SSD), Gen3x4, NVMe

RAID

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 support RAID 0,1,5,10

RAID levels and requirements:

• RAID 0 (striping) provides increased performance by writing data across multiple drives.

• RAID 1 (mirroring) provides fault tolerance by writing the data on two drives.

• RAID 5 (striping with parity) uses distributed parity data to provide fault tolerance more efficiently than RAID 1. Requires three or more drives.

• RAID 10 (or RAID 1+0) combines

• RAID 1 and RAID 0 to create a stripe of mirrors that is fault tolerant while offering increased performance. Requires four drives.

Optical Drive/Removable Media

P320 Tower	P320 SFF
DVD-ROM Drive	**DVD-ROM Drive**
DVD-ROM Drive – 16x/48x (SATA)	DVD-ROM Drive – 16x/48x (SATA)
9mm Slim SATA DVD ROM(SATA)	9mm Slim SATA DVD ROM(SATA)
DVD Burner/CD-RW Rambo Drive	**DVD Burner/CD-RW Rambo Drive**
DVD Burner/CD-RW Rambo Drive (SATA)	DVD Burner/CD-RW Rambo Drive (SATA)
9mm Slim DVD Burner/CD-RW Drive (SATA)	9mm Slim DVD Burner/CD-RW Drive (SATA)
Blu-Ray Burner Drive	**Blu-Ray Burner Drive**
Blu-Ray Burner Drive w/AACS encryption (SATA)	Blu-Ray Burner Drive w/AACS encryption (SATA)
9mm Slim SATA Blu-Ray Burner(SATA)	9mm Slim SATA Blu-Ray Burner(SATA)
Media Card Reader	**Media Card Reader**
Front 9 in 1 Media Card reader Standard	Front 9 in 1 Media Card reader Standard
Front 29 in 1 Media card reader, USB3.0, MPOB, 760mm (Requires FLEX Module)	Front 29 in 1 Media card reader, USB3.0, MPOB, 760mm (Requires FLEX Module)

Keyboard

Preferred Pro Fullsize Keyboard (PS/2)

Smart Card KYB

Chicony KUF1256 fingerprint KB

USB Calliope Keyboard Black

Traditional USB Keyboard

Pointing Devices

Lenovo USB Laser Mouse

PS2 black optical mouse with new logo

3DConnexion CadMouse

USB Calliope Mouse Black(Red wheel)

Graphics Cards

P320 Tower	P320 SFF
Integrated Graphics	**Integrated Graphics**
with Intel® Xeon™ E3-12*5v6/v5, i7™ Quad Core, i5™ Quad Core, i3™ Dual Core	with Intel® Xeon™ E3-12*5v6/v5, i7™ Quad Core, i5™ Quad Core, i3™ Dual Core
Discrete Graphics Cards	**Discrete Graphics Cards**
Nvidia NVS310 (DP x 2) – 1GB GDDR3-HP	Nvidia NVS310 (DP x 2) – 1GB GDDR3-LP
Nvidia NVS315 (with DMS-59 to Dual DVI single link dongle) – 1GB DDR3-HP	NVIDIA NVS315 (DMS-59) – 1GB GDDR3 w/ DMS-59 to Dual DVI Dongle(single link) – LP
Nvidia NVS315 (with DMS-59 to Dual Display Port dongle) – 1GB DDR3- HP	NVIDIA NVS315 (DMS-59) – 1GB GDDR3 w/ DMS-59 to Dual DP Dongle – LP
NVIDIA 510 (mini DP x4) – 2GB GDDR3 with 4x miniDP to DP Dongle – HP	NVIDIA 510 (mini DP x4) – 2GB GDDR3 with 4x miniDP to DP Dongle – LP
NVIDIA NVS810 (miniDP x8) – 4GB GDDR3 -HP (w/ short ext)	
NVIDIA Quadro P400(miniDP x3) – 2GB GDDR5 – HP	NVIDIA Quadro P400(miniDP x3) – 2GB GDDR5 – LP
NVIDIA Quadro P600(miniDP x4) – 2GB GDDR5 – HP	NVIDIA Quadro P600(miniDP x4) – 2GB GDDR5 – LP
NVIDIA Quadro P1000(miniDP x4) – 4GB GDDR5 – HP	NVIDIA Quadro P1000(miniDP x4) – 4GB GDDR5 – LP
NVIDIA Quadro P2000(DP x4) – 5GB GDDR5 – HP	
NVIDIA Quadro P4000(DP x4) – 8GB GDDR5 – HP	

FLEX Components

Flex Bay: Formerly known as ODD bays. Will support not only ODD, but also HDDs and
Flex Module

Flex Module: Module supported in the Flex Bay with several options integrated. Will
support slim ODD, High Speed Media Card Reader or 2 universal ports supporting
IEEE1394, eSATA, etc...

PCIe

	P320 Tower	P320 SFF
Network	Intel® I210-T1 Single Port Gigabit Ethernet Adapter	Intel® I210-T1 Single Port Gigabit Ethernet Adapter
	Intel® I350-T2 Dual Ports Gigabit Ethernet Adapter	Intel® I350-T2 Dual Ports Gigabit Ethernet Adapter
	Bitland BN8E88 1000M PCIE ASF HP	Bitland BN8E88 1000M PCIE ASF LP
	Aquantia PCIE 5G Full Height Ethernet adapter HP	Aquantia PCIE 5G Full Height Ethernet adapter LP
Thunderbolt		
IEE 1394	IEEE 1394 (Firewire) PCI Express x1 Adapter (TI XIO2213B) with 1 internal port, 1 external port-HP	IEEE 1394 (Firewire) PCI Express x1 Adapter (TI XIO2213B) with 1 internal port, 1 external port-LP
USB	Rear dual port USB 3.1 type C High-profile PCIe adapter	Rear dual port USB 3.1 type C Low-profile PCIe adapter
Audio Devices	SOUND BLASTER Z(SB1502) BULK PK (Tower only)	
WIFI Cards	Intel Windstorm Peak 8265 2*2ac+BT4.2 VPro M.2 Module QS sample HP	Intel Windstorm Peak 8265 2*2ac+BT4.2 VPro M.2 Module QS sample LP
Parallel card		
PCIe to M.2 Adapter Card	PCIE x4 to M.2 (For NVMe SSD) – HP	PCIE x4 to M.2 (For NVMe SSD) – LP
Front Access Storage Enclosure	5.25" Front Access Storage Enclosure	5.25" Front Access Storage Enclosure

Section III: System Technical Specifications
Power Supply Specifications

	P320 Tower		P320 SFF	
Power Supply	250W	400W	210W	210W
Power Efficiency	85%	92%	85%	92%
Manual / Auto-sensing	auto-sensing	auto-sensing	auto-sensing	auto-sensing
Type	ATX	ATX	ATX	ATX
Wattage	250W	400W	210W	210W
AC Input Voltage Range	100~240v	100~240v	100~240v	100~240v
AC Input Current (low ac range/high AC range)	4A	6A	3A	6A
	47~63 HZ	47~63 HZ	47~63 HZ	47~63 HZ
AC Holdup Time (50% load)	17ms	17ms	17ms	17ms
Minimum Efficiency	0.82	0.9	0.82	0.9
PFC (Active)	active	active	active	active
Aux Power Drop		Single Drop 6pin		

ThinkStation Power Calculator
BIOS Specifications

Features

WMI Support	Compliant with Microsoft WBEM and the DMTF Common Information Model
ROM-Based Setup Utility (F1)	System Configuration Setup program available at power-on with F1 key
Bootblock Recovery	Recovers system BIOS when Flash ROM corrupted.

Replicated Setup	Saves System Configuration settings to file that can then be used replicated 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 event of decrease in system memory
Thermal Alert	Power-on Error message in event of fan failure
Asset Tag	Support ability to set SMBIOS Type 2 Baseboard Asset Tag field.
System/Emergency ROM Flash Recovery with Video	Support process to recover system BIOS when Flash ROM corrupted
Remote Wakeup/Remote Shutdown	System admin can power on/off a client computer from remote location to provide maintenance
Quick Resume time	Support 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	Fans dynamically controlled by system BIOS based on temperature.
Security	User and Administrator passwords can protect boot and ROM-base Setup. Chassis intrusion detection protect
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 base attacks.
Memory modes	Supports mirroring, lock step, and sparing memory modes
Windows 10 ready	Supports Windows 10 requirements – Secure flash, UEFI v 2.3.1 spec

Industry Standard Specification Support

UEFI	Unified Extensible Firmware Interface v2.3.1
ACPI (Advanced Configuration and power Management Interface)	Advanced Configuration and Power Interface v4.0
ASF 2.0	DMTF Alert Standard Format Specification v2.0
ATA (IDE)	None
CD Boot	"El Torito" Bootable CD-Rom Format Specification, Version 1.0
EHCI	None, support RAID/AHCI
PCI	None
PCI Express	PCI Express Base Specification 3.0
SATA	Serial ATA Revision 3.0 Specification
TPM	Trusted Computing Group TPM Specification Version 1.2
UHCI	None
USB	Universal Serial Bus Revision 1.1
	Universal Serial Bus v2.0
	Universal Serial Bus v3.0
SMBIOS	DMTF System Management Spec v2.7.1
XHCI	eXtensible Host Controller Interface for Universal Serial Bus, Revision 3.0

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), hydrochlorofluorcarbons (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

If the product contains a battery or an accumulator, it is labeled with the disposal symbol and if it contains

more than 0.0005% of mercury (for button cells only) by weight, or more than 0.004% of lead, it shall be

marked with the chemical symbol for the metal concerned, Hg or Pb. Information on proper disposal is

provided in user manual

Button cells used in the product do not contain more than 2% by weight of mercury. Other batteries or

accumulators do not contain more than 0.0005% of mercury or 0.002% of cadmium

Batteries and accumulators are easily removable by either users or service providers (as dependent on the

design of the product). Exception: Batteries that are permanently installed for safety, performance, medical

or data integrity reasons do not have to be "easily removable

Safety, EMC connection to the telephone network and labeling

The product complies with legally required safety standards as specified

The product complies with legally required standards for electromagnetic compatibility

If product is intended for connection to a public telecom network or contains a radio transmitter, it complies

with legally required standards for radio and telecommunication devices

The product is labeled to show conformance with applicable legal requirements

Product packaging

Packaging and packaging components do not contain more than 0.01% lead, mercury, cadmium and

hexavalent chromium by weight of these together.

Plastic packaging material is marked according to ISO 11469 referring ISO 1043

The product packaging material is free from ozone depleting substances as specified in the Montreal

Protocol

For more information on Lenovo social environmental practices visit:
http://www.lenovo.com/social_responsibility/us/en/ThinkGreen_products.html#environment

Manageability

Industry Standard Specifications	This product meets the following industry standard specifications for manageability functionality:
	• Intel LAN with AMT
Remote Manageability Software Solutions	Lenovo ThinkStation is supported on the following remote manageability software consoles:
	• Lenovo ThinkManagement Console
	• LANDesk Management Suite for ThinkVantage Technologies (www.landesk.com/lenovo)
	• Microsoft System Center Configuration Manager

System Software Manager	Lenovo ThinkStation supports software management tools from the ThinkVantage System Update suite: • System Update • Update Retriever • Thin Installer		
Service, Support, and Warranty	On-site Warranty and Service: Three-years, limited warranty and service offering delivers on-site, next business-day service for parts and labor and includes free telephone support 8am – 5pm. Global coverage ensures that any product purchased in one country and transferred to another, non-restricted country will remain fully covered under the original warranty and service offering.		

Go to www.lenovo.com/support and www.lenovo.com/warranty for more details

Section IV: Component Specifications

HDD Specifications

3.5″ SATA Hard Disk Drive (HDD)

1TB SATA – 7200rpm, 6Gb/s, 3.5″

2TB SATA – 7200rpm, 6Gb/s, 3.5″

3.5″ Enterprise SATA Hard Disk Drive (HDD)

4TB SATA – 7200rpm, 6Gb/s, 3.5″

	3.5 7200 Enterprise 4T (Model:MakaraBP)	3.5″ 7200 2T (Model:Grenada BP-R)	3.5″ 7200 1T (Model:Pharaoh Oasis)
Connector	SATA	SATA	SATA
Transfer Rate (Gb/sec)	600MB/sec	600MB/sec	600MB/sec
Performance			
Spindle Speed(RPM)	7200	7200	7200
Power off to Spindle Stop(sec)	23 max	11 max	10 max
DC Power to Drive Ready(sec)	30 max	10 max	
Receipt of Start Unit Command to Drive Ready(sec)	30 max	17 max	10 max
Average Latency(msec)	4.16	4.16	4.16
Power Management			
Input(VDC)	+5v +- 5%+12v +- 5%	+5v +- 5%+12v +- 5%	+5v +- 5%+12v +- 5%
Typical(Watts)	10(6T)	8 max	5.57 max
Idle(Watts)	6.2(6T)	5.4 (Idle 2)	4.21
Dimensions			
Height(mm – Max)	26.11	26.1	20
Width(mm)	101.6	101.6	101.6
Depth(mm – Max)	146.99	146.99	146.99
Weight(grams)	705 max	626 max	415 max
Temprature			
Operating(C) Ambient	5 to 60	0 to 60	0 to 60
Operating(C) Base Casting			
Non-Operating(C) Ambient	-40 to 70	-40 to 70	-40 to 70
Gradient(C per Hour)	20 max	30 max	30 max
Shock			
Operating(Gs @ 2ms)	70(read) 40(write)	70 max	80 max
Non-Operating(Gs @ 2ms)	250 6T,300 other	350 max	300 max

SSD Specifications

2.5" SATA Solid State Drive (SSD)

256GB SATA SSD, 6Gb/s, 2.5" OPAL

512GB SATA SSD, 6Gb/s, 2.5" OPAL

512GB SATA SSD, 6Gb/s, 2.5" Non-OPAL

1 TB SATA SSD , 6Gb/s, 2.5" Non-OPAL

M.2 (NGFF) PCIe Solid State Drive (SSD)

256 GB M.2 PCIe OPAL NVMe- Solid State Drive (SSD), Gen3x4

512 GB M.2 PCIe NVMe- Solid State Drive (SSD), Gen3x4

1 TB SATA SSD, 6Gb/s, 2.5

	256GB Flash SSD (Solid State Drive)	512GB Flash SSD (Solid State Drive)	1TB Flash SSD (Solid State Drive)	2TB Flash SSD (Solid State Drive)	256GB NVMe M.2 SSD	512GB NVMe M.2 SSD	1TB NVMe M.2 SSD
Supported Types	Serial-ATA	Serial-ATA	Serial-ATA	Serial-ATA	PCIe Gen3	PCIe Gen3	PCIe Gen3
Dimensions inches/centimeters (W x D x H)	70 x 100 x 6.8 (Unit: mm)	70 x 100 x 6.8 (Unit: mm)	70 x 100 x 6.8 (Unit: mm)	70 x 100 x 6.8 (Unit: mm)	22.00 x 80.00 x 2.38 (Unit: mm)	22.00 x 80.00 x 2.38 (Unit: mm)	22.00 x 80.00 x 2.38 (Unit: mm)
Size	2.5"	2.5"	2.5"	2.5"	3.3" (diameter for PCB)	3.3" (diameter for PCB)	3.3" (diameter for PCB)
Interface Type	SATA-III	SATA-III	SATA-III	SATA-III	PCIe 4x(Gen3)	PCIe 4x(Gen3)	PCIe 4x(Gen3)
Read/Write IOPS Specifications	4KB Random Reads: Up to 70K IOPS. 4KB Random Writes: Up to 60K IOPS.	4KB Random Reads: Up to 70K IOPS. 4KB Random Writes: Up to 60K IOPS.	4KB Random Reads: Up to 70K IOPS. 4KB Random Writes: Up to 60K IOPS.	4KB Random Reads: Up to 92K IOPS. 4KB Random Writes: Up to 83K IOPS.	4KB Random Reads: Up to 330K IOPS. 4KB Random Writes: Up to 280K IOPS.	4KB Random Reads: Up to 330K IOPS. 4KB Random Writes: Up to 300K IOPS.	4KB Random Reads: Up to 430K IOPS. 4KB Random Writes: Up to 320K IOPS.
Bandwidth Performanche	Read: Up to 540 MB/s. Write: Up to 495 MB/s	Read: Up to 540 MB/s. Write: Up to 495 MB/s	Read: Up to 540 MB/s. Write: Up to 495 MB/s	Read: Up to 530 MB/s. Write: Up to 500 MB/s	Sequential Read:3100 MB/s, Sequential Write:1400 MB/s	Sequential Read:320 MB/s, Sequential Write:1700 MB/s	Sequential Read:320 MB/s, Sequential Write:1800 MB/s
Power Consumption(Max)	≤1800mW	≤1950mW	≤2220mW	≤6000mW	6.1W for read, 5.1W for write	6.1W for read, 5.1W for write	6.1W for read, 5.1W for write
Active(AVG)	56mW	62mW	66mW	150mW	5.9W for read, 4.5W for write	5.9W for read, 4.5W for write	5.9W for read, 4.5W for write
Idle	around 40mW	around40 mW	around 40mW	around 110mW	around 100mW	around 100mW	around 100mW
Min MTBF	1.5M hours	1.5M hours	1.5M hours	1.5M hours	1.5M hours	1.5M hours	1.5M hours
Hardware Encryption	AES 256 bit	AES 256 bit	AES 256 bit	AES 256 bit	AES 256 bit	AES 256 bit	AES 256 bit

Optical Drives Specifications

	DVD-ROM Drive (SATA)	DVD Burner/CD-RW Drive (SATA)	Blu-Ray Burner Drive (SATA)	9mm Slim SATA DVD ROM(SATA)	9mm Slim DVD Burner/CD-RW Drive (SATA)	9mm Slim SATA Blu-Ray Burner(SATA)
Type	DVD-ROM	DVD Recorder	DVD/BD Recordable	DVD-ROM	DVD Recordable	DVD/BD Recordable
External Dimensions INCHES/CENTIMETERS (Of Actual Drive Without Bezel-W x H x D)	146±0.5×41.5±0.5×175(Max) Unit:mm	146±0.5×41.5±0.5×175(Max) Unit:mm	146±0.5×41.5 +0.5/-0.7×184.7±0.5(Max) Unit:mm	128±0.4×9.0 ±0.4×127±0.4(Max) Unit:mm	128±0.4×9.0 ±0.4×127±0.4(Max) Unit:mm	128±0.4×9.0 ±0.4×127±0.4(Max) Unit:mm
Speed	16x/48x Max	16x/40x Max	6x Max	8x Max	24x Max(for CD-R), 8x Max(for DVD ROM)	24x Max(for CD-R), 8x Max(for DVD ROM)
Bay Type	Half-Height	Half-Height	Half-Height	9mm Slim Tray	9.5mm Slim Tray	9.5mm Slim Tray
Color	Business Black	Business Black	Business Black	Business Black	Business Black	Business Black

Removable	No	No	No	No	No	No
Interface Type and Speed	SATA 1.5 Gb/s	SATA 1.5 Gb/s	SATA 1.5 Gb/s	SATA 1.5 Gb/s	SATA 1.5 Gb/s	SATA 1.5 Gb/s
Weight (max) POUNDS/KILOGRAMS	1Kg	1Kg	1Kg	0.2Kg	0.2Kg	0.2Kg
Internal Buffer Size	196KB Min	0.75MB Min	2MB Min	0.5MB Min	0.5MB Min	2MB Min
Access Times (typical)	140 ms	140 ms	180 ms	160s	160s	160s
Rates						
Writes	NA	16x DVD+/-R / 8x DVD+RW/ 6x DVD-RW/5x DVD-RAM 40x CD-R / 24x CD-RW	6x BD-R / 2x BD-RE 16XDVD +R / 8XDVD+RW / 4XDVD+R DL 16XDVD-R / 6XDVD-RW / 4XDVD-R DL 5XDVD-RAM 40XCD-R / 24XCD-RW	N/A	8x DVD+/-R / 6x DVD+/-RW / 5x DVD-RAM / 24x CD-R / 16x CD-RW	8x DVD+/-R / 6x DVD+/-RW / 5x DVD-RAM / 24x CD-R / 16x CD-RW
Reads	48XCD-ROM/16XDVD-ROM	40XCD-ROM/16XDVD-ROM	6x BD-ROM 16XDVD-ROM, 40XCD-ROM	8XDVD-ROM / 24XCD-ROM	8XDVD-ROM / 24XCD-ROM	8XDVD-ROM / 24XCD-ROM
Power Source						
DC Power Requirements	(+5V±5%; 12V±10%)	(+5V±5%; 12V±10%)	+5V±5%; 12V±10%	+5V±5%	+5V±5%	+5V±5%
DC Current	Max 2.0A@12V Max 1.5A@5v	Max 2.5A@12V Max 2.0A@5v	Max 3.0A@12V, Max 1.9A@5v	Max 2.5A@5v	Max 2.5A@5v	Max 2.5A@5v
Operating Temperature	5° to 50° C (41° to 122° F)	5° to 50° C (41° to 122° F)	5° 50° C (41° to 122° F)	5° to 50° C (41° to 122° F)	5° to 50° C (41° to 122° F)	5° to 50° C (41° to 122° F)
Relative Humidity	8% to 80%	8% to 80%	8% to 80%	8% to 80%	8% to 80%	8% to 80%
Maximum Wet Bulb Temperature	30° C (86° F)	30° C (86° F)	30° C (86° F)	30° C (86° F)	30° C (86° F)	30° C (86° F)
Operating Systems Supported	Windows 10 Professional or Home 64-bit, Windows 7 Professional 64-bit Red Hat Enterprise Linux(RHEL) 7.2 Desktop/Workstation. No driver is required for this device. Native support is provided by the operating system.	Windows 10 Professional or Home 64-bit, Windows 7 Professional 64-bit Red Hat Enterprise Linux(RHEL) 7.2 Desktop/Workstation. No driver is required for this device. Native support is provided by the operating system.	Windows 10 Professional or Home 64-bit, Windows 7 Professional 64-bit Red Hat Enterprise Linux(RHEL) 7.2 Desktop/Workstation. No driver is required for this device. Native support is provided by the operating system.	Windows 10 Professional or Home 64-bit, Windows 7 Professional 64-bit Red Hat Enterprise Linux(RHEL) 7.2 Desktop/Workstation. No driver is required for this device. Native support is provided by the operating system.	Windows 10 Professional or Home 64-bit, Windows 7 Professional 64-bit Red Hat Enterprise Linux(RHEL) 7.2 Desktop/Workstation. No driver is required for this device. Native support is provided by the operating system.	Windows 10 Professional or Home 64-bit, Windows 7 Professional 64-bit Red Hat Enterprise Linux(RHEL) 7.2 Desktop/Workstation. No driver is required for this device. Native support is provided by the operating system.

Graphics Cards

Integrated Graphics Adapter

Type	Integrated
Bus Interface	Processor onboard
Display Interface	VGA/DP/DP
Video Resolution (max)	DP/HDMI: 4096 *2304
Graphics Cover Name	Intel HD Graphics
Video Ram Max	32G
Memory type	UDIMM ECC/No-ECC, 2CH DDR4 @ 1.2V
Trible Monitor Support	Yes
Display Rotation Support	4096×2304/60Hz/DP, 4096×2304/24Hz/HDMI, 4K support on 60Hz
3D Setup & Render Engine	Yes
GPU Core Clock	2GT
Maximum Color Depth	32bit
Supported Resolutions and Max Refresh Rates(Hz) (Note: analog and/or digital)	4096×2304/60Hz/DP, 4096×2304/24Hz/HDMI, 60Hz

Discrete Graphics Adapter

NVIDIA	NVIDIA NVS315	NVIDIA NVS510	NVIDIA	NVIDIA P400	NVIDIA P600	NVIDIA	NVIDIA	NVIDIA	NVIDIA	NVIDIA

	NVS310			NVS810			P1000	P2000	P4000	P5000	P6000
Type	Discrete	Discrete	discrete	Discrete	Discrete	Discrete	Discrete	Discrete	Discrete	Discrete	Discrete
Bus Interface	PCI-E 2.0, 16x	PCI-E 2.0, 16x	PCI-E 2.0, 16x	PCI-E 3.0, 16x	PCI-E 3.0, 16x	PCI-E 3.0, 16x	PCI-E 3.0, 16x	PCI-E 3.0, 16x	PCI-E 3.0, 16x	PCI-E 3.0, 16x	PCI-E 3.0, 16x
Display Interface	DP + DP	DMS59	4 xmini-DP	8 xmini-DP 1.2	3 xMini DP	4 xMini DP	4 xMini DP	4 xDP	4 xDP	4 xDP+DVI-D	4 xDP+DVI-D
Graphics Chipset	Q310 GF119-825	NVS315 GF119-825	NVS 510	NVS 510	GP107-825	GP107-850	GP107-806	GP106-875	GP104-850-A1	GP104-875-A1	GP102-875-A1
Memory clock frequency(MHz)	875 MHz	875MHz	891 MHz	TBD	2000MHz	2000MHz	2500 MHz	3500MHz	3802 MHz	4513 MHz	4513 MHz
Memory size	512 MB	1GB	2GB	4GB	2GB	2GB	4GB	5GB	8GB	16GB	24GB
Memory bit(bit)	64 bit	64 bit	128-bit	128-bit (64-bit per GPU)	64-bit	128-bit	128-bit	160-bit	256-bit	256-bit	384-bit
Memory BW	Up to 14GBps	Up to 14GBps	Up to 28.5GBs	28.8 GB/s (14.4 GB/s per GPU)	Up to 32 GBps	Up to 64 GBps	Up to 80 GBps	Up to 140 GBps	Up to 243 GBps	Up to 288 GBps	Up to 432 GBps
Dual Monitor Support	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Display Rotation Support	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3D Setup & Render Engine	DX 11	DX11	DX11	DX11	DX12	DX12	DX11	DX12	DX12	DX12	DX12
VRAM Type	DDR3	DDR3	DDR3	DDR3	DDR5	DDR5	GDDR5	DDR5	DDR5	GDDR5	GDDR5
GPU Cuda Cores	48	48	192	1024	256	384	640	1024	1792	2560	3840
GPU Core frequency(MHz)	523 MHz	523Mhz	797 MHz	900 MHz	1252 MHz	1556 MHz	1480 MHz	1480MHz	1480 MHz	1607 MHz	1506 MHz
Maximum Power Consumption	19.5 W	19.3W	33.4 W	68W	40W	40W	47w (Board Power)	75w (Board Power)	105W	180W	250W
Operating System Graphics/Video API Support	Window 7 64bit, Windows 10 64bit	Window 7 64bit, Windows 10 64bit	Window 7 64bit, Windows 10 64bit	Window 7 64bit, Windows 10 64bit, Linux 64bit	Window 7 64bit, Windows 10 64bit, Linux 64bit	Window 7 64bit, Windows 10 64bit, Linux 64bit	Window 7 64bit, Windows 10 64bit, Linux 64bit	Window 7 64bit, Windows 10 64bit, Linux 64bit	Window 7 64bit, Windows 10 64bit, Linux 64bit	Window 7 64bit, Windows 10 64bit, Linux 64bit	Window 7 64bit, Windows 10 64bit, Linux 64bit
Supported Resolutions and Max Refresh Rates(Hz) (Note: analog and/or digital)	Digital Display Support □ DisplayPort output ● Drives two DisplayPort enabled digital display at resolutions up to 2560 × 1600 at 60 Hz with reduced blanking, when connected natively using the 2 DisplayPort connectors on the NVS 310 graphics card ● Supports 2 monitors up to resolution of 1920 × 1200 at 60 Hz with reduced blanking using DisplayPort 1.2 multi stream topology technology. □ DVI-D output	Digital Display Support □ VESA® DisplayPort™ output ● Drives two DisplayPort enabled digital display at resolutions up to 2560 × 1600 at 60 Hz with reduced blanking using DMS-59 to dual DisplayPort cable adapters ● Supports 2 monitors up to resolution of 1920 × 1200 at 60 Hz with reduced blanking using DisplayPort 1.2 multi stream topology technology □ Single-link DVI-I output ● Drives two digital display at resolutions up to 1920 × 1200 at 60 Hz with reduced blanking using DMS-59 to dual DVI-I cable adapters □ HDMI output ● NVS 315 is capable of driving two high definition	Digital Display Support □ DisplayPort output ● Drives four DisplayPort enabled digital display at resolutions up to 3840 × 2160 at 60 Hz with reduced blanking, when connected natively using the 4 DisplayPort connectors on the NVS 510 graphics card. □ DVI-D output ● Drives four digital displays at resolutions up to 1920 × 1200 at 60 Hz with reduced blanking using DisplayPort to DVI-D single-link cable adaptors. ● Drives four digital displays at resolutions up to 2560× 1600 at 60 Hz with reduced blanking using DisplayPort to DVI-D dual-link cable adaptors. □ HDMI output ● The NVS 510 graphics board	Maximum pixel clock: 592 MPixels per second Maximum bandwidth: 17.2 Gbps Maximum supported resolution (eight simultaneous displays): 4096 × 2160 at 30 Hz	Maximum pixel clock: 592 MPixels per second Maximum bandwidth: 17.2 Gbps Maximum supported resolution (eight simultaneous displays): 4096 × 2160 at 30 Hz	Maximum pixel clock: 592 MPixels per second Maximum bandwidth: 17.2 Gbps Maximum supported resolution (eight simultaneous displays): 4096 × 2160 at 30 Hz	Maximum pixel clock: 592 MPixels per second Maximum bandwidth: 17.2 Gbps Maximum supported resolution (eight simultaneous displays): 4096 × 2160 at 30 Hz	Maximum pixel clock: 592 MPixels per second Maximum bandwidth: 17.2 Gbps Maximum supported resolution (eight simultaneous displays): 4096 × 2160 at 30 Hz	Maximum pixel clock: 592 MPixels per second Maximum bandwidth: 17.2 Gbps Maximum supported resolution (eight simultaneous displays): 4096 × 2160 at 30 Hz	Maximum pixel clock: 1050 MPixels per second Maximum bandwidth: 32.4 Gbps Example of maximum resolutions with CVT-RB timings: ● 7680 × 4320 × 24 bpp at 120 Hz2 ● 7680 × 4320 × 24 bpp at 60 Hz3 ● 5120 × 2880 × 24 bpp at 60 Hz	Maximum pixel clock: 1050 MPixels per second Maximum bandwidth: 32.4 Gbps Example of maximum resolutions with CVT-RB timings: ● 7680 × 4320 × 24 bpp at 120 Hz2 ● 7680 × 4320 × 24 bpp at 60 Hz3 ● 5120 × 2880 × 24 bpp at 60 Hz

	● Drives two digital display at resolutions up to 1920 × 1200 at 60 Hz with reduced blanking using DisplayPort to DVI-D single-link cable adaptors ● Drives two digital display at resolutions up to 2560× 1600 at 60 Hz with reduced blanking using DisplayPort to DVI-D dual-link cable adaptors □ HDMI output ● NVS 310 is capable of driving two high definition (HD) panels up to resolutions of 1920 × 1080P at 60 Hz using DisplayPort to HDMI cable adaptors Analog Display Support □ VGA display output ● Drives two analog display at resolutions up to 1920 × 1200 at 60 Hz using DisplayPort to VGA cable adaptors	(HD) panels up to resolutions of 1920 × 1080P at 60 Hz using HDMI cable adapters with either of the above digital DMS-59 cable adaptersAnalog Display Support □ VGA display output ● Drives two analog displays at resolutions up to 2048 × 1536 at 85 Hz using DMS-59 to dual VGA cable adapters	is capable of driving four high definition (HD) panels up to resolutions of 1920 × 1080P at 60 Hz using DisplayPort to HDMI cable adaptors.Analog Display Support □ VGA display output ● Drives four analog displays at resolutions up to 1920 × 1200 at 60 Hz using DisplayPort to VGA cable adaptors.								
Thermal	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Dimension	2.713 inches by 5.7 inches	2.713 inches by 5.7 inches	2.713 inches × 6.303 inches	4.4 inches × 7.8 inches	2.713 inches × 5.7 inches	2.713 inches × 5.7 inches	2.713 inches x 5.7 inches ,Single- slot 129 Grams	4.38 inches x 7.9 inches ,Single- slot 260 Grams	4.38 inches x 7.9 inches, Single-slot 260 Grams	4.376 inches × 10.5 inches, dual-slot	4.376 inches × 10.5 inches, dual-slot
Advanced Display	NO	NO	NO	NO	NO	NO	NO	NO	SDI, SYNC, Stereo	SDI, SYNC, Stereo	SDI, SYNC, Stereo
SLI Support	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES

Networking

	P320 Tower	P320 SFF
Connector	RJ-45	RJ-45
Controller	Intel, I219-LM	Intel, I219-LM

Intel® Ethernet Connection I219-LM

Data Rates Supported	10/100/1000 BASE-T IEEE 802.3

Controller Details	
Controller bus architecture	PCIe, SMBus
Integrated memory	Yes
Data transfer mode	DMA
Power consumption	TBD
IEEE Standards Compliance	Yes
Boot ROM Support	Yes
Network Transfer Mode (Full/Half Duplex)	Full/Half Duplex
Network Transfer Rate 10BASE-T (full-duplex) 20 Mbps 100BASE-TX (full-duplex) 100 Mbps 100BASE-TX (full-duplex) 200 Mbps 1000BASE-T (full-duplex) 2000 Mbps	Yes
Operating System Driver Support	Win7/Win10/Linux/ DOS
Manageability	AMT 11.0
Manageability Capabilities Alerting	AMT 11.0
Lithography	40 nm
TDP	0.5 W
Operating Temperature Range	0˚C to 85˚C
# of Ports	Single
Data Rate Per Port	1 Gbps
Jumbo Frames Supported	Yes
1000Base-T	Yes
IEEE 1588	Yes
Supported Under vPro	Yes

MEDIA CARD READER	9 in 1	29 in 1
	Description	Description
	The Media card reader device is standard in our Pseries products The device connects to a 2×5 two channel USB header on the motherboard of the system. There is no USB controller card provided. Please see the Disc Formats section below for a list of flash memory card formats that are supported.	The Media card reader mounts into our FLEX module which fits into a standared 5.25" Optical bay
	Mounting Orientation The Media Card Reader can not be changed and is hard wired into the system	Mounting Orientation The Media Card Reader can not be changed, it only fits into the FLEX Module one way
	Interface Type	Interface Type
	USB 2.0 (one channel dedicated to the separate USB port; one channel dedicated to the flash memory card slots)	USB 2.0 (one channel dedicated to the separate USB port; one channel dedicated to the flash memory card slots)
	Disc Formats	Disc Formats
	SD	xD-H
	SDHC	xD-M
	SDXC	Micro SD
	Mini SD	Micro SDHC
	Mini SDHC	SD
	Micro SD*	SDHC
	Micro SDHC*	SDXC
	Micro SDXC*	Mini SD
	RS-MMC	Mini SDHC

MMC	MultiMediaCard (MMC)
MMC Micro	Reduced Size MultiMediaCard (RS MMC)
MMC Mobile	(MMC Plus)
MMC Plus	(MMC Mobile)
M2	CompactFlash Card Type I (CF Type 1)
	CF Type 2
	MicroDrive (MD)
	Memory Stick (MS)
	Memory Stick Select
	MS Duo
	MS PRO
	MS PRO DuMS PRO-HG Duo
	MS XS Duo
	MS XC-HG Duo
	MS HG Micro*
	MS XC Micro*
	MS XC-HG Micro*
	MMC Micro
	Memory Stick Micro (M2)*
*Available with adapter	*Available with adapter

IEEE 1394a (Firewire-400) PCI Express x1 Adapter (1 internal port, 1 external port)

Data Transfer Rate	Supports up to 400 Mbps
Devices Supported	IEEE-1394 compliant devices
Bus Type	PCIe card full height PCIe slots
Ports	One IEEE-1394a bilingual 6-Pin Connector (Rear)
System Requirements	Genuine Windows 10® Professional 64-bit
	Genuine Windows 10DG to 7® Professional 64-bit
	Genuine Windows 10® 64-bit
	Not supported on Linux
	Pentium® III or high processor 128 MB-RAM 1-GB Hard Drive CD-ROM drive built in sound system available PCI slot
Temperature – Operating	50° to 131° F (10° to 55° C)
Temperature – Storage	–22° to 140° F (–30° to 60° C)
Relative Humidity – Operating	20% to 80%
Compliances	FCC Part 15B, cULus 60950, CE Mark EN55022B(1995)/EN55024-1998 STD, Taiwan BSMI CNS13438, Korea MIC

	Intel I210-T1 Single Port Gigabit Ethernet Adapter	Intel I350-T2 Dual Port Gigabit Ethernet Adapter	Intel I350-T4 Quad Port Gigabit Ethernet Adapter
Cable Medium	Copper	Copper	Copper
Cabling Type	RJ-45 Category-5, up to 100 m	Cat 5 up to 100m	Cat 5 up to 100m
Bracket Height	Low Profile and Full Height	Low Profile and Full Height	Low Profile and Full Height

TDP	1W	4.4W	5W
# of Ports	Single	Dual	Quad
System Interface Type	PCIe 2.1(2.5GT/s)	PCIe v2.1 (5.0GT/s)	PCIe v2.1 (5.0GT/s)
Intel® Virtualization Technology for Connectivity (VT-c)		Yes	Yes
Speed & Slot Width	2.5 GT/s, x1 Lane	5 GT/s, x4 Lane	5 GT/s, x4 Lane
Controller	Intel I210	Intel I350	Intel I350
iWARP/RDMA	No	No	No
Intel® Ethernet Power Management	Yes	Yes	Yes
Intel® Data Direct I/O Technology	No		
Intelligent Offloads	Yes	Yes	Yes
Storage Over Ethernet		iSCSI, NFS	iSCSI, NFS
On-chip QoS and Traffic Management	No	Yes	Yes
Flexible Port Partitioning	No	Yes	Yes
Virtual Machine Device Queues (VMDq)	No	Yes	Yes
PCI-SIG* SR-IOV Capable	No	Yes	Yes