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THINKSTATION E32





Product Overview

The single-processor E32 workstation uses a Micro Advanced Technology Extended (MATX) motherboard, both 280 watt (W), and an optional 450 watt (W) power supply unit (PSU) for Tower and a 240 watt(W) for the Small Form Factor (SFF). The motherboard chipset consists of the Intel® PCH supporting error-correcting code (ECC) Double Data Rate 3 (DDR3). Maximum memory supported is 32GB 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 (E3-1200V3 family of processors).

SECTION I: SYSTEM OVERVIEW

Operating Systems

Preloaded

Genuine Windows 7® Professional 64-bit
 Genuine Windows 7® Professional 32-bit
 Genuine Windows 8® Professional 64-bit
 Genuine Windows 8® 64-bit
 Genuine Windows 8® 64-bit China
 Genuine Windows 8.1® Professional 64-bit
 Genuine Windows 8.1® 64-bit
 Genuine Windows 8.1® 64-bit China

Supported

Red Hat Enterprise Linux 6.4

Motherboard - E32

Table 1. E32 Motherboard Summary

E32 Motherboard Summary

Form Factor

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

Motherboard Core

Processor Support	Intel® Xeon™ E3-1200V3 (Haswell) Intel® i7™ Quad Core Intel® i5™ Quad Core Intel® i3™ Dual Core
Socket Type	(1) x Intel Socket (LGA1150)

Memory Support	1600/1333/1066 MHz
Voltage Regulator	87W TDP
Chipset (PCH)	Denlow (Intel C226)
HW Monitor	N/A
Super I/O	IT8731F
Audio	ALC662VC1-GR/ALC662VD-GR (co-lay)
Ethernet	Intel L217LM Clarkville

Memory

Slots	4
Channels	2
Type	DDR3 Unbuffered DRAM (UDIMM)
ECC Support	Yes
Speed	Up to PC3-12800 (1600MHz)
Max DIMM Size	up to 8GB UDIMM, up to 32GB UDIMM
Max System Memory	Up to 32GB UDIMM (w/8GB)

Ethernet

Vendor	Intel
Count	1
EEPROM	None (part of SPI flash)
Speeds	10/100/1000 Mbps
Functions	PXE WOL AMT
Connectors	(1) x RJ45 on Rear I/O

Audio

Vendor	Realtek
Type	Integrated Audio
Internal Speaker	Yes
Connectors	(3) x Rear 3.5mm Jacks (Line In, Line Out, Microphone In) (2) x Front 3.5mm Jacks (Headphone out, Microphone In) One 14-pin connector cut pin 14
Chipset	ALC662
Stereo Conversion	24-bit DAC and 24-bit ADC
High Definition Stereo Support	✓
Number of Channels	6
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
Sampling Rate (recording/playback)	Support 44.1K/48K/96K sample rate

Signal to Noise Ratio	DAC SNR>98dBFS, ADC SNR>90dBFS
Wavetable Voices	32-voice wavetable(For XP only)
Analog Audio	✓
Dolby Digital	None
THX	None
Digital Out (S/PDIF)	None
Speaker Power Rating	Int Speaker (1.5W) / Ext 2.0 Speaker (4W) - Tower

Adapter(1) x PCI-E 3.0 16-lane Slot
 (1) x PCI-E 3.0 16 lane Slot (x4 electrical)

Video

Onboard	Supported
Type	Integrated
Bus Interface	Processor onboard
Display Interface	VGA/DP/DP
Video Resolution (max)	VGA/DP: 2560×1600@60Hz DVI/HDMI: 1920×1200@60Hz
Graphics Cover Name	Intel HD Graphics P4600

Storage

Floppy	None
IDE	None
SATA	(2) x SATA Connectors, Gen. 2 (AHCI)(2) x SATA Connectors, Gen. 3 (AHCI)(1) x eSATA Connector, Gen. 2 (eSATA bracket)SATA RAID 0,1, supported natively via Intel Controller
eSATA	(1) x eSATA Connector, Gen. 2, cabled to slot via bracket

Slots

PCI

Available Slots	1 Full Height, 1 Low Profile (SFF)
PIN Count	120 pins connectors
Data Bus Width	32bit /33MHz; 133MB/s
Voltage	3.3V

PCI Express x4 (physical x16)

Available Slots	1 Full Height, 1 Low Profile (SFF)
PIN Count	164 pins connectors
Data Bus Width	8GB/s per Direction; duplex 16GB/s
Voltage	12V
Power (Max)	75W, 45W (SFF)

PCI Express x1

Available Slots	1 Full Height, 1 Low Profile (SFF)
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PIN Count	36 pins connectors
Data Bus Width	500MB/s per Direction ; duplex 1GB/s
Voltage	12V
Power (Max)	25W

PCI Express x16

Available Slots	1 Full Height, 1 Low Profile (SFF)
PIN Count	164 pins connectors
Data Bus Width	8GB/s per Direction; duplex 16GB/s
12V	75W, 45W (SFF)

Rear I/O

COM	(1) x Serial Port (COM1), (1) x optional
eSATA	(1) x eSATA Port (Gen. 2), optional via bracket
LPT	None
Video	1 VGA 2 Display Port
Audio	Microphone-In, Line In, Line Out
Ethernet	(1) x RJ45
USB 2.0	(2) x USB 2.0 Ports
USB 3.0	(4) x USB 3.0 Ports

Internal I/O

USB 2.0	<ul style="list-style-type: none"> • Front Panel USB Header (2 ports) • Media Card Reader Header • Internal USB connector
PS/2	(1) x 2-port PS/2 Header, ports optional via bracket
Audio	(1) x Front Panel Mic & Line-Out Header
COM2	(1) x Serial Port (COM2)
Clear CMOS	3-Pin Clear CMOS Header
Speaker	2-Pin Internal Speaker Header
Chassis Intrusion	2-Pin Chassis Intrusion Switch Header

Thermal

Fans Headers	(1) x 4-Wire CPU Fan (1) x 4-Wire Rear Fan (1) x 3-Wire Front PCI Fan
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Power Connectors

Main	(1) 14-Pin (2x7) ATX Standard
VRM	(1) 4-Pin (2x2) ATX 12V Standard

Security

Nuvoton	Nuvoton NPCT421LA0WX / STMicro ST33ZP24AR28PVQC (co-lay)
Asset ID	Rohm BUL08-1FJ-W/FVJ-W / NXP PCA24S08AD
vPro	vPro for WS (AMT 9.x)

BIOS

Vendor	AMI
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Ethernet

The E32 motherboard implements onboard gigabit Ethernet via one Intel L217LM Clarkville controller. This integrated solution has support for the industry standard functions of Wake on LAN (WOL) and Preboot Execution Environment (PXE). Additionally, for Manageability features, Clarkville will support AMT.

Audio

The ALC662-VD chip from Realtek provides E32 with stereo audio capability that meets Windows7 Premium performance requirements. HD 5.1 audio is supported via jack remapping. There are 2 front analog jacks, and 3 rear color-coded (per MS Vista Logo Specification SYSFUND-0041) analog jacks.

Chassis Summary

E32 Chassis is a 25-liter ATX-form factor tower mechanical with 2 external 5.25" drive bays, 1 external 3.5" drive bay, and 2 internal 3.5" drive bays.

The other E32 chassis is a 12.9-liter ATX-form factor tower mechanical with 1 external 5.25" drive bays, 1 external 3.5" drive bay, 1 internal 3.5" drive bays and 1 optional internal 2.5" drive bay

Chassis Info:

	Tower	SFF
Color	Raven Black paint	Raven Black paint
Form Factor	Tower	SFF
Volume (Approximate)	25L	12.9L
Orientation	Vertical	Vertical or horizontal
Kensington slot	Yes	Yes
Padlock loop	Yes	No
Intrusion switch	Yes	Yes
Handles	Front removable & Handler filler & rear lip	No
5.25" to 3.5" HDD Conversion Kit,325BT(with 1to 2 power converter cable)	Yes	No
50mm 1 to 2 fan power converter cable	Yes	No
Q4000 bracket 325BT	Yes (Special bid only to support the K4000 card)	No

Chassis Dimensions

Height (mm)	425.2	338
Height (inch)	16.74	13.31
Width (mm)	175	102
Width (inch)	6.89	4.02
Depth (mm)	431	375
Depth (inch)	16.97	14.76
Weight (kgs)	12.5	7.8
Weight (lbs)	27.56	17.20

NOTE: HxWxD(mm) are based on maximum length, which include:
PCI holder, plastic foot

Packaging Parameters without External Speaker

Height (mm)	510	505
Height (inch)	20.08	19.88
Width (mm)	310	215
Width (inch)	12.20	8.46
Depth (mm)	540	530
Depth (inch)	21.26	20.87
Weight (kgs)	14	9.23
Weight (lbs)	30.86	20.34

1P Thermal Solution

The E32 1P system will utilize a single fansink solution supporting 87W, 69W, 77W, 55W, and 65W CPUs. In addition to the CPU fansink, the E32 1P system will contain a rear system fan, an optional front PCI fan (to be used only with Inactive powered graphics adapters).

Security & Serviceability

Physical Security and 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, USB, Audio, Network, Enable/Disable Port Control	Yes
Power-On Password	Yes
Setup Password	Yes
NIC LEDs (integrated)	Yes
Security Chip	Yes
Boot Sequence Control	Yes
Padlock Support	Yes, loop in rear for optional padlock, prevents side panel removal E32 SFF do not support it.
Boot without keyboard and/or mouse	Yes

OPERATING ENVIRONMENT

Temperature

Operating Temperature	10 degrees C - 35 degrees C (50F to 95F)
Non-operating Temperature	(-40 degrees C - 60 degrees C) (50F to 140F)
Wet bulb temperature	25 degrees C (max)(Operating) 40 degrees C (max) (Non-Operating)

Humidity

Operating Humidity	20% ~ 80% (non-condensing)
Non-Operating	20% ~ 90%(non-condensing)

Heat

Maximum: 955 Btu/hr / 280 W

Altitude

Operating	-15.2 to 3048 m (-50 to 10,000 ft)
Storage	-15.2 to 10,668 m (-50 to 35,000 ft)

Vibration

With Package	1.04 G at 2 to 200 Hz at 1 octave/min
Without package	
Operating	0.27 G at 5 to 500 Hz at 0.5 octave/min, Random(without LCD panel)
Non-Operating	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)

Temperature

- **Operating**
 - 10 - 35 degrees C

- **Non-Operating**
 - -40 - 60 degrees C

Humidity

- **Relative Humidity**
 - Operating: 20 - 80% non-condensing (10% per hour)
 - Storage: 20 - 90% non-condensing (10% per hour)
- **Wet Bulb Temperature**
 - Operating: 25 degrees C (max)
 - Non-Operating: 40 degrees C (max)

Altitude

Operating: -15.2 to 3048 m (-50 to 10,000 ft)

Storage: -15.2 to 10,668 m (-50 to 35,000 ft)

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	Yes
Mexico-NOM	Yes
Kazakhstan -GOST-K	Yes
Belarus-certificate	Yes
Croatia-certificate	Yes
Serbia - KVALITET	Yes
Ukraine - UKrCEPRO	Yes
Energy Star 5.0/5.2	Yes
PEP(Internal Certification)	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

Energy Star

All E32 systems are designed to with the premise of maximizing energy efficiency. The latest version of the Energy Star standard is still being defined. Pending ratification of the newest Energy Star spec, the Development team will assess which models will be able to be Energy Star compliant.

EPEAT™

E32 models which are Energy Star compliant (pending ratification of latest Energy Star spec) will also qualify for the EPEAT™ Gold rating.

EuP Lot-6 2012

E32 systems are complaint with the EuP Lot-6 2012 standard for low power consumption. This is enabled by default for all systems shipping to EMEA, and can be toggled on or off in the system BIOS.

SECTION II: SUPPORTED COMPONENTS

CPU Specifications

E3-1280V3 (3.60GHz / 4C / 8M / 1600 / 80w / T / 0GT)

E3-1270V3 (3.50GHz / 4C / 8M / 1600 / 80w / T / 0GT)

E3-1240V3 (3.40GHz / 4C / 8M / 1600 / 80w / T / 0GT)

E3-1230V3 (3.30GHz / 4C / 8M / 1600 / 80w / T / 0GT)

E3-1220V3 (3.10GHz / 4C / 8M / 1600 / 80w / T / 0GT)

E3-1275V3 (3.50GHz / 4C / 8M / 1600 / 84w / T / 2GT)

E3-1245V3 (3.40GHz / 4C / 8M / 1600 / 84w / T / 2GT)

E3-1225V3 (3.20GHz / 4C / 8M / 1600 / 84w / T / 2GT)

Haswell i7-4770 (3.40GHz / 4C / 8M / 1600 / 84w / T / 2GT)

Haswell i5-4670 (3.40GHz / 4C / 6M / 1600 / 84w / T / 2GT)

Haswell i5-4570 (3.20GHz / 4C / 6M / 1600 / 84w / T / 2GT)

Haswell i3-4340 (3.6GHz / 2C / 4M/ 1600 / 54W / 2GT)

Haswell i3-4330 (3.5GHz / 2C / 4M / 1600 / 54W / 2GT)

Haswell i3-4130 (3.4GHz / 2C / 3M / 1600 / 54W / 2GT)

Haswell Pentium G3430 (3.3GHz / 2C / 3M / 1600 / 53W / 1GT)

Haswell Pentium G3420 (3.2GHz / 2C / 3M / 1333 / 53W / 1GT)

Haswell Pentium G3220 (3.0GHz / 2C / 3M / 1333 / 53W / 1GT)

Intel processor numbers are not a measurement of higher performance. Processor numbers differentiate features within each processor family, not across different processor families.

Quad, Dual 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

RAM Specifications

UDIMMs (non-ECC)

2GB DDR3 non-ECC UDIMM PC3-12800 (1600MHz)

4GB DDR3 non-ECC UDIMM PC3-12800 (1600MHz)

8GB DDR3 non-ECC UDIMM PC3-12800 (1600MHz)

UDIMMs (ECC)

2GB DDR3 ECC UDIMM PC3-12800E (1600MHz)

4GB DDR3 ECC UDIMM PC3-12800E (1600MHz)

8GB DDR3 ECC UDIMM PC3-12800E (1600MHz)

Storage - HDD/SSD

Part Description

3.5" SATA Hard Disk Drive (HDD)

250GB SATA - 7200rpm, 6Gb/s, 3.5"

500GB SATA - 7200rpm, 6Gb/s, 3.5"

1TB SATA - 7200rpm, 6Gb/s, 3.5"

2TB SATA - 7200rpm, 6Gb/s, 3.5"

3TB SATA - 7200rpm, 6Gb/s, 3.5"

2.5" SATA Hard Disk Drive (HDD)

250GB SATA - 10000rpm, 6Gb/s, 2.5"

500GB SATA - 10000rpm, 6Gb/s, 2.5"

1TB SATA - 10000rpm, 6Gb/s, 2.5"

2.5" SATA Solid State Drive (SSD)

128GB SATA - Solid State Drive (SSD), 6Gb/s, MLC, 2.5"

180GB SATA - Solid State Drive (SSD), 6Gb/s, MLC, 2.5"

240GB SATA - Solid State Drive (SSD), 6Gb/s, MLC, 2.5"

256GB SATA - Solid State Drive (SSD), 6Gb/s, MLC, OPAL, 2.5"

256GB SATA - Solid State Drive (SSD), 6Gb/s, MLC, 2.5"

480GB SATA - Solid State Drive (SSD), 6Gb/s, MLC, 2.5"

512GB SATA 3 Solid State Drive (SSD), 2.5",6Gb/s Value

512GB SATA 3 Solid State Drive (SSD), 2.5",6Gb/s,Performance

3.5" SATA Hybrid

1TB SATA - 7200rpm, 6Gb/s, 3.5" Hybrid

2TB SATA - 7200rpm, 6Gb/s, 3.5" Hybrid

4TB SATA - 7200 rpm, 6Gb/s 3.5"

3.5" SATA Hybrid

500GB+8GB Hybrid HDD 5400RPM SATA 2.5"

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.

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.

Storage - Optical Drive/Removable Media

Part Description

DVD-ROM Drive - 16x/48x (SATA)

DVD Burner/CD-RW Rambo Drive (SATA)

Blu-Ray Burner Drive w/AACS encryption (SATA)

29-in-1 Media Card Reader, 3.5"

Keyboard Specifications

Part Description

Preferred Pro Fullsize Keyboard (USB)

Preferred Pro Fingerprint Keyboard (USB) (for EPEAT gold)

Pointing Devices Specifications

Part Description

Optical Wheel Mouse (800 DPI), USB - red wheel

Graphics Cards

Part Description	Intel	NVIDIA	NVIDIA	NVIDIA	NVIDIA	NVIDIA	NVIDIA	NVIDIA	NVIDIA	NVIDIA
(E32 SFF only can support LP Graphics Cards)	Integrated HD Graphics P4600	NVIDIA NVS300 (with DMS-59 to single link dongle) -	NVIDIA NVS300 (with DMS-59 to Display Port	NVIDIA NVS310 (Dual DP) 512MB DDR3 (HP/LP)	NVIDIA NVS510 (x4 DP, mini-DP, Link DVI-D, Dual	NVIDIA Quadro 410 (Dual link DVI, DP) - 512MB	NVIDIA Quadro K600 (DVI-I (1), DP 1.2 (1)) - 1GB	NVIDIA Quadro K2000 (DVI-I (1), DP 1.2 (2)) - 2GB	NVIDIA Quadro 2000D(Dual link DVIx2, mDP,) - 2GB GDDR5 (HP)	NVIDIA Quadro 4000 (Dual link DVI, DP, DP, Stereo

512MB
GDDR3
(HP/LP)

dongle) -
512MB
GDDR3
(HP/LP)

Link DVI-
D, VGA) -
2GB
DDR3
(HP)

GDDR3
(HP/LP)

GDDR3
(HP/LP)

GDDR5
(HP)

3D) - 2GB
GDDR5
(HP)

Network/Audio Devices

Part Description

USB 3.0 PCI Express x1 Adapter

IEEE 1394(Firewire) PCI Express x1 Adapter

Intel 1 Gigabit ET Dual Port Server Adapter

1000M Ethernet PCI Express 1x Adapter

SECTION III: SYSTEM TECHNICAL SPECIFICATIONS

Power Supply Specifications

DC Power Supply - Wattage	450W 92plus Single output	280W 85plus Single output	240W 92plus Single output	240W 85plus Single output
Power Efficiency	92%	85%	92%	85%
Manual / Auto-sensing	Auto-sensing	Auto-sensing	Auto-sensing	Auto-sensing
Type	115/230V(50/60Hz)	115/230V(50/60Hz)	115/230V(50/60Hz)	115/230V(50/60Hz)
Wattage	450W	280W	240W	240W
AC Input Voltage Range	100-127v/200-240v	100-127v/200-240v	100-127v/200-240v	100-127v/200-240v
AC Input Current (low ac range/high AC range)	8A/4A	8A/4A	8A/4A	8A/4A
AC Input Frequency	50/60HZ	50/60HZ	50/60HZ	50/60HZ
AC Holdup Time (50% load)	17MS	17MS	17MS	17MS
Minimum Efficiency	0.89	0.82	0.89	0.82
PFC (Active)	ACTIVE	ACTIVE	ACTIVE	ACTIVE
80 PLUS compliant	Yes - Platinum	Yes - Silver	Yes - Platinum	Yes - Silver

Power Supply Cable Length

Cable 1(SATA Power Cable 200mm + 200mm)	Yes		No
Cable 2(SATA Power Cable 400mm for ODD)	No		Yes
Cable 3(SATA Power Cable 200mm for HDD)	No		Yes
Cable 4(SATA Power Cable 210mm + 170mm + 180mm)	Yes		No
Cable 1 (2*7 Pin P1 main connector for MB)	280mm	250mm	230mm

Cable 2 (2*2 Pin P2 for CPU)	230mm	230mm	280mm	
Cable 3 (2x3 PIN,P3 for Gfx card)	400mm	NA	NA	
DC Parameters				
+3.3v Output	NA	NA	NA	NA
+5.0v Output	NA	NA	NA	NA
+12.0v Output	12V1/16A, 12V2/18A,12V3/12A	12V1/16A, 12V2/16A	12V1/12A, 12V2/16A	12V1/12A, 12V2/16A
+5.0v Auxiliary Output	3A	2.5A	1A	2.5A
-12.0v Output	0.2A	0.2A	0.2A	0.2A
Max Total Power	450W	280W	240W	240W
Max Combined +3.3v/+5.0v Power	NA	NA	NA	NA
Max Combined 12.0v Power	435W	270W	233W	233W
19.5V Output	NA	NA	NA	NA
Power Supply Meets Requirements of:				
Energy Star 4.0 Compliant Power Supply	Yes	Yes	Yes	Yes
Energy Star 5.0 Compliant Power Supply	Yes	Yes	Yes	Yes
Blue Angel Compliant	Yes	Yes	Yes	Yes
UL Certified	Yes	Yes	Yes	Yes

[Click here to access the 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 8 ready	Supports Windows 8 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)	ATA Attachment 6 with Packet Interface (ATA/ATAPI-6)
CD Boot	“El Torito” Bootable CD-Rom Format Specification, Version 1.0
EHCI	Enhanced Host Controller Interface for Universal Serial Bus, Revision 1.0
PCI	PCI Local Bus v3.0 PCI Firmware Specification 3.0
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	Universal Host Controller Interface Design Guide, Revision 1.1
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

Social and Environmental Responsibility

Quality Control

The company 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

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: TECHNICAL SPECIFICATIONS

HDD Specifications

3.5" SATA Hard Disk Drive (HDD)

250GB 7200RPM SATA	Yes
Supported Types	Serial-ATA
Dimensions inches/centimeters (W x D x H)	4.00 x 5.787 x 0.787 (inches)
Size	3.5"
Interface Type	SATA-III
Available Drives	7200RPM
Bus Transfer Rate	600MB/s
Partition Support	NTFS (Default) / FAT32
Average Seek Time	<10ms
Logical Blocks	488,397,168
IOEDC (Input/Output Error Detection Code) or SMART IV (Self Monitoring And Reporting Technology)	Yes
Power Source (Idle)	
DC Power (Max)	8.0W
DC Current	0.800@5V, 0.8@12V
500GB 7200RPM SATA	Yes
Supported Types	Serial-ATA
Dimensions inches/centimeters (W x D x H)	4.00 x 5.787 x 0.787 (inches)
Size	3.5"
Interface Type	SATA-III
Available Drives	7200RPM
Bus Transfer Rate	600MB/s
Partition Support	NTFS (Default) / FAT32
Average Seek Time	<10ms
Logical Blocks	976,773,168
IOEDC (Input/Output Error Detection Code) or SMART IV (Self Monitoring And Reporting Technology)	Yes
Power Source (Idle)	
DC Power (Max)	8.0W
DC Current	0.800@5V, 0.8@12V
1TB 7200RPM SATA	Yes

Supported Types	Serial-ATA
Dimensions inches/centimeters (W x D x H)	4.00 x 5.787 x 0.787 (inches)
Size	3.5"
Interface Type	SATA-III
Available Drives	7200RPM
Bus Transfer Rate	600MB/s
Partition Support	NTFS (Default) / FAT32
Average Seek Time	<10ms
Logical Blocks	1,953,525,168
IOEDC (Input/Output Error Detection Code) or SMART IV (Self Monitoring And Reporting Technology)	Yes
Power Source (Idle)	
DC Power (Max)	8.0W
DC Current	0.800@5V, 0.8@12V
2TB 7200RPM SATA	Yes
Supported Types	Serial-ATA
Dimensions inches/centimeters (W x D x H)	4.010 x 5.787 x 1.028 (inches)
Size	3.5"
Interface Type	SATA-III
Available Drives	7200RPM
Bus Transfer Rate	600MB/s
Partition Support	NTFS (Default) / FAT32
Logical Blocks	3,907,029,168
IOEDC (Input/Output Error Detection Code) or SMART IV (Self Monitoring And Reporting Technology)	Yes
Power Source (Idle)	
DC Power (Max)	8.0W
DC Current	0.800@5V, 0.8@12V, 0.8@12V
3TB 7200RPM SATA	Yes
Supported Types	Serial-ATA
Dimensions inches/centimeters (W x D x H)	4.010 x 5.787 x 1.028 (inches)
Size	3.5"
Interface Type	SATA-III
Available Drives	7200RPM
Bus Transfer Rate	600MB/s
Partition Support	NTFS (Default) / FAT32
Logical Blocks	5,860,533,168
IOEDC (Input/Output Error Detection Code) or SMART IV (Self Monitoring And Reporting Technology)	Yes

Monitoring And Reporting Technology)**Power Source (Idle)**

DC Power (Max)	8.0W
DC Current	0.800@5V, 0.8@12V, 0.8@12V

2.5" SATA Hard Disk Drive (HDD)

2.5" 10000rpm SATA, NCQ 250GB	Yes
Supported Types	Serial-ATA
Dimensions inches/centimeters (W x D x H)	2.750 x 3.955 x 0.591 (inches)
Size	2.5"
Interface Type	SATA-III
Available Drives	10000RPM
Bus Transfer Rate	600MB/s
Average Seek Time	Read 3.6 ms Write 4.2 ms
Power Source (Idle)	
DC Power (Max)	5.8W

2.5" 10000rpm SATA, NCQ 500GB	Yes
Supported Types	Serial-ATA
Dimensions inches/centimeters (W x D x H)	2.750 x 3.955 x 0.591 (inches)
Size	2.5"
Interface Type	SATA-III
Available Drives	10000RPM
Bus Transfer Rate	600MB/s
Average Seek Time	Read 3.6 ms Write 4.2 ms
Power Source (Idle)	
DC Power (Max)	5.8W

2.5" 10000rpm SATA, NCQ 1TB	Yes
Supported Types	Serial-ATA
Dimensions inches/centimeters (W x D x H)	2.750 x 3.955 x 0.591 (inches)
Size	2.5"
Interface Type	SATA-III
Available Drives	10000RPM
Bus Transfer Rate	600MB/s
Average Seek Time	Read 3.6 ms Write 4.2 ms
Power Source (Idle)	
DC Power (Max)	5.8W

2.5" SATA Solid State Drive (SSD)**Optical Drives Specifications****CD - RW Rambo Drive**

HH DVD Recorder	Yes	Yes
Type		
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	
Speed	16x/40x Max	
Bay Type	Half-Height	
Color	Business Black	
Removable	No	
Interface Type and Speed	SATA 1.5 Gb/s	
Weight (max) POUNDS/KILOGRAMS	1Kg	
Internal Buffer Size	0.75MB Min	
Access Times (typical)	140 ms	
Rates		
Writes	16x DVD+/-R / 8x DVD+RW/ 6x DVD-RW/5x DVD-RAM 40x CD-R / 24x CD-RW	
Reads	40XCD-ROM/16XDVD-ROM	
Power Source		
DC Power Requirements	(+5V±5%; 12V±10%)	
DC Current	Max 2.5A@12V Max 2.0A@5v	

DVD - ROM Drive

Type	DVD-ROM
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
Speed	16x/48x Max
Bay Type	Half-Height
Color	Business Black
Removable	No
Interface Type and Speed	SATA 1.5 Gb/s
Weight (max) POUNDS/KILOGRAMS	1Kg
Internal Buffer Size	196KB Min
Access Times (typical)	140 ms
Rates	
Writes	NA
Reads	48XCD-ROM/16XDVD-ROM
Power Source	

DC Power Requirements	(+5V±5%; 12V±10%)
DC Current	Max 2.0A@12V Max 1.5A@5v

Blu-Ray Burner Drive w/ AACs encryption

HH Blu-ray Recorder	Yes	Yes
Type	Blu-ray Recordable	
External Dimensions INCHES/CENTIMETERS (Of Actual Drive Without Bezel-W x H x D)	146±0.5×41.5 +0.5/-0.7×184.7±0.5(Max) Unit:mm	
Speed	6x Max	
Bay Type	Half-Height	
Color	Business Black	
Removable	No	
Interface Type and Speed	SATA 1.5 Gb/s	
Weight (max) POUNDS/KILOGRAMS	1Kg	
Internal Buffer Size	2MB Min	
Access Times (typical)	180 ms	
Rates		
Writes	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	
Reads	6x BD-ROM 16XDVD-ROM, 40XCD-ROM	
Power Source		
DC Power Requirements	+5V±5%; 12V±10%	
DC Current	Max 3.0A@12V, Max 1.9A@5v	

Disclaimer

As Blu-Ray is a new format containing new technologies, certain disc, digital connection, compatibility and/or performance issues may arise, and do not constitute defects in the product. Flawless playback on all systems is not guaranteed. In order for some Blu-Ray titles to play, they may require a DVI or HDMI digital connection and your display may require HDCP support. HD-DVD movies cannot be played on this workstation.

SLIM DVD Recorder:

Slim DVD Recorder	(SFF Support Only)
Type	DVD Recordable
External Dimensions INCHES/CENTIMETERS (Of Actual Drive Without Bezel-W x H x D)	126.5±0.4×12.7 ±0.4×128±0.4(Max) Unit:mm
Speed	8x Max
Bay Type	12.7mm Slim
Color	Business Black

Removable	No
Interface Type and Speed	SATA 1.5 Gb/s
Weight (max) POUNDS/KILOGRAMS	0.2Kg
Internal Buffer Size	0.5MB Min
Access Times (typical)	160s
Rates	
Writes	8x DVD+/-R / 6x DVD+/-RW/5x DVD-RAM 24x CD-R / 16x CD-RW
Reads	8XDVD-ROM / 24XCD-ROM
Power Source	
DC Power Requirements	+5V±5%
DC Current	Max 2.5A@5v

Slim DVD ROM

Slim DVD ROM	(SFF Support Only)
Type	DVD ROM
External Dimensions INCHES/CENTIMETERS (Of Actual Drive Without Bezel-W x H x D)	126.5±0.4×12.7 ±0.4×128±0.4(Max) Unit:mm
Speed	8x Max
Bay Type	12.7mm Tray
Color	Business Black
Removable	No
Interface Type and Speed	SATA 1.5 Gb/s
Weight (max) POUNDS/KILOGRAMS	0.2Kg
Internal Buffer Size	0.5MB Min
Access Times (typical)	160s
Rates	
Writes	NA
Reads	8XDVD-ROM / 24XCD-ROM
Power Source	
DC Power Requirements	+5V±5%
DC Current	Max 2.5A@5v

Slim - ODD Rambo:

Slim ODD Rambo	(SFF Support Only)
Type	BD Rambo
External Dimensions INCHES/CENTIMETERS (Of Actual Drive Without Bezel-W x H x D)	126.5±0.4×12.7 ±0.4×128±0.4(Max) Unit:mm
Speed	6x Max

Bay Type	12.7mm Tray
Color	Business Black
Removable	No
Interface Type and Speed	SATA 1.5 Gb/s
Weight (max) POUNDS/KILOGRAMS	0.2Kg
Internal Buffer Size	2MB Min
Access Times (typical)	160s
Rates	
Writes	6x BD-R / 2x BD-RE 8XDVD +R / 8XDVD+RW / 4XDVD+R DL 8XDVD-R / 6XDVD-RW / 4XDVD-R DL 5XDVD-RAM 24XCD-R / 16XCD-RW
Reads	6XBD-ROM / 8XDVD-ROM / 24XCD-ROM
Power Source	
DC Power Requirements	+5V±5%
DC Current	Max 2.5A@5v

Slim Blu-ray recorder:

Slim Blu-ray Recorder	(SFF Support Only)
Type	DVD ROM
External Dimensions INCHES/CENTIMETERS (Of Actual Drive Without Bezel-W x H x D)	126.5±0.4×12.7 ±0.4×128±0.4(Max) Unit:mm
Speed	8x Max
Bay Type	12.7mm Slim
Color	Business Black
Removable	No
Interface Type and Speed	SATA 1.5 Gb/s
Weight (max) POUNDS/KILOGRAMS	0.2Kg
Internal Buffer Size	1MB Min
Access Times (typical)	160s
Rates	
Writes	NA
Reads	8XDVD-ROM / 24XCD-ROM
Power Source	
DC Power Requirements	+5V±5%
DC Current	Max 2.5A@5v

29-in-1 Media Card Reader

Description

The Media Card Reader device uses the same physical form factor and mounting as a Floppy Disk Drive. 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.

Mounting Orientation The Media Card Reader can be mounted in a dedicated Floppy Drive bay (if the chassis provides one) or in an appropriate Optical Bay adapter. It will operate in any orientation.

Interface Type

USB 2.0 (one channel dedicated to the separate USB port; one channel dedicated to the flash memory card slots)

Disc Formats

	29 in 1 Card Reader (5 slots)				✓	o	With adapter
Card reader support	SD	✓	Micro SDXC	✓	MS PRO DUO	✓	MS DUO ✓
	SDHC	✓	RS-MMC	✓	MS PRO-HG Duo	✓	MS ✓
	SDXC	✓	MMC	✓	MS HG Micro	o	MS PRO ✓
	Mini SD	✓	MMC Micro	✓	MS XS Duo	✓	CF Type I ✓
	Mini SDHC	✓	MMC Mobile	✓	MS XC-HG Duo	✓	CF Type II ✓
	Micro SD	✓	MMC Plus	✓	MS XC Micro	o	MD ✓
	Micro SDHC	✓	M2	o	MS XC-HG Micro	o	XD-H ✓
	XD-M	✓					

Video Cards

Integrated Graphics Adapter

Supported on both Tower and SFF

Type	Integrated
Bus Interface	Processor onboard
Display Interface	VGA/DP/DP
Video Resolution (max)	VGA/DP: 2560×1600@60Hz DVI/HDMI: 1920×1200@60Hz
Graphics Cover Name	Intel HD Graphics P4600
Video Ram Max	TBD
Memory type	TBD
Triple Monitor Support	TBD
Display Rotation Support	TBD
3D Setup & Render Engine	TBD
GPU Core Clock	TBD
Maximum Color Depth	TBD
Supported Resolutions and Max Refresh Rates(Hz) (Note: analog and/or digital)	TBD

(Supported on both Tower and SFF)

NVIDIA NVS315

Type	Discrete
Bus Interface	PCI Express Gen2 ×16
Display Interface	DMS59
Video Resolution (max)	DVI(Dual Link):2560×1600 @ 60HZ
Graphics Chipset	NVS315 GF119-825
Video Ram Max	1G
Memory type	4 pcs 128M x16 DDR3 SDRAM
Memory clock frequency(MHz)	875MHz
Memory size(MB)	1G
Memory bit(bit)	64 bit
RAMDAC	TBD
Dual Monitor Support	Yes
Display Rotation Support	Yes
3D Setup & Render Engine	DX11
VRAM Type	DDR3
GPU Core frequency(MHz)	523Mhz
Maximum Power Consumption	19.3W
Operating System Graphics/Video API Support	Window 7, Window 8
Supported Resolutions and Max Refresh Rates(Hz) (Note: analog and/or digital)	DVI(Dual Link): 2560*1600 @ 60HZ DVI(Single Link): 1920*1200 @ 60HZ DP : 2560*1600 @ 60HZ
Thermal	Active
Dimension	2.713 inches by 5.7 inches

(Supported on both Tower and SFF)

NVIDIA NVS 310

Type	Discrete
Bus Interface	PCI Express 2 ×16
Display Interface	DP + DP
Video Resolution (max)	DVI(Dual Link): 2560×1600 @ 60HZ
Graphics Chipset	Q310 GF119-825
Video Ram Max	512 MB
Memory type	4 pcs 128M x 16 DDR3 SDRAM
Memory clock frequency(MHz)	875 MHz
Memory size(MB)	512 MB
Memory bit(bit)	64 bit
RAMDAC	TBD
Dual Monitor Support	Yes
Display Rotation Support	Yes
3D Setup & Render Engine	DX 11

VRAM Type	DDR3
GPU Core frequency(MHz)	523 MHz
Maximum Power Consumption	19.5 W
Operating System Graphics/Video API Support	Window 7, Window 8
Supported Resolutions and Max Refresh Rates(Hz) (Note: analog and/or digital)	DVI(Dual Link): 2560*1600 @ 60HZ DVI(Single Link): 1920*1200 @ 60HZ DP : 2560*1600 @ 60HZ
Thermal	Active
Dimension	2.713 inches by 5.7 inches

(Supported on both Tower and SFF)

NVIDIA Quadro 410

Type	discrete
Bus Interface	PCI Express 3.0 ×16
Display Interface	DVI-I + DP
Video Resolution (max)	DVI(Single Link): 2560 × 1600
Graphics Chipset	Quadro 410
Video Ram Max	512MB
Memory type	4 pcs 128M X16 DDR3
Memory clock frequency(MHz)	891 MHz
Memory size(MB)	512MB
Memory bit(bit)	64 bit
RAMDAC	400MHZ
Dual Monitor Support	Yes
Display Rotation Support	Yes
3D Setup & Render Engine	DX 11
VRAM Type	DDR3
GPU Core frequency(MHz)	706 MHz
Maximum Power Consumption	36.7W
Operating System Graphics/Video API Support	Window 7, Windows 8
Supported Resolutions and Max Refresh Rates(Hz) (Note: analog and/or digital)	VGA(through DVI to VGA): 2048*1536@85Hz DVI(Dual Link): 2560*1600 @ 60HZ DVI(Single Link): 1920*1200 @ 60HZ DP 1.2: 3840 *2160 @60Hz
Thermal	Active
Dimension	2.713 inches by 6.93 inches

(Supported on both Tower and SFF)

NVIDIA NVS 510

Type	discrete
Bus Interface	PCI Express 3.0 ×16
Display Interface	4 mini-DP

Video Resolution (max)	2560× 1600
Graphics Chipset	NVS 510
Video Ram Max	2048MB
Memory type	8 pcs 128M x 16 DDR3
Memory clock frequency(MHz)	891 MHz
Memory size(MB)	2048MB
Memory bit(bit)	128-bit
RAMDAC	TBD
Dual Monitor Support	Yes
Display Rotation Support	Yes
3D Setup & Render Engine	DX11
VRAM Type	DDR3
GPU Core frequency(MHz)	797 MHz
Maximum Power Consumption	33.4 W
Operating System Graphics/Video API Support	Window 7,Windows 8
Supported Resolutions and Max Refresh Rates(Hz) (Note: analog and/or digital)	DVI(Dual Link): 2560*1600 @ 60HZ DVI(Single Link): 1920*1200 @ 60HZ DP : 3840 *2160 @60Hz Multi-Stream Topology up to a maximum of 4 monitors at resolution of 1920 x1200 @60Hz with reduced blanking using.
Thermal	Active
Dimension	2.713 inches × 6.303 inches

(Supported on both Tower and SFF)

NVIDIA K600

Type	Discrete
Bus Interface	PCI-E 2.0, 16 lane
Display Interface	DVI-I + DP
Video Resolution (max)	DVI-I(Dual Link) :2560 x 1600 DP 1.2: 3840 x 2160
Graphics Chipset	GK107
Video Ram Max	1 GB
Memory type	8 pcs 128M x 16 DDR3
Memory clock frequency(MHz)	891 MHz
Memory size(MB)	1 GB
Memory bit(bit)	128-bit
RAMDAC	400 MHz
Dual Monitor Support	Yes
Display Rotation Support	Yes
3D Setup & Render Engine	DX11

VRAM Type	DDR3
GPU Core frequency(MHz)	875 MHz
Maximum Power Consumption	41W
Operating System Graphics/Video API Support	Window 7,Windows 8
Supported Resolutions and Max Refresh Rates(Hz) (Note: analog and/or digital)	VGA(through DVI to VGA): 2048*1536@85Hz DVI(Dual Link): 2560*1600 @ 60HZ DVI(Single Link): 1920*1200 @ 60HZ DP 1.2: 3840 *2160 @60Hz
Thermal	Active
Dimension	2.713 inches × 6.3 inches

(Supported on Tower only)

NVIDIA Quadro K2000

Type	Discrete
Bus Interface	PCI-E 2.0, 16 lane
Display Interface	DVI-I + DP + DP
Video Resolution (max)	DVI-I(Dual Link) :2560 x 1600 DP 1.2 :3840 x 2160
Graphics Chipset	GK107
Video Ram Max	2 GB
Memory type	GDDR5
Memory clock frequency(MHz)	2000 MHz
Memory size(MB)	2 GB
Memory bit(bit)	128-bit
RAMDAC	400MHz
Dual Monitor Support	Yes
Display Rotation Support	Yes
3D Setup & Render Engine	DX11
VRAM Type	DDR5
GPU Core frequency(MHz)	954 MHz
Maximum Power Consumption	51.1w
Operating System Graphics/Video API Support	Window 7,Windows 8
Supported Resolutions and Max Refresh Rates(Hz) (Note: analog and/or digital)	VGA(through DVI to VGA): 2048*1536@85Hz DVI(Dual Link): 2560*1600 @ 60HZ DVI(Single Link): 1920*1200 @ 60HZ DP 1.2: 3840 *2160 @60Hz
Thermal	Active
Dimension	4.38 inches x 7.97 inches

(Supported on Tower only)

NVIDIA Quadro K2000D

Type	Discrete
Bus Interface	PCI-E 2.0, 16 lane
Display Interface	DVI-I + DVI + mini DP

Video Resolution (max)	DVI-I :2560 x 1600 DP:3840 x 2160
Graphics Chipset	GK107
Video Ram Max	2 GB
Memory type	GDDR5
Memory clock frequency(MHz)	2000 MHz
Memory size(MB)	2 GB
Memory bit(bit)	128-bit
RAMDAC	400 MHz
Dual Monitor Support	Yes
Display Rotation Support	Yes
3D Setup & Render Engine	DX11
VRAM Type	8 pcs 128M x 16 GDDR5
GPU Core frequency(MHz)	954 MHz
Maximum Power Consumption	51.1w
Operating System Graphics/Video API Support	Window 7,Windows 8
Supported Resolutions and Max Refresh Rates(Hz) (Note: analog and/or digital)	VGA(through DVI to VGA): 2048*1536@85Hz DVI(Dual Link): 2560*1600 @ 60HZ DVI(Single Link): 1920*1200 @ 60HZ DP 1.2: 3840 *2160 @60Hz
Thermal	Active
Dimension	4.38 inches x 7.97 inches

(Supported on Tower only)

NVIDIA Quadro K4000

Type	Discrete
Bus Interface	PCI-E 2.0, 16 lane
Display Interface	DP + DP +DVI-I + 3-pin mini DIN(available via optional bracket)
Video Resolution (max)	DVI(Dual Link): 2560*1600 @ 60HZ DP 1.2: 3840 *2160 @60Hz
Graphics Chipset	GK106
Video Ram Max	3 GB
Memory type	12 pcs 128M x 16 GDDR5 SGRAM
Memory clock frequency(MHz)	2800MHz
Memory size(MB)	3 GB
Memory bit(bit)	192-bit
RAMDAC	400MHz
Dual Monitor Support	Yes
Display Rotation Support	Yes
3D Setup & Render Engine	DX11

VRAM Type	DDR5
GPU Core frequency(MHz)	810MHz
Maximum Power Consumption	80w (Board Power)
Operating System Graphics/Video API Support	Window 7,Windows 8
Supported Resolutions and Max Refresh Rates(Hz) (Note: analog and/or digital)	VGA(through DVI to VGA): 2048*1536@85Hz DVI(Dual Link): 2560*1600 @ 60HZ DVI(Single Link): 1920*1200 @ 60HZ DP 1.2: 3840 *2160 @60Hz
Thermal	Active
Dimension	4.376 inches x 9.5 inches ,Single- slot
Note:	K4000 is for special bid only. Requires 450w power supply

USB 3.0

Interface:	Single-Lane (x1) PCI Express Gen2
Mode:	Universal Serial Bus 3.0
Controller:	Renesas (NEC) μ PD720200
PCB Version:	Ver1.1
Port:	2 external USB3.0 ports
Speed:	Data Transfer rate of 1.5/12/480/5000 Mbps. Low Speed (1.5Mbps), Full Speed(12Mbps), High Speed(480Mbps), Super Speed(5Gpbs)
Power Output:	+5V / 900mA (each port)
Bracket:	Standard 121mm / Low Profile 79.2mm
O.S. support:	Windows XP/2003/Vista/7/2008, (32/64-bit) Linux 2.6.31 or later (Linux OS already implemented USB3.0 driver)
Environment:	Operation temp. 0 °C ~ 57 °C
Operation humidity:	5 ~ 95% RH
Storage temp.	-20 °C ~ 85 °C

Other PCI-E / PCI Adapters:

	Tower	SFF
1394 Firewire Adapter Card (PCIe x1,with 2 external ports)	Yes(High profile)	Yes(Low profile)
IEEE 1394 (Firewire) PCI Adapter with internal port -with 1 internal port, 1 external port	Yes(High profile)	Yes(Low profile)
Gigabit Ethernet Card(Bitland 88E8070@1000M PCIE ASF NIC FH(R))	Yes(High profile)	Yes(Low profile)
Intel ® 1Gbps ET Dual Port Server Adapter	Yes(High profile)	Yes(Need to replace high bracket low one)
Intel ® 1Gbps Ethernet Qual Port Adapter	Yes(High profile)	Yes(Need to replace high bracket low one)
USB3.0 Add-in Card	Yes(High profile)	Yes(Low profile)
PCI-E 1X Wifi Card (Taylor Peak)	Yes(High profile)	Yes(Low profile)

