



6.4 I219 Ultra Low Power (ULP)

To reduce the power consumption of the I219 during link disconnect, the I219 introduces a new Ultra Low Power (ULP) mode. In ULP mode the I219 will power gate most of its functionality and only maintain a small portion of the die powered sensing for future cable connection (energy on the Ethernet link). Once energy is detected the I219 will exit ULP mode and either send an in-band message (link connect status) or assert LANWAKE# according to configuration.

The I219 functionality in ULP mode (In-band/WoL exit, SMBus/PCIe exit etc.) is controlled by the host driver (on non ME systems) or the ME FW. The SW will configure I219 registers for proper entry and exit conditions.

The I219 can be configured to enter ULP on future link disconnect while the link is still connected so that during entry to Sx future link disconnects will benefit from the ULP mode.

For proper functionality and power consumption during ULP mode the board design of the I219 should be such that:

- LANWAKE_N, SMB_CLK, SMB_DATA, CLK_REQ_N are pulled up on board.
- TEST_EN is driven low or pulled down on board.
- LAN_DISABLE_N, PE_RST_N can be driven either low or high.
- PE_CLKP/N are both either driven low or tri-stated in ULP mode.
- LED0, LED1, LED2 are in tri-state mode during ULP

6.5 Off Board LAN Connected Device (OBLCD)

To enable OBLCD for platforms where the LAN Connected Device is not located on the motherboard (either located on a docking station or on a dongle) additional communication is required between the LAN Controller and the LAN Connected Device so that the LAN Controller would be aware of OBLCD connect and disconnect events.

6.5.1 Indicating /Sensing OBLCD Disconnect Event

During K0, CLKREQ# is asserted by the LAN Connected Device. On OBLCD disconnect the CLKREQ# would de-assert (board controlled) not as part of the K1 entry flow. The LAN Controller would refer to such event as an indication of OBLCD disconnect.

During K1, CLKREQ# is de-asserted. To indicate presence, the LAN Connected Device will send an in-band beacon message once every BCN_INTER for BCN_DUR to indicate that the LAN Controller that the dongle is still connected. The LAN Controller would not exit K1 when sensing these squelch pulses. K1 exit will only start after sensing a beacon pulse longer than LC.OFFSET+BCN_DUR. At this state the LAN Controller should enable the PLL and start the K1 exit flow.



If the LAN Controller misses these beacon pulse indications for LC.MISS_BCN*BCN_INTER it should refer to such event as an indication of dongle disconnect. In addition the LAN Controller will implement a mode to exit K1 on CLKREQ# assertion to avoid the additional latency in the K1 exit sequence.

While in SMBus the LAN Connected Device should be configured to send periodic status in-bands and RX packets. If the LAN Controller doesn't sense RX activity (packets or statuses) for NO_RX_ON_SMBUS time it should refer to such event as an indication of OBLCD disconnect.

While in ULP the LAN Connected Device is power gated so no notification on disconnect, the LAN Controller will not be notified of such event until:

- It will try to take the LAN Connected Device out of ULP without success.
- OBLCD will be reconnected (in S0) and the LAN Connected Device will assert CLKREQ#, indicating the LAN Controller to move to PCIe.

Note: When the LAN Connected Device is in WoL mode the LAN Controller is powered off, OBLCD disconnection will have no indication.

6.5.2 Indicating/Sensing OBLCD Connection

OBLCD connection will be detected by using CLKREQ# assertion on connection. The default interface of the OBLCD will be PCIe. Connection can be made on the following flows:

- In PCIe, the LAN Connected Device will cause K1 exit by asserting the CLKREQ# and then sending status in-bands over PCIe
- While the interface is defined as SMB, OBLCD connection will not be reflected up while the interface is SMB (and PERST# is asserted)





7.0 Device Functionality

7.1 Tx Flow

When packets are ready for transmission in the integrated LAN controller it transfers them to the I219 through the PCIe or the SMBus (depends on system state). The I219 starts transmitting the arrived packet over the wire after it gathers 8 bytes of data if the PCIe interface is active or after all packet data is received if it was transferred over the SMBus; this behavior has no dependency on the link speed. The I219 design is based on the assumption that the integrated LAN controller has the full packet ready for transmission.

In several cases the I219 has to stop transmission over the wire while still accepting data from the upper connection (PCIe or SMBus). For those cases, the I219 maintains a 3 KB FIFO. The cases where the I219 needs to stop Tx are:

- PAUSE packet was received on the Rx side while flow control is enabled. For full support of flow control, the *Receive Flow Control Enable (RFCE)* bit (bit 7) in the LCD Receive Control register should be set in addition to the configuration in the integrated LAN controller.
- In half-duplex mode while the I219 is in the middle of a receive (DEFER).
- In half-duplex mode while a collision was detected on the wire.

In addition to stop transmission, the I219 sends an in-band message to the integrated LAN controller with the Tx OFF bit set. This in-band message must be sent at the first gap between received packets if (at the same time) the event caused the stop transmit is not valid and transmission over the wire is activated, the I219 might avoid sending the in-band message. An in-band message with the Tx OFF bit cleared is sent when the collided packet was successfully transmitted or dropped after 16 retries (refer to Section 7.3.1).

In-band messages from the integrated LAN controller to the I219 always come in between packets during the IPG. The I219 does not accept in-band messages in the middle of a packet.



7.2 Rx Flow

The I219 maintains a 3 KB FIFO on the receive side in order not to lose packets when PCIe is active but at K1 power save mode. In this case, the I219 initiates recovery of the PCIe when a reception has started. If the link is at 1 Gb/s, the transmission of the packet over the PCIe bus starts immediately after recovery. If the link speed is lower, the I219 starts the transmission after the entire packet is received. The I219 assumes maximum recovery time (from the K1 state) of 10 μ s on both sides of the PCIe side. Higher recovery time causes a packet drop on the receive side.

The I219 identifies PAUSE packets, stop transmission, and a send in-band message as described in Section 7.1.

In-band messages from the I219 to the integrated LAN controller always come in between packets during the IPG.

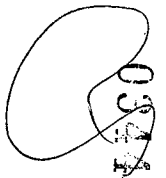
When the PCIe is not active, packet drop is not avoidable due to the big difference in line rate between the MDI and the SMBus.

7.3 Flow Control

Flow control as defined in 802.3x, as well as the specific operation of asymmetrical flow control defined by 802.3z, is supported in the integrated LAN controller during PCIe mode and in the LAN Connected Device during SMBus mode. Some of the flow control functionality has moved to the I219. The following registers are duplicated to the I219 for the implementation of flow control:

- Flow Control Address — 0x01, 0x80, 0xC2, 0x00, 0x00, 0x01; where 01 is the first byte on the wire, 0x80 is the second, etc.
- Flow Control Type (FCT) — 16-bit field to indicate flow control type.
- Flow Control Transmit Timer Value (FCTTV) — 16-bit timer value to include in transmitted PAUSE frame.
- Flow Control Refresh Threshold Value (FCRTV) — 16 bit PAUSE refresh threshold value.

Flow control is implemented as a mean of reducing the possibility of receive buffer overflows, which result in the dropping of received packets, and allows for local controlling of network congestion levels. This can be accomplished by sending an indication to a transmitting station of a nearly full receive buffer condition at a receiving station. The implementation of asymmetric flow control allows for one link partner to send flow control packets while being allowed to ignore their reception. For example, not required to respond to PAUSE frames.





7.3.1 MAC Control Frames and Reception of Flow Control Packets

Three comparisons are used to determine the validity of a flow control frame:

1. A match on the six-byte multicast address for MAC control frames or to the station address of the device (Receive Address Register 0).
2. A match on the type field
3. A comparison of the *MAC Control Opcode* field.

The 802.3x standard defines the MAC control frame multicast address as 01-80-C2-00-00-01. The *Flow Control Packet's Type* field is checked to determine if it is a valid flow control packet: XON or XOFF. 802.3x reserves this as 0x8808. The final check for a valid PAUSE frame is the *MAC Control Opcode* field. At this time only the PAUSE control frame opcode is defined. It has a value of 0x0001. Frame based flow control differentiates XOFF from XON based on the value of the *PAUSE Timer* field. Non-zero values constitute XOFF frames while a value of zero constitutes an XON frame. Values in the *Timer* field are in units of slot time. A slot time is hard wired to 64 byte times.

Note: An XON frame signals canceling the pause from being initiated by an XOFF frame (Pause for zero slot times).

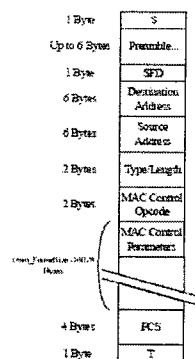


Figure 7-1 802.3x MAC Control Frame Format

Where S is the start-of-packet delimiter and T is the first part of the end-of-packet delimiter for 802.3z encapsulation. The receiver is enabled to receive flow control frames if flow control is enabled via the *RFCE* bit in the Device Control (CTRL) register.

Note: Flow control capability must be negotiated between link partners via the autonegotiation process. The auto-negotiation process might modify the value of these bits based on the resolved capability between the local device and the link partner.



Once the I219 has validated the reception of an XOFF, or PAUSE frame, it performs the following:

- Initializes the pause timer based on the packet's *PAUSE Timer* field.
- Disables packet transmission or schedules the disabling of transmission after the current packet completes.
- Sends an in-band status command with the TX OFF bit set.
- Forward the XOFF or PAUSE frame to integrated LAN controller.

Resuming transmission might occur under the following conditions:

- Expiration of the PAUSE timer.
- Reception of an XON frame (a frame with its PAUSE timer set to zero).¹

Once the I219 has validated the reception of an XON frame, it performs the following:

- Enables packet transmission.
- Sends an in-band status command with the Tx OFF bit cleared.
- Forwards the XON frame to the integrated LAN controller.

7.3.2 Transmitting PAUSE Frames

During PCIe mode transmitting PAUSE frames is done as a result of an In-Band Control command from the integrated LAN controller. The integrated LAN controller initiates an in-band message if it is enabled by software by writing a 1b to the *TFCE* bit in the Device Control register.

Note: Similar to receiving flow control packets previously mentioned, XOFF packets can be transmitted only if this configuration has been negotiated between the link partners via the auto-negotiation process. In other words, the setting of this bit indicates the desired configuration.

When the in-band message from the integrated LAN controller is received, the I219 sends a PAUSE frame with its PAUSE Timer field equal to FCTTV. Once the receive buffer fullness reaches the low water mark, the integrated LAN controller sends an in-band message indicating to send an XON message (a PAUSE frame with a timer value of zero).

During SMBus mode transmitting PAUSE frames is done as a result of the I219 receive and transmit FIFO status. If the sum of data in both FIFOs is greater than the configured FCTH.LTHRSH, the I219 sends a PAUSE frame with its PAUSE Timer field equal to FCTTV. Once the sum of data in the receive and transmit FIFOs is lower than FCTH.LTHRSH, the I219 sends a PAUSE frame with a timer value of zero (XON). The I219 will send an XOFF refresh message with the PAUSE Timer set to FCTTV if after FCRTV time from the previous XOFF message the transmit and receive buffer fullness is still above the low threshold value.

Note: Transmitting flow control frames should only be enabled in full-duplex mode per the IEEE 802.3 standard. Software should make sure that the transmission of flow control packets is disabled when the I219 is operating in half-duplex mode.

1. The XON frame is also forwarded to integrated LAN controller.





7.4 Wake Up

The I219 supports host wake up. The host can enable host wake up from the I219 by setting the *Host_WU_Active* bit.

To set the I219's wake up:

1. Verify *Host_WU_Active* bit (bit 4) in the Port General Configuration register (page 769, register 17) is clear, this is needed to allow the configuration of the filters to wake up mode.
 2. Set *MACPD_enable* bit (bit 2) of the Port Control register (page 769, register 17) to enable the I219 wake up capability and software accesses to page 800.
 3. Set the *Slave Access Enable* bit (bit 2) in the Receive Control register (page 800, register 0) to enable access to the Flex Filter register, if setting those bits is needed in the next stage. The registers affected are:
 - Flexible Filter Value Table LSB — FFVT_L (filters 01)
 - Flexible Filter Value Table MSBs — FFVT_H (filters 23)
 - Flexible Filter Value Table — FFVT_45 (filters 45)
 - Flexible Filter Value Table — FFVT_67 (filters 67)
 - Flexible TCO Filter Value/Mask Table LSBs — FTFT_L
 - Flexible TCO Filter Value/Mask Table MSBs — FTFT_H
 - Extended Flexible Filter Value Table — EFFVT (Filters 8-15)
 4. Configure the I219's wake up registers per ACPI/APM wake up needs.
 5. Clear the *Slave Access Enable* bit (bit 2) in the Receive Control register (page 800, register 0) to enable the flex filters.
 6. Set the *Host_WU_Active* bit (bit 4) in the Port General Configuration register (page 769, register 17) to activate the I219's wake up functionality.
- On a detection of Host wake up event, the I219 will:
1. Assert the LANWAKE# pin indicating wake to PMC.
 2. If in DeepSx, PMC will power up the SUS well.
 3. PMC will send a PINSTOP message to the I219 through SMBus
 4. On a reception of a PINSTOP message, the I219 will stop asserting the LANWAKE# pin and send a WU message over SMBus indicating the WU source.
 - The I219 will send a WU message on every PINSTOP message reception.
 5. The I219 will not assert the LANWAKE# pin again until a WU message was sent and acknowledged. The In case of host wake up the integrated LAN controller wakes the host.
 6. Host should issue a LCD reset to the I219 before clearing the *Host_WU_Active* bit.
 7. Host reads the Wake Up Status register (WUS); wake up status from the I219.

When a wake up packet is identified, the wake up in-band message is sent and the host should clear the *Host_WU_Active* bit (bit 4) in the Port General Configuration register (page 769, register 17) up to the LAN Controller, and clears the *PME_Status* bit in the WUC register.



While in wake up active mode new wake up packets received will not overwrite the packet in the FIFO. The I219 re-transmits the wake up in-band message after 50 ms if no change in the *Host_WU_Active* bits occurred.

7.4.1 Host Wake Up

The I219 supports two types of wake up mechanisms:

- Advanced Power Management (APM) wake up
- ACPI Power Management wake up

7.4.1.1 Advanced Power Management Wake Up

Advanced Power Management Wakeup or APM Wakeup was previously known as Wake on LAN (WoL). The basic premise is to receive a broadcast or unicast packet with an explicit data pattern, and then to assert a signal to wake up the system or issue an in-band PM_PME message (if configured to).

At power up, if the I219's wake up functionality is enabled, the *APM Enable* bits from the NVM are written to the I219 by the integrated LAN controller to the *APM Enable* (APME) bits of the Wakeup Control (WUC) register. These bits control the enabling of APM wake up.

When APM wake up is enabled, the I219 checks all incoming packets for Magic Packets. Refer to Section 7.4.1.4.1.4 for a definition of Magic Packets.

To enable APM wake up, programmers should write a 1b to bit 10 in register 26 on page 0 PHY address 01, and then the station address to registers 27, 28, 29 at page 0 PHY address 01. The order is mandatory since registers RAL0[31:0] and RAH0[15:0] are updated with a corresponding value from registers 27, 28, 29, if the *APM WoL Enable* bit is set in register 26. The *Address Valid* bit (bit 31 in RAH0) is automatically set with a write to register 29, if the *APM WoL Enable* bit is set in register 26. The *APM Enable bit* (bit 0 in the WUC) is automatically set with a write to register 29, if the *APM WoL Enable* bit is set in register 26.

Once the I219 receives a matching magic packet, it:

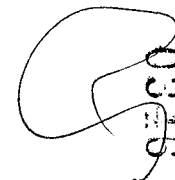
- Sets the *Magic Packet Received* bit in the WUS register.
- Initiates the integrated LAN controller wake up event through an in-band message.

APM wake up is supported in all power states and only disabled if a subsequent NVM read results in the *APM Wake Up* bit being cleared or software explicitly writes a 0b to the *APM Wake Up* (APM) bit of the WUC register.

7.4.1.1.1 Link Status Change

When the *LSCWO* bit (bit 5 in the WUC register) is set, wake up is generated if all of the following conditions are met:

- APM wake up is enabled (*APME* bit is set in the WUC register)
- The *LSCWE* bit (bit 4) is set in the WUC register
- Link status change is detected





When the I219 detects a link status change it:

- Sets the *Link Status Changed* (LNKC) bit (bit 0) in the WUS register.
- Initiates the integrated LAN controller wake up event.

When the *LSCWO* bit is set, wake up is never generated on link status change if either APM wake up is disabled or the *LSCWE* bit is cleared. In this case, the *LNKC* bit (bit 0) in the Wake up Filter Control (WUFC) register is read as zero, independent of the value written to it.

7.4.1.2 ACPI Power Management Wake Up

The I219 supports ACPI Power Management based wake ups and can generate system wake up events from three sources:

- Reception of a Magic Packet.
- Reception of a ACPI wake up packet.
- Detection of a link change of state.

Activating ACPI Power Management wake up requires the following steps:

1. Programming of the WUFC register to indicate the packets it needs to wake up and supplies the necessary data to the IPv4 Address Table (IP4AT) and the Flexible Filter Mask Table (FFMT), Flexible Filter Length Table (FFLT), and the Flexible Filter Value Table (FFVT). It can also set the *Link Status Change Wake up Enable* (LNKC) bit (bit 0) in the WUFC register to cause wake up when the link changes state.
2. Setting bit 2 (*MACPD_enable*) of the Port Control register (page 769, register 17) to put the I219 in wake up mode.

Once wake up is enabled, the I219 monitors incoming packets by first filtering them according to its standard address filtering method and then by filtering them with all enabled wake up filters. If a packet passes both the standard address filtering and at least one of the enabled wake up filters, the I219:

- Initiates an integrated LAN controller wake up event.
- Sets one or more of the *Received* bits in the WUS register. Note that more than one bit is set if a packet matches more than one filter.

If enabled, a link state change wake up causes similar results.

7.4.1.3 Wake Up Packet Storage

A packet initiating Host wake up can be stored in the I219 by setting 776.19[0] prior to WoL entry.

Post wakeup, the once the driver is ready to get the wake up packet (post LAN Controller configurations) the driver should set 776.19[1] and the wake up packet would be sent through the LC-LCD interface as an incoming packet.



7.4.1.4 Wake Up Packets

The I219 supports various wake up packets using two types of filters:

- Pre-defined filters
- Flexible filters

Each of these filters are enabled if the corresponding bit in the WUFC register is set to 1b. If the wake up packet passes one of the manageability filters enabled in the Management Control (MANC) register, then system wake up is also depends on the *NoTCO* bit (11) in the WUFC register being inactive or the *MANC.NoHostWoLonMEtraffic* bit that enable Host WoL only if a packet passed ME filter but was also directed to the Host using the MANC2H and MANC2H2 registers.

7.4.1.4.1 Pre-Defined Filters

The following packets are supported by the I219's pre-defined filters:

- Directed Packet (including exact, multicast indexed, and broadcast)
- Magic Packet
- ARP/IPv4 Request Packet
- Directed IPv4 Packet
- Directed IPv6 Packet
- Flexible UDP/TCP and IP filters packets

Each of the filters are enabled if the corresponding bit in the WUFC register is set to 1b.

The explanation of each filter includes a table showing which bytes at which offsets are compared to determine if the packet passes the filter. Note that both VLAN frames and LLC/Snap can increase the given offsets if they are present.

7.4.1.4.1.1 Directed Exact Packet

The I219 generates a wake up event after receiving any packet whose destination address matches one of the seven valid programmed receive addresses if the *Directed Exact Wake Up Enable* bit (bit 2) is set in the WUFC register.

Offset	# of Bytes	Field	Value	Action	Comment
0	6	Destination Address		Compare	Match any pre-programmed address as defined in the receive address.

0647



7.4.1.4.1.2 Directed Multicast Packet

For multicast packets, the upper bits of the incoming packet's destination address indexes a bit vector and the Multicast Table Array indicates whether to accept the packet. If the *Directed Multicast Wake Up Enable* bit (bit 3) is set in the WUFC register and the indexed bit in the vector is one, the I219 generates a wake up event. The exact bits used in the comparison are programmed by software in the *Multicast Offset* field (bits 4:3) of the RCTL register.

Offset	# of Bytes	Field	Value	Action	Comment
0	6	Destination Address		Compare	See above paragraph.

7.4.1.4.1.3 Broadcast Packet

If the *Broadcast Wake Up Enable* bit (bit 4) in the WUFC register is set, the I219 generates a wake up event when it receives a broadcast packet.

Offset	# of Bytes	Field	Value	Action	Comment
0	6	Destination Address	FF*6	Compare	

7.4.1.4.1.4 Magic Packet

Magic Packet Technology Details:

Once the I219 has been put into Magic Packet mode, it scans all incoming frames addressed to the node for a specific data sequence, which indicates to the MAC that this is a Magic Packet frame. A Magic Packet frame must also meet the basic requirements for the LAN technology chosen, such as Source address, Destination Address (which might be the receiving station's IEEE address or a Multicast address that includes the Broadcast address) and CRC. The specific data sequence consists of 16 duplications of the IEEE address of this node with no breaks or interruptions. This sequence can be located anywhere within the packet, but must be preceded by a synchronization stream. The synchronization stream enables the scanning state machine to be much simpler. The synchronization stream is defined as 6 bytes of 0xFF. The device also accepts a Broadcast frame, as long as the 16 duplications of the IEEE address match the address of the system that needs to wake up.

The I219 expects the destination address to either:

1. Be the broadcast address (FF.FF.FF.FF.FF.FF)
2. Match the value in Receive Address (RAH0/RAL0) register 0. This is initially loaded from the NVM but can be changed by the software device driver.
3. Match any other address filtering enabled by the software device driver.

If the packet destination address met one of the three criteria previously listed, the I219 searches for 16 repetitions of the same destination address in the packet's data field. Those 16 repetitions must be preceded by (in the data field) at least 6 bytes of 0xFF, which act as a synchronization stream. If the destination address is NOT the broadcast address (FF.FF.FF.FF.FF.FF), the I219 assumes that the first non-0xFF byte following at least 6 0xFF bytes is the first byte of the possible matching destination address. If the 96 bytes following the last 0xFF are 16 repetitions of the destination address, the I219 accepts the packet as a valid wake up Magic Packet. Note that this definition precludes the first byte of the destination address from being 0xFF.



A Magic Packet's destination address must match the address filtering enabled in the configuration registers with the exception that broadcast packets are considered to match even if the *Broadcast Accept* bit (bit 5) of the RCTL register is 0b. If APM wake up is enabled in the NVM, the I219 starts up with the RAH0/RAL0 register 0 loaded from the NVM. This enables the I219 to accept packets with the matching IEEE address before the software device driver comes up.

Offset	# of Bytes	Field	Value	Action	Comment
0	6	Destination Address		Compare	MAC Header. Processed by main address filter.
6	6	Source Address		Skip	
12	S = (0/4)	Possible VLAN Tag		Skip	
12 + S	D = (0/8)	Len/LLC/SNAP Header		Skip	
12 + S + D	2	Type		Skip	
Any	6	Synchronizing Stream	FF*6+	Compare	
any+6	96	16 copies of Node Address	A*16	Compare	Compared to RAH0/RAL0 register.

7.4.1.4.1.5 ARP/IPv4 Request Packet

The I219 supports receiving ARP Request packets for wake up if the *ARP* bit (bit 5) is set in the WUFC register. Three IPv4 addresses are supported, which are programmed in the IPv4 Address Table (IP4AT). A successfully matched packet must contain a broadcast MAC address, a protocol type of 0x0806, an ARP opcode of 0x01, and one of the three host programmed IPv4 addresses. The I219 also handles ARP Request packets that have VLAN tagging on both Ethernet II and Ethernet SNAP types.

To enable broadcast ARP wakeup RCTL.BAM should be set to accept broadcast packets.

Offset	# of Bytes	Field	Value	Action	Comment
0	6	Destination Address		Compare	MAC Header. Processed by main address filter.
6	6	Source Address		Skip	
12	S = (0/4)	Possible VLAN Tag		Skip	
12 + S	D = (0/8)	Possible Len/LLC/SNAP Header		Skip	
12 + S + D	2	Type	0x0806	Compare	ARP
14 + S + D	2	Hardware Type	0x0001	Compare	
16 + S + D	2	Protocol Type	0x0800	Compare	
18 + S + D	1	Hardware Size	0x06	Compare	
19 + S + D	1	Protocol Address Length	0x04	Compare	
20 + S + D	2	Operation	0x0001	Compare	
22 + S + D	6	Sender Hardware Address	-	Ignore	
28 + S + D	4	Sender IP Address	-	Ignore	
32 + S + D	6	Target Hardware Address	-	Ignore	
38 + S + D	4	Target IP Address	IP4AT	Compare	Might match any of three host values in IP4AT.



7.4.1.4.1.6 Directed IPv4 Packet

The I219 supports receiving Directed IPv4 packets for wake up if the *IPv4* bit (bit 6) is set in the WUFC register. Three IPv4 addresses are supported, which are programmed in the IPv4 Address Table (IP4AT). A successfully matched packet must contain the station's MAC address, a Protocol Type of 0x0800, and one of the three host programmed IPv4 addresses. The I219 also handles Directed IPv4 packets that have VLAN tagging on both Ethernet II and Ethernet SNAP types.

Offset	# of Bytes	Field	Value	Action	Comment
0	6	Destination Address		Compare	MAC Header. Processed by main address filter.
6	6	Source Address		Skip	
12	S = (0/4)	Possible VLAN Tag		Skip	
12 + S	D = (0/8)	Possible Len/LLC/SNAP Header		Skip	
12 + S + D	2	Type	0x0800	Compare	IP
14 + S + D	1	Version/ HDR length	0x4X	Compare	Check IPv4.
15 + S + D	1	Type of Service	-	Ignore	
16 + S + D	2	Packet Length	-	Ignore	
18 + S + D	2	Identification	-	Ignore	
20 + S + D	2	Fragment Info	-	Ignore	
22 + S + D	1	Time to live	-	Ignore	
23 + S + D	1	Protocol	-	Ignore	
24 + S + D	2	Header Checksum	-	Ignore	
26 + S + D	4	Source IP Address	-	Ignore	
30 + S + D	4	Destination IP Address	IP4AT	Compare	Might match any of three host values in IP4AT.

7.4.1.4.1.7 Directed IPv6 Packet

The I219 supports receiving Directed IPv6 packets for wake up if the *IPv6* bit (bit 7) is set in the WUFC register. One IPv6 address is supported, which is programmed in the IPv6 Address Table (IP6AT). A successfully matched packet must contain the station's MAC address, a protocol type of 0x0800, and the programmed IPv6 address. The I219 also handles Directed IPv6 packets that have VLAN tagging on both Ethernet II and Ethernet SNAP types.

Offset	# of Bytes	Field	Value	Action	Comment
0	6	Destination Address		Compare	MAC Header. Processed by main address filter.
6	6	Source Address		Skip	
12	S = (0/4)	Possible VLAN Tag		Skip	
12 + S	D = (0/8)	Possible Len/LLC/SNAP Header		Skip	
12 + S + D	2	Type	0x0800	Compare	IP
14 + S + D	1	Version/ Priority	0x6X	Compare	Check IPv6.
15 + S + D	3	Flow Label	-	Ignore	
18 + S + D	2	Payload Length	-	Ignore	
20 + S + D	1	Next Header	-	Ignore	



Offset	# of Bytes	Field	Value	Action	Comment
21 + S + D	1	Hop Limit	-	Ignore	
22 + S + D	16	Source IP Address	-	Ignore	
38 + S + D	16	Destination IP Address	IP6AT	Compare	Match value in IP6AT.

7.4.1.4.1.8 Flexible Filter

The I219 supports a total of 32 flexible filters. Each filter can be configured to recognize any arbitrary pattern within the first 128 bytes of the packet. To configure the flexible filter, software programs the mask values into the Flexible Filter Mask Table (FFMT) and the required values into the Flexible Filter Value Table (FFVT), and the minimum packet length into the Flexible Filter Length Table (FFLT). These contain separate values for each filter. Software must also enable the filter in the WUFC register, and enable the overall wake up functionality must be enabled by setting *PME_En* in the Power Management Control Status Register (PMCSR) or the WUC register.

Once enabled, the flexible filters scan incoming packets for a match. If the filter encounters any byte in the packet where the mask bit is one and the byte doesn't match the byte programmed in the Flexible Filter Value Table (FFVT) then the filter fails that packet. If the filter reaches the required length without failing the packet, it passes the packet and generates a wake up event. It ignores any mask bits set to one beyond the required length.

7.4.1.4.1.9 IPv6 Neighbor Solicitation Message Filter

In IPv6, a Neighbor Solicitation Message packet (type 135) is used for address resolution. A flexible filter can be used to check for a Neighborhood Solicitation Message packet (type 135).

Note: The fields checked for detection of a Neighbor Solicitation Message packet (type 135) are type, code and target addresses.

7.4.2 Management Engine (ME) Wake Up

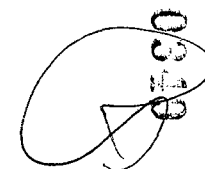
The I219 can also wake up the ME. Any packet that should be routed to the ME during normal operation should wake up the ME when it is in the Moff state. The ME firmware should configure the MANC register and the relevant manageability packet filters before setting the integrated LAN controller to the DMoff state.

The integrated LAN controller can also wake up the ME by a link status change in the same manner as host wake up. Wake up the ME on link status change is enabled by the *WoLS* bit (bit 12) in the MANC register.

7.4.2.1 Manageability Wake Up Receive Filter

The I219 has the ability to wake up the ME. Any packet that can cause ME wake up must first match the MAC address filtering this includes Exact Unicast/Multicast filtering; hash based Multicast filtering any unicast MAC address if Promiscuous is enabled and Broadcast packets if enabled. Other filters can be enabled based on the MANC register setting.

Figure 7-2 shows a top level diagram of the ME wake up filters. The following sections describe these filters.



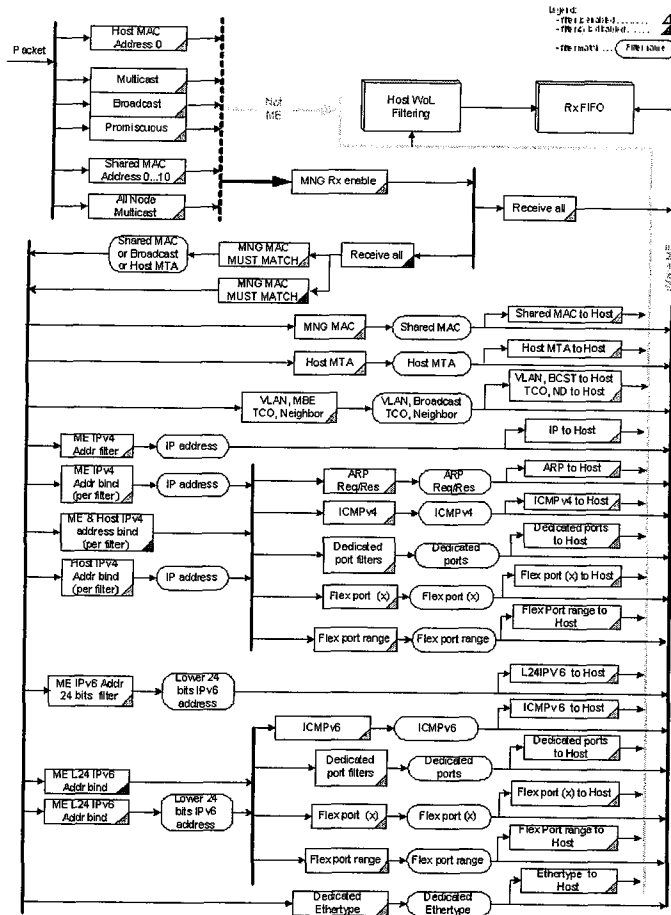


Figure 7-2 ME Receive Wake Up Filters Top Level



7.4.2.1.1 Manageability Registers

The Manageability filtering configuration is done by the manageability firmware. The following is a list of registers in the I219 ME control space that are used to setup the manageability filtering:

- Management VLAN filters — MAVTV[x], x=03
- Flexible TCO filters — FTFT table
- Flexible UDP/TCP and IP filters — MFUTP[11:0], MIP4AT, L24IPV6
- Management Filter control registers — MANC, MANC2, MANC3
- Shared MAC filters control — SHRAFER
- IP Binding Control registers — IPV4MBC, IPV4HBC, IPV6BC

These registers are only reset on an Internal Power On Reset.

7.4.2.1.2 Manageability Packets Types

This section describes the different types of packets that can be configured in the receive filters.

Packets cause an ME wake up if they match a specific filter that it is enabled in the MANC register and the *RCV_TCO_EN* bit (bit 17) is set.

A Unicast packet causes an ME wake up if (1) it matches a unicast MAC filter or (2) unicast promiscuous mode is enabled (these are L2 conditions), and it passes **any** of the enabled manageability filters as defined in the MANC register.

A Multicast packet causes an ME wake up if (1) it passes the L2 multicast filter or (2) multicast promiscuous mode is enabled (these are L2 conditions), and it passes **any** of the enabled manageability filters as defined in the MANC register.

A Broadcast packet cause an ME wake up if it passes **any** of the enabled manageability filters as defined in the MANC register.

In addition, unicast or multicast packets that match any of the previous conditions with a VLAN header causes an ME wake up if it passes one of the VLAN filters as defined by the MAVTV(x) registers.

7.4.2.1.3 ARP Packets Filtering

The I219 has the ability to wake the ME on ARP Request packets, ARP Response packets or both. ARP Request packets wake up the ME if the *ARP_REQ_EN* bit (bit 13) is set in the MANC register. ARP Response packets wake up the ME if *ARP_RES_EN* bit (bit 15) is set in the MANC register. Note that the hardware filter does not check the IP address for ARP Response packets.

There is also a support in Neighbor Solicitation Message packet (type 135) filtering. If the *NEIGHBOR_EN* bit (bit 14) is set in the MANC register, then Neighbor Solicitation Message packets (type 135) wake up the ME.





7.4.2.2 Flexible TCP UDP Port and IP Address Filtering

The I219 has the ability to direct packets to the ME if their L4 (TCP/UDP) destination port matches a specific value. There are 12 flexible TCP or UDP port numbers depending on the FLEXPORT(x) bits in the MANC/MANC2 registers and the corresponding MFUTP(x) registers.

The flexible port filters may be further dependent on IP address filtering as defined by the MIP4AT and IP6AT if the EN_IPFLEX(x) bits in the MANC register are set.

Six of the 12 flexible port filters can be configured to filter source port instead of destination port numbers.

To enhance the IPv6 filters four L3 filters were added each filter can be configured to match the 24 LSB of the L3 address and can also be combined to match one of the UDP/TCP flexible ports or ICMPv6 next header.

Note: For incoming tunneled packets TCP/UDP port filtering is done only for IPv6 packets in an IPv4 tunnel.

7.4.2.3 Dedicated TCP UDP Port and IP Address Filtering

The I219 has the ability to direct packets to the ME if their L4 (TCP/UDP) destination port matches a specific value. There are two constant port numbers (0x26F - depends on the RMCP_EN bit in the MANC register, 0x298 - depends on the EN_0298 bit in the MANC register). Additional dedicated TCP or UDP port filters are controlled by the MANC3 register.

The first two constant L4 filters may be further dependent on IP address filtering as defined by the MIP4AT and IP6AT if the EN_IP_ADDRFILTER bit in the MANC register is set.

Some of the dedicated port filters introduced in MANC3 have the ability to be further dependent on a specific IP address and to pass filtering the packet must pass IP filtering as well as port and protocol filtering.

7.4.2.3.1 L2 Filtering

The I219 has the ability to wake up the ME according to the packet L2 parameters:

- **Broadcast Filtering** — If bit BR_EN (bit 24) is set in the MANC register then all broadcast packets wake up the ME.
- **Unicast Filtering** — There are up to eleven MAC addresses that can be allocated to manageability MAC address filtering defined by the Shared Receive Address Low (SHRAL) register and the Shared Receive Address High (SHRAH) register. The MAC address filtering to manageability is controlled by the *MNG MAC Must Match* bit (bit 25) in the MANC register. Packets that match the MAC address filtering must match any of the manageability filters as defined in the SHRAFER register to wake up the ME.
- **VLAN Filtering** — There are four dedicated filters for VLAN addresses, which can be configured in registers MAVTV(x). Each register has a 12-bit field that represents the VID field of the incoming VLAN header and an enable bit. If the enable bit is set, HW compares the VID field to the VID field of the incoming packets. If it matches, the I219 wakes up the ME (the packet must pass any of the MAC filters as well).



7.4.2.3.2 Flexible TCO Filtering

The I219 includes two flexible filters as defined by the Flexible TCO Filter Table (FTFT). These filters compare an exact pattern match within the 1st 128 bytes of the packet. Enabling these filters is done by setting *FLEX_TCO1/0_FILTER_EN* bits (bits 6 and 7) in the MANC register.

7.4.2.4 Accessing the I219's Wake Up Register Using MDIC

When software needs to configure the wake up state (either read or write to these registers) the MDIO page should be set to 800 (for host accesses) or 801 (for ME accesses) until the page is not changed to a different value wake up register access is enabled. For more details on wake up configuration using MDIC, refer to Section 9.5.9.1.

7.5 Network Proxy Functionality

7.5.1 Introduction

In prior operating system releases, ARP and IPv6 neighbor discovery messages were one of the possible wakeup types for the platform. ARP and IPv6 neighbor discovery packets are required to enable other network devices to discover the link layer address used by the PC. Supporting these protocols while the host is in low power state is fundamental to maintain remote network accessibility to the sleeping host. If the host does not respond, other devices in the network will eventually not be able to send routable network traffic (such as IPv4 and IPv6) to the sleeping host.

Prior to network proxy, devices that wanted to maintain their network presence would have configured the ARP and neighbor discovery messages as wake up patterns to the system. Analysis show that many of these ARP wake-ups are unnecessary as they are generated by automated processes whose sole purpose is to verify that the system is alive on the network (Microsoft* has stated in their testing 95% of the wake-ups are due entirely to ARP wake-ups).

Ethernet devices that implement ARP offload must implement it as defined in the Power Management specification on the NDIS Program Connect site. Specifically, the offload must respond to an ARP Request (operation = 1) by responding with an ARP Reply (operation = 2) as defined in RFC 826.

Ethernet devices that implement IPv6 NS offload must implement it as defined in Power Management specification on the NDIS Program, Connect site. Specifically, the offload must respond to an Neighbor Solicitation (operation = 135) by responding with an NS Advertisement (operation = 136) as defined in RFC 2461. Devices must support at least 2 NS offloads, each with up to 2 target IPv6 addresses.

7.5.2 Network Proxy Activation

As part of the system sleep flow and after receiving from the OS the network proxy and WoL patterns the SW driver should follow the following steps to activate network proxy in the I219:

1. Program the WoL patterns according to the WoL flow with the addition of the network proxy specific configuration as described in the following steps.





2. Program the appropriate IPv4/IPv6 addresses in IP4AT and IP6AT registers.
3. Program the relevant L2 MAC addresses or broadcast reception.
4. Enable ARP/NS proxy through PRXC[6:5].

Note: A packet that matches both a proxy filter and a WoL filter should only cause WoL.

Note: The I219 should not respond to illegal network proxy packets with CRC or checksum errors.

7.5.3 IPv4 Proxy - ARP

In IPv4 networks, ARP provides the address mapping of the IP address to a corresponding MAC address. ARP is a key protocol for remaining responsive on the network.

The delay time between repeated packets is undefined but may be relatively short. As a consequence it is possible for the transition between the proxy and host to miss packets and for a brief time appear off the network (no ARP response). Since ARP is an unreliable protocol there are no specific requirements for proxies.

The sending node generates an ARP Request as a MAC broadcast datagram. The endpoint with the requested IP address must generate a MAC unicast or MAC broadcast datagram ARP Response informing the sending node of its presence. In order to be fully responsive on the network, the Proxy of a sleeping host must respond to ARP requests by generating the necessary responses. Response packet timings and ARP cache timeout values are undefined in the RFCs 826 and 1122.

The I219 supports responding to ARP Request packets (proxy) if enabled through PRXC register. Three IPv4 addresses are supported, which are programmed in the IPv4 Address Table (IP4AT). A successfully matched packet must contain a broadcast MAC address or one of the pre programmed unicast MAC addresses, a protocol type of 0x0806, an ARP opcode of 0x01, and one of the three programmed IPv4 addresses. The I219 also handles ARP Request packets that have VLAN tagging on both Ethernet II and Ethernet SNAP types.

7.5.3.1 ARP Request Packet

Offset	# of Bytes	Field	Value	Action	Comment
0	6	Destination Address		Compare	MAC Header. Processed by main address filter
6	6	Source Address		Skip	
12	S = (0/4)	Possible VLAN Tag		Skip	
12 + S	D = (0/8)	Possible LEN/LLC/SNAP Header		Skip	
12 + S + D	2	Type	0x0806	Compare	ARP
14 + S + D	2	Hardware Type	0x0001	Compare	
16 + S + D	2	Protocol Type	0x0800	Compare	
18 + S + D	1	Hardware Size	0x06	Compare	
19 + S + D	1	Protocol Address Length	0x04	Compare	
20 + S + D	2	Operation	0x0001	Compare	
22 + S + D	6	Sender Hardware Address	-	Ignore	
28 + S + D	4	Sender IP Address	-	Ignore	



Offset	# of Bytes	Field	Value	Action	Comment
32 + S + D	6	Target Hardware Address	-	Ignore	
38 + S + D	4	Target IP Address	IP4AT	Compare	match IP4AT values or zero
42 + S + D	18 - S - D	Padding	0x00	Ignore	Padding to 64bytes
60	4	CRC		Check	

7.5.3.2 ARP Response Packet

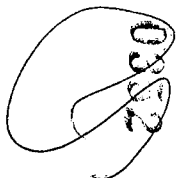
Offset	# of Bytes	Field	Value	Action
0	6	Destination Address		Copy from ARP Request Source Address
6	6	Source Address		Station address
12	S = (0/4)	Possible VLAN Tag		Copy from ARP Request
12 + S	D = (0/8)	Possible LLC/SNAP Header		Copy from ARP Request
12 + S + D	2	Type	0x0806	Constant (Copy from ARP Request)
14 + S + D	2	Hardware Type	0x0001	Constant (Copy from ARP Request)
16 + S + D	2	Protocol Type	0x0800	Constant (Copy from ARP Request)
18 + S + D	1	Hardware Size	0x06	Constant (Copy from ARP Request)
19 + S + D	1	Protocol Address Length	0x04	Constant (Copy from ARP Request)
20 + S + D	2	Operation	0x0002	Constant
22 + S + D	6	Sender Hardware Address		Station Address
28 + S + D	4	Sender IP Address		Target IP address from ARP Request or valid IP address if Target IP was zero
32 + S + D	6	Target Hardware Address		Sender MAC address from ARP Request
38 + S + D	4	Target IP Address		Sender IP address from ARP Request
42 + S + D	18 - S - D	Padding	0x00	Padding to 64 bytes
60	4	CRC		Calculate

7.5.4 IPv6 Proxy - Neighbor Discovery

In IPv6 networks, ICMPv6 Neighbor solicitation and Neighbor advertisement provides the address mapping of the IP address to a corresponding MAC address.

Neighbor Discovery is a set of 5 message types that are implemented on ICMPv6. The message types are:

- Router Solicitation
- Router Advertisement
- Neighbor Solicitation
- Neighbor Advertisement
- Redirect





Only two of these messages that are significant for resolving IPv6 addresses to the MAC address Neighbor Solicitation and Neighbor Advertisement.

Machines that operate in IPv6 networks are sent an ICMPv6 Neighbor Solicitation and must respond with their link-layer (MAC) address in their ICMPv6 Neighbor Advertisement response. The solicitation may be for either the link-local, global, or a temporary IPv6 addresses.

Neighbor discovery messages have both an IPv6 header and the ICMPv6 header. The IPv6 header is a standard one, including the source and destination IP addresses. The Network proxy offload does not support IPv6 Neighbor discovery messages that also have IPv6 header extensions these packets will be silently discarded with no reply.

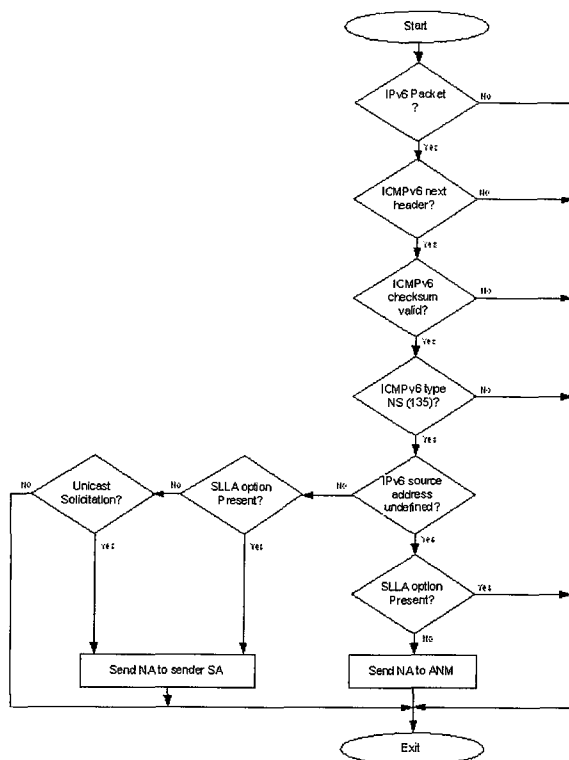


Figure 7-3 Neighbor Discovery



7.5.4.1 Ipv6 Neighbor Solicitation Packet

Offset	# of bytes	Field	Value (hex)	Action	Comment
0	6	Destination Address		Compare	MAC Header. Processed by main address filter
6	6	Source Address		Skip	
12	S=(0/4)	Possible VLAN Tag		Skip	
12+S	D=(0/8)	Possible LLC/SNAP Header		Skip	
IPv6 header					
12+D+S	2	Type	0x86DD	Compare	IPv6
14+D+S	1	Version/ Traffic Class	0x6	Compare	Check IPv6
15+D+S	3	Traffic Class/Flow Label		Ignore	
18+D+S	2	Payload Length		Ignore	
20+D+S	1	Next Header	0x3A	Check	ICMPv6
21+D+S	1	Hop Limit	0xFF	Compare	
22+D+S	16	Source Address		Ignore	Check if source address is undefined
38+D+S	16	Destination Address		Ignore	
ICMPv6 header					
54+D+S	1	Type	0x87	Compare	Neighbor Solicitation
55+D+S	1	Code	0x0	Compare	
56+D+S	2	Checksum		Check	
58+D+S	4	Reserved	0x0000	Ignore	
62+D+S	16	Target IP Address	IP6AT	Compare	
78+D+S	1	Type	0x1	Compare	Possible Source Link Layer Address option (Should not appear if source address is undefined)
79+D+S	1	Length	0x1	Compare	
80+D+S	6	Link Layer Address		Skip	
86+D+S	4	CRC		Check	

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7.5.4.2 Ipv6 Neighbor Advertisement Packet

Offset	# of bytes	Field	Value (hex)	Action
0	6	Destination Address		Copy from ND packet
6	6	Source Address		Station Address
12	S=(0/4)	Possible VLAN Tag		Copy from ND packet
12+S	D=(0/8)	Possible LLC/SNAP Header		Copy from ND packet
IPv6 header				
12+D+S	2	Type	0x86DD	Constant (Copy from ND packet)
14+D+S	1	Version/ Traffic Class	0x6	Constant (Copy from ND packet)
15+D+S	3	Traffic Class/Flow Label		Constant (Copy from ND packet)
18+D+S	2	Payload Length		
20+D+S	1	Next Header	0x3A	Constant
21+D+S	1	Hop Limit	0xFF	Constant
22+D+S	16	Source Address		relevant IPv6AT entry (ND target address)
38+D+S	16	Destination Address		Copy from ND packet Source address If source address was undefined - send to All Nodes Multicast (FF02::1)
ICMPv6 header				
54+D+S	1	Type	0x8B	Constant
55+D+S	1	Code	0x0	
56+D+S	2	Checksum		Calculate
58+D+S	4	Flags	0x60000000	Constant (Solicited, Override) if the source address was defined
			0x20000000	Constant (Override) if the source address was undefined
62+D+S	16	Target IP Address	IP6AT	Same as source address
78+D+S	1	Type	0x2	
79+D+S	1	Length	0x1	Target Link Layer Address option
80+D+S	6	Link Layer Address	From ND	
86+D+S	4	CRC		Calculate



7.5.5 Multicast Listener Discovery Support

Microsoft requires that any device that claims support of NS (IPv6 Neighbor Solicitation) Proxying will also support protocol offload of the Multicast Listener Discovery (MLD) protocol for the solicited node addresses of the device IPv6 addresses.

The purpose of Multicast Listener Discovery (MLD) is to enable each IPv6 router to discover the presence of multicast listeners (that is, nodes wishing to receive multicast packets) on its directly attached links, and to discover specifically which multicast addresses are of interest to those neighboring nodes. This information is then provided to whichever IPv6 multicast routing protocol such as Neighbor Solicitation (NS) is being used by the router, in order to ensure that multicast packets are delivered to all links where there are interested receivers. If no responses are received on a specific link where MLD queries for a specific multicast address then a packet with this multicast address will not be forwarded to this link.

MLD is a sub-protocol of ICMPv6, MLD message types are a subset of the set of ICMPv6 messages, and MLD messages are identified in IPv6 packets by a preceding Next Header value of 58 (i.e. the ICMPv6 Next Header value).

Two versions of MLD messaging (MLDv1 and MLDv2) are defined in:

- RFC 2710, Multicast Listener Discovery (MLDv1) for IPv6, 1999
- RFC 3810, Multicast Listener Discovery Version 2 (MLDv2) for IPv6, 2004

MLDv2 is designed to be inter-operable with MLDv1.

MLD messages supported by the I219

As a Receiver:

- Multicast Listener Query (ICMPv6 Type = decimal 130).

There are two subtypes of Multicast Listener Query messages supported by the I219:

- General Query used to learn which multicast addresses have listeners on an attached link.
- Multicast-Address-Specific Query, used to learn if a particular multicast address has any listeners on an attached link.

As a Transmitter:

- Multicast Listener Report (ICMPv6 Type = decimal 131).

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7.5.5.1 MLD Query Packet

Offset	# of bytes	Field	Value (hex)	Action	Comment
0	6	Destination Address		Compare	MAC Header. Processed by main address filter
6	6	Source Address		Skip	
12	S=(0/4)	Possible VLAN Tag		Skip	
12+S	D=(0/8)	Possible LLC/SNAP Header		Skip	
IPv6 header					
12+D+S	2	Type	0x86DD	Compare	IPv6
14+D+S	1	Version/ Traffic Class	0x6	Compare	Check IPv6
15+D+S	3	Traffic Class/Flow Label		Ignore	
18+D+S	2	Payload Length		Ignore	
20+D+S	1	Next Header	0x00	Compare	Hop by Hop
21+D+S	1	Hop Limit	0x01	Compare	
22+D+S	16	Source Address		Ignore	
38+D+S	16	Destination Address		Compare	
Hop by Hop header					
54+D+S	1	Next Header	0x3A	Compare	ICMPv6
55+D+S	1	Header Extended Length	0x00	Compare	
56+D+S	1	Type	0x05	Ignore	Router Alert
57+D+S	1	Length	0x02	Ignore	
58+D+S	2	MLD	0x0000	Ignore	MLD packet
60+D+S	1	PadN Option	0x01	Ignore	
61+D+S	1	PadN Length	0x00	Ignore	
ICMPv6 header					
62+D+S	1	Type	0x82	Compare	MLD Query
63+D+S	1	Code	0x0	Ignore	
64+D+S	2	Checksum		Check	
66+D+S	2	Maximum Respond Delay	0x0000	Ignore	
68+D+S	2	Reserved	0x0000	Ignore	
70+D+S	16	Multicast IP Address		Compare	104 MSB FF02::0001:FFxx:xxxx assume lower 24 bits match



7.5.5.2 MLD Report Packet

Offset	# of bytes	Field	Value (hex)	Action
0	6	Destination Address		Copy from MLD query packet
6	6	Source Address		Station Address
12	S=(0/4)	Possible VLAN Tag		Copy from MLD packet
12+S	D=(0/8)	Possible LLC/SNAP Header		Copy from MLD packet
IPv6 header				
12+D+S	2	Type	0x86DD	Constant (Copy from MLD packet)
14+D+S	1	Version/ Traffic Class	0x6	Constant (Copy from MLD packet)
15+D+S	3	Traffic Class/Flow Label		Constant (Copy from MLD packet)
18+D+S	2	Payload Length		
20+D+S	1	Next Header	0x00	Constant (Copy from MLD packet)
21+D+S	1	Hop Limit	0x01	Constant (Copy from MLD packet)
22+D+S	16	Source Address		Link Local Address
38+D+S	16	Destination Address		Multicast Address being reported
Hop by Hop header				
54+D+S	1	Next Header	0x3A	Constant (Copy from MLD packet)
55+D+S	1	Header Extended Length	0x00	Constant (Copy from MLD packet)
56+D+S	1	Type	0x05	Constant (Copy from MLD packet)
57+D+S	1	Length	0x02	Constant (Copy from MLD packet)
58+D+S	2	MLD	0x0000	Constant (Copy from MLD packet)
60+D+S	1	PadN Option	0x01	Constant (Copy from MLD packet)
61+D+S	1	PadN Length	0x00	Constant (Copy from MLD packet)
ICMPv6 header				
62+D+S	1	Type	0x83	Constant
63+D+S	1	Code	0x00	Constant
64+D+S	2	Checksum		Calculate
66+D+S	2	Maximum Respond Delay	0x0000	
68+D+S	2	Reserved	0x0000	
70+D+S	16	Multicast Address		Copy from MLD query packet, if undefined send a single packet for each of Product Name IP addresses

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7.6 Loopback

PHY loopback is supported in the LAN Connect Device. Software or Firmware should set the LAN Connected Device to the loopback mode via MDIC register writing to the PHY Control Register (Page 0 Register 00). The PHY supports a number of loopback modes configured through the Loopback Control Register (Page 0 Register 19).

For more information on the different loopback modes, refer to Section 9.5.2.14.1.

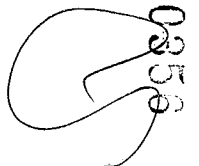
The LAN Controller must be in forced link and in full duplex mode for PHY loopback to operate. The following bits must be configured in the LAN Controller to enable PHY loopback:

- CTRL.FRCDPLX = 1b: // Force duplex mode by the integrated LAN controller
- CTRL.FD = 1b: // Set Full Duplex mode

Note: Host driver needs to disable energy detect prior to configuring the LAN Connected Device into loopback mode.



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8.0 PHY Functionality

8.1 Reverse Auto-Negotiation

When reverse auto-negotiation (LPLU) is enabled, the auto-negotiation process proceeds as usual except the priority resolution is resolved in the order shown in Table 8-1. The IEEE registers 4.8:5 and 9.9:8 are used to advertise the capability just like in normal auto-negotiation. Fullchip register 25_0.6 (PHY address 1, page 0, register 25, it 6) controls whether GbE mode should be advertised regardless of the values in registers 9.9:8.

Table 8-1 Reverse Auto-Negotiation Priority Resolution

Priority	Speed/Duplex
1 (highest)	10 full-duplex
2	10 half-duplex
3	100 full-duplex
4	100 half-duplex
5 (lowest)	1000 full-duplex

Full-chip registers 25_0.2 (PHY address 1, page 0, register 25, bit 1) and 25_0.6 (PHY address 1, page 0, register 25, bit 6) controls the auto-negotiation behavior as listed in Table 8-1. Note that the LPLU and 1000dis signals can toggle respectively. A 1b to 0b transition sets the register to zero, and a 0b to 1b transition set the register to one.

Since these registers can be changed via signal toggling or via MDIO write access, the latest occurring event (signal toggling or register write) will determine the values in the registers.

Registers 25_0.2 (PHY address 1, page 0, register 25, bit 2) and 25_0.6 (PHY address 1, page 0, register 25, bit 6) will not take effect unless one of the following occurs.

- Software reset is asserted (Register 0.15)
- Restart Auto-Negotiation-Now is asserted (Register 25_0.10)

The enabling of reverse auto-negotiation and the disabling of 1000BASE-T creates some conflicts. Table 8-2 clarifies the behavior.



Table 8-2 Reverse Auto-Negotiation, Disable 1000BASE-T, and Down-Shift Behavior

Reverse/ Normal Auto-Negotiation	Disable 1000BASE-T	Action
Reverse	Disable	Negotiates to the lowest of 10/100/1000.
Reverse	Enable	Negotiates to the lowest of 10/100.
Normal	Disable	Negotiates to the highest of 10/100/1000.
Normal	Enable	Negotiates to the highest of 10/100.

The reverse auto-negotiation mechanism works by temporarily stalling the base page exchange until the link partners 10/100 capabilities is learned. Once the PHY learns the link partner's capability it advertises only the desired capability, in this case the lowest speed with the highest duplex. Figure 8-1 illustrates the process in more detail.

Each time auto-negotiation is restarted all advertised capabilities are advertised to the link partner. If reverse auto negotiation is enabled then the pause bits for every other FLP burst is inverted. Since the link partner never sees 3 consecutive FLP burst having the same bit pattern its auto-negotiation is stalled. At the same time the link partner advertises its capabilities. Once the PHY learns the link partner's capabilities it determines the lowest common speed/duplex. It then no longer advertises any higher capabilities in the FLP burst. This new set of advertisement is used and the remainder of the auto-negotiation process continues. For example, the FLP burst pause bits are no longer toggling so the link partner's auto-negotiation process is no longer stalled.)

Note: If two PHYs with reverse auto-negotiation enabled are connected to each other, the process described above will still work. Since all advertised capabilities are initially sent to the link partner and the speed/duplex bits are not toggling it is possible for the PHY to determine each other's capabilities.



TEST REPORT IEC 60950-1 Information technology equipment - Safety - Part 1: General requirements	
Report Reference No	E307995-A405-CB-1
Date of issue	2017-06-02
Total number of pages	62
CB Testing Laboratory	UL-CCIC Company Limited
Address	No. 2, Chengwan Road, Suzhou Industrial Park, Suzhou 215122, China
Applicant's name	LENOVO (BEIJING) LTD
Address	NO 6 CHUANGYE RD SHANG DI INFORMATION INDUSTRY BASE HAIDIAN DISTRICT BEIJING 100085 CHINA
Test specification:	
Standard	IEC 60950-1:2005 (Second Edition); Am1:2009 + Am2:2013
Test procedure	CB Scheme
Non-standard test method	N/A
Test Report Form No.	IEC60950_1F
Test Report Form originator	SGS Fimko Ltd
Master TRF	Dated 2014-02
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Test item description	Desktop Workstation
Trade Mark	Lenovo
Manufacturer	LENOVO (BEIJING) LTD NO 6 CHUANGYE RD, SHANG DI INFORMATION INDUSTRY BASE, HAIDIAN DISTRICT, BEIJING 100085, CHINA
Model/Type reference	30BV*****, 30BD*****, 30BC***** (Where * may be 0-9, a-z, A-Z, any alphanumeric character, hyphen or blank.), ThinkStation P920
	***, for marketing purpose and no impact safety related critical components and constructions.
Ratings	I/P: 100-240Vac, 15-9A, 50/60Hz

Testing procedure and testing location:	
<input checked="" type="checkbox"/> CB Testing Laboratory	Testing location / address: UL-CCIC Company Limited No. 2, Chengwan Road, Suzhou Industrial Park, Suzhou 215122, China
<input type="checkbox"/> Associated CB Test Laboratory	Testing location / address:
	Tested by (name + signature): Vonty Zhang/ Project Handler <i>Vonty Zhang</i>
	Approved by (name + signature): Wei Chen/ Project Reviewer <i>Wei Chen</i>
<input type="checkbox"/> Testing Procedure: TMP/CTF Stage 1	
	Testing location / address:
	Tested by (name + signature):
	Approved by (name + signature):
<input type="checkbox"/> Testing Procedure: WMT/CTF Stage 2	
	Testing location / address:
	Tested by (name + signature):
	Witnessed by (name + signature):
	Approved by (name + signature):
<input type="checkbox"/> Testing Procedure: SMT/CTF Stage 3 or 4	
	Testing location / address:
	Tested by (name + signature):
	Approved by (name + signature):
	Supervised by (name + signature):
<input type="checkbox"/> Testing Procedure: RMT	
	Testing location / address:
	Tested by (name + signature):
	Approved by (name + signature):
	Supervised by (name + signature):

List of Attachments	
National Differences (57 pages)	
Enclosures (52 pages)	
Summary Of Testing	
Unless otherwise indicated, all tests were conducted at UL-CCIC Company Limited No. 2, Chengwan Road, Suzhou Industrial Park, Suzhou 215122, China.	
Tests performed (name of test and test clause)	Testing location / Comments
End Product Reference Page	

Power Supply Reference Page
Input: Single-Phase (1.6.2)
Energy Hazard Measurements (2.1.1.5, 2.1.2, 1.2.8.10)
Limited Power Source Measurements (2.5)
Stability (4.1)
Steady Force (4.2.1 - 4.2.4)
Impact (4.2.5, 4.2.1, Part 22 10.2)
Knob Pull/Handle Loading (4.3.2)
Heating (4.5.1, 1.4.12, 1.4.13)
Abnormal Operation (5.3.1 - 5.3.9)
Summary of Compliance with National Differences:
Countries outside the CB Scheme membership may also accept this report.
List of countries addressed: AR, AT, AU, BE, BG, BY, CA, CH, CN, CS, CZ, DE, DK, EU, FI, FR, GB, GR, HU, IL, IN, IT, JP, KR, MY, NL, NO, NZ, PL, RO, SA, SE, SG, SI, SK, UA, US, ZA
The product fulfills the requirements of: EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013 (which includes all European national differences, including those specified in this test report).



Copy of Marking Plate

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.



Test item particulars :	
Equipment mobility	stationary
Connection to the mains	pluggable A
Operating condition	continuous
Access location	operator accessible
Over voltage category (OVC)	OVC II
Mains supply tolerance (%) or absolute mains supply values	+10%, -10%
Tested for IT power systems	No
IT testing, phase-phase voltage (V)	N/A
Class of equipment	Class I (earthed)
Considered current rating of protective device as part of the building installation (A)	20 A
Pollution degree (PD)	PD 2
IP protection class	IP X0
Altitude of operation (m)	Up to 5000m
Altitude of test laboratory (m)	Up to 2000m
Mass of equipment (kg)	25.97kg
Possible test case verdicts:	
- test case does not apply to the test object	N / A
- test object does meet the requirement	P(Pass)
- test object does not meet the requirement	F(Fail)
Testing:	
Date(s) of receipt of test item	2017-02-11 to 2017-03-17
Date(s) of Performance of tests	2017-03-14 to 2017-05-19
General remarks:	
<p>“(see Enclosure #)” refers to additional information appended to the report.</p> <p>“(see appended table)” refers to a table appended to the report.</p> <p>Throughout this report a point is used as the decimal separator.</p>	
Manufacturer's Declaration per Sub Clause 4.2.5 of IEC 60950-1:	
<p>The application for obtaining a CB Test Certificate includes more than one factory and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided</p> <p>When differences exist, they shall be identified in the General Product Information section.</p>	
Name and address of Factory(ies):	<p>FLEXTRONICS INTERNATIONAL KFT</p> <p>IKERVARI U 25</p> <p>9600 SARVAR HUNGARY</p> <p>LENOVO CENTRO TECNOLÓGICO S DE RL DE CV</p> <p>APODACA TECHNOLOGY PARK</p>

0560

BLVD ESCOBEDO #316
CP 66601 APODACA
NL MEXICO

LENOVO US FULFILLMENT CENTER L L C
6540 FRANZ WARNER PKWY
WHITSETT NC 27377-9215
UNITED STATES

LENOVO INFORMATION PRODUCTS (SHEN ZHEN) CO LTD
NO 30 TAOHUA RD
FUTIAN FREE TRADE ZONE
FUTIAN DISTRICT
SHENZHEN
GUANGDONG 518038 CHINA

GENERAL PRODUCT INFORMATION:

Report Summary

All applicable tests according to the referenced standard(s) have been carried out.

Product Description

Workstation consist of certified power supply, RTC battery, DC fan, HDD, CD/DVD ROM, CPU, main board and housed in metal enclosure.

Model Differences

All models are identical to each other except for model designation.

Additional Information

- "Maximum normal load" was defined by client as follows: Two CPUs are running and operating continuously. With all HDDs and memory cards fully set up, with the graphic card PH400 sku500 (P/N: GP100) made by NVIDIA CORP and one USB 3.1 type C card added, and with the additional load 460.8W (12Vdc*9.6A*4) for 12Vdc.
- The label is a draft of an artwork for marking plate pending approval by National Certification Bodies and it shall not be affixed to products prior to such an approval.

Technical Considerations

- The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's specification of: 35 degree C --
- The means of connection to the mains supply is: Pluggable A Detachable power cord --
- The product is intended for use on the following power systems: TN --
- The equipment disconnect device is considered to be: Appliance inlet --
- The class of laser product is: Class 1 (I), applied on certified CD-ROM and/or DVD-ROM. --
- The following circuit locations (with circuit/schematic designation) were investigated as a limited power source (LPS): All outputs. --

- The following are available from the Applicant upon request: Installation (Safety) Instructions / Manual --
- LEDs provided in the product are considered low power devices: Yes --
- The product was investigated to the following additional standards: EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + A2:2013 (which includes all European national differences, including those specified in this test report). --

Abbreviations used in the report:

- normal condition	N.C.	- single fault condition	S.F.C
- operational insulation	OP	- basic insulation	BI
- basic insulation between parts of opposite polarity:	BOP	- supplementary insulation	SI
- double insulation	DI	- reinforced insulation	RI

Indicate used abbreviations (if any)



IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
1	GENERAL		Pass
1.5	Components		Pass
1.5.1	General		Pass
	Comply with IEC 60950-1 or relevant component standard	(See appended table 1.5.1)	Pass
1.5.2	Evaluation and testing of components	<p>Certified components are used in accordance with their ratings, certifications and they comply with applicable parts of this Standard.</p> <p>Components not certified are used in accordance with their ratings and they comply with applicable parts of IEC 60950-1 and the relevant component Standard.</p> <p>Components, for which no relevant IEC Standard exist, have been tested under the conditions occurring in the equipment, using applicable parts of IEC 60950-1.</p>	Pass
1.5.3	Thermal controls		N/A
1.5.4	Transformers	Evaluated as part of power supply.	N/A
1.5.5	Interconnecting cables	No interconnecting cables provided as part of the equipment.	N/A
1.5.6	Capacitors bridging insulation	Evaluated as part of power supply.	N/A
1.5.7	Resistors bridging insulation	Evaluated as part of power supply.	N/A
1.5.7.1	Resistors bridging functional, basic or supplementary insulation		N/A
1.5.7.2	Resistors bridging double or reinforced insulation between a.c. mains and other circuits		N/A
1.5.7.3	Resistors bridging double or reinforced insulation between a.c. mains and antenna or coaxial cable		N/A
1.5.8	Components in equipment for IT power systems		N/A
1.5.9	Surge suppressors	Evaluated as part of power supply.	N/A

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
1.5.9.1	General		N/A
1.5.9.2	Protection of VDRs		N/A
1.5.9.3	Bridging of functional insulation by a VDR		N/A
1.5.9.4	Bridging of basic insulation by a VDR		N/A
1.5.9.5	Bridging of supplementary, double or reinforced insulation by a VDR		N/A
1.6	Power interface		Pass
1.6.1	AC power distribution systems	TN	Pass
1.6.2	Input current	<p>(see appended table 1.6.2)</p> <p>The steady state input current of the equipment did not exceed the RATED CURRENT by more than 10% under NORMAL LOAD.</p>	Pass
1.6.3	Voltage limit of hand-held equipment		N/A
1.6.4	Neutral conductor	Neutral insulation is provided in the power supply.	Pass

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
1.7	Marking and instructions		Pass
1.7.1	Power rating and identification markings	Rating marking readily visible to operator.	Pass
1.7.1.1	Power rating mark		Pass
	Multiple mains supply connections		N/A
	Rated voltage(s) or voltage range(s) (V)	100-240Vac	Pass
	Symbol for nature of supply, for d.c. only		N/A
	Rated frequency or rated frequency range (Hz)	50/60Hz	Pass
	Rated current (mA or A)	15-9A	Pass
1.7.1.2	Identification markings		Pass
	Manufacturer's name or trademark or identification mark	LENOVO (BEIJING) LTD or Lenovo or E307995	Pass
	Model identification or type reference	30BV*****, 30BD*****, 30BC***** (Where * may be 0-9, a-z, A-Z, any alphanumeric character, hyphen or blank.), ThinkStation P920 ***, for marketing purpose and no impact safety related critical components and constructions.	Pass
	Symbol for Class II equipment only		N/A
	Other markings and symbols	Additional symbols may be provided when submitted for National Approval.	Pass
1.7.1.3	Use of graphical symbols		N/A
1.7.2	Safety instructions and marking	Operating/safety instructions made available to the user.	Pass
1.7.2.1	General		Pass
1.7.2.2	Disconnect devices		N/A
1.7.2.3	Overcurrent protective device		N/A
1.7.2.4	IT Power distribution systems		N/A
1.7.2.5	Operator access with a tool		N/A
1.7.2.6	Ozone		N/A
1.7.3	Short duty cycles		N/A
1.7.4	Supply voltage adjustment		N/A
	Method and means of adjustment; reference to		N/A

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
	installation instructions		
1.7.5	Power outlets on the equipment		N/A
1.7.6	Fuse identification (marking, special fusing characteristics, cross-reference)	Evaluated as part of power supply.	N/A
1.7.7	Wiring terminals		Pass
1.7.7.1	Protective earthing and bonding terminals	Appliance Inlet provided.	Pass
1.7.7.2	Terminals for a.c. mains supply conductors		N/A
1.7.7.3	Terminals for d.c. mains supply conductors		N/A
1.7.8	Controls and indicators		Pass
1.7.8.1	Identification, location and marking	The function of controls affecting safety is obvious regardless of language.	N/A
1.7.8.2	Colours	Only functional indicators use color.	Pass
1.7.8.3	Symbols according to IEC 60417	The stand-by switch in the plastic cover is marked with the correct symbol (60417-1-IEC-5009).	Pass
1.7.8.4	Markings using figures		N/A
1.7.9	Isolation of multiple power sources		N/A
1.7.10	Thermostats and other regulating devices		N/A
1.7.11	Durability	All markings provided on UL Recognized Component labels suitable for surface they are applied upon and meet the durability test	Pass
1.7.12	Removable parts	No marking is located on (a) removable part(s).	N/A
1.7.13	Replaceable batteries	The required warning is placed in the user guide.	Pass
	Language(s)	Reviewed only English markings/instructions. May be provided in other languages upon request from the manufacturer.	
1.7.14	Equipment for restricted access locations		N/A

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
2	PROTECTION FROM HAZARDS		Pass
2.1	Protection from electric shock and energy hazards		Pass
2.1.1	Protection in operator access areas		Pass
2.1.1.1	Access to energized parts	The operator has access to bare parts of SELV CIRCUITS. The hazardous energized parts cannot be bridged.	Pass
	Test by inspection.....	All accessible circuits are SELV circuits.	Pass
	Test with test finger (Figure 2A)	The test finger was unable to contact bare hazardous parts, basic insulation, or ELV circuits.	Pass
	Test with test pin (Figure 2B).....	The test pin was unable to contact bare hazardous parts.	Pass
	Test with test probe (Figure 2C)	No TNV circuits.	N/A
2.1.1.2	Battery compartments		N/A
2.1.1.3	Access to ELV wiring		N/A
	Working voltage (V _{peak} or V _{rms}); minimum distance through insulation (mm)		-
2.1.1.4	Access to hazardous voltage circuit wiring	Only SELV internal wiring accessible to the user.	N/A
2.1.1.5	Energy hazards	No accessible parts at hazardous energy can be bridged.	Pass
2.1.1.6	Manual controls	No shafts or knobs, etc. at ELV, TNV or hazardous voltage.	N/A
2.1.1.7	Discharge of capacitors in equipment	Evaluated as part of power supply.	N/A
	Measured voltage (V); time-constant (s)		-
2.1.1.8	Energy hazards - d.c. mains supply		N/A
	a) Capacitor connected to the d.c. mains supply ..		N/A
	b) Internal battery connected to the mains supply :		N/A
2.1.1.9	Audio amplifiers		N/A
2.1.2	Protection in service access areas		N/A
2.1.3	Protection in restricted access locations		N/A

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
2.2	SELV circuits		Pass
2.2.1	General requirements		Pass
2.2.2	Voltages under normal conditions (V)	All accessible voltages are less than 42.4 Vp or 60 V dc and are classified as SELV.	Pass
2.2.3	Voltages under fault conditions (V)	Under fault conditions voltage never exceed 71 Vp and 120 Vdc and do not exceed 42.4 Vp or 60 Vdc for more than 0.2 sec.	Pass
2.2.4	Connection of SELV circuits to other circuits	The SELV circuits are not connected to circuits other than protective earth and other SELV circuits.	Pass
2.3	TNV circuits		N/A
2.3.1	Limits		N/A
	Type of TNV circuits		-
2.3.2	Separation from other circuits and from accessible parts		N/A
2.3.2.1	General requirements		N/A
2.3.2.2	Protection by basic insulation		N/A
2.3.2.3	Protection by earthing		N/A
2.3.2.4	Protection by other constructions		N/A
2.3.3	Separation from hazardous voltages		N/A
	Insulation employed.....		-
2.3.4	Connection of TNV circuits to other circuits		N/A
	Insulation employed.....		-
2.3.5	Test for operating voltages generated externally		N/A

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
2.4	Limited current circuits		N/A
2.4.1	General requirements		N/A
2.4.2	Limit values		N/A
	Frequency (Hz)		-
	Measured current (mA)		-
	Measured voltage (V)		-
	Measured circuit capacitance (nF or μ F)		-
2.4.3	Connection of limited current circuits to other circuits		N/A
2.5	Limited power sources		Pass
	a) Inherently limited output	Except for Power Level Output Pins, other pins of VGA ports, HDMI, DP ports and USB ports are data ports only and are identified by schematic review as being supplied their signals by IC drivers, and thus are inherently LPS. Pins of LAN port, COM1 port, F_PANEL Header, Line-In port and Line-Out port are data ports only and are identified by schematic review as being supplied their signals by IC/PTC drivers, and thus are inherently LPS. For certified graphics cards, see table 1.5.1 for details.	Pass
	b) Impedance limited output	All USB ports and PS/2 ports on mainboard, are limited by PTC devices. For PTCs, see table 1.5.1 for details.	Pass
	c) Regulating network limited output under normal operating and single fault condition	For I/O board (USB 3.1 type C) card, UL2367 certified IC used.	Pass
	Use of integrated circuit (IC) current limiters	See table 1.5.1 for details.	-
	d) Overcurrent protective device limited output		N/A
	Max. output voltage (V), max. output current (A), max. apparent power (VA)	See table 2.5 for details.	-
	Current rating of overcurrent protective device (A):		-

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
2.6	Provisions for earthing and bonding		Pass
2.6.1	Protective earthing	Accessible conductive parts are earthed.	Pass
2.6.2	Functional earthing		Pass
	Use of symbol for functional earthing		N/A
2.6.3	Protective earthing and protective bonding conductors		Pass
2.6.3.1	General		Pass
2.6.3.2	Size of protective earthing conductors		Pass
	Rated current (A), cross-sectional area (mm^2), AWG	For North America, protective earthing conductor for flexible cord sized in accordance with NEC/CEC.	-
2.6.3.3	Size of protective bonding conductors	Evaluated as part of power supply.	N/A
	Rated current (A), cross-sectional area (mm^2), AWG		-
	Protective current rating (A), cross-sectional area (mm^2), AWG		-
2.6.3.4	Resistance of earthing conductors and their terminations; resistance (ohm), voltage drop (V), test current (A), duration (min)	Evaluated as part of power supply.	Pass
2.6.3.5	Colour of insulation		N/A
2.6.4	Terminals	Appliance inlet used.	Pass
2.6.4.1	General		Pass
2.6.4.2	Protective earthing and bonding terminals		Pass
	Rated current (A), type, nominal thread diameter (mm)	Evaluated as part of power supply.	-
2.6.4.3	Separation of the protective earthing conductor from protective bonding conductors		N/A
2.6.5	Integrity of protective earthing	Evaluated as part of power supply.	Pass
2.6.5.1	Interconnection of equipment		N/A
2.6.5.2	Components in protective earthing conductors and protective bonding conductors	Evaluated as part of power supply.	N/A
2.6.5.3	Disconnection of protective earth	Disconnection of the protective earth at one assembly removes connection of HAZARDOUS VOLTAGES from the other assemblies at	Pass

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
		the same time.	
2.6.5.4	Parts that can be removed by an operator	An appliance coupler used.	Pass
2.6.5.5	Parts removed during servicing	Evaluated as part of power supply.	N/A
2.6.5.6	Corrosion resistance		N/A
2.6.5.7	Screws for protective bonding		N/A
2.6.5.8	Reliance on telecommunication network or cable distribution system		N/A
2.7	Overcurrent and earth fault protection in primary circuits		N/A
2.7.1	Basic requirements	Evaluated as part of power supply.	N/A
	Instructions when protection relies on building installation		N/A
2.7.2	Faults not covered in 5.3.7		N/A
2.7.3	Short-circuit backup protection		N/A
2.7.4	Number and location of protective devices		N/A
2.7.5	Protection by several devices		N/A
2.7.6	Warning to service personnel		N/A
2.8	Safety interlocks		N/A
2.8.1	General principles		N/A
2.8.2	Protection requirements		N/A
2.8.3	Inadvertent reactivation		N/A
2.8.4	Fail-safe operation		N/A
	Protection against extreme hazard		N/A
2.8.5	Moving parts		N/A
2.8.6	Overriding		N/A
2.8.7	Switches, relays and their related circuits		N/A
2.8.7.1	Separation distances for contact gaps and their related circuits (mm)		N/A
2.8.7.2	Overload test		N/A
2.8.7.3	Endurance test		N/A
2.8.7.4	Electric strength test		N/A
2.8.8	Mechanical actuators		N/A

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
2.9	Electrical insulation		Pass
2.9.1	Properties of insulating materials	Natural rubber, materials containing asbestos and hygroscopic materials are not used as insulation.	Pass
2.9.2	Humidity conditioning	Evaluated as part of power supply.	N/A
	Relative humidity (%), temperature (°C)		-
2.9.3	Grade of insulation	Functional insulation is used in the system evaluation; for Basic, Supplementary, or Reinforced insulation are evaluated as part of power supply certification.	Pass
2.9.4	Separation from hazardous voltages		Pass
	Method(s) used	Method 1 and Method 2	-

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
2.10	Clearances, creepage distances and distances through insulation		N/A
2.10.1	General	Evaluated as part of power supply.	N/A
2.10.1.1	Frequency..... :		N/A
2.10.1.2	Pollution degrees..... :		N/A
2.10.1.3	Reduced values for functional insulation		N/A
2.10.1.4	Intervening unconnected conductive parts		N/A
2.10.1.5	Insulation with varying dimensions		N/A
2.10.1.6	Special separation requirements		N/A
2.10.1.7	Insulation in circuits generating starting pulses		N/A
2.10.2	Determination of working voltage		N/A
2.10.2.1	General		N/A
2.10.2.2	RMS working voltage		N/A
2.10.2.3	Peak working voltage		N/A
2.10.3	Clearances	Evaluated as part of power supply.	N/A
2.10.3.1	General		N/A
2.10.3.2	Mains transient voltages		N/A
	a) AC mains supply..... :		N/A
	b) Earthed d.c. mains supplies..... :		N/A
	c) Unearthed d.c. mains supplies..... :		N/A
	d) Battery operation..... :		N/A
2.10.3.3	Clearances in primary circuits		N/A
2.10.3.4	Clearances in secondary circuits		N/A
2.10.3.5	Clearances in circuits having starting pulses		N/A
2.10.3.6	Transients from a.c. mains supply..... :		N/A
2.10.3.7	Transients from d.c. mains supply..... :		N/A
2.10.3.8	Transients from telecommunication networks and cable distribution systems..... :		N/A
2.10.3.9	Measurement of transient voltage levels		N/A
	a) Transients from a mains supply		N/A
	For an a.c. mains supply..... :		N/A
	For a d.c. mains supply..... :		N/A
	b) Transients from a telecommunication network		N/A
2.10.4	Creepage distances	Evaluated as part of power supply.	N/A

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
2.10.4.1	General		N/A
2.10.4.2	Material group and comparative tracking index		N/A
	CTI tests..... :		-
2.10.4.3	Minimum creepage distances		N/A
2.10.5	Solid insulation		N/A
2.10.5.1	General		N/A
2.10.5.2	Distances through insulation		N/A
2.10.5.3	Insulating compound as solid insulation		N/A
2.10.5.4	Semiconductor devices		N/A
2.10.5.5	Cemented joints		N/A
2.10.5.6	Thin sheet material - General		N/A
2.10.5.7	Separable thin sheet material		N/A
	Number of layers (pcs)..... :		-
2.10.5.8	Non-separable thin sheet material		N/A
2.10.5.9	Thin sheet material - standard test procedure		N/A
	Electric strength test..... :		-
2.10.5.10	Thin sheet material - alternative test procedure		N/A
	Electric strength test..... :		-
2.10.5.11	Insulation in wound components		N/A
2.10.5.12	Wire in wound components		N/A
	Working voltage..... :		N/A
	a) Basic insulation not under stress..... :		N/A
	b) Basic, supplementary, reinforced insulation..... :		N/A
	c) Compliance with Annex U..... :		N/A
	Two wires in contact inside wound component; angle between 45° and 90°..... :		N/A
2.10.5.13	Wire with solvent-based enamel in wound components		N/A
	Electric strength test..... :		-
	Routine test		N/A
2.10.5.14	Additional insulation in wound components		N/A
	Working voltage..... :		N/A
	- Basic insulation not under stress..... :		N/A
	- Supplementary, reinforced insulation..... :		N/A
2.10.6	Construction of printed boards		N/A

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
2.10.6.1	Uncoated printed boards		N/A
2.10.6.2	Coated printed boards		N/A
2.10.6.3	Insulation between conductors on the same inner surface of a printed board		N/A
2.10.6.4	Insulation between conductors on different layers of a printed board		N/A
	Distance through insulation		N/A
	Number of insulation layers (pcs)..... :		N/A
2.10.7	Component external terminations		N/A
2.10.8	Tests on coated printed boards and coated components		N/A
2.10.8.1	Sample preparation and preliminary inspection		N/A
2.10.8.2	Thermal conditioning		N/A
2.10.8.3	Electric strength test		N/A
2.10.8.4	Abrasion resistance test		N/A
2.10.9	Thermal cycling		N/A
2.10.10	Test for Pollution Degree 1 environment and insulating compound		N/A
2.10.11	Tests for semiconductor devices and cemented joints		N/A
2.10.12	Enclosed and sealed parts		N/A

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
3	WIRING, CONNECTIONS AND SUPPLY		Pass
3.1	General		Pass
3.1.1	Current rating and overcurrent protection	Evaluated as part of power supply.	N/A
3.1.2	Protection against mechanical damage	The wires are routed away from sharp edges and parts which could damage insulation.	Pass
3.1.3	Securing of internal wiring		Pass
3.1.4	Insulation of conductors		N/A
3.1.5	Beads and ceramic insulators		N/A
3.1.6	Screws for electrical contact pressure		Pass
3.1.7	Insulating materials in electrical connections		N/A
3.1.8	Self-tapping and spaced thread screws		N/A
3.1.9	Termination of conductors	All conductors are reliable secured.	Pass
	10 N pull test		N/A
3.1.10	Steeving on wiring		N/A

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
3.2	Connection to mains supply		Pass
3.2.1	Means of connection	The unit is provided with an appliance inlet.	Pass
3.2.1.1	Connection to an a.c. mains supply		Pass
3.2.1.2	Connection to a d.c. mains supply		N/A
3.2.2	Multiple supply connections		N/A
3.2.3	Permanently connected equipment		N/A
	Number of conductors, diameter of cable and conduits (mm)		-
3.2.4	Appliance inlets	The appliance inlet complies with IEC 60320.	Pass
3.2.5	Power supply cords	Power supply cord suitable for application and subject to country's national code and regulations to be provided by the manufacturer.	Pass
3.2.5.1	AC power supply cords		Pass
	Type	Type SVT or SJT or SPT-2 or NISPT-2	-
	Rated current (A), cross-sectional area (mm ²), AWG	15-9A, 14 AWG	-
3.2.5.2	DC power supply cords		N/A
3.2.6	Cord anchorages and strain relief		N/A
	Mass of equipment (kg), pull (N)		-
	Longitudinal displacement (mm)		-
3.2.7	Protection against mechanical damage	No parts under this unit likely to damage the power supply cord.	N/A
3.2.8	Cord guards	The equipment does not use a non detachable power supply cord.	N/A
	Diameter of minor dimension D (mm); test mass (g)		-
	Radius of curvature of cord (mm)		-
3.2.9	Supply wiring space		N/A

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
3.3	Wiring terminals for connection of external conductors		N/A
3.3.1	Wiring terminals		N/A
3.3.2	Connection of non-detachable power supply cords		N/A
3.3.3	Screw terminals		N/A
3.3.4	Conductor sizes to be connected		N/A
	Rated current (A), cord/cable type, cross-sectional area (mm ²)		-
3.3.5	Wiring terminal sizes		N/A
	Rated current (A), type and nominal thread diameter (mm)		-
3.3.6	Wiring terminals design		N/A
3.3.7	Grouping of wiring terminals		N/A
3.3.8	Stranded wire		N/A
3.4	Disconnection from the mains supply		Pass
3.4.1	General requirement	The appliance inlet is considered to be the disconnect device.	Pass
3.4.2	Disconnect devices	The equipment is provided with an appliance coupler.	Pass
3.4.3	Permanently connected equipment		N/A
3.4.4	Parts which remain energized		N/A
3.4.5	Switches in flexible cords		N/A
3.4.6	Number of poles - single-phase and d.c. equipment	Disconnect device disconnects both poles simultaneously.	Pass
3.4.7	Number of poles - three-phase equipment		N/A
3.4.8	Switches as disconnect devices		N/A
3.4.9	Plugs as disconnect devices		N/A
3.4.10	Interconnected equipment	No interconnection of hazardous voltages.	Pass
3.4.11	Multiple power sources	One power source only.	N/A

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
3.5	Interconnection of equipment		Pass
3.5.1	General requirements		Pass
3.5.2	Types of interconnection circuits	Interconnection circuits are SELV CIRCUITS.	Pass
3.5.3	ELV circuits as interconnection circuits		N/A
3.5.4	Data ports for additional equipment	The SELV circuit of data ports is supplied by a limited power source that complies with 2.5.	Pass
4	PHYSICAL REQUIREMENTS		Pass
4.1	Stability		Pass
	Angle of 10°	This unit is of a stable mechanical construction and does not overbalance when tilted to an angle of 10 degrees from its normal upright position.	Pass
	Test force (N)	Not floor-standing.	N/A

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
4.2	Mechanical strength		Pass
4.2.1	General	The SUPPLEMENTARY and REINFORCED INSULATION was subjected to the electric strength test. No breakdown was recorded.	Pass
	Rack-mounted equipment		N/A
4.2.2	Steady force test, 10 N		N/A
4.2.3	Steady force test, 30 N		N/A
4.2.4	Steady force test, 250 N	No hazards as a result of the 250 N test.	Pass
4.2.5	Impact test	No hazard as result from impact test on metal enclosure.	Pass
	Fall test		Pass
	Swing test		N/A
4.2.6	Drop test; height (mm)		N/A
4.2.7	Stress relief test		N/A
4.2.8	Cathode ray tubes		N/A
	Picture tube separately certified		N/A
4.2.9	High pressure lamps		N/A
4.2.10	Wall or ceiling mounted equipment; force (N)		N/A

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IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
4.3	Design and construction		Pass
4.3.1	Edges and corners	All edges and corners are judged to be sufficiently well rounded so as not to constitute a hazard.	Pass
4.3.2	Handles and manual controls; force (N)	Force applied to each handle: 509.012N. The handle did support the weight.	Pass
4.3.3	Adjustable controls	Investigated during separate certification of power supply.	Pass
4.3.4	Securing of parts	Electrical and mechanical connections can be expected to withstand usual mechanical stress. For the protection, solder pins, cable ties and heat shrunk tubing are used.	Pass
4.3.5	Connection by plugs and sockets	IEC 60083 or IEC 60320 type connectors not used for SELV circuits.	Pass
4.3.6	Direct plug-in equipment		N/A
	Torque		N/A
	Compliance with the relevant mains plug standard:		N/A
4.3.7	Heating elements in earthed equipment		N/A
4.3.8	Batteries	UL recognized RTC battery used.	Pass
	- Overcharging of a rechargeable battery		N/A
	- Unintentional charging of a non-rechargeable battery		N/A
	- Reverse charging of a rechargeable battery	Unintentional charging is prevented by one blocking device and one current limiting device.	Pass
	- Excessive discharging rate for any battery		N/A
4.3.9	Oil and grease		N/A
4.3.10	Dust, powders, liquids and gases		N/A
4.3.11	Containers for liquids or gases		N/A
4.3.12	Flammable liquids		N/A
	Quantity of liquid (l)		N/A
	Flash point (°C)		N/A
4.3.13	Radiation	The equipment does not	Pass

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
		generate ionizing radiation or contain flammable liquids or gases.	
4.3.13.1	General	Certified CD/DVD ROM are provided.	Pass
4.3.13.2	Ionizing radiation		N/A
	Measured radiation (pA/kg)		-
	Measured high-voltage (kV)		-
	Measured focus voltage (kV)		-
	CRT markings		-
4.3.13.3	Effect of ultraviolet (UV) radiation on materials		N/A
	Part, property, retention after test, flammability classification		N/A
4.3.13.4	Human exposure to ultraviolet (UV) radiation		N/A
4.3.13.5	Lasers (including laser diodes) and LEDs	Class 1 CD/DVD ROM employed, see Table 1.5.1. This product contains only visible indicator LEDs (Class 1) operating in the range of 400 - 700 nm wavelength. No IEC60825-1 evaluation was deemed necessary. Additional review may be required at the discretion of the accepting NCB.	Pass
4.3.13.5.1	Lasers (including laser diodes)		Pass
	Laser class	Class 1 (I)	-
4.3.13.5.2	Light emitting diodes (LEDs)	Indication only	N/A
4.3.13.6	Other types		N/A

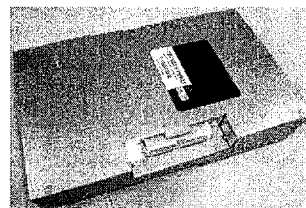
0371

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
4.4	Protection against hazardous moving parts		Pass
4.4.1	General		Pass
4.4.2	Protection in operator access areas	Hazardous moving parts of equipment are adequately enclosed and guarded.	Pass
	Household and home/office document/media shredders		N/A
4.4.3	Protection in restricted access locations		N/A
4.4.4	Protection in service access areas		Pass
4.4.5	Protection against moving fan blades		Pass
4.4.5.1	General		Pass
	Not considered to cause pain or injury. a)	For CPU fans, the moving fan blades are classified as "a" under operation condition, see Enclosure 7-01 for details. For front and rear system fans, the moving fan blades are classified as "a" if they are pulled out after 2s, see Enclosure 7-01 for details.	Pass
	Is considered to cause pain, not injury. b)		N/A
	Considered to cause injury. c)	For front and rear system fans, the moving fan blades are classified as "c" under operation condition, see Enclosure 7-01 for details.	Pass
4.4.5.2	Protection for users	The front and rear system fans are guarded so that the moving fan blades cannot be contacted under operation condition. If the fans are pulled out after 2s, the moving fan blades are classified as "a".	Pass
	Use of symbol or warning	CAUTION: Keep fingers and other parts of your body away from hazardous, moving parts. If you suffer an injury, seek medical care immediately.	Pass
4.4.5.3	Protection for service persons	The front and rear system fans are guarded so that the moving fan blades cannot be contacted under operation	Pass

IEC 60950-1			
Clause	Requirement + Test	Result - Remark	Verdict
		condition. If the fans are pulled out after 2s, the moving fan blades are classified as "a".	
	Use of symbol or warning	CAUTION: Keep fingers and other parts of your body away from hazardous, moving parts. If you suffer an injury, seek medical care immediately.	Pass
4.5	Thermal requirements		Pass
4.5.1	General		Pass
4.5.2	Temperature tests	(See appended table 4.5)	Pass
	Normal load condition per Annex L	Operated in the most unfavorable way of operation given in the operating instructions until steady conditions established.	
4.5.3	Temperature limits for materials		Pass
4.5.4	Touch temperature limits		Pass
4.5.5	Resistance to abnormal heat		N/A

80 PLUS Verification and Testing Report

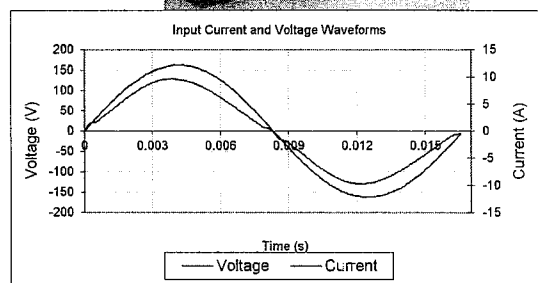
TYPICAL EFFICIENCY (50% Load): 92.62%
AVERAGE EFFICIENCY: 91.55%
80 PLUS COMPLIANT: YES



Ecos ID #	4619
Manufacturer	Lenovo (United States), Inc.
Model Number	(Lenovo)DPS-1400EB A
Serial Number	NA
Year	2016
Type	CUSTOM
Test Date	6/30/16

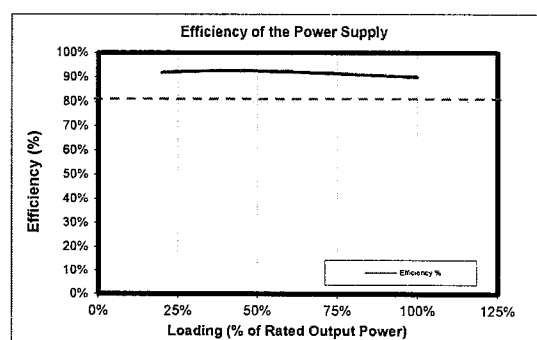
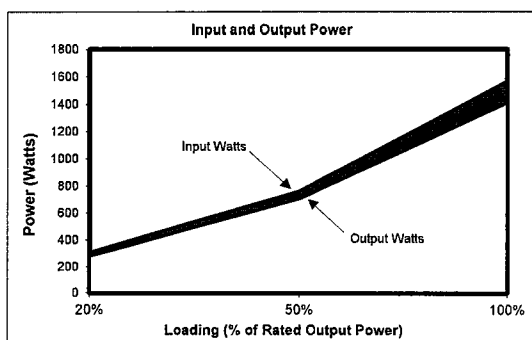
Rated Specifications	Value	Units
Input Voltage	100-240	Volts
Input Current	15-9	Amps
Input Frequency	50/60	Hz
Rated Output Power	1400	Watts

Note: All measurements were taken with input voltage at 115 V nominal at 60 Hz.



Input AC Current Waveform (ITHD = 6.54%, 50% Load)

I _{RMS} A	PF	I _{THD} (%)	Load (%)	Input Watts	DC Terminal Voltage (V)/ DC Load Current (A)					Output Watts	Efficiency %
					12V (cumulative of 12V1, 12V2, etc.)	-12V	3.3V	5V	5Vsb		
1.40	0.98	9.38%	10%	158.37	12.04/11.57	0/0	0/0	0/0	5.14/0.29	140.74	88.87%
2.69	0.99	6.44%	20%	307.00	12.05/23.19	0/0	0/0	0/0	5.14/0.57	282.30	91.95%
6.64	1.00	6.54%	50%	761.30	12.06/57.85	0/0	0/0	0/0	5.14/1.43	705.15	92.62%
13.68	1.00	7.52%	100%	1566.70	12.09/115.49	0/0	0/0	0/0	5.13/2.85	1411.13	90.07%



These tests were conducted by a third party independent testing firm on behalf of the 80 PLUS Program. 80 PLUS is a certification program to promote highly-efficient power supplies (greater than 80% efficiency in the active mode) in technology applications.
<http://www.80plus.org/>



PC Support (/br/pt) > Estações de trabalho > P Series workstations (ThinkStation) > P920 Workstation (ThinkStation) - Type 30BD (/br/pt/products/workstations/thinkstation-p-series-workstations/thinkstation-p920/30bd)



P920 Workstation (ThinkStation) - Type 30BD

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Página Inicial do Produto

Informação do produto

Número de Série: Não informado

Tipo de Máquina: 30BD

Ligações rápidas

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Status da garantia: Garantia desconhecida

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Veja o nosso Relatório Global de Sustentabilidade.
(https://www3.lenovo.com/us/en/social_responsibility/sustainability_reports/)

0375

DATASHEET



NVIDIA RTX A2000 | A2000 12GB

Design Compacto. Desempenho Inigualável.

Acelere Seu Workflow

A NVIDIA RTX™ A2000 traz o poder da tecnologia NVIDIA RTX, ray tracing em tempo real, computação acelerada por AI e gráficos de alto desempenho para mais profissionais. Construído na arquitetura NVIDIA Ampere, a RTX A2000 pronto para VR combina 26 núcleos RT de segunda geração, 104 núcleos tensores de terceira geração e 3.328 núcleos CUDA® de próxima geração e 6 ou 12 GB de memória gráfica GDDR6 com código de correção de erros (ECC) suporte para computação livre de erros. As GPUs RTX A2000 apresentam um formato PCIe de dois slots e baixo perfil com baixo consumo de energia que se encaixa em uma ampla variedade de workstations de formato pequeno, e a RTX A2000 12 GB duplica a memória para modelos e conjuntos de dados ainda maiores. Projete maior, renderize mais rápido e trabalhe de forma mais inteligente do que nunca com as GPUs RTX A2000. As GPUs profissionais NVIDIA RTX são certificadas com uma ampla variedade de aplicações profissionais, testadas pelos principais fornecedores de software independentes (ISVs) e fabricantes de workstations, e apoiado por uma equipe global de especialistas em suporte. Obtenha a tranquilidade necessária para se concentrar no que importa com a principal solução de computação visual para negócios de missão crítica.

Recursos

- > PCI Express Gen 4
- > quatro conectores Mini DisplayPort 1.4a com mecanismo de travamento
- > Suporte de decodificação AV1
- > DisplayPort com áudio
- > NVIDIA RTX Experience™
- > Software NVIDIA RTX Desktop Manager
- > Suporte HDCP 2.2
- > Tecnologia NVIDIA Mosaic¹

¹ Windows 10 e Linux. ² Taxas de pico baseadas no GPU Boost Clock. ³ 3 TeraFLOPS efetivos (TFLOPS) usando o novo recurso de esparsidade. ⁴ 4 GPU suporta API DX 12.0, nível de recurso de hardware 12.1. ⁵ O produto é baseado em uma especificação Khronos publicada e espera-se que passe no processo de teste de conformidade Khronos quando disponível. O status de conformidade atual pode ser encontrado em www.khronos.org/conformance

Especificações

Memória da GPU	NVIDIA RTX A2000 NVIDIA RTX A2000 12GB	6 GB GDDR6 12 GB GDDR6
Interface de memória		192-bit
Largura de banda de memória		288 GB/s
Código de correção de erros (ECC)		Sim
Núcleos CUDA baseados na arquitetura NVIDIA Ampere		3.328
Núcleos Tensor de terceira geração da NVIDIA		104
Núcleos RT NVIDIA de segunda geração		26
Desempenho de precisão única		8,0 TFLOPS²
Desempenho do núcleo RT		15,6 TFLOPS²
Desempenho Tensor		63,9 TFLOPS³
Interface do sistema		PCI Express 4.0 x16
Consumo de energia		Potência total da placa: 70 W
Solução térmica		Ativa
Formato		2.7" H x 6.6" L, slot duplo
Conectores para visor		4x mDP 1.4a com mecanismo de travamento
Máximo de visores simultâneos		4x 4096 x 2160 @ 120 Hz, 4x 5120 x 2880 @ 60 Hz 2x 7680 x 4320 @ 60 Hz
Mecanismos de codificação/decodificação		1x codificador, 1x decodificador (+ decodificador AV1)
Pronto para VR		Sim
APIs de gráficos		DirectX 12.0⁴, Shader Model 5.1⁴, OpenGL 4.6⁵, Vulkan 1.2⁵
APIs de computação		CUDA, DirectCompute, OpenCL™

Saiba mais

Para saber mais sobre a NVIDIA RTX A2000 ou NVIDIA RTX A2000 12GB, visite www.nvidia.com/rtx-a2000/

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Documentos Lenovo

São Paulo, 09 de Outubro de 2023.

À

E.R. SOLUÇÕES INFORMÁTICA LTDA

A **LENOVO TECNOLOGIA (BRASIL) LTDA.** ("Lenovo"), pessoa jurídica de direito privado, inscrita no CNPJ/MF sob o nº 07.275.920/0001-61, com escritório administrativo estabelecido na Rua Werner Von Siemens, 111 — Prédio 11 / Torre A — 3º e 4º andar— Bairro da Lapa — São Paulo / SP - CEP 05069-900, **DECLARA** que a empresa **E.R. SOLUÇÕES INFORMÁTICA LTDA**, inscrita no CNPJ/MF sob o nº **05.778.325/0001-13**, sediada na **AV. SENADOR CESAR VERGUEIRO, 1069 - RIBEIRÃO PRETO - SP**, está cadastrada nos sistemas internos da Lenovo como revenda autorizada, estando apta a comercializar os produtos de fabricação Lenovo abaixo discriminados:

Família	Part Number	Garantia/SLA
ThinkStation P920 Tower	30BDCTO	5WS0T36199 - Garantia de 36 meses on site

A Lenovo declara ainda que os produtos acima citados:

- Componentes do produto são novos (sem uso, reforma ou recondicionamento) e produtos pertencentes à Linha Corporativa
- Os produtos estarão continuados pelo os próximos 90 dias.
- BIOS Com direitos copyright e em conformidade com a norma NIST 800-147 ou ISO/IE19678
- Placa mãe fabricada para uso exclusivo
- CPU, teclado, mouse e monitor possuem mesmo padrão de cor e são de fabricação Lenovo.
- Teclado no padrão ABNT-2 Português.
- Os equipamento serão entregues devidamente acondicionados em embalagens individuais adequadas, que utilizam materiais recicláveis.
- Todo equipamento será integrado em fábrica.
- Os produtos estão em linha de produção sem previsão de encerramento antes de 90 dias.

Para acesso a certificações e quaisquer outras informações sobre os produtos acima listados, podem ser consultadas no site: <https://psref.lenovo.com>.

Para acesso a Drivers, atualizações, Software, Diagnósticos, Catálogos, Manuais e Guia de Instalação, podem ser consultados no site: <https://pcsupport.lenovo.com/br/pt>

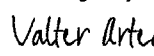
Os drivers, atualizações e suporte dos produtos Lenovo estão disponíveis para download, e busca das autorizadas técnicas Lenovo mais próxima no site:

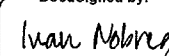
<https://pcsupport.lenovo.com/br/en/partnerlocator#providerProductName>

A Lenovo dispõe de telefone gratuito 0800-701-4815 (ligações fora da cidade de São Paulo) e 11 3889-8986 (ligações da cidade de São Paulo) para abertura de chamados técnicos em Língua Portuguesa e service desk.

A presente declaração foi emitida por solicitação da **E.R. SOLUÇÕES INFORMÁTICA LTDA** para atendimento ao Edital **25/2023**, promovido pela **CÂMARA MUNICIPAL DE SOROCABA**.

Atenciosamente,

DocuSigned by:

Valter Artea
81511403867D44E...

DocuSigned by:

Ivan Nobrega
3001903D0C54419...

LENOVO TECNOLOGIA (BRASIL) LTDA.

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DECLARAÇÃO

A IBM Brasil - Indústria, Máquinas e Serviços Ltda., inscrita no CNPJ nº33.372.251/0001-56, por intermédio do seu representante legal abaixo assinado, declara para os devidos fins, que presta serviços de suporte técnico para a Lenovo Tecnologia (Brasil) Ltda, incluindo serviços de instalação e reparos para toda a sua linha de produtos Think (Servidores, Workstation, Desktops, Notebooks e Tablets) em todo o território nacional, de acordo com o contrato Master Agreement for Services & MA-14-000138 (the "Master Agreement") e os contratos: SERVICES AGREEMENT SOW & SA-49S1600326 (the "CC&FS SOW") e o contrato SERVICES AGREEMENT SOW SA-49S1600327 the "Parts SOW") firmados entre ambas as partes.

Informamos ainda que possuímos centros de apoio reparos para assegurar atendimento local, na modalidade Centro de Atendimento Técnico do Próprio Fabricante, através de nossas filiais assim distribuídas:

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e-Signed by Carlos Affonso Formici

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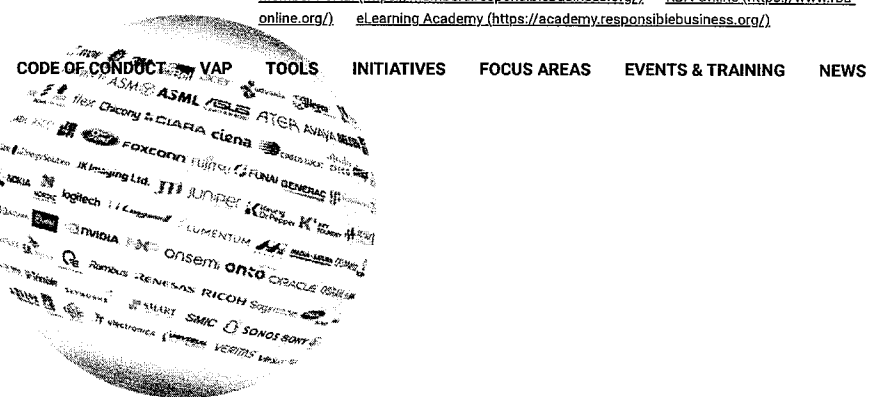
Beginning with eight members in 2004, today the RBA core membership (not counting initiative-only members) is composed of more than 200 electronics, retail, auto and toy companies with combined annual revenue greater than \$7.7 trillion, directly employing over 6 million people. In addition to RBA members, thousands of companies that are Tier 1 suppliers to those members are required to implement the RBA Code of Conduct. More than 3.5 million people from over 120 countries contribute to the manufacture of RBA members' products.

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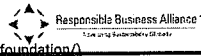
The RBA has four membership categories: Full, Regular, Affiliate, and Supporter. View the requirements of each category [here \(join-us/\)](#). Full and Regular members are designated by an "F" or "R" following their company names below:

A

- | | |
|---|---|
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B

- Belden
- Best Buy - F
- Beyondsoft International
- Block, Inc.
- BMW Group
- Bosch Sensortec - R

C

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- Canon Inc. - R
- CECONOMY AG
- Celestica - R
- ChargePoint, Inc.
- Chicony Electronics Co., Ltd - R
- Ciena - R

D

- Dell Technologies - F
- Dexcom Malaysia - R
- Dupont Electronics & Industrial

E

- ASM International - F
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- Avaya

VAP TOOLS INITIATIVES FOCUS AREAS

- Bose Corporation - R
- Broadcom, Inc.
- Brother Industries Ltd.
- BT plc
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- Cisco - F
- Citrix
- Comcast Corporation
- Compal Electronics - R
- Continental AG
- Currys PLC

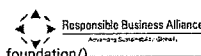
- Dustin AB
- Dyson's Operations



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Initiatives will hold a European
Conference May 23-24. This event
will focus on emerging trends and
opportunities, #EU regulations,
#SupplyChain #sustainability,
tackling #ForcedLabor, and more:
bit.ly/3GmBaFz

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the @RBAAllianceOrg's online news
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resources; including its new
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- Eaton Corporation
- Edwards Ltd. - R
- EIZO Corporation



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G

- Fabrinet - R
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- F5 Networks
- First Solar Inc. - R
- Flex - R
- Generac Power Systems
- General Motors Company

H

- HARMAN International
- Hasbro, Inc. - F
- Hexagon AB
- Hewlett Packard Enterprise - F
- Hisense USA Corporation - R

I

- IBM Corporation - R
- Ichor Systems
- Impinj
- Infineon Technologies Americas Corp.
- R

- Element Solutions Inc.
- Elem...
- Ericsson R

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April 27. Discussions to include
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emergency preparedness, building
capacity to meet cust requirements,
top #audit findings, the RBA's
#Emissions Mgt Tool: bit.ly/3xppflz
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- JBHFI Limited
- JK Imaging Ltd. - R
- JT International SA
- Juniper Networks - R

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K

- Keurig Dr Pepper - F
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- Kingston Technology
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- KYOCERA AVX Components Corporation
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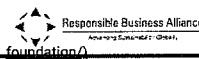
L

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- LG Electronics - R
- LG Energy Solution
- Logitech Inc. - R
- Longwell Company - R
- Lumentum Holdings Inc. - R

M

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- ModusLink
- Molex - R
- Monolithic Power Systems, Inc.

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- NetApp - R
- NETGEAR - R
- New Kinpo Group - R
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- Nielsen

- Nikon Corporation
- Nokia Solutions and Networks Oy
- Nordic Semiconductor ASA
- Nvidia Corporation - F
- NXP Semiconductors - F

O

- onsemi - F
- Onto Innovation Inc.
- Oracle America, Inc.

P

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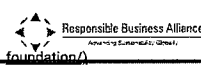
- Sagemcom, R
- Samsung Display
- Samsung Electronics - R
- Sanmina - R
- Schneider Electric
- Seagate Technology - F
- Seiko Epson Corporation - R
- Semtech Corporation
- Senju Metal Industry Co., Ltd. - R
- Sharp Corporation
- Signify - R
- Silicon Laboratories Inc.
- Silicon Motion Technology Corp.
- Siltronic AG

- Simatex, Manufacture Co. Ltd.
- Simplo Technology Co., Ltd.
- SK hynix Inc. - R
- Skyworks Solutions, Inc. - F
- SMART Global Holdings - R
- Snap Inc. - R
- Solidigm - R
- Sonos, Inc.
- Sony Group Corporation - F
- STMicroelectronics - F
- Sumitomo Electric Industries, Ltd.
- Symantec
- Synopsys, Inc.

T

- Taiwan Chinsan Electronics Industrial Co., Ltd. - R
- Taiwan Semiconductor Manufacturing Company, Ltd. - F
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- Tesla, Inc.
- Texas Instruments - R
- The LEGO Group
- 3M Electronics and Energy Business Group
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- Toshiba Corp. - R
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- Vantiva SA - F
- Veritas - R
- Versuni
- VIAVI Solutions Inc.
- Vishay Intertechnology, Inc. - R
- Vitesco Technologies GmbH
- VIZIO Inc. - R
- Volvo Car Group
- V.S. Industry Berhad

W

- Walmart
- Western Digital - R
- Wistron Corp. - R

X

- Xerox - R
- XP Power - R

Z

- Zebra Technologies Corporation - R
- Zhen Ding Technology Holding Ltd.
- ZT Systems


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(vap/svap-on-forced-labor/)	Environmental Sustainability (focus-areas/environmental-sustainability/)	Emissions Management Tool (tools/emt/)	Board of Directors (about/board/)	
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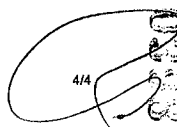
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Alex Kunovszky	Karl O. Van Leuven IV
Barry Gian James	Kushal Koolwal
Ben Lee Hughes	Lee Fisher
Benson Lin	Liqiang Ni
Cheng-Lung Chang	Lucien Pullen
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Elika S. Kohen	Pete Batard
Gail B. Keown	Phoon Sonpooshi
George Fulk	Priyanshu Pareek
Gregory Havenga	Priyanshu Pareek
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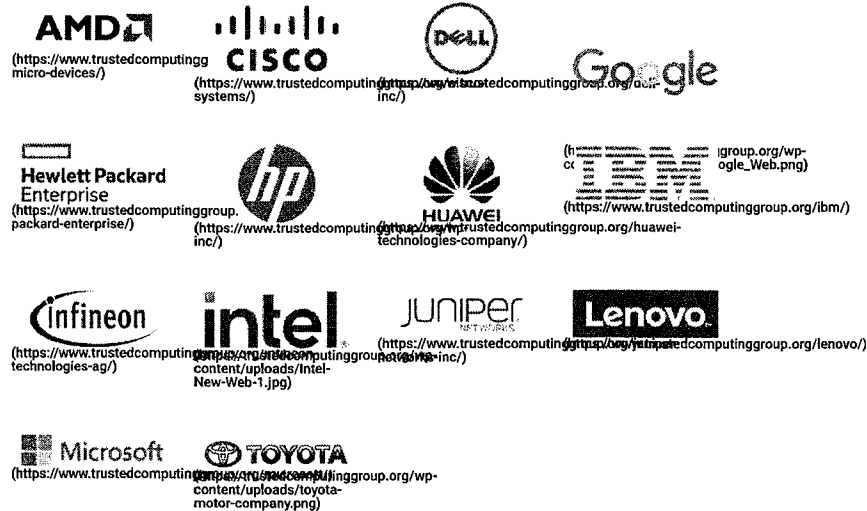
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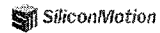
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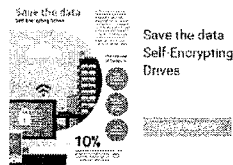
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Registro n.º: 5283519 Data da consulta: 31/10/2023 CR emitido em: 30/10/2023 CR válido até: 30/01/2024

Dados básicos

CNPJ: 07.275.920/0001-61

Razão social: LENOVO TECNOLOGIA (BRASIL) LTDA

Nome fantasia: LENOVO TECNOLOGIA (BRASIL) LTDA

Data de abertura: 03/03/2005

Endereço

Logradouro: ESTM JOSE COSTA DE MESQUITA

N.º: 200

Bairro: CHACARA ALVORADA

CEP: 13337-200

Complemento: MOD 5 A 10

Município: INDAIATUBA

UF: SP

Cadastro Técnico Federal de Atividades Potencialmente Poluidoras e Utilizadoras de Recursos Ambientais - CTF/APP

<u>Categoria</u>	<u>Detalhe</u>
5 - Indústria de material Elétrico, Eletrônico e Comunicações	2 - Fabricação de material elétrico, eletrônico e equipamentos para telecomunicação e informática

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Página Inicial do Produto

Usar o Lenovo Vantage facilita a sua vida

Descrição

Seu PC Lenovo possui características únicas que você não encontrará em nenhum outro computador, e o Lenovo Vantage torna mais fácil para que você obtenha o máximo do seu dispositivo. Tudo dentro do Lenovo Vantage é feito sob medida para você: você encontrará informações úteis e recomendações com base no seu dispositivo e a maneira como você o utiliza. Com uma interface fácil de usar, você pode:

- Personalizar suas configurações
- Melhorar a segurança do WiFi,
- Atualizar drivers
- Executar o diagnóstico do dispositivo
- Identificar o número de série do sistema e o número de produto
- Solicitação de suporte e muito mais.

Conheça mais sobre o **Lenovo Vantage** assistindo vídeos tutoriais no **Lenovo Suporte no YouTube**
(<https://www.youtube.com/channel/UCALvKsUHOASlZduN8Tuv3jA/videos>)

- (vídeo) Obtenha drivers recentes através do Lenovo Vantage (<https://www.youtube.com/watch?v=JV69KDHrOsw&t=2s>)
- Dicas Lenovo: www.lenovo.com/tips (<https://www.lenovo.com/tips>)

Nota:

- Lenovo Vantage foi criado especificamente para PCs com o Windows 10. Link para download: <https://www.microsoft.com/en-us/store/p/lenovo-companion/9wzdncrfj4mv> (<https://www.microsoft.com/en-us/store/p/lenovo-companion/9wzdncrfj4mv>)
- O Lenovo Vantage substitui o Lenovo Companion, Lenovo Settings e o Lenovo Account Portal.

Marcas aplicáveis

Desktops, Notebooks, Tablets,

Workstations

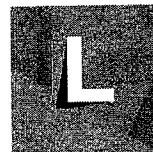
Sistema Operacional

<https://support.lenovo.com/ng/pl/solutions/ht505081>

- Windows 10

Solução

Lenovo Vantage (substituto do Lenovo Companion) é um app que mantém o seu dispositivo funcionando corretamente e o ajuda a fazer ainda mais com o seu dispositivo.



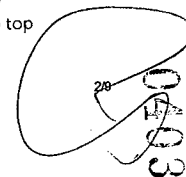
Principais características:

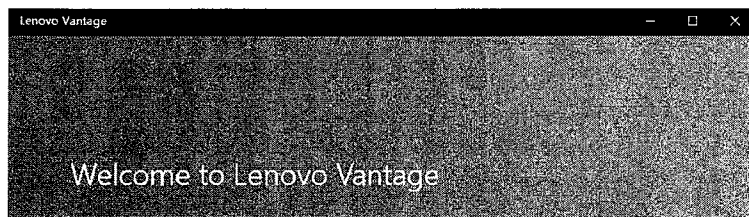
- Ajuste o seu PC Lenovo com configurações personalizadas:
 - Power: Ajuda a gerenciar e prolongar a vida da bateria do notebook
 - Áudio, Visual: Configurações da câmera, controle de brilho, configurações de microfone, configurações Dolby
 - Configurações inteligentes: Ajusta automaticamente o seu áudio e exibição com base em aplicativos que estão sendo usados.
 - Entrada: Touchpad, tecla de função (Fn), teclado luminoso, as configurações do mouse/caneta/toque
- Acesso para o Lenovo Migration Assistant - um aplicativo gratuito que transfere perfeitamente arquivos e configurações de um PC para outro
- Protege o seu PC e atualiza os drivers e softwares de sistemas importantes
- Avaliação da integridade do sistema e execução do diagnóstico no seu dispositivo
- Acesso ao guia do usuário do seu sistema e obtenção de suporte
- Descubra outras coisas divertidas e aplicativos úteis
- Veja os acessórios compatíveis com seu dispositivo
- Explore ofertas exclusivas em serviços e produtos da Lenovo
- Identifique o status da garantia
 - Data de início e data de término
 - Links para as opções de garantia e upgrades
- Obter dicas úteis e manter-se atualizado sobre as últimas notícias de tecnologia, com artigos da Lenovo

Como baixar o Lenovo Vantage

Consulte abaixo os passos para baixar e instalar o Lenovo Vantage.

1. Encontre a Microsoft Store no menu Iniciar



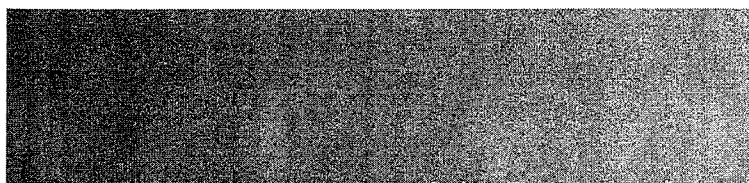


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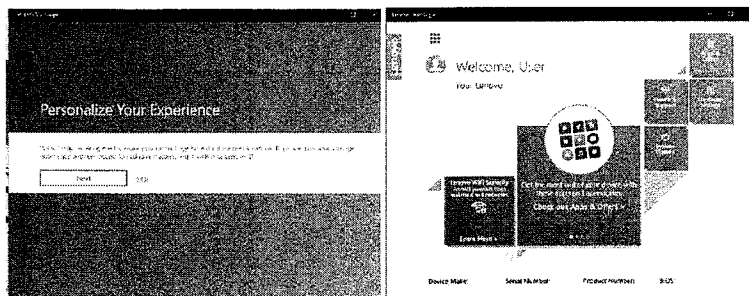
To help us make Vantage more useful and enjoyable, we need to collect some information on how you use our app. Selecting the checkbox below indicates that you agree to our license and privacy policy. No personal or identifying information is ever collected and we never share the data we collect with other parties.

☒ Accept [Lenovo's Privacy Policy](#) and allow the collection of anonymous usage statistics.

Next



5. Se você possui o Lenovo ID, pode entrar com ele. Se você não tiver, você pode pular esta etapa para acessar diretamente o Lenovo Vantage, e registrar mais tarde se quiser.



Como encontrar o Lenovo Vantage

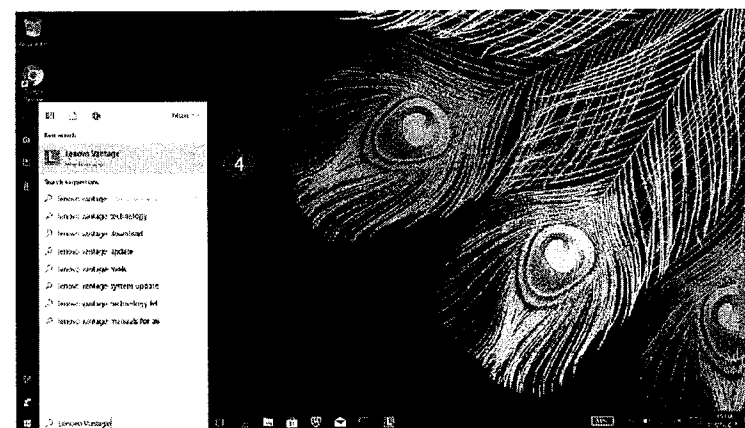
Use um dos procedimentos a seguir para encontrar Lenovo Vantage no seu dispositivo:

1. Menu iniciar: Listados na lista de aplicativos instalados.
2. **Tiles** (quadrinhos) do Windows
3. Barra de tarefas



Back to top

4. Barra de pesquisa do Windows



Caso o Lenovo Vantage não esteja instalado no seu dispositivo, você deve baixá-lo gratuitamente na Microsoft Store em <https://www.microsoft.com/en-us/store/p/lenovo-companion/9wzdncrfj4mv> (<https://www.microsoft.com/en-us/store/p/lenovo-companion/9wzdncrfj4mv>).

Artigos relacionados

- (videos) Saiba tudo sobre o Lenovo Vantage (<https://www.youtube.com/watch?v=JV69KDHrOsw&list=PL02UOv7eDI1U8cN2fg0hvwG37HqIASstQJaqi> (<https://support.lenovo.com/br/pt/videos/VID500030>))
- Encontrar número de série (<https://support.lenovo.com/br/pt/solutions/HT505229>)



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Fóruns (<http://forums.lenovo.com/>)

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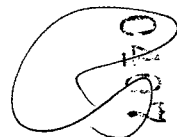
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Support (/us/en)

Documentation

Lenovo System Update: Update Drivers, BIOS and Applications

Lenovo System Update saves you time and effort by helping automate the process of finding and installing the latest drivers, BIOS, and other applications. It helps optimize the performance of your Lenovo system.



Watch our video: How to use Lenovo System Update (/videos/VID100774)

Notes:

- Lenovo System Update was previously named ThinkVantage System Update (TVSU), and is one of the ThinkVantage Technologies (/solutions/HT03)
- Lenovo Vantage (/solutions/nt505081) includes Lenovo System Update
 - [Video] Lenovo Vantage Overview (/videos/VID500030)
 - [Video] How to get the latest drivers and BIOS With Lenovo Vantage (/videos/VID500028)
- For IT Administrators, the Lenovo System Update Solution Deployment Guide is available at: ThinkVantage Technologies IT Administrator Tools (/sol)
- Lenovo System Update is only for systems that run on Windows. Android users can refer to:
 - Android Upgrade Matrix (/solutions/HT501098)

Where to download

For Windows 10, 8, 8.1 and 7

Click the button to download:

[Download tool now \(/downloads/D5012808\)](/downloads/D5012808)

Note: Microsoft .NET Framework version 4.0 (<http://www.microsoft.com/en-US/download/details.aspx?id=17718>) or above is required for System Update to

+ How to run Lenovo System Update

Note: Run Windows Update before using Lenovo System Update. When using Lenovo System Update, some of the updates are dependent on certain Windows information on Windows Update, go to:

- Windows Update: Frequently Asked Questions (<https://support.lenovo.com/us/en/solutions/HT501271>)
- Run Windows Update before using Lenovo System Update to retrieve system and software updates for your computer – ThinkCentre, ThinkPad and (/solutions/HT102010)

Important

- Lenovo System Update is used to update/install Lenovo drivers, BIOS, and applications.
- Lenovo System Update should be used to update your system after a new setup or re-image.
- It is recommended that you do not install BIOS updates along with other updates.
- Lenovo System Update may need to be run multiple times to ensure all updates have been downloaded and installed successfully.
- Lenovo System Update is supported on the following systems:
 - Lenovo 3000 C100, C200, N100, N200, V100, V200

- Lenovo 3000 J100, J105, J110, J115, J200, J200p, J205, S200, S200p, S205
- All ThinkPad
- All ThinkCentre
- All ThinkStation
- Lenovo V/B/H/E Series

Related Articles

- [Video] How to download and install a driver from the Lenovo Support site (/videos/VID100754)
- [Video] How to download multiple drivers with Lenovo Download Manager (/videos/VID100755)
- An error occurred while installing Lenovo System Update within Windows 7 - ThinkPad, ThinkCentre (/solutions/HT503532)
- Lenovo System Update unable to connect to proxy server using Internet explorer in Windows 7 - ThinkPad (/solutions/HT117141)
- Understanding Drivers, BIOS, UEFI and Firmware (/solutions/HT103672)
- Device Drivers: Frequently Asked Questions (FAQ) (/solutions/HT001609)
- How to update system BIOS (/solutions/HT500008)
- Recommended way to enter BIOS for Think Series (/solutions/HT500222)
- How to navigate and download Lenovo software or drivers from Support Site (/solutions/HT117260)
- Lenovo Service Bridge: Automatically detects your system type and serial number for an improved Lenovo support experience (/solutions/HT10405)
- Popular Topics: Tips for PC's (/solutions/HT503909)
- Windows Support Center (<https://support.lenovo.com/windows-support>)

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Your feedback helps to improve this site.

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No

Alias
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Last

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(<https://www.lenovo.com/us/en/about#social-responsibility>)

See our Sustainability Report, (https://www3.lenovo.com/us/en/social_responsibility/sustainability_reports/)

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Workstations (<https://www.lenovo.com/us/en/thinkworkstations>)
Accessories & Software (<https://www.lenovo.com/us/en/accessories-and-monitors/c/ACCESSORY?PromoID=LEN1301156>[linkTrack=footer:Shop_Accessories%20And%20Softwares](#))
Servers (https://www.lenovo.com/us/en/data-center/servers/c/servers?menu-id=explore_servers)
Storage (https://www.lenovo.com/us/en/data-center/storage/c/storage?menu-id=explore_storage)
Networking (https://www.lenovo.com/us/en/data-center/networking/c/networking?menu-id=explore_networking)
Laptop Deals (<https://www.lenovo.com/us/en/deals/laptops?menu-id=Deals>)
Outlet (https://outlet.lenovo.com?linkTrack=footer:Shop_Outlet)

Support

Downloads ([/us/en/products/desktops-and-all-in-ones/thinkcentre-m-series-desktops/m720q/downloads?linkTrack=footer:Support_Downloads](#))
Knowledge Base & Guides ([/us/en/products/desktops-and-all-in-ones/thinkcentre-m-series-desktops/m720q/documentation?linkTrack=footer:Support_Manuals](#))
How-tos & Solutions ([/us/en/products/desktops-and-all-in-ones/thinkcentre-m-series-desktops/m720q/documentation/doc_userguide?linkTrack=footer:Support_Solutions](#))
Warranty Lookup ([/us/en/warrantylookup?linkTrack=footer:Support_Warranty_Lookup](#))
Parts Lookup ([/us/en/partsookup?linkTrack=footer:Support_Parts_Lookup](#))
Contact Us ([/us/en/contactus?linkTrack=footer:Support_Contact%20Us](#))
Repair Status Check ([/us/en/repairstatus?linkTrack=footer:Support_Repair_Status](#))

Resources

Where to Buy ([https://www.lenovo.com/us/en/landingpage/reseller-locator?linkTrack=footer:Resources_Where To Buy](https://www.lenovo.com/us/en/landingpage/reseller-locator?linkTrack=footer:Resources_Where_To_Buy))
Shopping Help ([https://www.lenovo.com/us/en/shopping-faq?linkTrack=footer:Resources_Shopping Help](https://www.lenovo.com/us/en/shopping-faq?linkTrack=footer:Resources_Shopping_Help))
Sales Order Status ([https://ovp.lenovo.com/lenovo-ovp/public/showDetail?publicStatusIndex.action?linkTrack=footer:Resources_Order Status](https://ovp.lenovo.com/lenovo-ovp/public/showDetail?publicStatusIndex.action?linkTrack=footer:Resources_Order_Status))
Product Specifications (PSREF) (<https://psref.lenovo.com/>)
Blogs (https://blog.lenovo.com?linkTrack=footer:Resources_Blogs)
Forums (https://forums.lenovo.com?linkTrack=footer:Resources_Forum)
Registration (<https://support.lenovo.com/productregistration>)
Product Accessibility ([https://www.lenovo.com/us/en/lenovo/accessibility?linkTrack=footer:Resources_Product Accessibility](https://www.lenovo.com/us/en/lenovo/accessibility?linkTrack=footer:Resources_Product_Accessibility))
Environmental Information ([https://www.lenovo.com/us/en/social_responsibility/environment?linkTrack=footer:Resources_Environmental Information](https://www.lenovo.com/us/en/social_responsibility/environment?linkTrack=footer:Resources_Environmental_Information))

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