

QNAP Enterprise-class NAS Series: ES1642dc, ES1640dc

Hardware User Manual

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Thank you for choosing QNAP products! This user manual provides description of the hardware of the ES NAS and relevant guideline of certain functions. Please read carefully and strictly adhere to the instructions of the manual.

This user manual is applicable to the following ES NAS models:

ES1642dc and ES1640dc

NOTE:

- The “ES NAS” is hereafter referred to as “NAS” or “ES NAS”.
- The product you purchased may not support certain functions dedicated to specific models.
- All features, functionality, and other product specifications are subject to change without prior notice or obligation.
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Note:

- Back up your system periodically to avoid any potential data loss. QNAP disclaims any responsibility of all sorts of data loss or recovery.
- Should you return any components of the ES NAS package for refund or maintenance, make sure they are carefully packed for shipping. Any form of damages due to improper packaging will not be compensated.

Regulatory Notice



FCC Notice

The QNAP NAS complies with different FCC compliance classes. Please refer to 0 for details. Once the class of the device is determined, refer to the following corresponding statement.

=====

FCC Class A Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

Modifications: Any modifications made to this device that are not approved by QNAP Systems, Inc. may void the authority granted to the user by the FCC to operate this equipment.

FCC Class B Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/television technician for help.

Modifications: Any modifications made to this device that are not approved by QNAP Systems, Inc. may void the authority granted to the user by the FCC to operate this equipment.



The QNAP NAS complies with different CE compliance classes. Please refer to 0 for details.

Symbols in this document



 Warning	This icon indicates the instructions must be strictly followed. Failure to do so could result in injury to human body or death.
 Caution	This icon indicates the action may lead to disk clearance or loss OR failure to follow the instructions could result in data damage, disk damage, or product damage.

Table of Contents

Chapter 1. Introduction to QNAP ES NAS series	9
Chapter 2. Hardware Specifications.....	11
Chapter 3. System Components	13
Front Panel Features.....	13
Font Panel LEDs and Buttons	13
Rear Panel Features	14
Rear Panel LEDs and Buttons	15
Storage Controllers	16
Redundant Power Supply.....	17
PCIe expansion adaptors.....	17
Onboard SAS ports.....	17
SAS HBAs	17
Battery Backup Units (BBU)	17
10GbE networking	17
Storage Features	18
Disk drives and Disk Enclosures	18
RAID implementation.....	18
Reset Button Behavior	20
Management port.....	20
Service port	20
Connecting Expansion Units	22
Expansion Units Features.....	23
Enclosure IDs.....	24
Rear Panel LEDs and Buttons	24
Rear Panel LEDs and Buttons	24
Onboard SAS ports.....	25
Disk drives and Disk Enclosures	25
Service port of expansion units.....	25

Chapter 4. Service and Maintenance	27
Safety Considerations	27
Preparation Procedures.....	28
Powering Down the ES NAS	28
Replacing the battery backup unit (BBU).....	28
Replacing hot-plug power supply	29
Replacing hot-plug SAS HDDs	30
Replacing field-replaceable fan modules.....	31
Installing expansion cards	32
Installing DIMMs	33
Chapter 5. Quick-Deploy Rack kit installation instructions.....	36
Overview	36
Kit contents	36
Mounting the Device	37
Appendix A: Multipathing Support for High Availability	40
Appendix B: Beep alarm.....	41
Appendix C. Product Compliance Class.....	42
Technical Support	43
GNU GENERAL PUBLIC LICENSE	44

Safety Warnings

1. The ES NAS can operate normally in temperatures of 0°C–40°C (32°F -104°F) and relative humidity of 5%–95%. Please make sure the environment is well-ventilated.
2. The power cord and devices connected to the ES NAS must provide correct supply voltage (770W, 100-240 V@50/60Hz).
3. Do not place the ES NAS in direct sunlight or near chemicals. Make sure the temperature and humidity of the environment are in optimized level.
4. Unplug the power cord and all connected cables before cleaning. Wipe the ES NAS with a dry towel. Do not use chemical or aerosol to clean the ES NAS.
5. Do not place any objects on the ES NAS for the server's normal operation and to avoid overheat.
6. Use the flat head screws in the product package to lock the hard disks in the ES NAS when installing hard disks for proper operation.
7. Do not place the ES NAS near any liquid.
8. Do not place the ES NAS on any uneven surface to avoid falling off and damage.
9. Make sure the voltage is correct in the location where the ES NAS is installed. Contact the distributor or the local power supply company for the information.
10. Do not place any object on the power cord.
11. Do not attempt to repair the ES NAS in any occasions. Improper disassembly of the product may expose the users to electric shock or other risks. For any enquiries, please contact the distributor.
12. The ES NAS models should only be installed in the server room and maintained by the authorized server manager or IT administrator. The server room is locked by key or keycard access and only certified staff is allowed to enter the server room.



Warning:

- Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.
- Do NOT touch the fan inside the system to avoid serious injuries.

Chapter 1. Introduction to QNAP ES NAS series

The Enterprise Storage NAS (ES NAS) series offers robust functionality, exceptional reliability, and availability with the common ease of storage management being shared by all of QNAP NAS product lines.

The ES NAS series consist of two new major products: the ES1642dc and the ES1640dc. Both of these models are a good fit for the mid-range to large-scale SAN and direct-attach enterprise storage systems.

The ES NAS models have an improved 19 inches high-density frame design. It can support 16 drives, in a small, high-density footprint that helps to preserve valuable space and energy required for system cooling in data center environments.

The new ES NAS series has a high availability and serviceability architecture what supports two redundant Storage Controllers and two power supply units. In addition, the EJ1602 and EJ1600 expansion enclosure allow for the growth of the storage system up to the 128 drive maximum, by adding the 16-drive expansion units to the ES NAS's SAS drive expansion. These expansion units also have high availability features such as dual power supplies and redundant cross loop connection to their base ES NAS. The new ES NAS series provides a number of new capabilities from other enterprise-class NAS. The enhancements are:

- To deliver high performance and advanced data services, the ES NAS series uses a combination of standard enterprise-grade hardware and a storage-optimized, Enterprise operating system (QES) based on the ZFS file system at its core.
- The dual storage controllers are powered by Intel® Xeon® E5 series processors that can deliver the exceptional compute power required to concurrently run multiple modern storage workloads along with advanced data services. In addition, the two active storage controllers work as a cluster, monitoring one another so that a single controller can take over the storage resources managed by the other controller in the event of a controller failure.
- New 12 Gbps SAS technology for host and drive attachments.
- Support for greater capacity with new larger capacity SAS drive offerings.
- Cache configurations are available that range from 4 drives up to 16 drives (full-SSD drive set) system cache.
- Write data is always protected by maintaining a copy in battery-backed nonvolatile storage (NVS) until the data is written to the HDDs.
- High-density storage enclosures offer a considerable reduction in footprint and energy consumption.
- Storage Pool Striping (across different expansion units) provides a mechanism to aggregates hard drives into a bigger storage space, and with the ability to support multiple RAID groups across different expansion enclosures. (Note that all RAID groups must have the same RAID type.) Storage Pool Striping helps maximize performance by reducing hot spots in arrays and provide better data safety.

- RAID-TP (Triple parity) provided by RAID 7 support with the specialized Storage Controller on the system
- Triple Mirroring writes data simultaneously to three separate HDDs so if two-thirds of the HDDs fail in the same RAID group, no data will be lost.
- The support for OpenStack enables the integration with the OpenStack cloud environment. After the driver is installed on the OpenStack Cinder (OpenStack Block Storage) nodes, storage volumes can be allocated by the Cinder nodes to the Nova-compute nodes. Virtual machines on the Nova-compute nodes can then use storage resources on the ES NAS.

Data safety and encryption

Combined with the world-class business resiliency and encryption features, the ES NAS series provides a unique combination of high availability, performance, and security. Shared folder and LUN encryption offered the QES operating system can protect business-sensitive data by utilizing drive-based hardware encryption in combination with a software key. In addition, the WORM (Write Once Read Many) function provides data tampering prevention and original content retention at shared-folder level. The LUN Encryption is available for all drive types, including flash drives (SSDs).

Chapter 2. Hardware Specifications



Caution: Modifying the hardware, software, or firmware of the QNAP products will void the warranty. QNAP is not responsible for any form of damage or loss of data caused by modifying the QNAP products. Users should bear their own risks of all sorts of possible data loss or system instabilities due to changing the hardware parts, modifying the default system firmware or installing any unauthorized third party applications on QNAP products.

Model No.	ES1642dc	ES1640dc
Form Factor	3U, Rackmount	
Processor	Intel Xeon E5-2420 v2 (2.2GHz, 6 core, 15MB L3, 80W TDP)	
Storage Controller (x2 for every system)	DDR3 ECC RDIMM 16GB x2 (total of 32GB) 16GB x 1 (NVRAM)	
Number of Disk Drives	16 x 2.5"/3.5" 4 x 2.5" SSD (Default configuration for read cache acceleration) 12 X 3.5"	16 x 2.5"/3.5" 4 x 2.5" SSD (Default configuration for read cache acceleration) 12 X 3.5"
HDD Interface	SAS 12Gb/s; backward-compatible to SAS 6Gb/s and SATA (SATA drives need SAS-to-SATA interposer boards.)	SAS 6Gb/s backward-compatible to SATA (SATA drives need SAS-to-SATA interposer boards.)
JBOD Expansion connectors (x2 for every system)	Two Mini-SAS 12Gb/s ports (SFF-8644)	Two Mini-SAS 6Gb/s ports (SFF-8088)
Battery-Backed Write Cache (x2 for every system)	M.2 2280 for NVRAM (SATA signal)	mSATA for NVRAM
10G LAN Port (x2 for every system)	Four SFP+ (Intel XL710-AM1)	Two RJ45 (Intel X540-BT2)
PCIe expansion slots (x2 for every system)	PCIe Slot x8 (Gen3 x8) for 40GbE network cards PCIe Slot x4 (Gen2 x4): Pre-installed with a dual-port Mini-SAS adapter	

Fan module (x2 for every system)	Field-replaceable fan module (60*60*38mm, 16000 RPM/12v/2.8A x 3)	
Power Supply	770W 1+1, 100-240V@50/60Hz (hot-swappable, redundant)	
Temperature	0° C to 40 °C	
Relative Humidity	5 % to 95 %	
Dimensions (mm)	618 (Depth) x 446.2 (Width) x 132 (Height), excluding the handles	
Weight (Net)	27.75kg	
Expansion Enclosures		
Expansion Model	EJ1602	EJ1600
Form Factor	3U, Rackmount	3U, Rackmount
Number of Disk Drives	16 x 2.5"/3.5"	16 x 2.5"/3.5"
HDD Interface	SAS 12Gb/s backward-compatible to SAS 6Gb/s and SATA (SATA drives need SAS-to-SATA interposer boards.)	SAS 6Gb/s backward-compatible to SATA (SATA drives need SAS-to-SATA interposer boards.)
JBOD expansion connector (x2 for every system)	Two Mini-SAS 12Gb/s ports (SFF-8644)	Two Mini-SAS 6Gb/s ports (SFF-8088)
Fan module (x2 for every system)	Field-replaceable fan module (60*60*38mm, 16000 RPM/12v/2.8A x 3)	Field-replaceable fan module (60*60*38mm, 16000 RPM/12v/2.8A x 3)
Power Supply	450W 100-240V@50/60Hz (hot-swappable, redundant)	450W 100-240V@50/60Hz (hot-swappable, redundant)
Temperature	0°C to 40 °C	0°C to 40 °C
Relative Humidity	5 % to 95 %	5 % to 95 %
Dimensions (mm)	618 (Depth) x 446.2 (Width) x 132 (Height), excluding the handles	618 (Depth) x 446.2 (Width) x 132 (Height), excluding the handles
Weight (Net)	27.75kg	27.75kg
All product specifications are subject to change without prior notice.		

Chapter 3. System Components




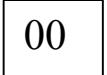
Front Panel Features

The power button, Power/Status LED indicators and LCD status display are conveniently located at the front panel for easy access.



Note: Refer to next section on Front Panel LEDs and Buttons for detailed descriptions on these features.

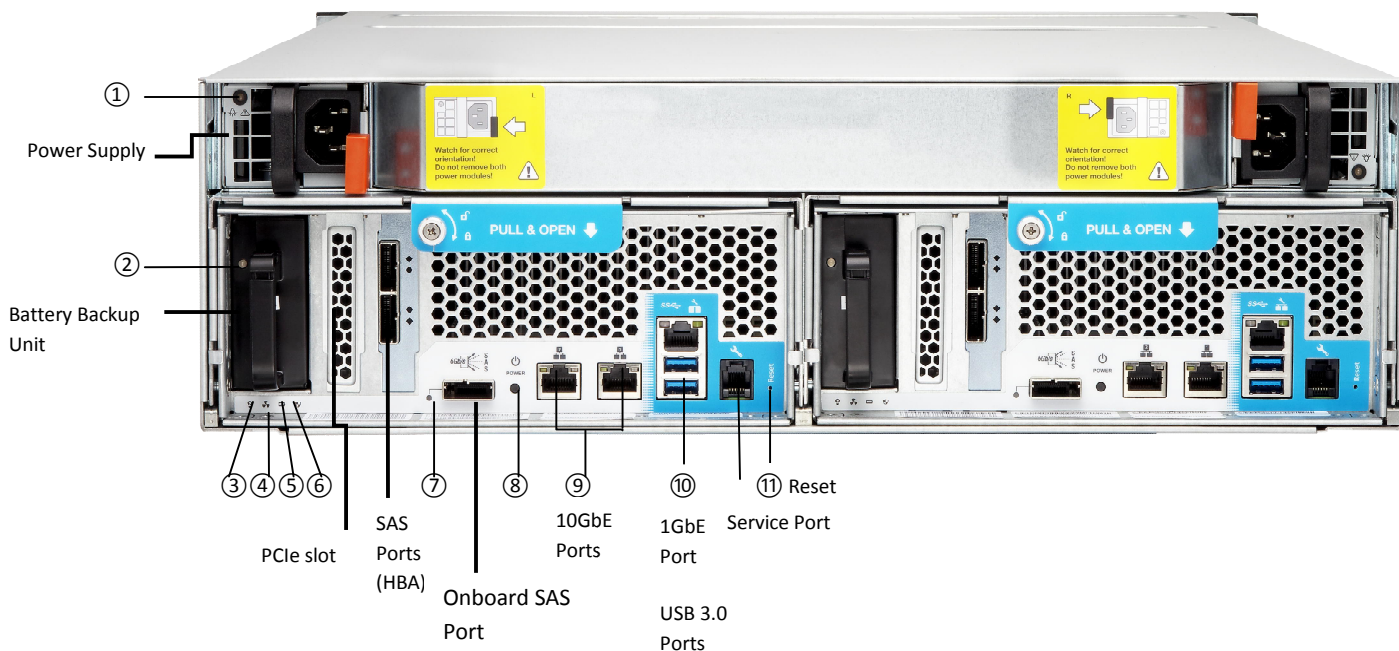
Front Panel LEDs and Buttons

Item	Description	LED Color	Status
1	Power on button 		System power on button. To force shut down the ES NAS, press and hold it for about 5 seconds.
2	System Power LED 	Green	On = System power on Off = System power off
3	Status 	Green Orange	Green = The system is operating normally. Orange = One or more of the following conditions exist: <ul style="list-style-type: none">There are system errors or warnings (e.g. degraded RAID mode, memory failure, fan/power supply failure, system/disk temperature too high, storage pool reaching threshold value) recorded in system logs of the QES to notify system administrators. Correct errors to reset the LED to green.The system is performing takeover. (*)The power supply unit has been unplugged.
4	LCD status display 		The two-digit number represents various states of device booting process. The left and right digits represent the left Storage Controller and the right Storage Controller (when facing the front panel) respectively. No-Display: BIOS booting

			1: Device detecting 2: Network settings 3: System settings 4: Services start 5: System self-testing 0: System ready
5	HDD Status LEDs (upper)	Green Red	Green On = Drive is actively online. Red = Error/Damage Off = No HDD present
5	HDD Activity LEDs (lower)	Green	On/Slow flashing = No Drive activity Flashing = High activity on the drive or drive is being configured as part of an array Caution: Do not replace a drive without bring it offline first in the QES. You may replace a drive online only when The drive is online and part of an array that has been configured for fault tolerance and all other drives in the array are online, and a predictive failure alert is received from the QES. For more information, refer to the software user manual.
* The dual active-active controller system enables a single controller to take over the pool disk resources managed by the other controller in the event of a controller failure. Takeovers can be initiated manually or occur automatically when a failover event happens.			





Rear Panel Features

The rear panel comprises of two Storage Controllers, which includes I/O expansion slots, Ethernet ports, USB connectors, onboard SAS ports, SAS adaptors, power-on button, reset, system management port and the BBU.



Note: Refer to the following sections for detailed descriptions on these features.

Rear Panel LEDs and Buttons

Item	Description	LED Color	Status
1	Power supply LED	Green Orange	On = Power turned on and power supply functioning properly Flashing green= System off Flashing orange= AC power cord is unplugged Off = One or more of the following conditions exist: <ul style="list-style-type: none"> • AC power unavailable • Power supply failed • Power supply exceeded current limit
2	BBU LED (on the battery module)	Green Red Orange	Green = Normal Flashing Green = Copying data to the mSATA flash Red = Damage Orange= Charging/learning Off = Not correctly attached to the ES NAS
3	Status 	Green Orange	Off = The system is powered off. Green = The system is operating normally. Flashing green = The system is booting.
4	Fan 	Green Orange	Green = The fan is operating normally. Orange = Damage/error Off = Not detecting any fans
5	BBU LED (on the Storage Controller) 	Green Orange	Green = Normal Orange = Error/Damage Off = One or more of the following conditions exist: <ul style="list-style-type: none"> •The Storage Controller is not powered on •The system cannot detect the BBU
6	High Availability LED 	Green Orange	Green = Active state Flashing orange = performing takeover* or undergoing giveback** Orange = The Storage Controller has taken over from the other Storage Controller. Off = One or more of the following conditions exist: <ul style="list-style-type: none"> • The Storage Controller has failed over to the other Storage Controller. • The Storage Controller is not powered on.
7	Onboard SAS Port LED	Green Red	Off = No link Green = Network link Flashing = Network activity

			Red = Error/damage
8	Power-on Button		The Power-on button of the Storage Controller. To shut down the Storage Controller, press and hold it for about 5 seconds. It provides the same function as the Power on and Shut Down function in the High Availability app on QES.
9 (Left)	10 Gigabit Ethernet RJ-45 Ports LAN1/LAN2 Speed LED	Green Orange Off	Green = 10 GbE connection Orange = 1 GbE connection Off = 100Mbps connection
9 (Right)	10 Gigabit Ethernet RJ-45 Ports LAN1/LAN2 link/activity LED	Green	Off = No link Green = Network link Flashing = Network activity
9 (for Model ES1642dc)	10 Gigabit Ethernet SFP+ LAN1/LAN2 Speed LED	Green Orange Off	Green = 10 GbE connection Orange = 1 GbE connection
9 (for Model ES1642dc)	10 Gigabit Ethernet SFP+ LAN1/LAN2 link/activity LED		Off = No link Green = Network link Flashing = Network activity
10	Management Port Link/activity LED	Green Off	Off = No link Green = Network link Flashing = Network activity
10	Management Port Speed LED	Green Orange	Orange = 1 GbE connection Green = 100Mbpsconnection
11	Reset		System reset button for rebooting the Storage Controller without turning off the system power.
<p>* The dual active-active controller system enables the controller to take over the pool disk resources and have access to all data and serve the data upon failure of the other controller. Takeovers can be initiated manually or occur automatically when a failover event happens.</p> <p>**Storage Controller A (or B) has taken over the system. Any issues on Storage Controller B (or A) have been resolved and it is ready to resume serving data. Giveback is initiated either manually or automatically.</p>			

Storage Controllers

With the dual-controller configuration, the controller on the left is Storage Controller A (SCA) and the right is Storage B (SCB), as named in the QES, when viewed from the rear of the system.

Dual controller configurations offer redundant access to disk storage. In case of controller or I/O path failure, the other controller will continue to provide access to disk drives.

Each storage controller features a BBU, one SAS HBA (pre-installed in one of the PCIe slot), one PCIe expansion slot, an onboard 6Gb/s SAS port, power-on button, two 10 Gigabit Ethernet ports, one system management port, two USB 3.0 ports, one service port, and a reset button.

Redundant Power Supply

The power supply module is a 770 Watt switching power supply. It is auto ranging, 100-127 and 200-240VAC input capable. The ES NAS has two identical power supply modules for power redundancy. If either power supply fails, the other module will keep the system running until it can be replaced.

Note: Refer to *Rear Panel LEDs and Buttons* for power supply LED description.

PCIe expansion adaptors

The ES NAS adopts point-to-point, high-speed PCI Express (PCIe) Gen2 (x4) and Gen3 (x8) for I/O expansions. The adapters can be either device adapters or host adapters. The system can support one additional PCIe (Gen3 x8) attachment. The one with Gen2 (x4) is pre-installed with a SAS HBA.

Onboard SAS ports

Two onboard Serial Attached SCSI (SAS) provides point-to-point 6Gb/s data (or 12Gb/s depending on the model) transmission to other computer storage devices.

SAS HBAs

In addition to the above Serial Attached SCSI (SAS) host attachment port built into the Storage Controller, a pre-installed SAS HBA provides two additional mini-SAS ports for direct attachment to the expansion units. The SAS HBA supports either 12Gb/s or 6Gb/s transmission speed depending on the models. (ES1642dc comes with 12Gb/s SAS HBA whereas ES1640dc comes with 6Gb/s SAS HBA.)

Battery Backup Units (BBU)

The battery is 10.8V 2200mAh.

The cache of QES NAS Storage is protected by a battery against power loss. The BBU provides power to Battery-Backed Write Cache. The battery provides power if the data in the cache needs to be written to the mSATA memory card if power is disrupted. The write cache is only used if the cache battery is fully charged. If the batteries fail or are not fully charged, for example, just after powering on, the controllers automatically disable the write cache. You can schedule the BBU learning cycle in the QES; for more information, please refer to the software user manual.

10GbE networking

4 x SFP+ (Intel® XL710-AM1) for Model ES1642dc or 2 x RJ45 (Intel® X540-BT2) for Model ES1640dc

Architected and validated with Intel® Xeon® processor E5 v2 platform to deliver a balanced platform as this ES NAS series, the Ethernet ports base on the Intel XL710 or X540 Ethernet controller implements hardware optimizations and off-loads for exceptional performance in usage models such as TCP Stateless Off-loads and Host iSCSI Initiator. In addition, with the virtualization technology built-in on the controller such as VMDq and SR-IOV, the virtualization on the ES NAS can achieve optimization of

the processing of VM data traffic while improving CPU utilization and bandwidth. 40GbE networking can be easily achieved with the installation of network cards via the PCIe expansion (PCIe Gen3 x8).

Storage Features

Disk drives and Disk Enclosures

The QES NAS storage system supports up to two redundant Storage Controllers with the latest SAS 12Gb/s or 6Gb/s HDD interface (ES1642dc comes with 12Gb/s SAS HDD interface whereas ES1640dc comes with 6Gb/s HDD interface) in 16 drive configuration, which can be expanded to a maximum of 128 by attaching up to 7 expansion units. The system supports all-SSD drive set as well as SAS – SATA intermix within an enclosure. The drives are numbered 1 - 16 sequentially starting from the bottom left to the top right.

Solid-state drives (SSDs)

The system can accommodate superfast solid-state drives, and traditional spinning disk drives such as SAS, NL-SAS and SATA drives. (For SATA drives, please order additional SAS-to-SATA interposer boards.) However, SSDs are the best choice for I/O intensive workload and they can be used for cache acceleration in QES. Cache configurations are available that range from 4 drives up to 16 drives (full-SSD drive set) system cache. If you plan to install SSDs as partial drive set, please populate the bottom 4 drives (Drive 1~4) slots since these drives will be the system drives.

RAID implementation

RAID implementation improves data storage reliability and performance.

Redundant array of independent disks (RAID) is a method of configuring multiple disk drives in a storage subsystem for high availability and high performance. The collection of two or more disk drives presents the image of a single disk drive to the system. If a single device failure occurs, data can be read or regenerated from the other disk drives in the array. RAID implementation provides fault-tolerant data storage by storing the data in different places on multiple disk drive modules (DDMs). By placing data on multiple disks, I/O operations can overlap in a balanced way to improve the basic reliability and performance of the attached storage devices. Physical capacity can be configured as RAID 0, RAID 1, RAID 5, RAID 6, RAID7 and RAID 10, or a combination of these configurations. The specialized Storage Controller enables the support of RAID 7 on the system. The following provides an overview of these RAID types:

RAID 0 overview

RAID 0 offers Striping, a process of dividing data into blocks and spreading the data blocks across several hard drives, but without redundancy for handling disk failures.

RAID 1 overview

Writes a mirrored copy of data to each hard drive, providing data redundancy and protection, and continues to operate as long as at least one drive is operating normally.

RAID 5 overview (also referred as RAID-Z1 in ZFS)

RAID 5 is a method of spreading volume data across multiple disk drives. RAID 5 increases performance by supporting concurrent accesses to the multiple disk drives within each logical volume. Data protection is provided by parity, which is stored throughout the drives in the array. If a drive fails, the data on that drive can be restored using all the other drives in the array along with the parity bits that were created when the data was stored.

RAID 6 overview (also referred as RAID-Z2 in ZFS)

RAID 6 is a method of increasing the data protection of arrays with volume data spread across multiple disk drives. RAID 6 increases data protection by adding an extra layer of parity over the RAID 5 implementation. By adding this protection, RAID 6 can restore data from an array with up to two failed drives. The calculation and storage of extra parity slightly reduces the capacity and performance compared to a RAID 5 array. RAID 6 is suitable for storage using archive-class disk (slower) technologies.

RAID 10 overview

RAID 10 provides high availability by combining features of RAID 0 and RAID 1. RAID 0 increases performance by striping volume data across multiple disk drives. RAID 1 provides disk mirroring, which duplicates data between two disk drives. By combining the features of RAID 0 and RAID 1, RAID 10 provides a second optimization for fault tolerance.

RAID- Triple Parity (or RAID 7) overview

RAID- Triple Parity primarily incorporates features from RAID level 3 and 4. RAID 7 has integrated cache and a purpose-built processor for managing the array that helps in achieving faster data read/write operations. It also has lesser dependency on parity disks because of the specialized controller. RAID 7 provides triple parity.

Triple Mirroring

Triple mirroring by has high speed of RAID-1 and high reliability of RAID-6 at the same time. Triple mirroring writes data simultaneously to three separate HDDs so if two-thirds of the HDDs fail in the same RAID group, data operation can still continue. This RAID type is useful especially for Database and OLTP which require high performance and availability.

Reset Button Behavior

Reset button: Press to reset the system settings.

System	Basic system reset (1 beep)	Advanced system reset (2 beeps)
All ES models	3 sec	10 sec

Basic system reset (3 sec)

Press the reset button for 3 seconds, a beep sound will be heard. The System administration password will be reset to default.

Advanced system reset (10 sec)

Press the reset button for 10 seconds; you will hear two beeps at the third and the tenth seconds. The settings such as the users and user groups previously created will be cleared. The ES NAS will reset all the system settings to default as it would by using the web-based system reset in "Control Panel" > "System Settings" > "Backup / Restore" > "Restore to Factory Default" > "Reinitialize NAS". *However, resetting the ES NAS by holding the button, the data on the ES NAS will not be deleted.*

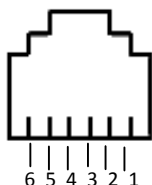
Management port

The management is provided by Intel® 82579 Gigabit Ethernet controller. The management port allows you to connect to the QES desktop of the ES NAS. The default ES NAS management website is 169.254.100.100:8080. If the ES NAS has been configured to use DHCP, you can use the QNAP Qfinder Pro to check the IP address of the ES NAS. Make sure the ES NAS and the computer that runs the QNAP Qfinder Pro are connected to the same subnet. The system requires that the management IP addresses are configured on both controllers and that the controllers' management ports are connected to the management network. This should be a separate LAN or a VLAN because you should not use the production LAN or VLAN for management network traffic. To configure the management port IP Address, please refer to the software user manual. In case of the failure of the Storage Controller, you can enable takeover function from the High Availability app in QES to manage the system through the management port of the other Storage Controller with the same IP address. For more information, please see the software user manual.

Service port

Note: The service port is the main point for hardware installation, configuration, and maintenance activities and it should only be used by QNAP technical support personnel or when you are instructed by QNAP technical support.

The service port is an RS-232 port with RJ-11 receptacle. Please use the appropriate cable/adaptor (i.e. RJ-11 to DB9/DB9 to USB or RJ-11 to USB) to connect this port with your computer. The pin-outs are defined as the following:



Pin No.	Signal	Description
1	Rx1	Receive Data of UART1
2	Tx1	Transmit Data of UART1
3	GND	Ground
4	Rx2	Receive Data of UART2
5	Tx2	Transmit Data of UART2
6	GND	Ground

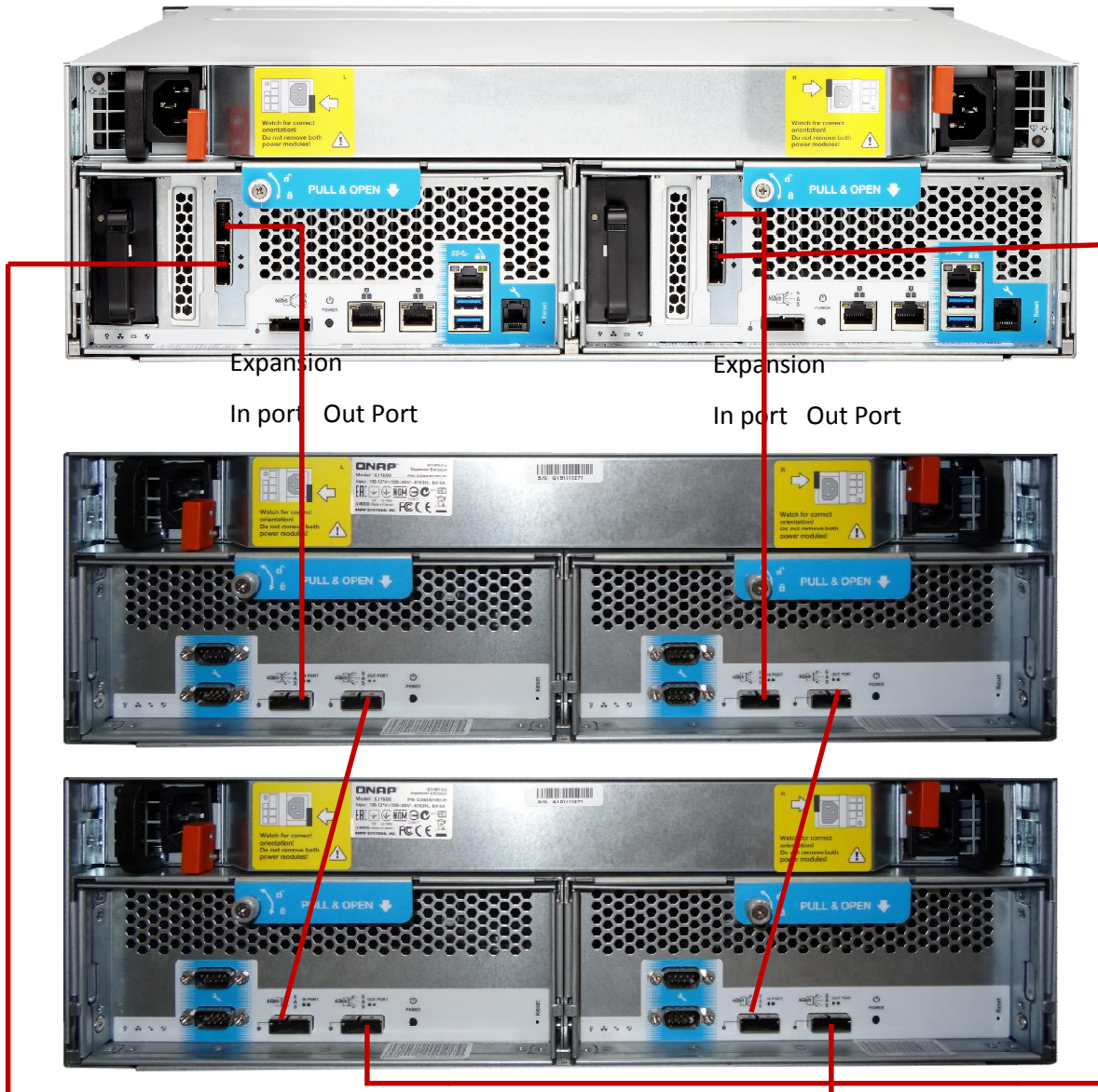
Configure the baud rate and character format of the PC or terminal to match these console port default characteristics:

- 115200 baud rate
- 8 data bits
- 1 stop bit
- No parity
- Flow control: XON/XOFF
- Default username/*password*: admin/*admin*.

Connecting Expansion Units

The ES NAS Series offers the expansion enclosures for expanding the storage system beyond the internal drive count of the base enclosure. There are two models of expansions to choose from: the EJ1600 and the EJ1602. These expansions connect to the ES NAS system through the 12 or 6 Gbps SAS expansion ports (depending on the base enclosure model) on the Storage Controller.

The following figure is an example of the storage system ES1640dc and expansion enclosure EJ1600:



As shown in the above figure, the cabling scheme used for connecting these expansions creates a cross-cascaded loop configuration. This provides the expansion loops with redundant paths to the enclosures, and in the event of one expansion encountering a catastrophic failure the others are still able to continue to run. With a proper RAID layout this can provide for uninterrupted operations.



The following procedure describes the steps required to attach an expansion enclosure to a *running* ES NAS configuration.



1. Ensure that the status of ES NAS is online or “OK” via the QES.
2. Connect one end of a Serial Attached SCSI (SAS) cable to either of the SAS ports of the SAS HBA on Storage Controller A in the ES NAS. Connect the other end of the SAS cable to the SAS IN port on the left controller in the expansion enclosure.
3. Connect one end of a second SAS cable to either of the SAS ports of the SAS HBA on Storage Controller B in the ES NAS. Connect the other end of the SAS cable to the SAS IN port on the right controller in the expansion enclosure.
4. If there are more expansion enclosures to be connected, connect the SAS OUT port on the left controller in the expansion enclosure to the SAS IN port on the left controller in the next expansion enclosure with a SAS cable. Repeat this step with the right controllers in both expansion enclosures.
4. Connect one end of the SAS cable to the OUT port on the left controller in the *last* expansion enclosure in the configuration and use this cable to directly connect this expansion enclosure to the SAS expansion port on *Storage Controller B* of the ES NAS (cross-connect to the other Storage Controller of the ES NAS).
5. Connect one end of the SAS cable to the OUT port on the right controller in the last expansion enclosure in the configuration and use this cable to directly connect this expansion enclosure to the SAS expansion port on *Storage Controller A* of the ES NAS (cross-connect to the other Storage Controller of the ES NAS).
6. Connect the power cables to the new expansion enclosures and power-on the expansion enclosures.

Note: If the ES NAS is not powered on, it is recommended to power-on the expansion units first and then power-on the ES NAS.

Expansion Units Features

Just like the ES NAS system, the power button, Power/Status LED indicators and LCD status display are conveniently located at the front panel on the EJ expansion units for easy access.

Item	Description	LED Color	Status
1	Power on button 		System power on button
2	System Power LED 	Green	On = System power on Off = System power off

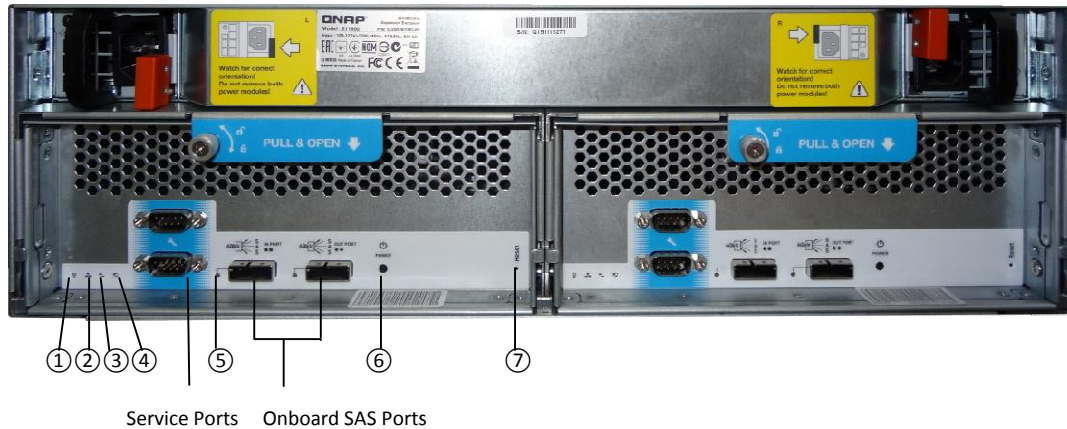
3	Status 	Green Orange	Green =The system is operating normally. Orange = The Power Supply Unit has been unplugged.
4	LCD status display 		The two-digit number represents the expansion unit number. It corresponds to the REXP# in the Storage Manager of the QES.

Enclosure IDs



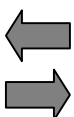
Each expansion enclosure has an ID number associated with it. The ID allows each enclosure to be identified properly to the ES NAS system. Each enclosure must use a unique value. The Storage Manager of the QES uses the Enclosure IDs to identify each expansion enclosure.


For both enclosure models EJ1600 and EJ1602, the enclosure ID is indicated by a two-digit LCD status display located on the front panel. The QES automatically sets the enclosure ID number as the REXP#. There are no switches on the expansion enclosures to manually set the enclosure ID.

Rear Panel LEDs and Buttons



Rear Panel LEDs and Buttons

1	Status 	Green Orange	Off = The system is powered off. Green = The system is operating normally. Flashing green = The system is booting.
2	Fan 	Green Orange	Green = The fan is operating normally. Orange = Damage/error Off = Not detecting any fans
3	Connection Status 	Green Orange	Green = Normal Orange = Either of the IN or Out SAS port is disconnected. Off = One or more of the following conditions exist: •The expansion unit is not powered on. •The ES NAS system cannot detect the expansion unit.

4	High Availability LED 	Green Orange	Green = Active state Orange = The Expansion Controller has taken over from the other Expansion Controller. Off = One or more of the following conditions exist: • The Expansion Controller has failed over to the other one. • The Expansion Controller is not powered on.
5	Onboard SAS Port LED	Green Red	Off = No link Green = Network link Flashing = Network activity Red = Error/damage
6	Power-on Button		The Power-on button of the Expansion Controller. To shut down the Expansion Controller, press and hold it for about 5 seconds. *
7	Reset		The Expansion Controller reset button
* The QES does not provide Power on and Shut Down function for the expansion units.			

Onboard SAS ports

Two onboard Serial Attached SCSI (SAS) ports provide direct attachment to the base ES NAS enclosure with 6Gb/s data transmission (or 12Gb/s depending on the expansion enclosure model).

Disk drives and Disk Enclosures

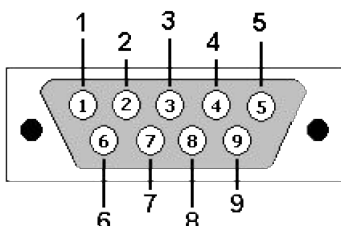
The ES NAS system

- The system can accommodate superfast solid-state drives, and traditional spinning disk drives such as SAS, NL-SAS and SATA drives. (For SATA drives, please order additional SAS-to-SATA interposer boards.) However, SSDs are the best choice for I/O intensive workload and they can be used for cache acceleration in QES. Cache configurations are available that range from 4 drives up to 16 drives (full-SSD drive set) system cache.

Service port of expansion units

Note: The service port is the main point for hardware installation, configuration, and maintenance activities and it should only be used by QNAP technical support personnel or when you are instructed by QNAP technical support.

The service port of the expansion unit is an RS-232 port with DB-9 (or DE-9) receptacle. The pin-outs are defined as the following:



Pin No.	Signal	Description
1	NC	No Connection
2	Rx	Receive Data
3	Tx	Transmit Data
4	NC	No connection
5	GND	Ground

6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection

Figure: Service Port (DB-9) Pin-outs

Configure the baud rate and character format of the PC or terminal to match these console port default characteristics:

- 115200 baud rate
- 8 data bits
- 1 stop bit
- No parity
- Flow control: XON/XOFF
- Default username/*password*: admin/*admin*.

Chapter 4. Service and Maintenance

Note: This chapter is for the person who services systems. QNAP assumes you are qualified in the servicing of computer equipment and trained in recognizing hazards in products with hazardous energy levels and are familiar with weight and stability precautions for rack installations.

Safety Considerations

Before performing service procedures, review all the safety information.

To prevent damaging the system, be aware of the precautions you need to follow when setting up the system or handling parts. A discharge of static electricity from a finger or other conductor may damage system boards or other static-sensitive devices. This type of damage may reduce the life expectancy of the device.



WARNING: To prevent electrostatic damage:

- Avoid hand contact by transporting and storing products in static-safe containers.
- Place parts on a grounded surface before removing them from their containers.
- Avoid touching pins, leads, or circuitry.
- Always be properly grounded when touching a static-sensitive component or assembly.

Before installing a device, be sure that you understand the following warnings and cautions.



WARNING: To reduce the risk of electric shock or damage to the equipment:

- Do not disable the power cord grounding plug. The grounding plug is an important safety feature.
- Plug the power cord into a grounded (earthed) electric outlet that is easily accessible at all times.
- Unplug the power cord from the power supply to disconnect power to the equipment.
- Do not route the power cord where it can be walked on or pinched by items placed against it. Pay particular attention to the plug, electric outlet, and the point where the cord extends from the ES NAS.



WARNING: To reduce the risk of personal injury from hot surfaces, allow the drives and the internal system components to cool before touching them.

Preparation Procedures

To access some components and perform certain service procedures, you must perform one or more of the following procedures:

- You must use the locking feature of the rack rails to support the ES NAS and gain access to internal components if your rack provides one.
- Power down the system

If you must remove a system from a rack or a non-hot-plug component from a system, power down the system. Please refer to the next section for more details on powering down the system.

- Power down the system
- If the rack environment or the ES NAS location in the rack creates awkward conditions, remove the ES NAS from the rack. Reverse rack mounting procedure to remove the ES NAS from the rack. Please refer to the next chapter: *Quick-Deploy Rack kit installation* for details.

Powering Down the ES NAS



WARNING: To reduce the risk of personal injury, electric shock, or damage to the equipment, remove the power cord to remove power from the ES NAS. The front panel Power-On button does not completely shut off system power. Portions of the power supply and some internal circuitry remain active until AC power is removed.

IMPORTANT: If installing a hot-plug device, it is not necessary to power down the ES NAS.

1. Back up the system data.
2. Shut down the system via the shut-down function from QES as directed by the Software User Manual.
3. The system power LED on the front of the system should be off now.
4. Disconnect the power cords.

The system is now without power.

Replacing the battery backup unit (BBU)

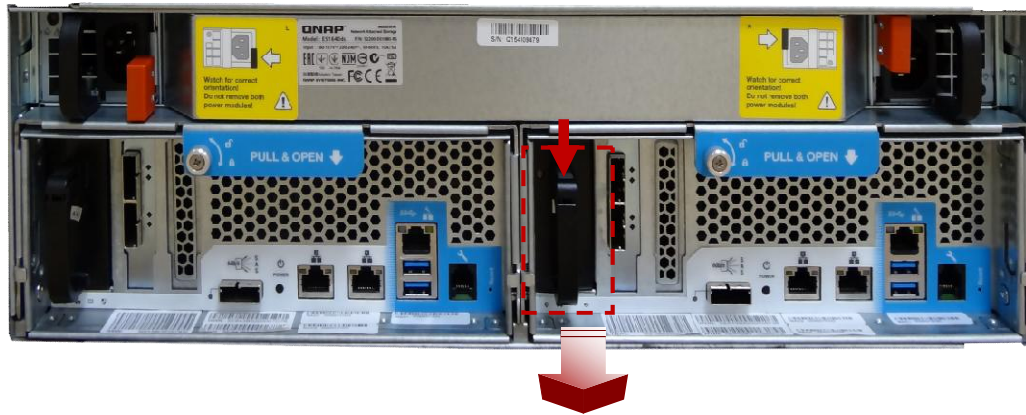
Batteries can be replaced only when the LED indicates that they are failed, or by the QES's warning of possibility of failure.

Each Storage Controller contains one battery backup unit (BBU). To remove the BBU:

Note: If the battery module is installed, be sure the battery LED on the battery module is not blinking. If the battery LED (refer to Rear Panel LEDs and Buttons in *Chapter 3: System Components*) is blinking, the

battery module is backing up data. Wait until the LED stops blinking before continuing with the procedure.

1. Release the lock by pressing the battery module's handle. Remove the battery module by sliding it out from the Storage Controller.



To replace the component, reverse the removal procedure.

Replacing hot-plug power supply

The system comes with two hot-plug power supplies (770W) with integrated cooling fans. These PSUs are capable of redundant power supply; when one of them fails, the other will provide power to the entire system.

To remove a hot-plug power supply:

1. Determine how many hot-plug power supplies are installed:
 - If only one hot-plug power supply is installed, power down and remove the power cord from the ES NAS. Disconnect the power cord from the power supply.
 - If more than one hot-plug power supply is installed, continue with the next step.
2. Unplug the AC power cord.
3. Press the red latch next to the handle to unlock it.
4. Slide the power supply out of the power supply bay.



To replace the component, reverse the removal procedure. Observe the following warning.



Warning: To reduce the risk of electric shock or damage to the equipment, do not connect the power cord to the power supply until the power supply is installed.

Replacing hot-plug SAS HDDs

Warning:

- I. Do not remove the bottom 4 HDDs as they are used to install or configure the operating system.
- II. To avoid data loss, please back up all data on the hard drives.

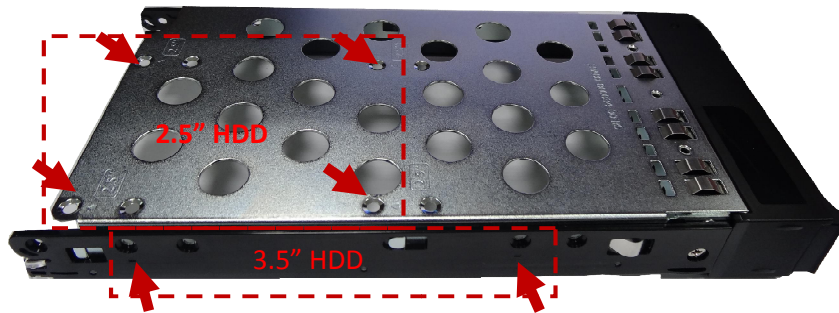
To remove a HDD:

1. First bring the storage pool that comprises this HDD that you would like to remove or replace offline. For more information, please refer to the Storage Manager app in software manual.



2. Press to unlock the drive.
3. Remove the hard drive.

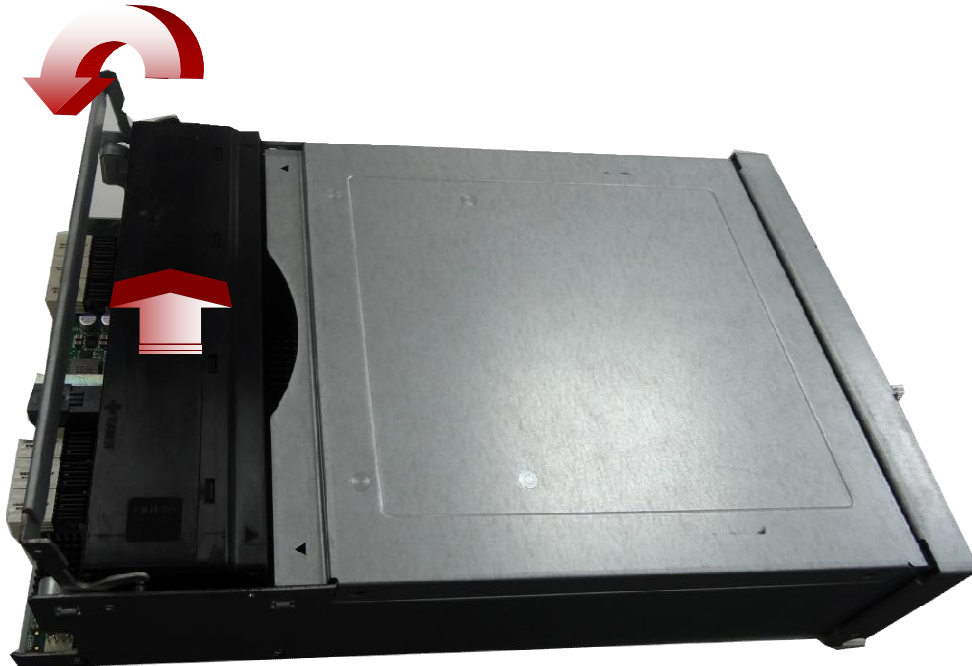
To replace the HDD, install the HDD drive on the tray with screws.



Replacing field-replaceable fan modules

To remove a fan:

1. Shut down the respective Storage Controller that contains this fan either from QES (refer to the High Availability app in software manual) or by pressing the power button on the Storage Controller's back panel.
2. Remove the Storage Controller from the system by loosening the thumb screws on the Storage Controller.
3. Remove the fan module.



To replace the fan module, reverse the removal steps and push the handle (not press down the fan module) to be sure it is seated properly.

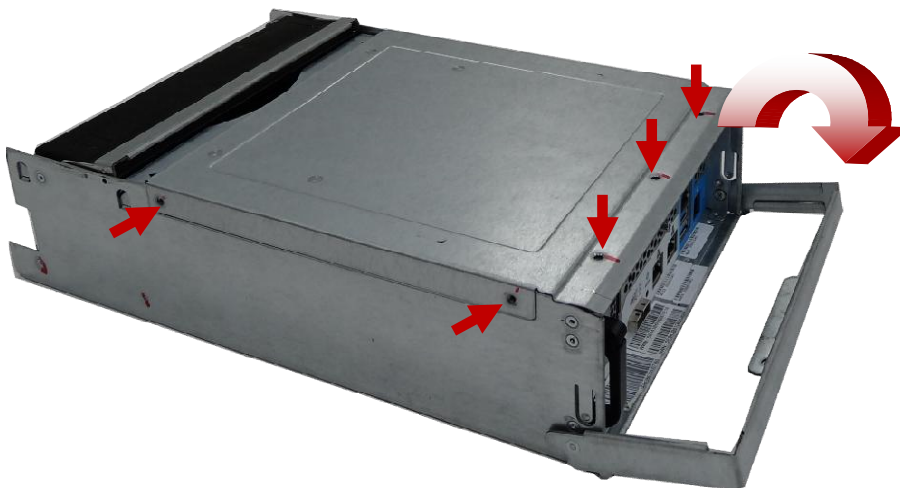
Installing expansion cards

To install a PCIe expansion card:

1. Shutdown the respective Storage Controller on which you would like to install an expansion card from QES (refer to the High Availability app in software manual) or by pressing the power button on the Storage Controller (back panel).
2. Remove the Storage Controller from the system by loosening the thumb screws on the Storage Controller.



3. Take off the top cover of the Storage Controller by uninstalling the screws (3 at the top, 2 at each side).



4. Remove the screw that secures the metal bracket to the chassis then remove the metal bracket.



5. Align and insert the expansion card into the PCIe slot.

6. Replace the screw of the metal bracket to secure the card to the chassis.

Note: When removing or inserting the Storage Controller, please use the handle of the Storage Controller to ensure proper handling of the Storage Controller. Always lock the Storage Controller to make sure that it is seated in place after installing it to the system.

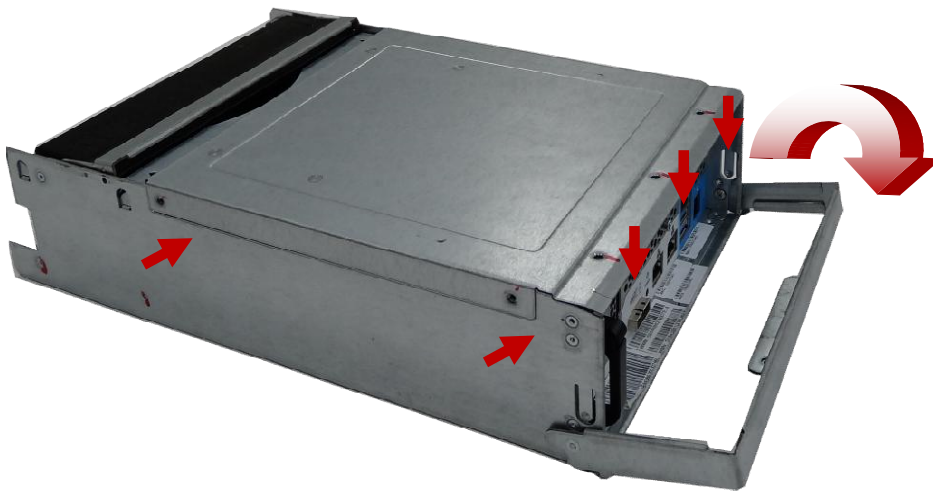
Installing DIMMs

To install a DIMM:

1. Shutdown the respective Storage Controller on which the DIMMs are installed from QES (refer to the High Availability app in software manual) or by pressing the power button on the Storage Controller (Refer to Rear Panel LEDs and Buttons in *Chapter 3: System Components*).
2. Remove the Storage Controller from the system by loosening the thumb screws on the Storage Controller.



3. Take off the top cover of the Storage Controller by uninstalling the screws (3 at the top, 2 at each side).



4. Insert the DIMMs.



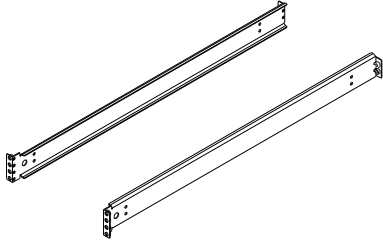


Note: To replace or upgrade a system component, refer to the QNAP website for a list of optional accessories that have been validated with the ES NAS series.

Chapter 5. Quick-Deploy Rack kit installation instructions

Overview

This chapter details instructions for installing QNAP rack rails into square-hole racks for the 3-U ES NAS. These quick rails automatically latch into the square holes of racks and greatly reduce installation time.

Kit contents

Item	Figure
Two mounting rails (left and right) NOTE: This rail will fit a rack between 24" and 36" deep.	
Two cage nuts	
Six Phillips Screw	



Caution

Electrostatic discharge (ESD) can damage electronic components. Be sure you are properly grounded (earthed) before beginning any installation procedure.



Caution

Always plan the rack installation so that the heaviest item is on the bottom of the rack. Install the heaviest item first, and continue to populate the rack from the bottom to the top.



Warning

Ensure that the rack is level and stable before working on the rack. Ensure that the rack is level and stable before working on the rack. Be sure the leveling jacks (feet) extend to the floor and that the full weight of the rack rests firmly on the floor.



Warning

Ensure that the rack has anti-tip measures in place. Such measures may include floor-bolting, anti-tip feet, ballast, or a combination of these as specified by the rack manufacturer and applicable codes.



Warning

To reduce the risk of personal injury or damage to the equipment, at least two people are required to lift the ES NAS during installation or removal.

Mounting the Device

1. Position left and right rack rails at the desired 'U' position in the rack (step 1 in Figure 1).

Important

When installing the rack rails, be sure they are oriented Front Left and Front Right, as indicated on the rails.

Note: The rails can be adjusted to fit the rack.

2. Push the release tab to hang the hooks of the rails onto the rack holes and release the tab to snap the rails into place. Secure the back end of the rails to the back rack columns by using the screws provided (Step 2 in Figure 1).

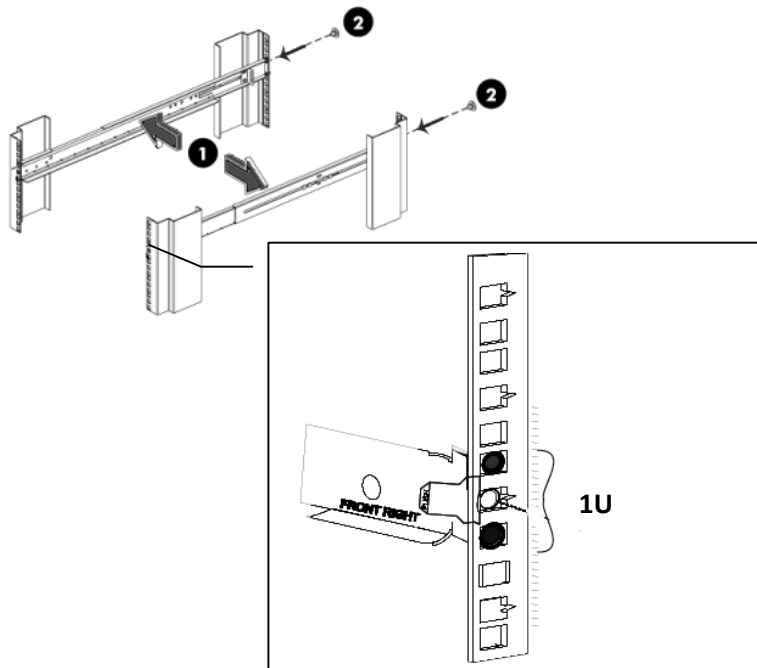


Figure 1: Attach the rails to the rack columns

3. Place the cage nuts 6 holes (or 2U space from the centerline of the rail) above and snap it into the square holes of the front columns. These cage nuts will be used to attach the ES NAS to the rack later (Figure 2).

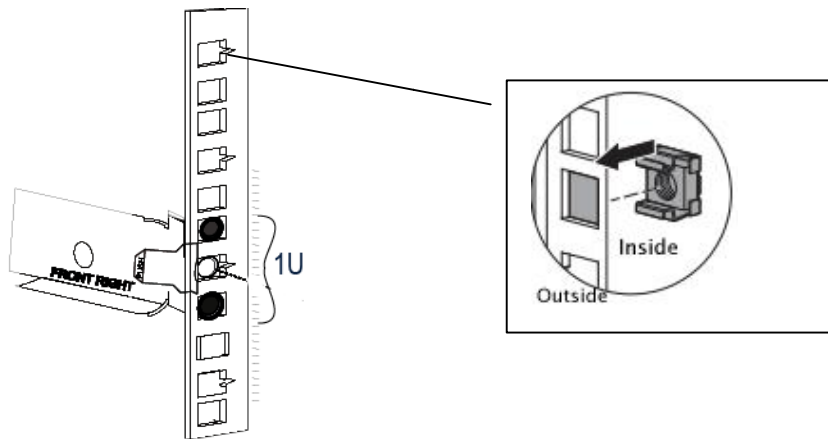


Figure 2: Attach the cage nuts to the rack columns

4. Slide the ES NAS into position on the rails (Figures 3).

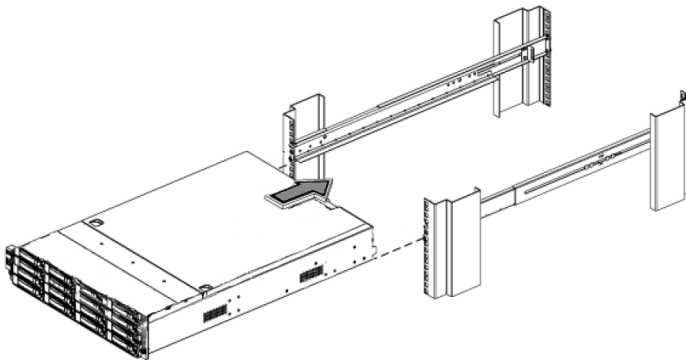


Figure 3: Insert the device into the rack

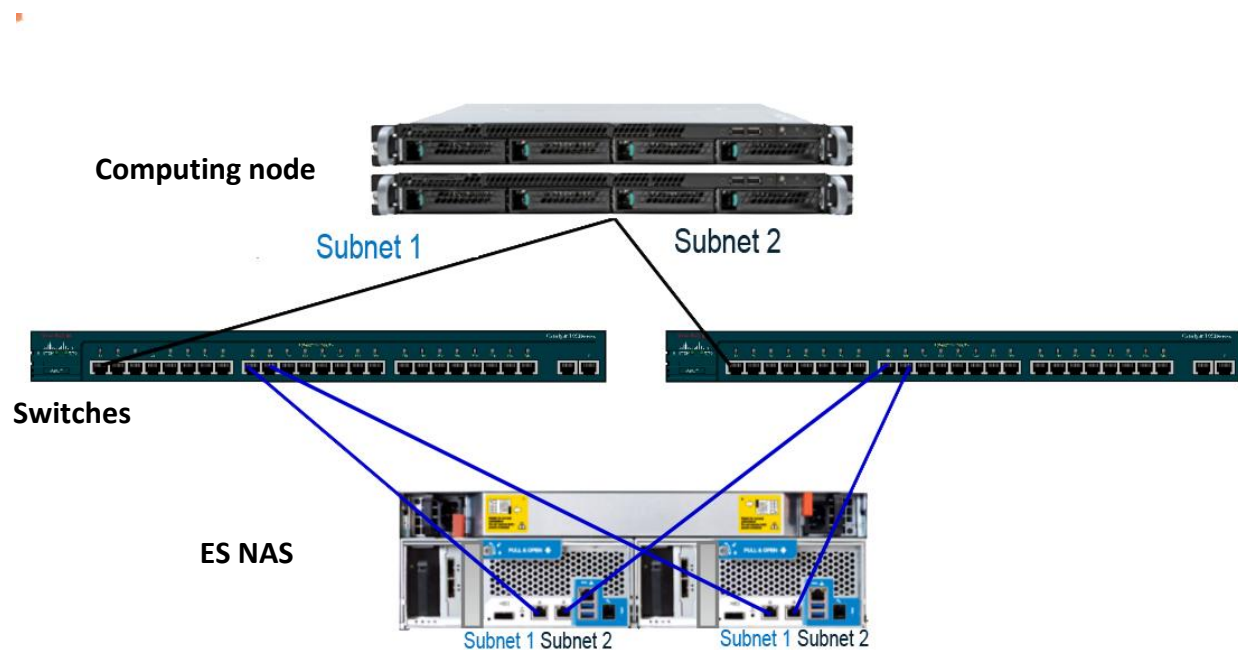
5. Secure the device and the front end of the rails to the front rack columns by using the screws provided (Step 1 in Figure 4). The bottom hole can be installed with only screws where as the upper hole (the centerline of 2U space above or 6 holes above) should be installed with the cage nuts (Step 3). Place the LED cap onto the device (Step 2 in Figure 4). (You might want to do this after powering on your system since the power-on button will not be accessible after the cap is attached.)



Figure 4: Attach the screws

Appendix A: Multipathing Support for High Availability

The ES NAS allows for the connectivity of a host computer running a Windows server-class operating system with the integrated Multipath I/O (MPIO) support in the storage area networking (SAN) environment. Multipathing solutions use redundant physical path components (controllers, cables, and switches) to create logical paths between the server and the storage device. In the event that one or more of these components fails, causing the path to fail, multipathing logic uses an alternate path for I/O so that applications can still access their data. Each Storage Controller should be connected by using redundant switch infrastructures to provide continued access to storage in the event of a failure in a storage fabric component. New MPIO features in Windows Server 2008 include a Device Specific Module (DSM) designed to work with storage arrays that support the storage arrays that follow the Active/Active controller model like the ES NAS. The following diagram is an example of how the configuration should be implemented.



Appendix B: Beep alarm

The beep alarm can be disabled in “Control Panel” > “System Settings” > “Hardware”> “Buzzer”.

Beep	Times	Description
Short beep (0.5 Sec)	1	1) The ES NAS/SAN is starting up 2) The ES NAS/SAN is being shut down (software shutdown) 3) The user presses the reset button to reset the ES NAS/SAN 4) The ES NAS is performing giveback.
Short beep (0.5 Sec)	2	The ES NAS is performing takeover.
Short beep (0.5 Sec)	3	The system firmware has been updated
Long beep (0.5 sec)	3, every 5 min	1) The system fan is out of function 2) Heart beat lost connection
Long beep (1.5 Sec)	2	1) The disk volume is going to be full 2) The disk volume has reached its full capacity 3) The hard drives on the ES NAS/SAN are in degraded mode 4) BBU/power supply plug-out 5) JBOD lost
	1	1) The ES NAS/SAN is turned off by force shutdown (hardware shutdown) 2) The ES NAS/SAN has been turned on successfully and is ready

Appendix C. Product Compliance Class

NAS Models	FCC	CE
ES1640dc	Class A	Class A
ES1642dc	Class A	Class A

Technical Support

QNAP provides dedicated online support and customer service via instant messenger.

Online Support: <http://helpdesk.qnap.com/>

Forum: <http://forum.qnap.com>

Technical Support in the USA and Canada:

Online Support: <http://helpdesk.qnap.com/>

TEL: +1-909-595-2782 #3

Address: 168 University Parkway, Pomona CA 91768

Service Hours: 08:00-17:00 (GMT- 08:00 Pacific Time, Monday to Friday)

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1. Source Code.

The “source code” for a work means the preferred form of the work for making modifications to it. “Object code” means any non-source form of a work.

A “Standard Interface” means an interface that either is an official standard defined by a recognized standards body, or, in the case of interfaces specified for a particular programming language, one that is widely used among developers working in that language.

The “System Libraries” of an executable work include anything, other than the work as a whole, that (a) is included in the normal form of packaging a Major Component, but which is not part of that Major Component, and (b) serves only to enable use of the work with that Major Component, or to implement a Standard Interface for which an implementation is available to the public in source code form. A “Major Component”, in this context, means a major essential component (kernel, window system, and so on) of the specific operating system (if any) on which the executable work runs, or a compiler used to produce the work, or an object code interpreter used to run it.

The “Corresponding Source” for a work in object code form means all the source code needed to generate, install, and (for an executable work) run the object code and to modify the work, including scripts to control those activities. However, it does not include the work's System Libraries, or general-purpose tools or generally available free programs which are used unmodified in performing those activities but which are not part of the work. For example, Corresponding Source includes interface definition files associated with source files for the work, and the source code for shared libraries and dynamically linked subprograms that the work is specifically designed to require, such as by intimate data communication or control flow between those subprograms and other parts of the work.

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