**Hewlett Packard Enterprise**
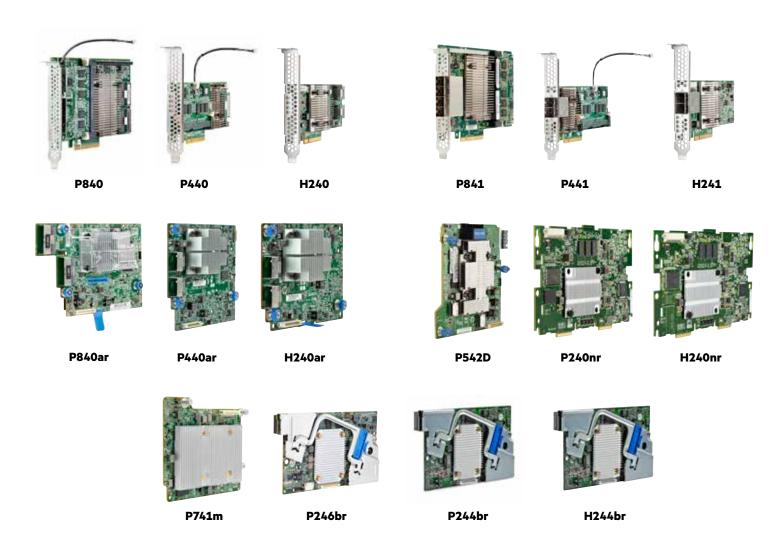
# HPE Smart Storage Controllers for HPE ProLiant Gen9 servers

Increased performance, data availability, and storage capacity

| | | | | | | |
|---|---|---|---|---|---|---|
| **P840** | **P440** | **H240** | **P841** | **P441** | **H241** |
| **P840ar** | **P440ar** | **H240ar** | **P542D** | **P240nr** | **H240nr** |
| **P741m** | **P246br** | **P244br** | **H244br** | | |

# Achieve new levels of data protection and accessibility

As data—and data storage and accessibility requirements—grow exponentially, your storage solutions need to meet a variety of needs. HPE Smart Storage solutions for HPE ProLiant Gen9 servers improve your storage utilization and performance while delivering the scalability, reliability, and accessibility you require—and help you deal with data privacy challenges.

**Use storage more effectively**
Modular HPE Smart Array and Smart Host Bus Adapter solutions provide 12 Gb/s performance, scalability, and choice, and offer significant benefits that can help you make better use of your storage environment.

**Data security**
HPE Secure Encryption (supported on the HPE Smart Array Controller and Smart Host Bus Adapter in simple RAID mode) is a simple, secure, key-based, local and remote encryption solution that protects data at rest.

## Leverage HPE Smart Storage solutions for HPE ProLiant Gen9 servers

Making IT a strategic enabler of the business has never been more challenging. Data storage requirements are growing exponentially, along with government regulations for protecting sensitive data. That means your storage solution must meet a variety of needs.

To rise to the challenge, you need new technologies and capabilities that deliver compelling business outcomes faster. HPE Smart Storage solutions for **HPE ProLiant Gen9 servers** are built to give you compute for the **New Style of IT**—where IT is tightly aligned with business requirements to streamline operations, contain costs, accelerate the delivery of new products and services, and optimize application performance. HPE Smart Storage controllers improve your storage utilization and performance while delivering the scalability, reliability, and accessibility required to compete.

## HPE Smart Storage product family

### HPE Smart Array Controllers
Designed to enhance server uptime and maintain flexibility for future growth, **HPE Smart Array Controllers** blend the reliability of SCSI with the performance advantages of serial architecture. Providing industry-leading performance with unmatched data protection, this is the solution for companies with direct-attached SAS storage.

With support for more than 576 TB[1] of total storage, HPE Smart Array Controllers can help you meet the requirements of a broad range of applications. Moreover, by giving you extensive choices for server and storage deployment, these controllers provide high levels of flexibility and return on investment.

### HPE Smart Host Bus Adapters
Perfect for environments that require fast access, HPE Smart Host Bus Adapters (HBAs) provide cost-effective and reliable high-performance SAS connectivity to direct attached storage, shared storage, and tape drives for HPE ProLiant servers running Hadoop, Database Availability Group, VMware® Virtual SAN™, and Microsoft® Storage Spaces. Smart Host Bus Adapters are a perfect conduit for deploying software-defined storage to manage the IT storage pool. For greater flexibility, HPE Smart Host Bus Adapters can run in either HBA or simple RAID mode.

[1] 576 TB is derived using the HPE Smart Array P441 Controller on an HPE ProLiant Gen9 DL380 Server supporting up to 96 drives with a configuration of 12 LFF drives; multiply by 6 TB HDD in a total of eight D3600 Disk enclosures.

**HPE Dynamic Smart Array**

HPE Dynamic Smart Array provides an embedded SATA software RAID solution for HPE ProLiant Gen9 servers. The common metadata format on the drives allows disks to migrate from Dynamic Smart Array to Smart Array Controller or Smart Host Bus Adapter (when running in RAID mode) if needed, to achieve higher performance, capacity, and availability. This controller is ideal for supporting boot device and applications that do not require a significant I/O workload.

**HPE 12G SAS Expander Card**

The HPE 12G SAS Expander Card provides servers with internal storage scalability. It is ideal if you want to RAID more than eight internal hard disk drives or add an additional internal drive cage and RAID across all the internal drives. The drives attached behind the expander card are managed by the supported HPE Smart Array Controller or Smart HBA. The expander card dynamically optimizes the bandwidth of existing 6 Gb/s drives to match the 12 Gb/s speed in a mixed environment of 6 Gb/s and 12 Gb/s drives.

A server-specific expander card kit is available for HPE ProLiant DL380 Gen9 and ML350 Gen9 servers.

**HPE Smart Storage Administrator**

**HPE Smart Storage Administrator (HPE SSA)** is an advanced utility that allows you to perform many complex configuration tasks via a GUI, a command line interface, or scripting. The addition of HPE SSA can help you configure array controllers, expand an existing array configuration by adding drives, or reconfigure an array by extending volume sizes. You can also make use of enterprise-class features—such as online RAID-level migration and online capacity expansion—to make alterations to the storage system without disrupting the current workload. HPE SSA is also the utility used to manage the HPE Smart Host Bus Adapters, such as configuring it to run in either the HBA mode or simple RAID mode. It deploys and manages HPE SmartCache and HPE Secure Encryption.

# HPE Smart Storage Controllers on HPE ProLiant and Apollo Gen9 servers

| | B140i | H240ar (726757-B21) | P440ar (726736-B21) | P840ar (843199-B21)[2] | H240 (726907-B21) | P440/2 GB (820834-B21)[3] | P440/4 GB (726821-B21) | P840 (726897-B21) | H241 (726911-B21) | P441 (726825-B21) | P841 (726903-B21) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Form factor: Flexible PCIe card** | | ✓ | ✓ | ✓ | | | | | | | |
| **Form factor: PCIe plug-in card** | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Internal ports** (physical lanes) | 10 | 8 | 8 | 16 | 8 | 8 | 8 | 16 | | | |
| **External ports** (physical lanes) | | | | | | | | | 8 | 8 | 16 |
| **Connectors** | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 4 |
| **Cache size** (FBWCache) | | | 2 GB | 2 GB | | 2 GB | 4 GB | 4 GB | | 4 GB | 4 GB |
| **Storage protocol: 12G SAS** | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Storage protocol: 6G SATA** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **I/O slot: PCI Express 3.0 x8 link** | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Maximum physical drives: SFF** | 10 | | 48 | 24 | | 24 | 48 | 48 | 200 | 200 | 200 |
| **Maximum physical drives: LFF** | 10 | 12 | 12 | 12 | 68 | 12 | 68 | 68 | 96 | 96 | 140 |
| **Maximum logical drives** | | 64 | 64 | 64 | 64 | 64 | 64 | 64 | 64 | 64 | 64 |
| **RAID: 0/1/5/10** | ✓ | ✓ | | | ✓ | | | | ✓ | | |
| **RAID: 0/1/10/5/50/6/60/1 ADM/10 ADM** | | | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ |
| **HBA mode** | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **RAID mode** | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Boot mode: UEFI** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Boot mode: Legacy** | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **HPE SSD Smart Path** | | | ✓ | ✓ | | ✓ | ✓ | ✓ | | ✓ | ✓ |
| **HPE Secure Encryption license** | | Optional | Optional | Optional | Optional | Optional | Optional | Optional | Optional | Optional | Optional |
| **HPE SmartCache license** | | | Optional | ✓ | | Optional | Optional | ✓ | | Optional | ✓ |
| **FIPS 140–2 Level 1 validation** | | | ✓ | | | ✓ | ✓ | | | ✓ | |
| **OS: Windows®** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **OS: Red Hat® Enterprise Linux** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **OS: SUSE Linux Enterprise** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| **OS: VMware vSphere®** | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

[2] HPE Smart Array P840ar Controller (843199-B21) is only supported on DL360 and DL380 Gen9 servers.

[3] HPE Smart Array P440/2 GB Controller (820834-B21) is only supported on DL20/DL60/DL80/DL120/DL160/DL180 Gen9 servers and ML30/ML110/ML150 Gen9 servers.

## HPE Smart Storage Controllers on HPE ProLiant BladeSystem Gen9

| | B140i | H244br (726809-B21) | P244br (749680-B21) | P246br (726793-B21) | P741 (726782-B21) |
|---|---|---|---|---|---|
| **Form factor: Flexible PCIe card** | | ✓ | ✓ | ✓ | |
| **Form factor: Mezzanine PCIe card** | | | | | ✓ |
| **Internal ports** (physical lanes) | 10 | 2 | 2 | 4 | |
| **External ports** (physical lanes) | | | | | 8 |
| **Connectors** | 2 | 2 | 2 | 4 | 4 |
| **Cache size** (FBWCache) | | | 1 GB | 1 GB | 2 GB |
| **Storage protocol: 12G SAS** | | ✓ | ✓ | ✓ | ✓ |
| **Storage protocol: 6G SATA** | ✓ | ✓ | ✓ | ✓ | ✓ |
| **I/O slot: PCI Express 3.0 x8 link** | | ✓ | ✓ | ✓ | ✓ |
| **Maximum physical drives: SFF** | 2 | 2 | 2 | 4 | 200 |
| **Maximum physical drives: LFF** | | | | | 96 |
| **Maximum logical drives** | | 64 | 64 | 64 | 64 |
| **RAID: 0/1** | ✓ | ✓ | | | |
| **RAID: 0/1/10/5/50/6/60/10 ADM** | | | ✓ | ✓ | ✓ |
| **HBA mode** | | ✓ | ✓ | ✓ | ✓ |
| **RAID mode** | | ✓ | ✓ | ✓ | ✓ |
| **Boot mode: UEFI** | ✓ | ✓ | ✓ | ✓ | ✓ |
| **Boot mode: Legacy** | | ✓ | ✓ | ✓ | ✓ |
| **HPE SSD Smart Path** | | | ✓ | ✓ | ✓ |
| **HPE Secure Encryption license** | | Optional | Optional | Optional | Optional |
| **HPE SmartCache license** | | | | | ✓ |
| **FIPS 140–2 Level 1 validation** | | | ✓ | ✓ | ✓ |
| **OS: Windows** | ✓ | ✓ | ✓ | ✓ | ✓ |
| **OS: Red Hat Enterprise Linux** | ✓ | ✓ | ✓ | ✓ | ✓ |
| **OS: SUSE Linux Enterprise** | ✓ | ✓ | ✓ | ✓ | ✓ |
| **OS: VMware vSphere** | ✓ | ✓ | ✓ | ✓ | ✓ |

## HPE Smart Storage Controllers on HPE Synergy Compute Models Gen9

| | B140i | H240nr (759553-B21) | P240nr (758801-B21) | P542D (759557-B21) |
|---|---|---|---|---|
| **Form factor: Flexible PCIe card** | | ✓ | ✓ | |
| **Form factor: Mezzanine PCIe card** | | | | ✓ |
| **Internal ports** (physical lanes) | 10 | 4 | 4 | 8 |
| **External ports** (physical lanes) | | | | 8 |
| **Connectors** | 2 | 2 | 2 | 4 |
| **Cache size** (FBWCache) | | | 1 GB | 2 GB |
| **Storage protocol: 12G SAS** | | ✓ | ✓ | ✓ |
| **Storage protocol: 6G SATA** | ✓ | ✓ | ✓ | ✓ |
| **I/O slot: PCI Express 3.0 x8 link** | | ✓ | ✓ | ✓ |
| **Maximum physical drives: SFF** | 2 | 4 | 4 | 71 |
| **Maximum physical drives: LFF** | | | | 71 |
| **Maximum logical drives** | | 64 | 64 | 64 |
| **RAID: 0/1/5/10** | ✓ | ✓ | | |
| **RAID: 0/1/10/5/50/6/60/10 ADM** | | | ✓ | ✓ |
| **HBA mode** | | ✓ | ✓ | ✓ |
| **RAID mode** | | ✓ | ✓ | ✓ |
| **Boot mode: UEFI** | ✓ | ✓ | ✓ | ✓ |
| **Boot mode: Legacy** | | ✓ | ✓ | ✓ |
| **HPE SSD Smart Path** | | | ✓ | ✓ |
| **HPE Secure Encryption license** | | Optional | Optional | Optional |
| **HPE SmartCache license** | | | | Optional |
| **FIPS 140–2 Level 1 validation** | | ✓ | ✓ | ✓ |
| **OS: Windows** | ✓ | ✓ | ✓ | ✓ |
| **OS: Red Hat Enterprise Linux** | ✓ | ✓ | ✓ | ✓ |
| **OS: SUSE Linux Enterprise** | ✓ | ✓ | ✓ | ✓ |
| **OS: VMware vSphere** | ✓ | ✓ | ✓ | ✓ |

## HPE Secure Encryption

HPE Secure Encryption is a Smart Array Controller-based data encryption solution for HPE ProLiant Gen9 servers that protects sensitive, mission-critical data. This is an enterprise-class encryption solution for data at rest on any bulk storage (with the exception of tape or external arrays, such as P2000 and MSA 2040) attached to the supported HPE Smart Array Px4x family of controllers. The solution is available for both local and remote deployments. Many companies under government regulations require that sensitive data be secured. HPE Secure Encryption is an important component for complying with government regulations like HIPAA and Sarbanes-Oxley, both of which have data privacy requirements.

**FIPS 140–2 Cryptographic Module Validation**
FIPS provides a security assurance level validation for cryptographic modules. HPE Smart Array P440ar, P440, P441, H240nr, P240nr, P542D, and P741m controllers have completed FIPS 140-2 Level 1 validation (certificate #2506). The National Institute of Standards and Technology (NIST) issued the FIPS 140–2 requirements and standards for cryptography modules that include both hardware and software components.

**Benefits**
- Data on the cache module of the HPE Smart Array Px4x Controllers, as well as the attached bulk storage, is encrypted.

- Any HDD or SSD in the Smart Drive portfolio for ProLiant Gen9 servers is supported.

- Easily scales with your business data growth. Local Key Management Mode provides a simple key management solution, using just HPE SSA and HPE Smart Array Px4x Controllers.

- Remote Key Management mode allows for the central management and secure key storage for all HPE Secure Encryption related keys. The HPE Enterprise Secure Key Manager 3.1 scales to more than 25,000 attached servers and millions of associated keys.

- Single interface of the HPE Smart Storage Administrator also manages the cryptographic features of HPE Secure Encryption.

- HPE Secure Encryption license per server is required. HPE SSA configures the cryptographic features of HPE Secure Encryption.

**HPE Secure Encryption orderable part number**

HPE Secure Encryption per server entitlement C9A82AAE

For more information, please visit: **hpe.com/servers/secureencryption**

## HPE Smart Storage Administrator

HPE Smart Storage Administrator gives you a single interface for quickly setting up, configuring, and managing HPE Smart Arrays, HPE Smart Host Bus Adapters, and other storage devices, such as SAS switches. HPE SSA is designed to enhance the HPE ProLiant Server storage experience, and will expose new features and functionality for various HPE Smart Storage initiatives as they come online. For more information, please visit: **hpe.com/servers/ssa**.

## HPE SmartCache

HPE SmartCache is a Smart Array Controller-based read and write caching solution for HPE ProLiant Gen9 servers in a direct attach storage (DAS) environment. It caches the most frequently accessed data ("hot" data) onto lower latency SSDs to dynamically accelerate application workloads. HPE SmartCache operates transparently to host applications, which means you do not have to change the application, but can still realize better performance with a minimal number of SSDs in your configuration.

HPE SmartCache supports two write policies:

• The write-through policy is designed to accelerate read-intensive workloads. Writes of hot data may go to the accelerator, but writes always go to bulk storage. There is no data loss if the accelerator fails.

• The write-back policy is designed to accelerate both read and write workloads. Writes of hot data may go to the accelerator and be forwarded to bulk storage later. If the accelerator fails before all write data has been forwarded to bulk storage, then there is data loss. HPE recommends a RAID 1 accelerator. In certain workloads, all writes may go to the accelerator before being forwarded to bulk storage. As a result, Read Intensive (RI) SSDs are generally not a wise choice for accelerator, for two reasons: RI SSDs may wear out quickly in a heavy write workload, and they typically provide much less write performance than Write Intensive (WI) SSDs.

The Write-back feature enables write commands to be stored temporarily on the accelerator(s) prior to being written to bulk storage. HPE SmartCache is available as an option on the HPE Smart Array P440 and P440ar Controllers. HPE SmartCache is included and does not require the purchase of a license on the HPE Smart Array P840 Controller.

The basic HPE SmartCache architecture is comprised of the following three elements:

1. Bulk storage—Any supported storage attached to the HPE Smart Array Controller

2. Accelerator—A faster/lower latency SSD device that caches data

3. Metadata—Information held in the FBWC that maps the location of information residing on the accelerator and bulk storage devices

The HPE SmartCache architecture is flexible and supports any HPE ProLiant Gen9 supported HDD for bulk storage and any HPE ProLiant Gen9 supported SSD as an accelerator. HPE SmartCache is deployed and managed through the same management tool as HPE Smart Array—the HPE SSA.

**HPE SmartCache orderable part numbers[4]**

| **Physical**—D7S26A | **Electronic**—D7S27AAE | **Flexible**—D7S27A |
|---|---|---|

For more information, please visit: **hpe.com/servers/smartcache**

## HPE SSD Smart Path

The HPE SSD Smart Path feature included in the HPE Smart Array software stack improves SSD read performance. The HPE Smart Array driver chooses the optimum path to access each SSD. With up to 3.5X better SSD read performance, HPE SSD Smart Path chooses the optimum path to the SSD and accelerates reads for all RAID levels and RAID 0 writes. HPE SSD Smart Path is ideal for read intensive workloads and is included as a base feature on HPE Smart Array P-series Controllers.

For more information, please visit: **hpe.com/servers/ssa**.

## Fault tolerance using RAID striping

**RAID 6 (Advanced Data Guarding):** Supported with a minimum of four drives. This allocates two sets of parity data across drives. This level of fault tolerance can withstand a double drive failure without downtime or data loss.

**RAID 60:** Supported with a minimum of eight drives. This volume is composed of two or more RAID 6 sub-volumes (parity groups) where data is striped across each parity group as if it were a single physical drive. Each RAID 6 parity group can sustain up to two drive failures without incurring data loss.

[4] HPE SmartCache requires 1 Gb FBWC minimum; HPE ProLiant supported HDDs and SSD.

**RAID 5 (Distributed Data Guarding):** Supported with a minimum of three drives. This allocates one set of parity data across drives. This level of fault tolerance can withstand a single drive failure without downtime or data loss.

**RAID 50:** Supported with a minimum of six drives. This volume is composed of two or more RAID 5 sub-volumes (parity groups) where data is striped across each parity group as if it were a single physical drive. Each RAID 5 parity group can sustain a single drive failure without incurring data loss.

**RAID 1 and RAID 10 (Drive Mirroring):** Supported with a minimum of two drives. This allocates half of the drive array to the data and the other half to the mirrored data, providing two copies of the data.

**RAID 1 ADM and RAID 10 ADM (Advanced Data Mirroring):** Supported with a minimum of three drives. RAID 1 ADM creates redundant copies of the data using three drives. RAID 10 ADM stripes data across two or more sets of RAID 1 ADM volumes. This level of fault tolerance can withstand a double drive failure within a RAID 1 ADM volume without downtime or data loss.

## HPE Services

**Simplify implementation and support of your server solution**
To streamline installation and enhance ongoing support, HPE recommends the following set of service offerings:

• **Installation and Startup Service**—HPE Services offers complete installation and implementation support—including global rollout capabilities—to get your HPE solution up and running rapidly, with minimal business disruption. Options encompass all server options and storage for inclusion in the server, Microsoft and Linux® operating software, plus HPE Insight Control software management solutions.

• **Hardware support**—You can cover all the options installed in your server with a single convenient service package. HPE Care Pack services for HPE ProLiant and HPE BladeSystem servers, as well as HPE storage systems, provide support for all HPE-branded hardware options qualified for inclusion in your server at the time of purchase or afterwards. Any additional HPE qualified option installed within the server is covered at the same service level and for the same period as the server.

Learn more at
**hpe.com/servers/smartarray**

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