IBM DS8910F Model 993
Rack Mounted Storage System

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IBM Redbooks

IBM DS8910F Model 993
Rack Mounted Storage System

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Note: Before using this information and the product it supports, read the information in “Notices” on page v.

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Preface

This IBM® Redpaper publication presents and positions the DS8910F Model 993.

The modular system can be integrated into 15U contiguous space of an existing IBM z14® Model ZR1 (z14 Model ZR1), IBM LinuxONE Rockhopper II (z14 Model LR1), or other standard 19-inch wide rack.

The DS8910F allows you to take advantage of the performance boost of all-flash systems and advanced features while limiting datacenter footprint and power infrastructure requirements.

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Thanks to the following people for their contributions to this project:

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DS8910F Model 993 introduction

This chapter gives a brief overview of the DS8910F model 993 and positioning. Each of the following topics is further developed in subsequent chapters:

- Chapter 1, “DS8910F Model 993 introduction” on page 1
- Chapter 2, “DS8910F hardware configuration” on page 5
- Chapter 3, “DS8910F installation and integration” on page 27
1.1 DS8910F overview

The IBM DS8900 family offers a new all-flash array model, DS8910F model 993, to meet the demand for higher-speed storage in a smaller footprint.

The DS8910F model 993 adds a modular rack-mountable enterprise storage system to the 533x all-flash machine type family. As such, it does not come in its own rack, but can be integrated into a standard 19-inch wide rack that conforms to EIA 310D specifications. The standard 19-inch wide rack installation (feature code 0939), requires a minimum of 15U contiguous space to mount the modules. Figure 1-1 shows the DS8910F model 993 with the maximum configuration (2 pairs of HPFE Gen2) requiring 19U contiguous space, not counting the optional KVM.

The DS8910F model 993 is designed for clients with small capacity requirements looking to boost performance, in particular in mainframe environments. It is designed for clients with small capacity requirements looking to boost performance, in particular in mainframe environments.

![DS8910F Model 993 for 19-inch form factor racks (maximum configuration)](image)

The DS8910F Rack Mounted Storage System supports continuous operation, data security, and data resiliency. For high-availability, the hardware components are redundant.
The modular system can be integrated into a 15U contiguous space of an existing IBM z14 Model ZR1 (feature code 0937) and IBM LinuxONE Rockhopper II (z14 Model LR1, feature code 0938) as shown in Figure 1-2 on page 3. When integrated in either of those IBM Z racks, only one HPFE Gen2 enclosure pair is supported. The added 1U KVM will bring the total to 16U contiguous space. For detailed information on how to integrate the DS8910F, see Chapter 3, “DS8910F installation and integration” on page 27.

The DS8910F enables you to take advantage of the DS8900 advanced features, while limiting datacenter footprint and power infrastructure requirements. The modular system contains POWER9™ processor nodes, an I/O enclosure, High Performance Flash Enclosures Gen2, a management enclosure (which includes the Hardware Management Consoles (HMCs), Ethernet Switches, and Rack Power Control (RPCs)).

For detailed information about the DS8910F Architecture, Hardware, and components, see Chapter 2, “DS8910F hardware configuration” on page 5.

The DS8910F provides a mid-level product with the same advanced functions as larger DS8900 family systems, with support for both IBM Z® Systems or distributed hosts. It is an ideal replacement for older IBM Storage systems, small-capacity DS8700 and DS8800 systems with comparable capacity requirements.
1.2 Product highlights

The DS8910F delivers the following hardware features:

- Eight-core processors with options of 96 GB and 256 GB memory combinations
- Support for up to 32 FCP/FICON® Ports (16 Gbps 4-port HA or 32GFC 4-port EDiF HA)
- Support for up to two high-performance flash enclosure (HPFE) Gen2 pairs that can be populated with either high-performance or high-capacity drive sets, and a maximum storage capacity of 1.47 PB raw capacity based on the 15.36 TB high-capacity (Tier 2) flash drives
- The following performance-optimized flash drive (Tier 0) sets: 800 GB, 1600 GB, and 3200 GB
- Three capacity-optimized flash drive set options: 3.84 TB (Tier 1), 7.68 TB (Tier 2), 1.92 TB (Tier 2) and 15.36 TB (Tier 2)
- Power Intelligent rack PDUs (iPDUs) supply power to the storage system and
- Backup power modules (BPMs) provide power to the non-volatile dual in-line memory module (NVDIMM) when electrical power is removed
- Requires a minimum for 15U contiguous space in a conforming 19 inch rack (additional 1U for the optional KVM and 4U for the second HPFE enclosure pair)
- Same advanced functions as for the other DS8900F models

Functions are licensed as for the others DS8900F models:

- Base Function
  The Base Function license is required for each DS8910F storage system. The licensed functions include Database Protection, Encryption Authorization, Easy Tier®, the Operating Environment License, and Thin Provisioning.

- z-synergy Services
  The z-synergy Services include z/OS® functions that are supported on the storage system. The licensed functions include transparent cloud tiering, High Performance FICON for z Systems, SuperPAV, HyperPAV, PAV, and z/OS Distributed Data Backup.

- Copy Services
  Copy Services features help you implement storage solutions to keep your business running 24 hours a day, 7 days a week by providing data duplication, data migration, and disaster recovery functions. The licensed functions include Global Mirror, Metro Mirror, Metro/Global Mirror, Point-in-Time Copy/IBM FlashCopy®, z/OS Global Mirror, Safeguarded Copy, and z/OS Metro/Global Mirror Incremental Resync (RMZ).

You can use the DS8000 Storage Management GUI and the DS command-line interface (DS CLI) to manage and logically configure the storage system.
DS8910F hardware configuration

This chapter describes the hardware components of the IBM DS8910F. It describes each of the modules that make up the DS8910F. It provides insights into the architecture and individual components and a comparison between the DS8910F model 993 and the previous DS8882F model 983.
2.1 DS8910F machine types

There are several machine type options available for the DS910F. Table 2-1 lists the available hardware machine types and their corresponding function authorization machine types.

<table>
<thead>
<tr>
<th>Hardware machine type</th>
<th>Available hardware models</th>
<th>Corresponding function authorization machine type</th>
<th>Available function authorization models</th>
</tr>
</thead>
<tbody>
<tr>
<td>5331 (1-year warranty period)</td>
<td>993</td>
<td>9046 (1-year warranty period)</td>
<td></td>
</tr>
<tr>
<td>5332 (2-year warranty period)</td>
<td></td>
<td>9047 (2-year warranty period)</td>
<td>LF8</td>
</tr>
<tr>
<td>5333 (3-year warranty period)</td>
<td></td>
<td>9048 (3-year warranty period)</td>
<td></td>
</tr>
<tr>
<td>5334 (4-year warranty period)</td>
<td></td>
<td>9049 (4-year warranty period)</td>
<td></td>
</tr>
</tbody>
</table>

The machine types for the DS8910F specify the service warranty period. The warranty is used for service entitlement checking when notifications for service are called home. The DS8910F model 993 reports 2107 as the machine type to attached host systems.

2.2 DS8910F hardware components

The DS8910F is an entry-level, high-performance storage system that includes only High Performance Flash Enclosures Gen2. The DS8910F hardware components are consistent with the rest of the DS8900 all-flash family. The modular system contains processor nodes, an I/O Enclosure, High Performance Flash Enclosures Gen2, and a Management Enclosure (which includes the HMCs, Ethernet Switches, and RPCs). The DS8910F storage system features 8-core processors and supports one High Performance Flash Enclosure Gen2 pair with the model ZR1 or LR1 installation, or up to two High Performance Flash Enclosure Gen2 pair with the standard 19-inch wide rack installation, with up to 96 Flash Tier 0, Flash Tier 1, or Flash Tier 2 drives. It supports up to 512 GB system memory, four zHyperLink adapters, and up to 32 host adapter ports. The DS8910F consists of six modules with the model ZR1 or LR1 installation and six or eight modules with a standard conforming 19-inch rack. See Chapter 3, “DS8910F installation and integration” on page 27 for more detailed information about installing into a conforming 19-inch rack.

The DS8910F includes the following components:

- Two 2U POWER® processor nodes (CECs)
- Up to two High-Performance Flash Enclosure (HPFE) Gen2 pairs
- One 5U I/O enclosure pair
- One 2U management enclosure
- Optional 1U Display (feature code 1765)
Figure 2-1 shows the DS8910F eight modules that make up the 19U of contiguous space, and the order in which they must be installed. An optional 1U display can be added that make up the 20U of contiguous space.

![DS8910F Eight 2U Modules Diagram](image)

**Figure 2-1  DS8910F Eight 2U Modules**

### 2.2.1 High Performance Flash Enclosure Gen2 pair

The top 4 modules that make up the DS8910F are the HPFE Gen2 pairs. The HPFE Gen2 is a 2U flash enclosure that is installed in pairs. DS8910F supports one HPFE Gen2 pair when installed into an IBM Z model ZR1 or IBM LinuxONE Rockhopper II model LR1. The DS8910F will occupy 15U of contiguous reserved space.

The HPFE Gen2 pair contains the following hardware components:

- Two 2U 24-slot serial-attached SAS (SAS) flash drive enclosures. Each of the two enclosures contains the following components:
  - Two power supplies with integrated cooling fans
  - Two SAS expander modules with two x4 SAS ports each
  - One midplane or backplane for plugging components that accommodate the flash drives, SAS expander modules, and power supplies
  - 24 2.5-inch flash drives (or drive fillers)

The two 2U HPFE Gen2 modules are positioned as the top two modules in the DS8910F.
For more detailed information about the High Performance Flash Enclosures Gen2, see *
*DS8000 High-Performance Flash Enclosure Gen2*, REDP-5422.

Figure 2-2 shows views of HPFE Gen2 front (top) and rear (bottom).

**DS8910F flash drives**
The DS8910F provides a choice of the following drives with the HPFE Gen2:

- 2.5-inch High Performance Flash Tier 0 drives
  - 800 GB
  - 1.6 TB
  - 3.2 TB
- 2.5-inch High Capacity Flash Tier 1 drives
  - 3.84 TB
- 2.5-inch High Capacity Flash Tier 2 drives
  - 1.92 TB
  - 7.68 TB
  - 15.36 TB

**Note:** Intermix of High Performance Flash Tier 0 drives with High Capacity Flash Tier 1 and Flash Tier 2 drives is not supported in a HPFE G2 pair.

All flash drives in DS8910F are Full Drive Encryption (FDE) capable.

Flash drives are ordered in drives sets of 16. The HPFE Gen2 pair can contain 16, 32, or 48 flash drives (1, 2 or 3 drive sets). All flash drives in an HPFE Gen2 pair must be the same type. Half the drive set is installed in each enclosure of the pair.
Figure 2-3 shows the HPFE Gen2 flash drive install order.

Table 2-2 lists the DS8910F feature codes for flash drive sets for HPFE Gen2.

<table>
<thead>
<tr>
<th>Feature code</th>
<th>Disk size</th>
<th>Drive type</th>
<th>RAID support</th>
</tr>
</thead>
<tbody>
<tr>
<td>1611</td>
<td>800 GB</td>
<td>Flash Tier 0</td>
<td>5, 6, 10</td>
</tr>
<tr>
<td>1612</td>
<td>1.6 TB</td>
<td>Flash Tier 0</td>
<td>6, 10&lt;sup&gt;1, 2&lt;/sup&gt;</td>
</tr>
<tr>
<td>1613</td>
<td>3.2 TB</td>
<td>Flash Tier 0</td>
<td>6, 10&lt;sup&gt;1, 2&lt;/sup&gt;</td>
</tr>
<tr>
<td>1622</td>
<td>1.92 TB</td>
<td>Flash Tier 2</td>
<td>6, 10&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>1623</td>
<td>3.84 TB</td>
<td>Flash Tier 1</td>
<td>6, 10&lt;sup&gt;1, 2&lt;/sup&gt;</td>
</tr>
<tr>
<td>1624</td>
<td>7.68 TB</td>
<td>Flash Tier 2</td>
<td>6&lt;sup&gt;1, 2&lt;/sup&gt;</td>
</tr>
<tr>
<td>1625</td>
<td>15.36 TB</td>
<td>Flash Tier 2</td>
<td>6&lt;sup&gt;1, 2&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Note:
1. RAID 5 is not supported for drives larger than 1 TB, and requires a request for price quote (RPQ).
2. RAID 6 is the default and preferred RAID type for all drives larger than 1 TB, and it is the only supported RAID type for 7.68 TB and 15.36 TB drives.
3. Within a High Performance Flash Enclosure Gen2 pair, no intermix of High Performance Flash (Tier 0) with High Capacity Flash (Tier 1 and Tier 2) is supported.

Storage enclosure fillers
Storage enclosure fillers fill empty drive slots in the storage enclosures.

The fillers ensure sufficient airflow across populated storage. For HPFE Gen2, one filler feature provides a set of 16 fillers (feature code 1699).
RAID capacities for DS8910F

Use the following information to calculate the physical and effective capacity for the HPFE Gen2.

The default and preferred RAID type for all drives larger than 1 TB is RAID 6, and it is the only RAID type supported for 7.68 TB and 15.36 TB drives. RAID 5 is not supported for drives larger than 1 TB, and requires a request for price quote (RPQ).

Table 2-3 lists the DS8910F effective RAID capacities.

<table>
<thead>
<tr>
<th>Flash Tier 0, Flash Tier 1, Flash Tier 2 drive size</th>
<th>Physical capacity of Flash Tier 0, Flash Tier 1, Flash Tier 2 drive sets</th>
<th>Effective capacity of one rank in number of extents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rank Type</td>
<td>Raid-10 arrays</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3+3</td>
</tr>
<tr>
<td>800 GB</td>
<td>FB Lg Ext</td>
<td>2133</td>
</tr>
<tr>
<td></td>
<td>FB Sm Ext</td>
<td>136542</td>
</tr>
<tr>
<td></td>
<td>CKD Lg Ext</td>
<td>2392</td>
</tr>
<tr>
<td></td>
<td>CKD Sm Ext</td>
<td>126821</td>
</tr>
<tr>
<td>1.6 TB</td>
<td>FB Lg Ext</td>
<td>4301</td>
</tr>
<tr>
<td></td>
<td>FB Sm Ext</td>
<td>275284</td>
</tr>
<tr>
<td></td>
<td>CKD Lg Ext</td>
<td>4824</td>
</tr>
<tr>
<td></td>
<td>CKD Sm Ext</td>
<td>255684</td>
</tr>
<tr>
<td>1.92TB</td>
<td>FB Lg Ext</td>
<td>5168</td>
</tr>
<tr>
<td></td>
<td>FB Sm Ext</td>
<td>330783</td>
</tr>
<tr>
<td></td>
<td>CKD Lg Ext</td>
<td>5796</td>
</tr>
<tr>
<td></td>
<td>CKD Sm Ext</td>
<td>307231</td>
</tr>
<tr>
<td>3.2 TB</td>
<td>FB Lg Ext</td>
<td>8637</td>
</tr>
<tr>
<td></td>
<td>FB Sm Ext</td>
<td>552771</td>
</tr>
<tr>
<td></td>
<td>CKD Lg Ext</td>
<td>9687</td>
</tr>
<tr>
<td></td>
<td>CKD Sm Ext</td>
<td>513414</td>
</tr>
<tr>
<td>3.84 TB</td>
<td>FB Lg Ext</td>
<td>10371</td>
</tr>
<tr>
<td></td>
<td>FB Sm Ext</td>
<td>663766</td>
</tr>
<tr>
<td></td>
<td>CKD Lg Ext</td>
<td>11632</td>
</tr>
<tr>
<td></td>
<td>CKD Sm Ext</td>
<td>616506</td>
</tr>
</tbody>
</table>
2.2.2 DS8910F 5U I/O enclosure

The DS8910F I/O enclosure holds the I/O adapters and provides connectivity between the I/O adapters and the processor nodes. DS8910F has one pair of 5U I/O enclosure logical names I/O bay 02 and 03. I/O adapters are installed in pairs in the two I/O bays for redundancy.

The I/O adapters in the I/O enclosures can be either flash RAID adapters or host adapters. Each I/O enclosure supports two Flash RAID adapter pairs, and four host adapters pairs (32 ports). Host adapters are either 4-port 16 Gbps or 4-port 32 Gbps (GFC).

The DS8910F I/O enclosure supports at minimum configuration one pair of flash device adapter. At maximum configuration, two pairs of flash device adapter are supported. The I/O enclosure configuration contains the following components:

- Up to four pairs of 4-port 16 Gbps or 4-port 32 GFC host adapters
- Power control network (PCN) adapter
- Redundant power supplies (PSUs)
- Redundant fans for enclosure cooling
- Up to two pairs of flash device adapter
- Four zHyperLink adapters

Figure 2-4 on page 12, shows the DS8910F I/O enclosure maximum configuration with a flash RAID adapter pair, and four host adapter pairs.
PCIe connectivity is from the 4-port PCIe adapters in the processor nodes to the base PCIe I/O expander. There is a separate PCIe connection to each base, which provides redundant access to each I/O bay and shared access to the flash device and host adapters. Failover occurs during code load, or during node failure and service actions.

The minimum configuration supports one flash device adapter pair (one adapter in each I/O bay) and up to four host adapter pairs (four adapters in each I/O bay).

**Note:** For continued availability during a logical I/O enclosure or a host adapter failure, ensure host connectivity has a redundant path to a different host adapter in the other logical I/O enclosure.

Figure 2-5 on page 12 shows the PCIe connectivity from the processor nodes to the DS8910F 5U I/O enclosures. There are two connections, one from each processor node to each I/O enclosure.
zHyperLink connections

Up to four zHyperLink connections with IBM Z hosts can be used to provide low latency for random reads and writes. Each zHyperLink connection requires a zHyperLink I/O adapter to connect the zHyperLink cable to the storage system. Each zHyperLink I/O adapter card (feature code 3500) has one port, but you must order them in sets of two. Table 2-4 lists the feature codes for the available zHyperLink cables.

Table 2-4  Feature codes for zHyperLink cables

<table>
<thead>
<tr>
<th>Feature code</th>
<th>Cable type</th>
<th>Cable length</th>
<th>zHyperLink I/O adapter features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1450</td>
<td>OM4 50/125 micrometer, multimode, MTP connectors</td>
<td>40 m (131 ft.)</td>
<td>3500</td>
</tr>
<tr>
<td>1451</td>
<td>OM4 50/125 micrometer, multimode, MTP connectors</td>
<td>150 m (492 ft.)</td>
<td>3500</td>
</tr>
<tr>
<td>1452</td>
<td>OM4 50/125 micrometer, multimode, MTP connectors. For Model 993 installed in IBM Z model ZR1/LR1</td>
<td>3 m (9.8 ft.)</td>
<td>3500</td>
</tr>
</tbody>
</table>

Figure 2-6 shows the zHyperLink adapter locations for connecting to IBM Z host system. When configuring host connections T3 ports are connected first, then T4 ports.
**Fibre Channel (SCSI-FCP and FICON) host adapters and cables**

The DS8910F Fibre Channel host adapters enable attachment to Fibre Channel (SCSI-FCP) and FICON servers, and SAN fabric components. They can also be used for remote mirror and copy control paths between DS8000 series storage systems.

The DS8910F host adapters are 4-port 16 Gbps or 4-port 32 GFC similar to those in other DS8900 models. The DS8910F host adapters can be long wave or short wave.

Supported protocols include the following types:

- SCSI-FCP upper layer protocol (ULP) on point-to-point and fabric
- FICON ULP on point-to-point and fabric topologies

**Note:** The 16 Gbps or 32 GFC (EDiF) Encryption capable host adapters do not support arbitrated loop topology at any speed.

**Fibre channel port identification**

The DS8910F host adapters are installed as pair in the two I/O enclosures. Up to four 4-port 16 Gbps or 4-port 32 GFC pairs can be installed in DS8910F. The host adapter plug order is shown in Figure 2-7 on page 14.

![Figure 2-7 DS8910F Host adapter plug order](image)

The install order is:

1. Install all 32 GFC host adapters
2. Install 16 Gbps host adapters
3. Install Long Reach host adapters
4. Install Short Reach host adapters
The DS8910F fibre channel ports can be identified by the physical host adapter port location code and the fibre channel port ID. Figure 2-8 on page 15 lists the fibre port IDs for host adapters installed in I/O enclosure 1B3.

<table>
<thead>
<tr>
<th>Adapter ID</th>
<th>Logical name</th>
</tr>
</thead>
<tbody>
<tr>
<td>B10</td>
<td>vra022</td>
</tr>
<tr>
<td>B11</td>
<td>cpssf021</td>
</tr>
<tr>
<td>1812</td>
<td>cpssf023</td>
</tr>
<tr>
<td>B13</td>
<td>cpssf024</td>
</tr>
<tr>
<td>B14</td>
<td>vra025</td>
</tr>
<tr>
<td>1815</td>
<td></td>
</tr>
</tbody>
</table>

![Figure 2-8](image)

Figure 2-8 Fibre port IDs for the host adapters in I/O enclosure 1B3

Figure 2-9 shows the fibre channel port IDs assigned to the host adapters installed in I/O enclosure 1B4. Slots number shown are logical so slot 0 is physical slot 1 in 1B4.

<table>
<thead>
<tr>
<th>Adapter ID</th>
<th>Logical name</th>
</tr>
</thead>
<tbody>
<tr>
<td>B18</td>
<td>vra032</td>
</tr>
<tr>
<td>B19</td>
<td>cpssf031</td>
</tr>
<tr>
<td>181A</td>
<td>cpssf033</td>
</tr>
<tr>
<td>B1B</td>
<td>cpssf034</td>
</tr>
<tr>
<td>181D</td>
<td>vra035</td>
</tr>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>cpssf030</td>
<td>cpssf0310</td>
</tr>
<tr>
<td>cpssf0301</td>
<td>cpssf0311</td>
</tr>
<tr>
<td>cpssf0302</td>
<td>cpssf0312</td>
</tr>
<tr>
<td>cpssf0303</td>
<td>cpssf0313</td>
</tr>
<tr>
<td>daPair 10</td>
<td>daPair 11</td>
</tr>
<tr>
<td>daPair 11</td>
<td>daPair 10</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Slot 8</td>
<td>Slot 9</td>
</tr>
<tr>
<td>1938</td>
<td>1939</td>
</tr>
<tr>
<td>syncio038</td>
<td>syncio039</td>
</tr>
</tbody>
</table>

![Figure 2-9](image)

Figure 2-9 Fibre channel port IDs for the host adapters in I/O enclosure 1B4

Figure 2-10 shows the Fibre Channel ports displayed from the Storage Manager GUI. The FC port logical ID, frame number, I/O enclosure, and host adapter slot are shown with other FC port properties. Looking at port ID I0232 for example, and referencing Figure 2-8, the port is in I/O enclosure 1B3 slot 4 port 2.
Fibre channel cables

A Fibre Channel cable is required to attach each Fibre Channel adapter port to a server or fabric component port. The Fibre Channel cables can be 50 or 9μm, OM3 or higher fiber graded, single or multimode cables.

For more information about DS8910F host adapter and fibre channel cable features, see “Planning for host connectivity” on page 32.

Flash RAID Adapters

Up to two pairs of The flash RAID adapter can be installed in DS8910F to connect to 2 pairs of HPFE. The main processor is a RAID engine that provides RAID and sparing management to the flash drives in the HPFE Gen2 flash enclosures.

The flash RAID adapter has four SAS ports, which provide connectivity from the RAID adapter to the HPFE Gen2 enclosures.

The flash RAID adapters are installed as a pair, one in each of the logical I/O enclosures. This is known as a device adapter pair (DA pair). Logical configuration should be balanced across the DA pair for load balancing and the highest throughput.

The redundant DA pair ensures continued availability in the event of a flash RAID adapter or a logical I/O enclosure failure.

2.2.3 IBM POWER9-based servers

A pair of POWER9-based servers, also known as processor nodes, are at the heart of all of the IBM DS8900F models. The DS8910F model 993 shares the same processor nodes that are used in the DS8910F model 994.

The two POWER9 servers share the load of receiving and moving data between the attached hosts and the storage arrays. However, they are also redundant, so that if either server fails, the system operations fail over to the remaining server and continue to run without any host interruption.

The DS8910F configuration uses two POWER9 servers (9009-22A servers, each with two 4 core Single Chip Modules (3.4 - 3.9 GHz) and 96 GB or 256 GB processor memory.
The DS8910F processor node is a 2U high enclosure, and features the following configuration:

- DDR4 Registered DIMM (RDIMM) slots.
- One storage cage with two hard disk drives
- Two PCIe x16 Gen3 slots
- Four PCIe x8 Gen3 slots
- Two power supplies with integrated cooling

The two 2U processor nodes are positioned below the I/O enclosure, and the management enclosure. Figure 2-11 shows the front view of the DS8910F Processor node.

![Figure 2-11 DS8910F Processor node front view](image)

For more information about the server hardware that is used in the DS8910F models 993 and 994, see *IBM Power Systems S922, S914, and S924 Technical Overview and Introduction*, REDP-5497.

**Processor memory**

The DS8910F configuration offers up to 512 GB of total system memory. Each processor node contains half of the total system memory. All memory that is installed in each processor node is accessible to all processors in that node. The absolute addresses that are assigned to the memory are common across all processors in the node. The set of processors is referred to as a *symmetric multiprocessor* (SMP) system.

The POWER9 processor that is used in the DS8910F operates in simultaneous multithreading (SMT) mode, which runs multiple instruction streams in parallel. The number of simultaneous instruction streams varies according to processor and Licensed Internal Code (LIC) level. SMT mode enables the POWER9 processor to maximize the throughput of the processor cores by offering an increase in core efficiency.

DS8910F memory upgrades can be performed non disruptively from 96 GB to 256 GB per node.

Caching is a fundamental technique for reducing I/O latency. Like other modern caches, the DS8910F processor nodes contain volatile memory that is used as a read and write cache, and nonvolatile memory (NVDIMM) that is used to maintain and back up a second copy of the write cache. If power is lost, the NVDIMMs will be supplied “hold up” power from one Backup Power Modules (BPM). This allows all data in nonvolatile storage (NVS) be written to the processor nodes’ internal disks. The 2.5” Smart BPM is installed in the vacant drive location D7 (which is inside the CEC cage). Two cables will connect to the motherboard, adjacent to the NVDIMM slots (C22 and C36) as shown in Figure 2-12.
The NVS scales to the processor memory that is installed, which also helps to optimize performance. DS8910F NVS is 4GB for 96 GB processor nodes and 16 GB per node for 256 GB processor nodes. Figure 2-13 show the top view of a processor node with 256 GB memory.
Flexible service processor
Each POWER9 processor complex is managed by a service processor that is called a flexible service processor (FSP). The FSP is an embedded controller that is based on an IBM PowerPC® processor.

The FSP controls power and cooling for the processor nodes. The FSP performs predictive failure analysis for installed processor hardware, and performs recovery actions for processor or memory errors. The FSP monitors the operation of the firmware during the boot process, and can monitor the operating system for loss of control and take corrective actions.

Figure 2-14 shows the rear view of the DS8910F processor node and slot C1 is the FSP.

![Figure 2-14  DS8910F Server rear view](image)

The following adapters are installed in the processor nodes as shown in Figure 2-14:

1. Peripheral Component Interconnect® Express adapter
   Each DS8910F processor node contains 2 single port PCIe3 adapters. These adapters allow point-to-point connectivity between the processor nodes and the I/O enclosure and I/O adapters. Adapters are installed in slots C6 and C12.

2. Ethernet connections
   Each POWER9 processor complex has a single 4-port 1 Gb ethernet adapter installed in slot C11. Top two ports connect to the internal network switches described in “Ethernet switches” on page 22. The bottom two unused connections are available for Transparent Cloud Tiering (TCT). These are the bottom 2 ports of the LPAR ethernet adapter, and were the original low-speed TCT connections.

3. TCT connections
   An optional high-speed ethernet adapter feature can be ordered for Transparent Cloud Tiering (TCT), which provides two 10 Gbps LC connections and two RJ-45 1 Gbps connections. For DS8910 model 993, the 10 Gbps adapter (FC3602) is installed in slot C4 of each processor node.
   These ports are the 2 high-speed and 2 low-speed TCT connections, an optional chargeable hardware feature. In summary, there are 6 TCT connections available, 2 low-speed included, and optionally, 2 high-speed and 2 low-speed.
2.2.4 Management enclosure

The DS8910F management enclosure is a 2U chassis containing the following components:

- Two Hardware Management Consoles (HMCs)
- Two Ethernet switches
- Two power control cards (RPCs)
- Two power supply units (PSUs) to power the management enclosure components
- One Local/Remote switch assembly
- Internal cabling for communications and power for each of the components

The DS8910F management enclosure is unique and does not exist in other DS8900 models.

Because the DS8910F system modules can be mounted in any conforming rack, the management enclosure is designed to create a compact container for all essential system management components.

Figure 2-15 shows the layout of the components of the management enclosure.

![Figure 2-15 DS8910F management enclosure component layout](image)

The management enclosure provides internal communications to all of the modules of the DS8910F system. The management enclosure also provides external connectivity using two ethernet cables from each HMC for remote management, and provides keyboard/mouse and video connectivity from each HMC for local management. Cables are routed from the management consoles to the rear of the management enclosure through a cable management arm (CMA).
Figure 2-16 shows the front view of the 2U management enclosure.

![Figure 2-16  DS8910F management enclosure (front view)](image)

Figure 2-17 shows a rear view of the DS8910F management enclosure, the rear tailgate connectors, and the installed components.

![Figure 2-17  DS8910F management enclosure (rear view)](image)

**Hardware Management Consoles**

The management console is also referred to as the *Hardware Management Console* (or HMC). It supports the DS8910F hardware and firmware installation and maintenance activities.

The HMC connects to the customer network, and provides access to functions that can be used to manage the DS8910F. Management functions include logical configuration, problem notification, call home for service, remote service, and Copy Services management.

Management functions can be performed from the DS8000 Storage Management GUI, DS command-line interface (DS CLI), or other storage management software that supports the DS8910F.
Clients who use the DS8900 advanced functions, such as Metro Mirror or FlashCopy, for example, can communicate to the storage system with Copy Services Manager (CSM).

The Management Console provides connectivity between the DS8910F and Encryption Key Manager servers, if used.

The Management Console also provides the functions for remote call-home and remote support connectivity.

To provide continuous availability of access to the management console functions, the DS8910F order must include the second management console.

**Ethernet switches**

The DS8910F management enclosure has two 8-port Ethernet switches. The two switches provide two redundant *private* management networks. Each processor node includes connections to each switch to allow each server to access both private networks. These networks cannot be accessed externally, and no external connections are allowed. External client network connection to the DS8910F system is through dedicated connections to each of the management consoles.

Figure 2-18 shows the connections at the rear of the DS8910F management enclosure.

![Figure 2-18 Management enclosure connections](image)

2.2.5 **Power subsystem**

Intelligent rack Power Distribution Units (iPDUs) supply power to the storage system, and backup power modules (BPMs) provide power to the non-volatile dual in-line memory module (NVDIMM) when electrical power is removed. The rack mounted model 993 standard 19-inch wide rack installation (feature code 0939) supports an optional pair of iPDUs as shown in
Figure 2-19. E23 (Green) must connect all the green enclosure line cords, and connect to the gray private network. E24 (Yellow) must connect all the yellow enclosure line cords, and connect to the black private network. Each enclosure connects to the specified output port on the iPDUs.

**Note:** only DS8910F model 993 enclosures are allowed to be connected to the optional iPDU pair.

Rack power control is through ethernet managed iPDUs and HMC manages system power state and monitoring,

![Figure 2-19 DS8910F model 993 customer rack integration](image)

iPDUs provide following benefits:

- IBM Active Energy Manager (AEM) support
- IBM Power Line Disturbance (PLD) compliance up to 20 milliseconds
- Individual outlet monitoring and control
- Firmware updates
- Circuit breaker protection

NVDIMM Backup Power Module (BPM) is a Nickel based hybrid energy storage system with High power discharge and Fast charge time as shown in Figure 2-20. BPMs retain NVDIMM data when electrical power is removed, either from an unexpected power loss, or from a normal system shutdown. This improves data security, reliability, and recovery time.
Power input and distribution
The DS8910F model 993 supports single-phase and three-phase power. For ZR1/LR1 integration DS8910F model 993 shares iPDUs and monitor with IBM Z System.

The standard 19-inch wide rack installation (feature code 0939) requires the following power connections:
- 15U config requires 7x IEC C13 power on two different PDU’s (total 14). Optional monitor adds an additional C13 on either PDU.
- 19U config requires 9x IEC C13 power on two different PDU’s (total 18) and monitor adds on additional C13 on either PDU.

For more information about power input requirements, see “Planning for power requirements” on page 30.

2.2.6 DS8882F to DS8910F Rack Mounted comparison

The DS8882F is the rack mounted model 983 introduced with DS8880 family. The new rack mounted member of DS8900 family, DS8910F model 993 is completely redesigned with new POWER9 processor nodes, power, capacity, I/O enclosure, host adapter, and zHyperLink adapter. Table 2-5 compares the DS8882F with DS8910F.

<table>
<thead>
<tr>
<th>Features</th>
<th>DS8882F</th>
<th>DS8910F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rack Size</td>
<td>no rack</td>
<td>no rack</td>
</tr>
<tr>
<td>Min Size</td>
<td>17(^1)</td>
<td>16 including the optional display</td>
</tr>
<tr>
<td>Max Size</td>
<td>17(^1)</td>
<td>20 including the optional display</td>
</tr>
<tr>
<td>Processor Complex (CEC)</td>
<td>2 POWER8®</td>
<td>2 POWER9</td>
</tr>
<tr>
<td>IO Bay Pairs</td>
<td>1 2U</td>
<td>1 5U</td>
</tr>
<tr>
<td>Max HA Ports</td>
<td>16 ports</td>
<td>32 ports</td>
</tr>
<tr>
<td></td>
<td>16 GFC 4-port HA</td>
<td>16GFC 4-port HA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32GFC 4-port EDiF HA</td>
</tr>
<tr>
<td>Max zHyperLink Ports</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>
Figure 2-21 shows a comparison of the two rack mounted models, DS8882F and DS8910F with maximum supported configuration.

<table>
<thead>
<tr>
<th>Features</th>
<th>DS8882F</th>
<th>DS8910F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max Flash Drives</td>
<td>48</td>
<td>96</td>
</tr>
<tr>
<td>Max HPFE Gen 2 pair</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4 U UPS single phase per rack</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Display and Keyboard Optional</td>
<td>1- 19-inch wide rack mounted</td>
<td>1- 19-inch wide rack mounted</td>
</tr>
<tr>
<td>HMC in Management Enclosure (ME)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ethernet Switch in ME</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

1. DS8882F when integrated into ZR1/LR1, consumes 16U contiguous space and shares the Keyboard display unit provided by Z.
Chapter 3. DS8910F installation and integration

The DS8910F Rack Mounted storage system can be integrated into 16U contiguous space of an existing IBM z14 Model ZR1 (z14 Model ZR1), IBM LinuxONE Rockhopper II (z14 Model LR1), or other standard 19-inch wide rack that conforms to EIA 310D specifications.

This chapter provides information about installation and integration.
3.1 DS8910F integration

The DS8910F model 993 is a rack mountable system consisting of six or eight modules.

There are three different rack integration scenarios:

- An existing IBM z14 Model ZR1 (z14 Model ZR1) - Feature Code 0937
- An existing IBM LinuxONE Rockhopper II (z14 Model LR1) - Feature Code 0938
- Other standard 19-inch wide rack that conforms to EIA 310D specifications - Feature Code 0939. The rack must have:
  - 19-inch EIA rails
  - Minimum rail depth of 720 mm
  - Maximum rail depth of 780 mm

The first 2 scenarios are identical from a DS8910F perspective, can be considered the same process, and are described in 3.2, “Integrating the DS8910F into z14 Model ZR1 or LR1 Rack" on page 34.

The third scenario is described in 3.3, “Integrating the DS8910F into a standard 19-inch rack” on page 40.

This section details common items to be understood for both scenarios.

3.1.1 Planning the DS8910F installation and integration

The DS8910F arrives in boxes on a pallet. The boxes contain all eight modules, which constitute the complete system, as well as all required cabling and any additional features that might have been ordered.

The system needs to be assembled into the rack that has been designated for the DS8910F. The system must be installed by IBM Service Representatives. The designated rack must at minimum have 15U of contiguous dedicated space. The maximum configuration into a standard 19-inch rack requires 19U of contiguous dedicated space. An optional display feature code 1765 will add 1U to the configuration.

When ordering the DS8910F, a field merge feature code is required to indicate what rack scenario to use for installing the DS8910F. A Feature Code (FC) 0937 or FC 0938 indicates that the intended installation is for an IBM z14 Model ZR1 (z14 Model ZR1) or IBM LinuxONE Rockhopper II (z14 Model LR1), respectively. This choice drives a few unique features for this scenario and excludes others. See 3.2, “Integrating the DS8910F into z14 Model ZR1 or LR1 Rack” on page 34.

Conversely, if FC 0939 is selected, other optional features are available for selection as well. See 3.3, “Integrating the DS8910F into a standard 19-inch rack” on page 40. Regardless of which rack scenario is selected for the DS8910F, there are some common physical planning requirements to be considered.

Planning for floor loading and rack space

When planning the location of the DS8910F system, consider the following requirements that relate to floor types, floor loads, and space.

The six modules each have a specified position within the 15U. No spaces or any other components can be inserted into the 15U of contiguous space.
Figure 3-1 shows the six modules that make up the DS8910F and the order that they must be installed.

The intended installation site must accommodate the following criteria:

- Weight distribution area that is needed to meet floor load requirements
  
  The floor of the installation site must meet the floor-load requirements for the existing z14 Model ZR1 or z14 Model LR1 or other standard 19-inch wide frame, plus the additional weight of the DS8910F.

- Service clearance requirements

The DS8910F dimensions and weight are listed in Table 3-1 on page 30.
3.1.2 Planning for power requirements

The DS8910F requires two independent power outlets for the two power cords connecting to iPDUs.

**Important:** To eliminate a single point of failure, independent power feeds to each DS8910F iPDUs are required. At least one of the feeds must have power conditioning to ensure an acceptable level of power quality, such as specified in standards ANSI C84.1 and EN 50160.

Further, each power source must have its own circuit breaker.

### Power connector requirements

The rack mounted model 993 standard 19-inch wide rack installation (feature code 0939) supports an optional pair of iPDUs. A pair of power cables are required for the two iPDUs when it is integrated into 19-inch wide standard rack. DS8910F supports single or three phase power. Ensure that you order the appropriate power cords for your outlets, based on the country or region requirements.

If client PDUs are used, they will not have integrated control or monitoring. DS8910F model 993 when integrated into a ZR1 or LR1, uses the top two iPDUs in the z frame.

For power cord feature codes, connector diagrams, and countries and regions in which each connector type is commonly used, see *DS8910F Introduction and Planning Guide*, SC27-9560.

---

**Table 3-1  DS8910F Dimensions and weight**

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Maximum Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>15U contiguous vertical rack space without optional keyboard and display</td>
<td>66.7 cm (26.25 in.)</td>
</tr>
<tr>
<td>16U contiguous vertical rack space with optional keyboard and display</td>
<td>71.1 cm (28 in.)</td>
</tr>
<tr>
<td>20U contiguous vertical rack space with optional keyboard, display, and 2 HPFE Gen2</td>
<td>88.9 cm (35 in.)</td>
</tr>
<tr>
<td>Distance between rack front and rear EIA rails (Depth)</td>
<td>70 cm - 78 cm (27.6 in. - 30.7 in.)</td>
</tr>
<tr>
<td>Width</td>
<td>46.5 cm (18.3 in.)</td>
</tr>
<tr>
<td>Minimum distance from cabinet rear rail to rear door</td>
<td>70 - 78 cm (27.6 in. - 30.7 in.)</td>
</tr>
<tr>
<td>Minimum distance from cabinet front rail to front door</td>
<td>5 cm (2 in.)</td>
</tr>
</tbody>
</table>

---
Input power requirements

The DS8910F supports single or three phase power. Table 3-2 lists the supported input voltages and frequencies.

Table 3-2  DS8910F Single-phase input voltages and frequencies

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Voltage (single phase)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal input voltages</td>
<td>200-240 RMS V AC</td>
</tr>
<tr>
<td>Minimum tolerated input voltage</td>
<td>180 RMS V AC</td>
</tr>
<tr>
<td>Maximum tolerated input voltage</td>
<td>256 RMS V AC</td>
</tr>
<tr>
<td>System maximum current rating</td>
<td>14.4 Amps</td>
</tr>
<tr>
<td>Recommended wall breaker rating (1 ph)</td>
<td>15 - 20 Amps</td>
</tr>
<tr>
<td>Steady-state input frequencies</td>
<td>50 ± 3 or 60 ± 3.0 Hz</td>
</tr>
<tr>
<td>PLD input frequencies</td>
<td>&lt; 20 milliseconds</td>
</tr>
</tbody>
</table>

And table Table 3-3 lists the supported three phase input voltages and frequencies.

Table 3-3  DS8910F three-phase input voltages and frequencies

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Three-phase delta (3ØΔ)</th>
<th>Three-phase wye (3ØY: LL[Line-to-Line])</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal input voltages</td>
<td>Nominal input voltages</td>
<td>380, 400, or 415 RMS V AC</td>
</tr>
<tr>
<td>Minimum tolerated input voltage</td>
<td>180 RMS V AC</td>
<td>315 RMS V AC</td>
</tr>
<tr>
<td>Maximum tolerated input voltage</td>
<td>256 RMS V AC</td>
<td>456 RMS V AC</td>
</tr>
<tr>
<td>System maximum current rating</td>
<td>48 Amps (per PDU cord)</td>
<td>32 Amps (per PDU cord)</td>
</tr>
<tr>
<td>Wall breaker rating (3 ph)1</td>
<td>60 - 63 Amps</td>
<td>30 - 32 Amps</td>
</tr>
<tr>
<td>Steady-state input frequencies</td>
<td>50 ± 3 or 60 ± 3.0 Hz</td>
<td>50 ± 3 or 60 ± 3.0 Hz</td>
</tr>
<tr>
<td>PLD input frequencies (&lt;10 seconds)</td>
<td>50 ± 3 or 60 ± 3.0 Hz</td>
<td>50 ± 3 or 60 ± 3.0 Hz</td>
</tr>
</tbody>
</table>

Power consumption and environmental information

When planning the power requirements, consider the power consumption and other environmental points of the DS8910F.
Table 3-4 provides the DS8910F power consumption and environmental information.

Table 3-4  DS8910F Power Consumption and environmental information

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Unit of measure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak electric power</td>
<td>kilowatt (kW)</td>
<td>2.2 kW</td>
</tr>
<tr>
<td>Thermal load</td>
<td>British thermal units (BTU) per hour</td>
<td>7464</td>
</tr>
<tr>
<td>Capacity of exhaust</td>
<td>Cubic meters per minute (cubic feet per minute or CFM)</td>
<td>44.2 (1500)</td>
</tr>
<tr>
<td>Ground leakage current</td>
<td>Milliamperes (mA)</td>
<td>&lt; 21</td>
</tr>
<tr>
<td>Temperature</td>
<td>celsius (fahrenheit)</td>
<td>16°C to 32°C (60°F to 90°F)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>percent</td>
<td>20% - 80%</td>
</tr>
<tr>
<td>Declared operating A-weighted sound power level</td>
<td>bels</td>
<td>7.9</td>
</tr>
</tbody>
</table>

3.1.3 Planning for host connectivity

The DS8910F host connectivity is provided by up to four pairs of 16 Gbps or 32 Gbps (GFC) EDiF Fibre Channel host adapters (HAs). The new 32 GFC adapter features hardware (ASIC) Encryption of Data In Flight (EDiF) to enable IBM FC Endpoint Security. Table 3-5 shows the available feature codes for the DS8910F HAs.

Table 3-5  Feature codes for D8910F fibre channel host adapters

<table>
<thead>
<tr>
<th>Feature Code</th>
<th>Description</th>
<th>Receptacle type</th>
</tr>
</thead>
<tbody>
<tr>
<td>3354</td>
<td>4-port, 16 Gbps shortwave FCP and FICON host adapter Minimum quantity is 2</td>
<td>LC</td>
</tr>
<tr>
<td>3454</td>
<td>4-port, 16 Gbps longwave FCP and FICON host adapter Minimum quantity is 2</td>
<td>LC</td>
</tr>
<tr>
<td>3355</td>
<td>4-port, 32 Gbps longwave FCP and FICON host adapter, PCIe</td>
<td>LC</td>
</tr>
<tr>
<td>3455</td>
<td>4-port, 32 Gbps shortwave FCP and FICON host adapter, PCIe</td>
<td>LC</td>
</tr>
</tbody>
</table>

Note:
1. Longwave and shortwave host adapter intermix is only supported if a pair of each is ordered.
2. The 16 Gbps or 32 Gbps adapter does not support arbitrated loop topology at any speed.

For more detailed information about DS8910F host adapters refer to Chapter 2, “DS8910F hardware configuration” on page 5.

To connect the hosts to the DS8910F, fibre channel (SCSI-FCP or FICON) cables must be provided. To connect fibre channel host adapters to a server or fabric port, provide the following cables:
For shortwave Fibre Channel host adapters, provide a 50-μm, multimode OM3 or higher fiber-optic cable that ends in an LC connector.

For longwave Fibre Channel host adapters, provide a 9-μm, single-mode OS1 or higher fiber-optic cable that ends in an LC connector.

Table 3-6 lists the fiber-optic cables that are available for order from IBM for the DS8910F.

<table>
<thead>
<tr>
<th>Feature code</th>
<th>Cable type</th>
<th>Cable length</th>
<th>Compatible Fibre Channel host adapter features</th>
</tr>
</thead>
<tbody>
<tr>
<td>1410</td>
<td>50 μm OM3 or higher Fibre Channel cable, multimode</td>
<td>40 m (131 ft) LC</td>
<td>Shortwave Fibre Channel or FICON host adapter (feature code 3353, 3455)</td>
</tr>
<tr>
<td>1411</td>
<td>31 m (102 ft) LC/SC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1412</td>
<td>2 m (6.5 ft) LC/SC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1413</td>
<td>3 m (10 ft) LC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1420, 1421, 1422, 1423</td>
<td>9 μm OS1 or higher Fibre Channel cable, single mode</td>
<td>31 m (102 ft) LC</td>
<td>Longwave Fibre Channel or FICON adapter (feature code 3453, 3455)</td>
</tr>
<tr>
<td></td>
<td>31 m (102 ft) LC/SC</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2 m (6.5 ft) LC/SC</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 m (10 ft) LC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Feature code 1413, and 1423 fibre channel cables
These cables are short and available for all DS8900 models. The four short cable features are particularly relevant to the DS8910F when integrated into the same rack as the host, such as in the case of the integration into the IBM z14 Model ZR1 (z14 Model ZR1) or the IBM LinuxONE Rockhopper II (z14 Model LR1).

For more information about host adapter and fiber channel cable features, see the DS8910F Introduction and Planning Guide, SC27-9560.

Note: When integrated in the z14 model ZR1 or LR1 rack, it is expected that this will be the host system that connects to the DS8910F.

However, that does not exclude the connectivity to other System Z or distributed systems outside the z14 rack.

Additionally, the DS8910F supports connectivity to other DS8000 systems with Copy Services.

3.1.4 Planning external connectivity

The DS8910F provides external connectivity for:

- Keyboard and monitor to each HMC
  - ~900 mm (3 feet) of video cable to each HMC is available for a monitor.
  - ~900 mm (3 feet) of USB cable to each HMC is available for a keyboard/mouse function.
Ethernet connectivity
- ~900 mm (3 feet) of ethernet cables are provided for remote connectivity to the customer networks.
- There is 2 ethernet cables available to each HMC.

For information about keyboard and monitor options for connection to z14 Model ZR1 or z14 Model LR1, see 3.2, “Integrating the DS8910F into z14 Model ZR1 or LR1 Rack” on page 34.

For information about keyboard and monitor options for connection to other standard 19-inch wide rack, see 3.3, “Integrating the DS8910F into a standard 19-inch rack” on page 40.

3.1.5 Planning for safety and service

The DS8910F requires two service representatives to install the modules into the designated rack. The DS8910F can be installed in 15U of contiguous space at any height in the rack. However, because of the weight of the components and accessibility requirements for service, consider the position where the DS8910F is installed in the rack.

Ensure an approved safety appliance is available for installation and service. Table 3-7 provides a list of safety equipment that can be ordered with the DS8910F.

<table>
<thead>
<tr>
<th>Feature code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1101</td>
<td>5 ft. ladder for servicing components at a height of 35U or more</td>
</tr>
<tr>
<td>1102</td>
<td>3 ft. platform ladder for servicing components at a height of 20U or more</td>
</tr>
<tr>
<td>1103</td>
<td>Rolling step stool</td>
</tr>
</tbody>
</table>

3.2 Integrating the DS8910F into z14 Model ZR1 or LR1 Rack

Both options are described in the following section.

3.2.1 IBM z14 Model ZR1 and LinuxONE Rockhopper II

In April 2018, IBM announced a new model for the z14 family with a lower cost and point of entry to extend the IBM Z to clients of all sizes.

The IBM z14 Model ZR1 (z14 Model ZR1) and IBM LinuxONE Rockhopper II (z14 Model LR1), deliver secure capabilities in a smaller, industry-standard, 19-inch frame, which can
easily co-exist with other platforms in a cloud data center. It can be the base for an integrated hybrid cloud for mission-critical core business workloads that demand maximum security. The introduction of the z14 ZR1 also demonstrates that IBM no longer distinguishes between “midrange” and “high end” systems.

The z14 Model ZR1 is housed in an industry-standard, 19-inch rack form factor. The design has power distribution unit (PDU)-based power, with redundant power, cooling, and line cords. These factors result in lower power costs, reduce footprint cost, and install in virtually any existing data center.

The new 19-inch rack design opens a new opportunity for IBM Z, by allowing the ability to integrate the DS8910F enterprise storage system into the IBM z14 models ZR1/LR1 16U of reserved space.

To enable the DS8910F to be installed into the IBM z14 Model ZR1 (z14 Model ZR1), IBM LinuxONE Rockhopper II (z14 Model LR1), the z14 system must have Feature Code 0617 (FC 0617) for 16U reserved space.

The FC 0617 provides several hardware pre-requisites from the z14 perspective:

- Limits the hardware in the z14 to:
  - The CEC cage
  - No more than two I/O cages
- Provides the second PDU pair:
  - The second PDU is installed as part of FC 0617
  - The second PDU pair is required for DS8910F and the second I/O cage.
- Provides the rack enclosure fibre channel cable management system

Figure 3-2 shows a block diagram and a front view image of a z14 model ZR1 with FC 0617.

Figure 3-3 on page 36 shows the z14 rack enclosure fibre channel cable management system. This is intended to dress and route host fibre channel cables from the z14 Model ZR1 or the z14 Model LR1 to the DS8910F.
Figure 3-2  z14 model ZR1 feature code 0617 16U reserved space

Figure 3-3  FC 0617 provides the z14 fiber channel cable management system
3.2.2 Integrating the DS8910F into the z14 model ZR1 or LR1

The DS8910F modular system can be integrated into 16U contiguous space of an existing IBM z14 Model ZR1 (z14 Model ZR1) or IBM LinuxONE Rockhopper II (z14 Model LR1), with Feature Code 0617, 16U reserved space feature.

When ordering the DS8910F to be integrated into an existing z14 Model ZR1 or z14 Model LR1, the appropriate DS8910F field merge feature must be ordered:

- An existing IBM z14 Model ZR1 (z14 Model ZR1) - Feature Code 0937
- An existing IBM LinuxONE Rockhopper II (z14 Model LR1) - Feature Code 0938

**Note:** Both of these feature codes are associated with physically identical systems from a DS8910F hardware perspective, except to identify the intended host system. This section will treat both feature codes as one.

Feature code 0937 or 0938 adds 2 KVM converter cables to the system components. These cables provide connectivity from each of the DS8910F HMCs video and USB cables to the z14 system KVM switch. These connections allow the DS8910F to share the z14 system keyboard and monitor.

Feature code 0937 or 0938 also prevents ordering of feature code 1765 optional 1U keyboard and display. The z14 already provides a keyboard and monitor, there is no room to install feature code 1765.

All internal and inter-module cables required for the DS8910F are shipped with the DS8910F. When installed in the z14, the cables are dressed and routed within the defined 16U of reserved space.

Two service representatives are required to install the DS8910F into the z14 system. The optional safety equipment described in 3.1.5, “Planning for safety and service” on page 34, should not be required. The first z14 model ZR1 and LR1 installed at a your site should be provided with the z14 model 3907 lift tool shown in Figure 3-4.

![Figure 3-4  z14 service lift tool](image)
The z14 models ZR1 and LR1 systems have their power provided by two pairs of power distribution units (PDUs). These will be independently powered from your facility power.

DS8910F is powered via the second set of Z iPDUs (3 and 4) as shown in Figure 3-5 on page 38.

Figure 3-5  DS8910F power connections to Z iPDUs

Figure 3-6 on page 39 shows a block diagram of the z14 ZR1/LR1 16U reserved space, feature code 0617. The DS8910F modules will fit into this space and the six modules must be installed in the order shown.
Chapter 3. DS8910F installation and integration

Figure 3-6  Block diagram of z14 ZR1 or LR1 16U reserved space and DS8910F modules

Figure 3-7 on page 39 shows the DS8910F integrated into a Z14 model LR1 16U reserved space.

Figure 3-7  DS8910F integrated into a z14 ZR1/LR1

1U KMM location
3.3 Integrating the DS8910F into a standard 19-inch rack

The DS8910F can be integrated into 15U contiguous space of an existing, customer-supplied, standard 19-inch wide rack that conforms to EIA 310D specification.

When ordering the DS8910F to be integrated into a conforming standard 19-inch wide rack, the DS8910F field merge feature code 0939 must be ordered.

The standard 19-inch wide rack must conform to EIA 310D specifications:

- 19-inch EIA rails
- Minimum rail depth of 720 mm
- Maximum rail depth of 780 mm

There are two possible configurations when integrating into the standard 19-inch wide rack:

1. All six DS8910F modules are integrated into 15U contiguous space of the intended rack in the specified order. Example 3-8 shows a block diagram presenting the DS8910F in a standard 19-inch rack. This is the minimum configuration with one pair of HPFE. An optional 1U Display can be installed at 16U.

2. All eight DS8910F modules are integrated into 19U contiguous space of the intended rack in the specified order. This is the maximum supported configuration with two pairs of HPFEs. The optional display FC 1765 will add 1U to contiguous space. Figure 3-9 on page 41 shows the maximum possible configuration when integrating DS8910F into the 19-inch wide standard rack.
### 3.3.1 Planning the installation into a conforming standard 19-inch rack

A keyboard/mouse and monitor *must* be available to install and service the DS8910F.

The standard 19-inch wide rack installation (feature code 0939) supports an optional 1U keyboard and display (feature code 1765). The 15U contiguous space requirement does not include space for the optional keyboard and display, but they are not required to reside contiguously with the DS8910F.

For accessibility, the keyboard and display must be mounted at a height of 38 - 117 cm. (15 - 46 inches). If a keyboard and display is added, ensure that adequate space is provided to accommodate them. Feature code 1765 requires one IEC C13 power connection. The model 993 power supplies have no available power output connectors. You must make one available on the C13 power connection in the rack.

**Note:** Optional feature code 1765 (1U keyboard and display) cannot be added between modules of the DS8910F in the 15U of contiguous space.

Alternatively, the customer can provide their own keyboard and display solution. The video connection should be a SVGA connector. The USB connection should support keyboard and mouse functionality. See “Planning external connectivity” on page 33.

When the DS8910F is integrated into a conforming standard 19-inch wide rack, host connectivity can be to:

- Any supported distributed systems, residing inside or outside the same rack
- IBM Z hosts
Other DS8000 systems through Copy Services.

For more information about supported host connectivity, see the *DS8910F Introduction and Planning Guide*, SC27-9560.

The DS8910F requires two service representatives to install into the designated rack. Although the DS8910F can be installed in 15U or 19U of contiguous space at any height in the rack, due to the weight of the components and accessibility for service, consider the position in the rack where it is installed.

Ensure an approved safety appliance is available for installation and service. Table 3-7 on page 34 provides a list of safety equipment that may be ordered with the DS8910F.
Appendix A. Remote Code Load

Remote Code Load

For the DS8910F and other DS8900 models, IBM is adopting Remote Code Load (RCL) as the default delivery and installation of microcode upgrades.

This appendix describes the process.
Remote Code Load

With Remote Code Load (RCL), IBM provides an efficient and secure method to update the DS8000 systems microcode in a concurrent way without interrupting business operations.

**Important:** IBM is adopting RCL as the default delivery for DS8000 code upgrades.

Remote Code Load (RCL) is the trusted process of having IBM support personnel securely connect to a DS8000 system, enable the remote acquisition, perform the distribution and activation of License Internal Code (LIC) bundles, and Install Corrective Service (ICS) images.

The Remote Code Load process is concurrent; it can be run without interruptions in the business operations. This process consists of the following steps, also illustrated in Figure A-1:

1. IBM Remote Support work with IBM Technical Advisors for the planning of the microcode update. This ensure that the client's environment is considered in the planning phase.
2. When a remote code load is agreed upon and scheduled, an IBM trained resource in the support center initiates a session with the target HMC.
3. During the agreed upon window, IBM directs the HMC to acquire the code images from the FixCentral repository and prepare for code activation.
4. During the customer maintenance window, IBM initiates the activation request, moving the HMC(s) and DS8000 to the new target microcode level.

![Figure A-1  Remote Code Load process](image-url)

- The RCL process can be executed without interruptions in the business operations.
- RCL is completely executed by IBM Remote Support, SSR support is only required if a hardware failure occurs.
- Existing warranty and maintenance agreements support RCL.
Related publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this paper.

IBM Redbooks

The following IBM Redbooks publications provide additional information about the topic in this document. Note that some publications referenced in this list might be available in softcopy only.

- *IBM DS8900F Architecture and Implementation (Release 9.0)*, SG24-8456
- *DS8000 High-Performance Flash Enclosure Gen2*, REDP-5422
- *IBM DS8900F Product Guide (Release 9.0)*, REDP-5554
- *IBM Power Systems S922, S914, and S924 Technical Overview and Introduction*, REDP-5497

You can search for, view, download or order these documents and other Redbooks, Redpapers, Web Docs, drafts, and additional materials, at the following website:

ibm.com/redbooks

Other publications

These publications are also relevant as further information sources:

- *IBM DS8000 High-Performance Flash Enclosure Gen2 (DS8000 R9.0)*, REDP-5422
- *IBM DS8000 Host Systems Attachment Guide*, SC27-9563

Online resources

These websites are also relevant as further information sources:

- DS8900F IBM Knowledge Center:
  
  https://www.ibm.com/support/knowledgecenter/SSHGBU_9.0.0/

Help from IBM

IBM Support and downloads

ibm.com/support

IBM Global Services

ibm.com/services