IBM TotalStorage DS8000

Introduction and Planning Guide

IBM TotalStorage DS8000

Introduction and Planning Guide

IBM

> **Note:**
> Before using this information and the product it supports, read the information in the **Safety and environmental notices** and **Notices** sections.

Contents

Figures

Tables

About this guide

This publication introduces the IBM® TotalStorage® DS8000 series.

This guide discusses:
* What you need to consider when planning for the DS8000 storage unit.
* How you can customize your DS8000 storage unit.

Who should use this guide

This publication is for storage administrators, system programmers, and performance and capacity analysts.

Safety and environmental notices

This section contains information about safety notices that are used in this guide and environmental notices for this product.

Safety notices

Use this process to find information about safety notices.

To find the translated text for a danger or caution notice:

1. Look for the identification number at the end of each danger notice or each caution notice. In the following examples, the numbers **1000** and **1001** are the identification numbers.

   DANGER

   > **A danger notice indicates the presence of a hazard that has the potential of causing death or serious personal injury.**
   >
   > **1000**

   CAUTION:
   A caution notice indicates the presence of a hazard that has the potential of causing moderate or minor personal injury.

   1001

2. Find the number that matches in the *IBM TotalStorage Solutions Safety Notices for IBM Versatile Storage Server and IBM TotalStorage Enterprise Storage Server*, GC26-7229.

Environmental notices

This section identifies the environmental guidelines that pertain to this product.

Product recycling

This unit contains recyclable materials.

Recycle these materials at your local recycling sites. Recycle the materials according to local regulations. In some areas, IBM provides a product take-back program that ensures proper handling of the product. Contact your IBM representative for more information.

Disposing of products

This topic contains information about how to dispose of products.

This unit might contain batteries. Remove and discard these batteries, or recycle them, according to local regulations.

Conventions used in this guide

The following typefaces are used to show emphasis:

boldface
> Text in **boldface** represents menu items and lowercase or mixed-case command names.

italics Text in *italics* is used to emphasize a word. In command syntax, it is used for variables for which you supply actual values.

monospace
> Text in `monospace` identifies the data or commands that you type, samples of command output, or examples of program code or messages from the system.

Related information

The tables in this section list and describe the following publications:

- The publications that make up the IBM® TotalStorage™ DS8000 series library
- Other IBM publications that relate to the DS8000 series
- Non-IBM publications that relate to the DS8000 series

See "Ordering IBM publications" on page xx for information about how to order publications in the IBM TotalStorage DS8000 series publication library. See "How to send your comments" on page xxi for information about how to send comments about the publications.

DS8000 series library

These customer publications make up the DS8000 series library.

Unless otherwise noted, these publications are available in Adobe portable document format (PDF) on a compact disc (CD) that comes with the storage unit. If you need additional copies of this CD, the order number is SK2T-8803. These publications are also available as PDF files by clicking on the **Documentation link** on the following Web site:

http://www-1.ibm.com/servers/storage/support/disk/ds8100/index.html

See "Ordering IBM publications" on page xx for information about ordering these and other IBM publications.

Title	Description	Order Number
IBM TotalStorage DS: Command-Line Interface User's Guide	This guide describes the commands that you can use from the command-line interface (CLI) for managing your DS8000 configuration and Copy Services relationships. The CLI application provides a set of commands that you can use to write customized scripts for a host system. The scripts initiate predefined tasks in a Copy Services server application. You can use the CLI commands to indirectly control Remote Mirror and Copy and FlashCopy® configuration tasks within a Copy Services server group.	SC26-7625 (See Note.)
IBM TotalStorage DS8000: Host Systems Attachment Guide	This guide provides guidelines for attaching the DS8000 to your host system and for migrating to fibre-channel attachment from a small computer system interface.	SC26-7628 (See Note.)
IBM TotalStorage DS8000: Introduction and Planning Guide	This guide introduces the DS8000 product and lists the features you can order. It also provides guidelines for planning the installation and configuration of the storage unit.	GC35-0495

Title	Description	Order Number
IBM TotalStorage Multipath Subsystem Device Driver User's Guide	This publication describes how to use the IBM Subsystem Device Driver (SDD) on open-systems hosts to enhance performance and availability on the DS8000. SDD creates redundant paths for shared logical unit numbers. SDD permits applications to run without interruption when path errors occur. It balances the workload across paths, and it transparently integrates with applications.	SC30-4096
IBM TotalStorage DS8000: User's Guide	This guide provides instructions for setting up and operating the DS8000 and for analyzing problems.	SC26-7623 (See Note.)
IBM TotalStorage DS Application Programming Interface Reference	This publication provides reference information for the IBM TotalStorage DS application programming interface (API) and provides instructions for installing the Common Information Model Agent, which implements the API.	GC35-0493
IBM TotalStorage DS8000 Messages Reference	This publication provides explanations of error, information, and warning messages that are issued from the DS8000 user interfaces.	GC26-7659
Note: No hardcopy book is produced for this publication. However, a PDF file is available from the following Web site: http://www-1.ibm.com/servers/storage/support/disk/ds8100/index.html		

Other IBM publications

Other IBM publications contain additional information that is related to the DS product library.

The following list is divided into categories to help you find publications that are related to specific topics. Some of the publications are listed under more than one category. See "Ordering IBM publications" on page xx for information about ordering these and other IBM publications.

Title	Description	Order Number
Data-copy services		
z/OS DFSMS Advanced Copy Services	This publication helps you understand and use IBM Advanced Copy Services functions. It describes three dynamic copy functions and several point-in-time copy functions. These functions provide backup and recovery of data if a disaster occurs to your data center. The dynamic copy functions are peer-to-peer remote copy, extended remote copy, and coupled extended remote copy. Collectively, these functions are known as remote copy. FlashCopy, SnapShot, and concurrent copy are the point-in-time copy functions.	SC35-0428
IBM Enterprise Storage Server	This publication, from the IBM International Technical Support Organization, introduces the Enterprise Storage Server and provides an understanding of its benefits. It also describes in detail the architecture, hardware, and functions, including the advanced copy functions, of the Enterprise Storage Server.	SG24-5465
Implementing Copy Services 0n S/390	This publication, from the IBM International Technical Support Organization, tells you how to install, customize, and configure Copy Services on an Enterprise Storage Server that is attached to an S/390 or zSeries host system. Copy Services functions include peer-to-peer remote copy, extended remote copy, FlashCopy®, and concurrent copy. This publication describes the functions, prerequisites, and corequisites and describes how to implement each function into your environment.	SG24-5680

Title	Description	Order Number
IBM TotalStorage ESS Implementing Copy Services in an Open Environment	This publication, from the IBM International Technical Support Organization, tells you how to install, customize, and configure Copy Services on UNIX, Windows NT®, Windows 2000, Sun Solaris, HP-UX, Tru64, OpenVMS, and iSeries host systems. The Copy Services functions that are described include peer-to-peer remote copy and FlashCopy. This publication describes the functions and shows you how to implement them into your environment. It also shows you how to implement these functions in a high-availability cluster multiprocessing environment.	SG24-5757
Fibre channel		
Fibre Channel Connection (FICON) I/O Interface: Physical Layer	This publication provides information about the fibre-channel I/O interface. This book is also available as a PDF file from the following Web site: http://www.ibm.com/servers/resourcelink/	SA24-7172
Fibre Transport Services (FTS): Physical and Configuration Planning Guide	This publication provides information about fibre-optic and ESCON-trunking systems.	GA22-7234
IBM SAN Fibre Channel Switch: 2109 Model S08 Installation and Service Guide	This guide describes how to install and maintain the IBM SAN Fibre Channel Switch 2109 Model S08.	SC26-7350
IBM SAN Fibre Channel Switch: 2109 Model S08 User's Guide	This guide describes the IBM SAN Fibre Channel Switch and the IBM TotalStorage ESS Specialist. It provides information about the commands and how to manage the switch with Telnet and the Simple Network Management Protocol.	SC26-7349
IBM SAN Fibre Channel Switch: 2109 Model S16 Installation and Service Guide	This publication describes how to install and maintain the IBM SAN Fibre Channel Switch 2109 Model S16. It is intended for trained service representatives and service providers.	SC26-7352
IBM SAN Fibre Channel Switch: 2109 Model S16 User's Guide	This guide introduces the IBM SAN Fibre Channel Switch 2109 Model S16 and tells you how to manage and monitor the switch using zoning and how to manage the switch remotely.	SC26-7351
Implementing Fibre Channel Attachment on the ESS	This publication, from the IBM International Technical Support Organization, helps you install, tailor, and configure fibre-channel attachment of open-systems hosts to the Enterprise Storage Server. It provides you with a broad understanding of the procedures that are involved and describes the prerequisites and requirements. It also shows you how to implement fibre-channel attachment.	SG24-6113
Open-systems hosts		
ESS Solutions for Open Systems Storage: Compaq AlphaServer, HP, and Sun	This publication, from the IBM International Technical Support Organization, helps you install, tailor, and configure the Enterprise Storage Server when you attach Compaq AlphaServer (running Tru64 UNIX), HP, and Sun hosts. This book does not cover Compaq AlphaServer that is running the OpenVMS operating system. This book also focuses on the settings that are required to give optimal performance and on the settings for device driver levels. This book is for the experienced UNIX professional who has a broad understanding of storage concepts.	SG24-6119

Title	Description	Order Number
IBM TotalStorage ESS Implementing Copy Services in an Open Environment	This publication, from the IBM International Technical Support Organization, tells you how to install, customize, and configure Copy Services on UNIX or Windows 2000 host systems. The Copy Services functions that are described include peer-to-peer remote copy and FlashCopy. This publication describes the functions and shows you how to implement them into your environment. It also shows you how to implement these functions in a high-availability cluster multiprocessing environment.	SG24-5757
Implementing Fibre Channel Attachment on the ESS	This publication, from the IBM International Technical Support Organization, helps you install, tailor, and configure fibre-channel attachment of open-systems hosts to the Enterprise Storage Server. It gives you a broad understanding of the procedures that are involved and describes the prerequisites and requirements. It also shows you how to implement fibre-channel attachment.	SG24-6113
S/390 and zSeries hosts		
Device Support Facilities: User's Guide and Reference	This publication describes the IBM Device Support Facilities (ICKDSF) product that are used with IBM direct access storage device (DASD) subsystems. ICKDSF is a program that you can use to perform functions that are needed for the installation, the use, and the maintenance of IBM DASD. You can also use it to perform service functions, error detection, and media maintenance.	GC35-0033
z/OS Advanced Copy Services	This publication helps you understand and use IBM Advanced Copy Services functions. It describes three dynamic copy functions and several point-in-time copy functions. These functions provide backup and recovery of data if a disaster occurs to your data center. The dynamic copy functions are peer-to-peer remote copy, extended remote copy, and coupled extended remote copy. Collectively, these functions are known as remote copy. FlashCopy, SnapShot, and concurrent copy are the point-in-time copy functions.	SC35-0428
DFSMS/MVS V1: Remote Copy Guide and Reference	This publication provides guidelines for using remote copy functions with S/390 and zSeries hosts.	SC35-0169
Fibre Transport Services (FTS): Physical and Configuration Planning Guide	This publication provides information about fibre-optic and ESCON-trunking systems.	GA22-7234
Implementing ESS Copy Services on S/390	This publication, from the IBM International Technical Support Organization, tells you how to install, customize, and configure Copy Services on an Enterprise Storage Server that is attached to an S/390 or zSeries host system. Copy Services functions include peer-to-peer remote copy, extended remote copy, FlashCopy, and concurrent copy. This publication describes the functions, prerequisites, and corequisites and describes how to implement each function into your environment.	SG24-5680
ES/9000, ES/3090: IOCP User Guide Volume A04	This publication describes the Input/Output Configuration Program that supports the Enterprise Systems Connection (ESCON) architecture. It describes how to define, install, and configure the channels or channel paths, control units, and I/O devices on the ES/9000 processors and the IBM ES/3090 Processor Complex.	GC38-0097
IOCP User's Guide, IBM e(logo)server zSeries 800 and 900	This publication describes the Input/Output Configuration Program that supports the zSeries 800 and 900 servers. This publication is available in PDF format by accessing ResourceLink at the following Web site: www.ibm.com/servers/resourcelink/	SB10-7029

Title	Description	Order Number
IOCP User's Guide, IBM e(logo)server zSeries	This publication describes the Input/Output Configuration Program that supports the zSeries server. This publication is available in PDF format by accessing ResourceLink at the following Web site: www.ibm.com/servers/resourcelink/	SB10-7037
S/390: Input/Output Configuration Program User's Guide and ESCON Channel-to-Channel Reference	This publication describes the Input/Output Configuration Program that supports ESCON architecture and the ESCON multiple image facility.	GC38-0401
IBM z/OS Hardware Configuration Definition User's Guide	This guide provides conceptual and procedural information to help you use the z/OS Hardware Configuration Definition (HCD) application. It also explains: • How to migrate existing IOCP/MVSCP definitions • How to use HCD to dynamically activate a new configuration • How to resolve problems in conjunction with MVS/ESA HCD	SC33-7988
OS/390: Hardware Configuration Definition User's Guide	This guide provides detailed information about the input/output definition file and about how to configure parallel access volumes. This guide discusses how to use Hardware Configuration Definition for both OS/390® and z/OS V1R1.	SC28-1848
OS/390 V2R10.0: MVS System Messages Volume 1 (ABA - ASA)	This publication lists OS/390 MVS™ system messages ABA to ASA.	GC28-1784
Using IBM 3390 Direct Access Storage in a VM Environment	This publication provides device-specific information for the various models of the 3390 and describes methods you can use to manage storage efficiently using the VM operating system. It provides guidance on managing system performance, availability, and space through effective use of the direct access storage subsystem.	GG26-4575
Using IBM 3390 Direct Access Storage in a VSE Environment	This publication helps you use the 3390 in a VSE environment. It includes planning information for adding new 3390 units and instructions for installing devices, migrating data, and performing ongoing storage management activities.	GC26-4576
Using IBM 3390 Direct Access Storage in an MVS Environment	This publication helps you use the 3390 in an MVS environment. It includes device-specific information for the various models of the 3390 and illustrates techniques for more efficient storage management. It also offers guidance on managing system performance, availability, and space utilization through effective use of the direct access storage subsystem.	GC26-4574
z/Architecture Principles of Operation	This publication provides a detailed definition of the z/Architecture™. It is written as a reference for use primarily by assembler language programmers and describes each function at the level of detail needed to prepare an assembler language program that relies on a particular function. However, anyone concerned with the functional details of z/Architecture will find this publication useful.	SA22-7832
SAN		

Title	Description	Order Number
IBM OS/390 Hardware Configuration Definition User's Guide	This guide explains how to use the Hardware Configuration Data application to perform the following tasks: • Define new hardware configurations • View and modify existing hardware configurations • Activate configurations • Query supported hardware • Maintain input/output definition files (IODFs) • Compare two IODFs or compare an IODF with an actual configuration • Print reports of configurations • Create graphical reports of a configuration • Migrate existing configuration data	SC28-1848
IBM SAN Fibre Channel Switch: 2109 Model S08 Installation and Service Guide	This guide describes how to install and maintain the IBM SAN Fibre Channel Switch 2109 Model S08.	SC26-7350
IBM SAN Fibre Channel Switch: 2109 Model S08 User's Guide	This guide describes the IBM SAN Fibre Channel Switch and the IBM TotalStorage ESS Specialist. It provides information about the commands and how to manage the switch with Telnet and the Simple Network Management Protocol (SNMP).	SC26-7349
IBM SAN Fibre Channel Switch: 2109 Model S16 Installation and Service Guide	This publication describes how to install and maintain the IBM SAN Fibre Channel Switch 2109 Model S16. It is intended for trained service representatives and service providers.	SC26-7352
IBM SAN Fibre Channel Switch: 2109 Model S16 User's Guide	This guide introduces the IBM SAN Fibre Channel Switch 2109 Model S16 and tells you how to manage and monitor the switch using zoning and how to manage the switch remotely.	SC26-7351
Implementing Fibre Channel Attachment on the ESS	This publication, from the IBM International Technical Support Organization, helps you install, tailor, and configure fibre-channel attachment of open-systems hosts to the Enterprise Storage Server. It provides you with a broad understanding of the procedures that are involved and describes the prerequisites and requirements. It also shows you how to implement fibre-channel attachment.	SG24-6113
Seascape family		
IBM Enterprise Storage Server	This publication, from the IBM International Technical Support Organization, introduces the Enterprise Storage Server and provides an understanding of its benefits. It also describes in detail the architecture, hardware, and functions, including the advanced copy functions, of the Enterprise Storage Server.	SG24-5465
IBM Enterprise Storage Server Performance Monitoring and Tuning Guide	This guide, from the IBM International Technical Support Organization, provides guidance on the best way to configure, monitor, and manage your Enterprise Storage Server to ensure optimum performance.	SG24-5656
IBM Versatile Storage Server: Introduction and Planning Guide	This publication introduces the IBM Versatile Storage Server™ and lists the features you can order. It also provides planning information for both 2105 Models B09 and 100.	GC26-7223
Implementing the IBM Enterprise Storage Server in Your Environment	This publication, from the IBM International Technical Support Organization, can help you install, tailor, and configure the Enterprise Storage Server in your environment.	SG24-5420
Storage management		

Title	Description	Order Number
Device Support Facilities: User's Guide and Reference	This publication describes the IBM Device Support Facilities (ICKDSF) product used with IBM direct access storage device (DASD) subsystems. ICKDSF is a program that you can use to perform functions that are needed for the installation, the use, and the maintenance of IBM DASD. You can also use it to perform service functions, error detection, and media maintenance.	GC35-0033
IBM TotalStorage Solutions Handbook	This handbook, from the IBM International Technical Support Organization, helps you understand what makes up enterprise storage management. The concepts include the key technologies that you must know and the IBM subsystems, software, and solutions that are available today. It also provides guidelines for implementing various enterprise storage administration tasks so that you can establish your own enterprise storage management environment.	SG24-5250

Ordering IBM publications

This section tells you how to order copies of IBM publications and how to set up a profile to receive notifications about new or changed publications.

IBM publications center

The publications center is a worldwide central repository for IBM product publications and marketing material.

The IBM publications center offers customized search functions to help you find the publications that you need. Some publications are available for you to view or download free of charge. You can also order publications. The publications center displays prices in your local currency. You can access the IBM publications center through the following Web site:

http://www.ibm.com/shop/publications/order

Publications notification system

The IBM publications center Web site offers you a notification system for IBM publications.

If you register, you can create your own profile of publications that interest you. The publications notification system sends you a daily e-mail that contains information about new or revised publications that are based on your profile.

If you want to subscribe, you can access the publications notification system from the IBM publications center at the following Web site:

http://www.ibm.com/shop/publications/order

Web sites

The following Web sites provide information about the IBM TotalStorage DS8000 series and other IBM storage products.

Type of Storage Information	Web Site
Concurrent Copy for S/390 and zSeries host systems	http://www.storage.ibm.com/software/sms/sdm/

Type of Storage Information	Web Site
Copy Services command-line interface (CLI)	http://www-1.ibm.com/servers/storage/support/software/cscli.html
DS8000 series publications	http://www-1.ibm.com/servers/storage/support/disk/ds8100/index.html Click **Documentation**.
FlashCopy for S/390 and zSeries host systems	http://www.storage.ibm.com/software/sms/sdm/
Host system models, operating systems, and adapters that the storage unit supports	http://www.ibm.com/servers/storage/disk/ds8000/interop.html Click **Interoperability matrix**.
IBM Disk Storage Feature Activation (DSFA)	http://www.ibm.com/storage/dsfa
IBM storage products	http://www.storage.ibm.com/
IBM TotalStorage DS8000 series	http://www-1.ibm.com/servers/storage/disk/ds8000
IBM version of the Java (JRE) that is often required for IBM products	http://www-106.ibm.com/developerworks/java/jdk/
Multiple Device Manager (MDM)	http://www.ibm.com/servers/storage/support/ Click **Storage Virtualization**.
Remote Mirror and Copy (formerly PPRC) for S/390 and zSeries host systems	http://www.storage.ibm.com/software/sms/sdm/
SAN fibre channel switches	http://www.ibm.com/storage/fcswitch/
Storage Area Network Gateway and Router	http://www-1.ibm.com/servers/storage/support/san/index.html
Subsystem Device Driver (SDD)	http://www-1.ibm.com/servers/storage/support/software/sdd.html
z/OS Global Mirror (formerly XRC) for S/390 and zSeries host systems	http://www.storage.ibm.com/software/sms/sdm/

How to send your comments

Your feedback is important to help us provide the highest quality information. If you have any comments about this information or any other DS8000 series documentation, you can submit them in the following ways:

- e-mail

  Submit your comments electronically to the following e-mail address:

  starpubs@us.ibm.com

  Be sure to include the name and order number of the book and, if applicable, the specific location of the text you are commenting on, such as a page number or table number.

- Mail

  Fill out the Readers' Comments form (RCF) at the back of this book. Return it by mail or give it to an IBM representative. If the RCF has been removed, you can address your comments to:

  International Business Machines Corporation
  RCF Processing Department

Department 61C
9032 South Rita Road
TUCSON AZ   85775-4401

Summary of Changes for SC35-0495-04 IBM TotalStorage DS8000 Introduction and Planning Guide

This document contains terminology, maintenance, and editorial changes. Technical changes or additions to the text and illustrations are indicated by a vertical line to the left of the change. This summary of changes describes new functions that have been added to this release.

New Information

Added feature codes for disk drive power module second pair in "Disk drive power module" on page 30.

Changed Information

RIO-G cable group 6 added to Table 13 on page 41.

The 92E and 9AE rows have been updated in "Configuration rules for storage features" on page 33.

The tables have been updated in "Configuration rules for I/O enclosures, I/O cables, and device adapters" on page 46.

Clarified the name of the Hubbell inline connector and receptacle in "Power connector requirements" on page 82.

Media speed has been updated and IP addresses and name server information revised in Appendix C, "Management console network settings work sheet," on page 115.

Chapter 1. Introduction to IBM TotalStorage DS8000 series

IBM TotalStorage DS8000 is a high-performance, high-capacity series of disk storage that is designed to support continuous operations. DS8000 series models (machine type 2107) use the IBM POWER5™ server technology that is integrated with the IBM Virtualization Engine™ technology. DS8000 series models consist of a storage unit and one or two management consoles, two being the recommended configuration. The graphical user interface (GUI) or the command-line interface (CLI) allows you to logically partition storage and use the built-in Copy Services functions. For high-availability, hardware components are redundant.

You can read the following information to familiarize yourself with the DS8000 series:

- DS8000 series models, including a model comparison chart
- DS8000 series performance features
- DS8000 series interfaces
- DS8000 series hardware specifics
- Supported systems for open systems, S/390®, and zSeries® hosts
- Data management elements
- Copy Services
- Data migration

DS8000 models

The DS8000 series offers various choices of base and expansion models, so you can configure storage units that meet your performance and configuration needs.

DS8100

The DS8100 (Model 921) features a dual two-way processor complex and support for one expansion frame.

DS8300

The DS8300 (Models 922 and 9A2) features a dual four-way processor complex and support for one or two expansion frames. The Model 9A2 supports two IBM TotalStorage System LPARs (Logical Partitions) in one storage unit.

The DS8000 expansion frames (Models 92E and 9AE) expand the capabilities of the base models. You can attach the Model 92E to either the Model 921 or the Model 922 to expand their capabilities. You can attach the Model 9AE to expand the Model 9A2.

Figure 1 on page 2 provides a high-level view at the components for the DS8100 and DS8300 base models (Models 921, 922, and 9A2).
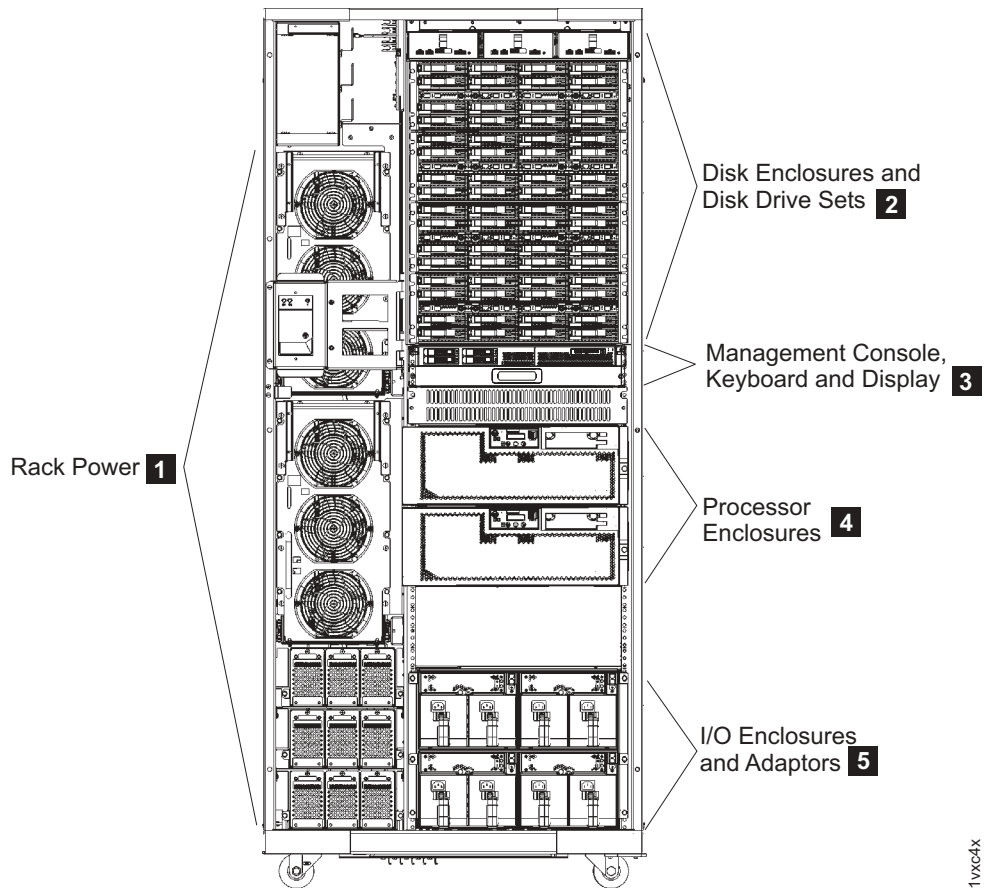
Figure 1. A base model (with front cover off) and its main components

The following notes provide additional information about the labeled components on Figure 1:

1. The rack power area of the base models provides redundant power supplies (two primary power supplies), power control cards, and backup battery assemblies to help protect data in the event of a loss of external power. Model 921 contains two batteries. Model 922 and Model 9A2 contain three batteries to support the 4-way processors.

2. All base models allow up to eight disk enclosures, which contain the disk drives. In a maximum configuration, each base model can hold up to 128 disk drives.

3. All base models contain one management console, a keyboard, and display. The management console is the focal point for configuration, copy services management, and maintenance activities.

4. All base models contain two processor enclosures. The processor enclosures contain the computer electronic complex (CEC). The Model 921 processor enclosures have 2-way processors. Processor enclosures on the Model 922 and Model 9A2 have 4-way processors.

5. All base models contain I/O enclosures and adapters. The I/O enclosures hold the adapters and provide connectivity between the adapters and the processors. Both device adapters and host adapters are installed in the I/O enclosure.

Figure 2 on page 3 provides a high-level view at the components for the expansion models (Models 92E and 9AE).

Rack Power **1**

Disk Enclosures and
Disk Drive Sets **2**

I/O Enclosures
and Adaptors **3**
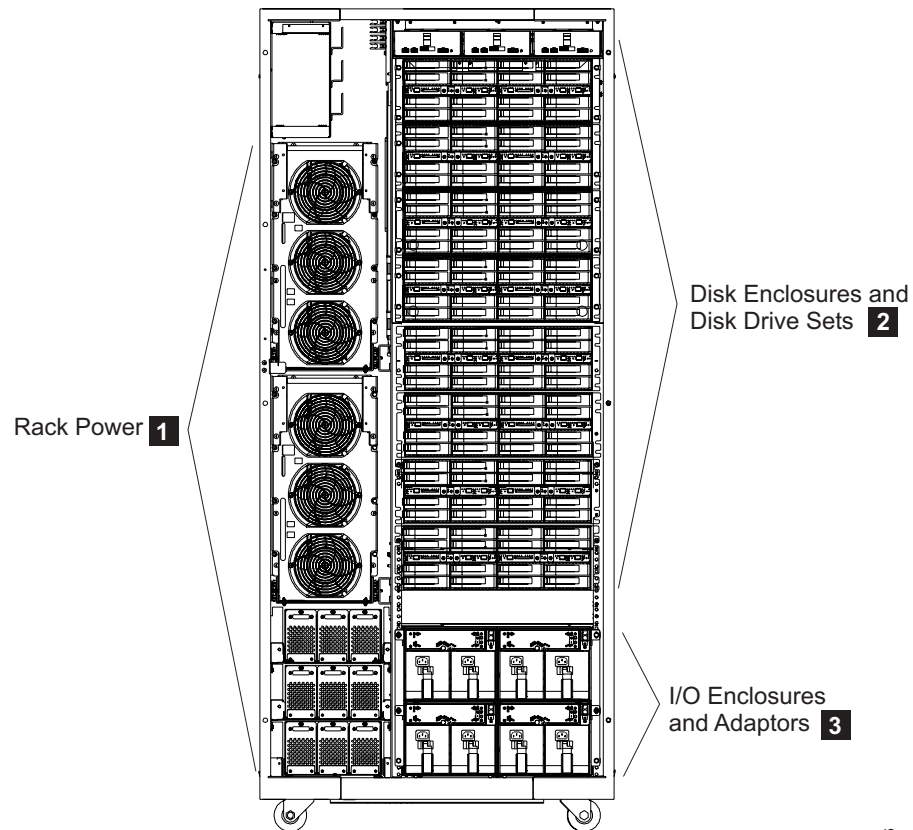
1vxc86

Figure 2. An expansion model (with front cover off) and its main components

The following notes provide additional information about the labeled components on
Figure 2:

1. The rack power area of each expansion model provides redundant power
   supplies (two primary power supplies) and power control cards. If the expansion
   unit contains I/O enclosures or the extended power line disturbance (PLD)
   feature, three backup battery assemblies are also installed to help protect data
   in the event of a loss of external power.

2. All expansion models allow up to 16 disk enclosures, which contain the disk
   drives. In a maximum configuration, each expansion model can hold 256 disk
   drives.

3. Expansion models can contain I/O enclosures and adapters if they are the first
   expansion units that are attached to either a Model 922 or a Model 9A2. The
   second expansion model in a 922 or 9A2 configuration cannot have I/O
   enclosures and adapters, nor can any expansion unit that is attached to a
   Model 921. If the expansion unit contains I/O enclosures, the enclosures provide
   connectivity between the adapters and the processors. The adapters contained
   in the I/O enclosures can be either device or host adapters.

DS8100 (Model 921)

The IBM TotalStorage DS8100, which is Model 921, offers many features.

These features include:

- Dual two-way processor complex

- Up to 128 disk drives, for a maximum capacity of 38.4 TB
- Up to 128 GB of processor memory (cache)
- Up to 16 fibre-channel/FICON or ESCON® host adapters

The DS8100 model can support one expansion frame. With one expansion frame, you can expand the capacity of the Model 921 as follows:

- Up to 384 disk drives, for a maximum capacity of 115.2 TB

Note: IBM service representatives can upgrade a Model 921 in the field when you order a model conversion to a Model 922 or Model 9A2.

Figure 3 shows the maximum configuration of a Model 921, which is the 921 base model plus one 92E expansion model.
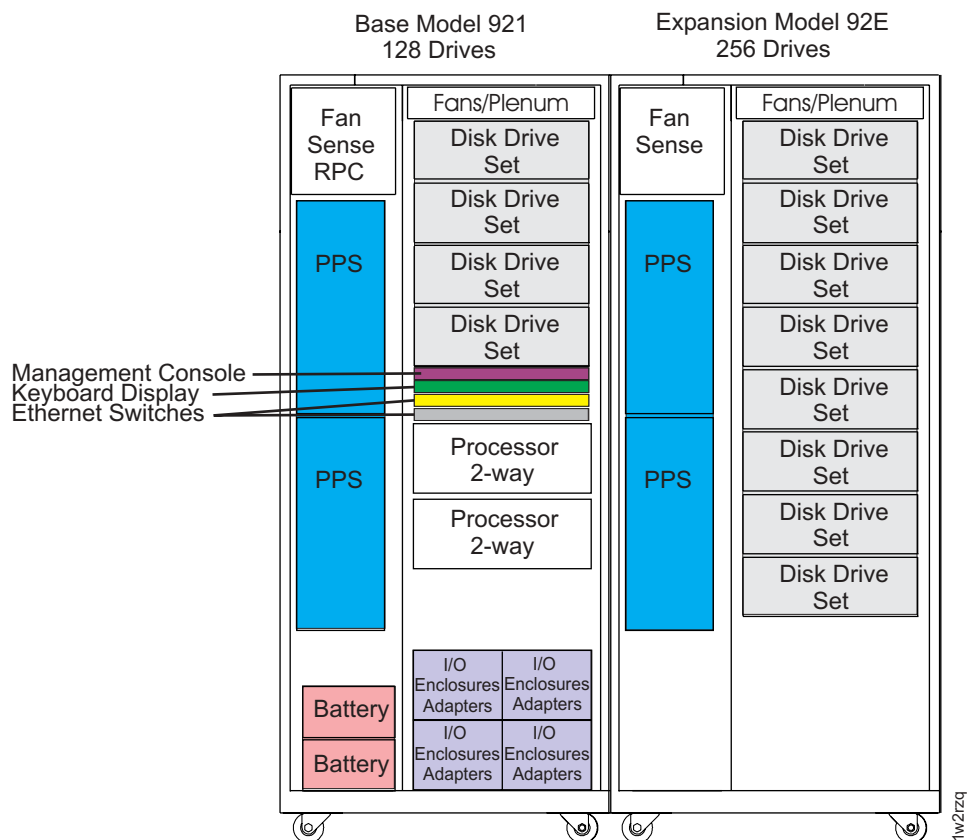
Figure 3. Maximum configuration for Model 921

DS8300 (Models 922 and 9A2)

IBM TotalStorage DS8300 models (Model 922 and Model 9A2) offer higher performance and capacity than the DS8100. The Model 9A2 also enables you to create two storage system LPARs (or images) within the same storage unit.

Both DS8300 models offer the following features:

- Dual four-way processor complex
- Up to 128 disk drives, for a maximum capacity of 38.4 TB
- Up to 256 GB of processor memory (cache)
- Up to 16 fibre-channel/FICON or ESCON host adapters

The DS8300 models can support either one or two expansion frames. With expansion frames, you can expand the Model 922 and 9A2 as follows:

- With one expansion frame, you can support the following expanded capacity and number of adapters:
  - Up to 384 disk drives, for a maximum capacity of 115.2 TB
  - Up to 32 fibre-channel/FICON or ESCON host adapters
- With two expansion frames, you can support the following expanded capacity:
  - Up to 640 disk drives, for a maximum capacity of 192 TB

Figure 4 shows the maximum configuration of a Model 922 and 9A2. Both of these models can attach up to two expansion models. Model 922 uses the 92E expansion model. Model 9A2 uses the 9AE expansion model.

Figure 4. Maximum configuration for Models 922 and 9A2

Model comparison

DS8000 models vary on the processor types that they use, their disk capacity, and other supported features.

Table 1 on page 6 compares the various supported features that are available on different DS8000 model configurations.

Table 1. DS8000 model comparison chart

Base model	Images (logical partitions)	Expansion models	Processor type	Disk drives	Processor memory	Host adapters
Model 921	1 image	None	2-way	Up to 128 disks (maximum capacity of 38.4 TB)	Up to 128 GB	Up to 16 host adapters
		With 1 expansion model (92E)	2-way	Up to 384 disks (maximum capacity of 115.2 TB)	Up to 128 GB	Up to 16 host adapters
Model 922	1 image	None	4-way	Up to 128 disks (maximum capacity of 38.4 TB)	Up to 256 GB	Up to 16 host adapters
		With 1 expansion model (92E)	4-way	Up to 384 disks (maximum capacity of 115.2 TB)	Up to 256 GB	Up to 32 host adapters
		With 2 expansion models (92E)	4-way	Up to 640 disks (maximum capacity of 192 TB)	Up to 256 GB	Up to 32 host adapters
Model 9A2	2 images	None	4-way	Up to 128 disks (maximum capacity of 38.4 TB)	Up to 256 GB	Up to 16 host adapters
		With 1 expansion model (9AE)	4-way	Up to 384 disks (maximum capacity of 115.2 TB)	Up to 256 GB	Up to 32 host adapters
		With 2 expansion models (9AE)	4-way	Up to 640 disks (maximum capacity of 192 TB)	Up to 256 GB	Up to 32 host adapters

Note: IBM service representatives can upgrade a Model 921 in the field when you order a model conversion to a Model 922 or a Model 9A2.

DS8000 physical footprint

The physical footprint dimensions, caster locations, and cable openings for a DS8000 unit help you plan your installation site.

Figure 5 on page 7 shows the overall physical footprint of a DS8000 unit.
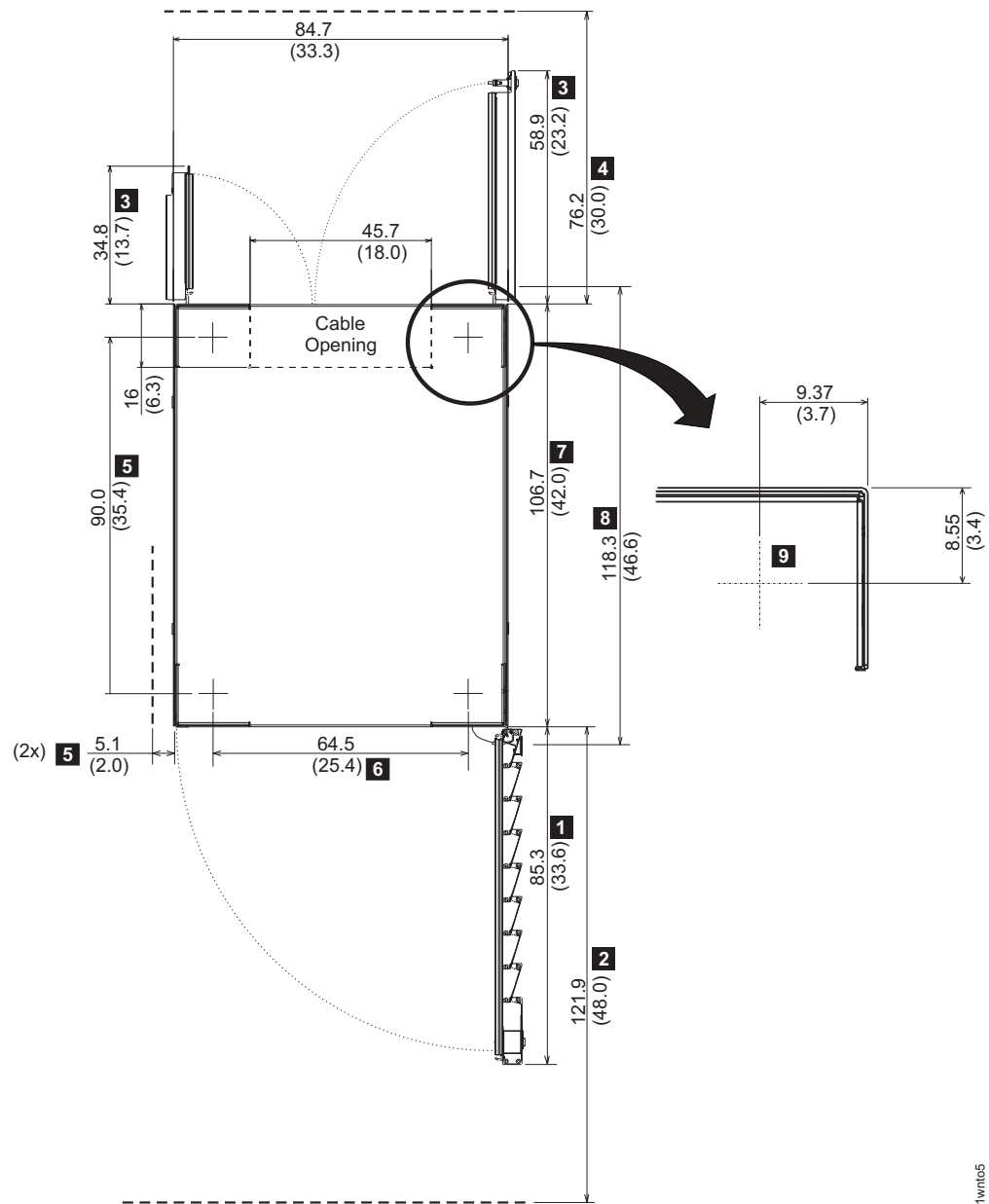
Figure 5. DS8000 physical footprint. Dimensions are in centimeters (inches).

The following dimensions are labeled on Figure 5:

1. Front cover width
2. Front service clearance
3. Back cover widths
4. Back service clearance
5. Clearance to allow front cover to open
6. Distance between casters
7. Depth of frame without covers
8. Depth of frame with covers
9. Minimum dimension between casters and outside edges of frames
   Related tasks

"Hard mounting your storage unit" on page 90
If you decide to hard mount your storage unit (physically attach the unit to the floor), use these guidelines.

Related reference

"Dimensions and weight of individual models" on page 77
When you are planning the floor and space requirements for your storage units, consider the dimensions and weights of the models that compose your storage units.

Storage complexes

A storage complex is the storage unit plus the Management Consoles (MCs) that manage it.

Each storage complex must have an internal MC that resides within the base model of the storage unit. You also can attach an external MC to the storage complex for redundancy.

DS8000 performance features

The DS8000 series is designed to provide you with high-performance, connectivity, and reliability allowing your workload to be easily consolidated into a single storage subsystem.

The following list provides an overview of some of the features that are associated with the DS8000 series:

POWER5 processor technology
> The DS8000 features IBM POWER5 server technology. Depending on workload, the maximum host I/O operations per second of the DS8100 Model 921 is up to three times the maximum operations per second of the ESS Model 800. The maximum host I/O operations per second of the DS8300 Model 922 or 9A2 is up to six times the maximum of the ESS model 800.

Industry standard fibre channel disk drives
> The DS8000 series offers a selection of fibre channel disk drives, including 300 GB drives, allowing a DS8100 to scale up to 115.2 TB of capacity and a DS8300 to scale up to 192 TB of capacity.

Four-port fibre channel/FICON adapters
> These new adapters not only enhance connectivity, but increase configuration flexibility because the individual ports can be configured to support fibre channel or FICON.

HOST attachments
> The DS8100 offers up to 16 host adapters (64 FCP/FICON ports) and the DS8300 offers up to 32 host adapters (128 FCP/FICON ports), further increasing your ability to share your disk storage.

IBM Standby Capacity on Demand
> The IBM Standby Capacity on Demand (Standby CoD) offering allows the installation of inactive disk drives that can be easily activated as business needs require. With this offering, up to four Standby CoD disk drive sets (64 disk drives) can be factory or field installed into your system. To activate, you logically configure the disk drives for use—a non-disruptive activity that does not require intervention from IBM. Upon activation of any portion of

the Standby CoD disk drive set, you must place an order with IBM to initiate billing for the activated set. At that time, you can also order replacement Standby CoD disk drive sets.

Online Information Center

The online Information Center is an information database that provides you the opportunity to quickly familiarize yourself with the major aspects of the DS8000 and to easily recognize the topics for which you might require more information. It provides information regarding user assistance for tasks, concepts, reference, user scenarios, tutorials, and other types of user information. Because the information is all in one place rather than across multiple publications, you can access the information that you need more efficiently and effectively.

Interfaces of the DS8000

The DS8000 provides management interfaces that contain management tools and utilities to help you increase productivity.

IBM TotalStorage DS Storage Manager

The IBM TotalStorage DS Storage Manager is a program interface that is used to perform logical configurations and Copy Services management functions.

The DS Storage Manager program is installed as a GUI (graphical mode) or as an unattended (silent mode) installation for the supported operating systems. It can be accessed from any location that has network access using a Web browser. It offers you the following choices:

Simulated configuration

You install this component on your PC or the Master Console which provides the ability to create or modify logical configurations when your storage unit is disconnected from the network. After creating the configuration, you can save it and then apply it to a network attached storage unit at a later time.

Real-time configuration

This component is preinstalled on your HMC. It provides you the ability to create logical configurations and use Copy Services features when your storage unit is attached to the network. This component provides you with real-time (online) configuration support.

DS command-line interface

The IBM TotalStorage DS Command-Line Interface (CLI) enables open systems hosts to invoke and manage FlashCopy and Metro and Global Mirror functions through batch processes and scripts.

The command-line interface provides a full-function command set that allows you to check your storage unit configuration and perform specific application functions when necessary.

The following list highlights a few of the specific types of functions that you can perform with the DS command-line interface:

- Check and verify your storage unit configuration
- Check the current Copy Services configuration that is used by the storage unit
- Create new logical storage and Copy Services configuration settings

- Modify or delete logical storage and Copy Services configuration settings

Note: You cannot install the DS CLI on a Windows 64-bit operating system.

DS Open application programming interface

The DS Open application programming interface (API) is a nonproprietary storage management client application that supports routine LUN management activities, such as LUN creation, mapping and masking, and the creation or deletion of RAID5 and RAID10 volume spaces. The DS Open API also enables Copy Services functions such as FlashCopy and Remote Mirror and Copy (formally known as peer-to-peer remote copy).

The IBM TotalStorage DS Open API helps integrate DS configuration management support into storage resource management (SRM) applications, which allow customers to benefit from existing SRM applications and infrastructures. The DS Open API also enables the automation of configuration management through customer-written applications. Either way, the DS Open API presents another option for managing storage units by complementing the use of the IBM TotalStorage DS Storage Manager web-based interface and the DS command-line interface.

You must implement the DS Open API through the IBM TotalStorage Common Information Model (CIM) agent, a middleware application that provides a CIM-compliant interface. The DS Open API uses the CIM technology to manage proprietary devices as open system devices through storage management applications. The DS Open API allows these storage management applications to communicate with a storage unit.

DS8000 hardware specifics

The DS8000 models offer a high degree of availability and performance through the use of redundant components that can be replaced while the system is operating. You can use the DS8000 models with a mix of different operating systems and clustered and nonclustered variants of the same operating systems.

Contributing to the high degree of availability and reliability are the structure of the DS8000 storage unit, the host systems it supports, and its processor memory and processor speeds.

Storage unit structure

The design of the storage unit, which contains the base model and the expansion models, contributes to the high degree of availability that is associated with the DS8000. The primary components that support high availability within the storage unit are the storage server, the processor complex, and the rack power control card.

Storage unit
> The storage unit contains a storage server and one or more storage (disk) enclosures that are packaged in one or more racks with associated power supplies, batteries, and cooling.

Storage server
> The storage server consists of two processor complexes, two or more I/O enclosures, and a pair of rack power control cards.

Processor complex
> A processor complex controls and manages the storage unit to perform the function of the storage server. The two processor complexes form a

redundant pair such that if either processor complex fails, the remaining processor complex performs all storage server functions.

Rack power control card

A redundant pair of rack power control (RPC) cards coordinate the power management within the storage unit. The RPC cards are attached to the service processors in each processor complex, the primary power supplies in each rack, and indirectly to the fan/sense cards and storage enclosures in each rack.

All DS8000 models include the IBM TotalStorage Multi-path Subsystem Device Driver (SDD). The SDD provides load balancing and enhanced data availability capability in configurations with more than one I/O path between the host server and the DS8000 series storage unit. Load balancing can reduce or eliminate I/O bottlenecks that occur when many I/O operations are directed to common devices using the same I/O path. The SDD can eliminate the single point of failure by automatically rerouting I/O operations when a path failure occurs.

IBM TotalStorage Management Console

The IBM TotalStorage Management Console is the focal point for configuration, copy services management, and maintenance activities.

The Management Console is a dedicated workstation that is physically located (installed) inside your DS8100 and DS8300 and can automatically monitor the state of your system, notifying you and IBM when service is required. The Management Console can also be connected to your network to enable centralized management of your system using the IBM TotalStorage DS Command-Line Interface or the storage management software that uses the IBM TotalStorage DS Open API.

To provide continuous availability of customer access to the management console functions, having a second management console is recommended. This second management console can be provided in two ways:

- **External** (outside the 2107) - This console is generally installed in the customer-provided rack. It uses the same hardware as the internal management console.
- **Internal** (a second management console that resides within a second 2107) - This console can be cabled together with the primary internal management console of the first 2107.'

Host systems that the storage unit supports

The DS8000 storage unit provides a variety of host attachments so that you can consolidate storage capacity and workloads for open-systems hosts, S/390 hosts, and eServer™ zSeries hosts.

The DS8100 Model 921 supports a maximum of 16 host adapters and 4 device adapter pairs, and the DS8300 Models 922 and 9A2 supports a maximum of 32 host adapters and 8 device adapter pairs.

You can configure the storage unit for any of the following system adapter types and protocols:

- Fibre-channel adapters, for support of fibre-channel protocol (FCP) and fibre connection (FICON®) protocol
- Enterprise Systems Connection Architecture® (ESCON) adapters

For fibre-channel attachments, you can establish zones. The zones must contain a single port that is attached to a system adapter with the desired number of ports that are attached to the storage unit. By establishing zones, you reduce the possibility of interactions between system adapters in switched configurations. You can establish the zones by using either of two zoning methods:

- Port number
- Worldwide port name (WWPN)

You can configure switch ports that are attached to the storage unit in more than one zone. This enables multiple system adapters to share access to the storage unit fibre-channel ports. Shared access to a storage unit fibre-channel port might come from host platforms that support a combination of bus adapter types and the operating systems.

Attaching a DS8000 series to an open-systems host with fibre channel adapters

You can attach a DS8000 series to an open-systems host with fibre-channel adapters.

Fibre channel is a 1 Gbps or 2 Gbps, full-duplex, serial communications technology to interconnect I/O devices and host systems that are separated by tens of kilometers.

The IBM TotalStorage DS8000 series supports SAN connections at 1 Gbps to 4 Gbps with 2 Gbps host bus adapters. The DS8000 series negotiates automatically and determines whether it is best to run at 1 Gbps link or 2 Gbps link. The IBM TotalStorage DS8000 series detects and operates at the higher link speed.

Fibre channel transfers information between the sources and the users of the information. This information can include commands, controls, files, graphics, video, and sound. Fibre-channel connections are established between fibre-channel ports that reside in I/O devices, host systems, and the network that interconnects them. The network consists of elements like switches, bridges, and repeaters that are used to interconnect the fibre-channel ports.

Fibre-channel (SCSI-FCP) attached open-systems hosts that the storage unit supports

You can attach the DS8000 storage unit to fibre-channel (SCSI-FCP) attached open-systems hosts.

Each storage unit fibre-channel adapter has four ports. Each port has a unique worldwide port name (WWPN). You can configure the port to operate with the SCSI-FCP upper-layer protocol. Shortwave adapters and longwave adapters are available on the storage unit.

Fibre-channel adapters for SCSI-FCP support provide the following configurations:

- A maximum of 64 host ports for DS8100 Model 921 and a maximum of 128 host ports for DS8300 Models 922 and 9A2
- A maximum of 509 host logins per fibre-channel port
- A maximum of 2000 N-port logins per storage image
- Access to all 63.7KB LUNs per target (one target per host adapter), depending on host type
- Either arbitrated loop, switched fabric, or point-to-point topologies

The storage unit supports the following host systems for shortwave fibre-channel attachment and longwave fibre-channel attachment:

- IBM eServer iSeries™ servers that run an IBM OS/400® operating system
- IBM eServer i5 servers that run an IBM i5/OS™ operating system
- IBM RS/6000®, pSeries®, eServer p5, RS/6000 SP™, and pSeries SP server that run an IBM AIX® operating system
- IBM zSeries servers that run the Linux™ operating system
- IBM zSeries servers that run the z/VM® operating system
- Apple Macintosh servers
- Fujutsu PRIMEPOWER servers that run the Solaris operating system
- Hewlett-Packard servers that run an HP Tru64 UNIX® operating system
- Hewlett-Packard servers that run an HP OpenVMS operating system
- Hewlett-Packard servers that run an HP-UX operating system
- Intel-based servers that run a Microsoft® Windows® 2000 operating system
- Intel-based servers that run a Microsoft Windows Server 2003 operating system for both 32-bit and 64-bit configurations
- Intel-based servers that run a Novell NetWare operating system
- IBM servers that run the IBM SAN Volume Controller operating system
- IBM servers that run the IBM SAN File System operating system
- iSCSI Gateway servers that run a Microsoft Windows 2000, Microsoft Windows 2003, or UNIX operating system
- Linux servers that run a Red Hat Linux, Red Flag Linux, Asianux, and SUSE Linux operating system
- SGI servers that run an IRIX operating system
- Sun servers that run a Solaris operating system

See the Interoperability Matrix at http://www.ibm.com/servers/storage/disk/ds8000/interop.html for details about types, models, adapters, and the operating systems that the storage unit supports.

ESCON-attached S/390 and zSeries hosts that the storage unit supports

You can attach the DS8000 storage unit to the ESCON-attached S/390 and zSeries hosts.

With ESCON adapters, the storage unit provides the following configurations:

- A maximum of 32 host ports for DS8100 Model 921 and a maximum of 64 host ports for DS8300 Models 922 and 9A2
- A maximum of 64 logical paths per port
- Access to 16 control-unit images (4096 CKD devices) over a single ESCON port on the storage unit
- Zero to 64 ESCON channels; two per ESCON host adapter
- Two ESCON links with each link that supports up to 64 logical paths

  A DS8100 storage unit supports up to 16 host adapters that provide a maximum of 32 ESCON links per machine. A DS8300 storage unit supports up to 32 host adapters that provide a maximum of 64 ESCON links per machine.

Note: ESCON host channels limit the number of devices per channel to 1024. To fully access 4096 devices on a storage unit, it is necessary to connect a minimum of four ESCON host channels to the storage unit. You can access

the devices through a switch to a single storage unit ESCON port. This method exposes four control-unit images (1024 devices) to each host channel.

The FICON bridge card in ESCON director 9032 Model 5 enables a FICON bridge channel to connect to ESCON host adapters in the storage unit. The FICON bridge architecture supports up to 16 384 devices per channel. This enables you to attach other control units or other storage units to the same host channel up to the limit that the host supports.

The storage unit supports the following operating systems for S/390 and zSeries hosts:
- Transaction Processing Facility (TPF)
- Virtual Storage Extended/Enterprise Storage Architecture (VSE/ESA™)
- z/OS®
- z/VM
- Linux

For details about models and the operating system versions and releases that the storage unit supports for these host systems, see the *Interoperability Matrix* at http://www.ibm.com/servers/storage/disk/ds8000/interop.html.

FICON-attached S/390 and zSeries hosts that the storage unit supports

You can attach the DS8000 storage unit to FICON-attached S/390 and zSeries hosts.

Each storage unit fibre-channel adapter has four ports. Each port has a unique world wide port name (WWPN). You can configure the port to operate with the FICON upper-layer protocol. When configured for FICON, the fibre-channel port supports connections to a maximum of 128 FICON hosts. On FICON, the fibre-channel adapter can operate with fabric or point-to-point topologies. With fibre-channel adapters that are configured for FICON, the storage unit provides the following configurations:
- Either fabric or point-to-point topologies
- A maximum of 64 host ports for DS8100 Model 921 and a maximum of 128 host ports for DS8300 Models 922 and 9A2
- A maximum of 509 channel connections per fibre-channel port
- A maximum of 2048 logical paths on each fibre-channel port
- Access to all 32 control-unit images (8000 CKD devices) over each FICON port

Note: FICON host channels limit the number of devices per channel to 16 384. To fully access 65 280 devices on a storage unit, it is necessary to connect a minimum of four FICON host channels to the storage unit. You can access the devices through a switch to a single storage unit FICON port. This method exposes 64 control-unit images (16 384 devices) to each host channel.

The storage unit supports the following operating systems for S/390 and zSeries hosts:
- Transaction Processing Facility (TPF)
- Virtual Storage Extended/Enterprise Storage Architecture (VSE/ESA)
- z/OS

- z/VM
- Linux

For details about models, versions of operating systems, and releases that the storage unit supports for these host systems, see the *Interoperability Matrix* at http://www.ibm.com/servers/storage/disk/ds8000/interop.html.

Processor memory

The DS8100 Model 921 offers up to 128 GB of processor memory and the DS8300 Models 922 and 9A2 offer up to 256 GB of processor memory. The Non-Volatile Storage (NVS) scales to the selected processor memory size, which can also help optimize performance.

Data management features

The DS8000 storage unit is designed with the following management features that allow you to securely process and access your data according to your business needs even if it is 24 hours a day and 7 days a week.

RAID

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. In the event of a single device failure, data can be read or regenerated from the other disk drives in the array.

With RAID implementation, the storage unit offers fault-tolerant data storage. The storage unit supports RAID implementation on the storage unit device adapters. The storage unit supports groups of disk drive modules (DDMs) in both RAID 5 and RAID 10.

RAID 5

RAID 5 is a method of spreading volume data plus data parity across multiple disk drives. RAID 5 increases performance by supporting concurrent accesses to the multiple DDMs within each logical volume.

RAID 10

RAID 10 implementation provides data mirroring from one DDM to another DDM. RAID 10 stripes data across half of the disk drives in the RAID 10 configuration. The other half of the array mirrors the first set of disk drives. In some cases, RAID 10 offers faster data reads and writes than RAID 5 because it does not need to manage parity. However, with half of the DDMs in the group used for data and the other half used to mirror that data, RAID 10 disk groups have less capacity than RAID 5 disk groups.

You can reconfigure RAID 5 disk groups as RAID 10 disk groups or vice versa.

Arrays across loops

The arrays across loops helps prevent data loss.

The storage unit provides arrays across loops on open-systems, S/390, and zSeries hosts. For RAID 10, arrays across loops provides mirroring across two loops, which prevents loss of the array during loop failure.

Storage System LPARs (logical partitions)

The DS8300 Model 9A2 exploits LPAR technology, allowing you to run two separate storage server images.

Each Storage System LPAR has access to:
- 50 percent of the processors
- 50 percent of the processor memory
- Up to 16 host adapters
- Up to 320 disk drives (up to 96 TB of capacity)

With these separate resources, each Storage System LPAR can run the same or different versions of microcode, and can be used for completely separate production, test, or other unique storage environments within this single physical system. This may enable storage consolidations where separate storage subsystems were previously required, helping to increase management efficiency and cost effectiveness.

Copy Services

Copy Services is a collection of functions that provides disaster recovery, data migration, and data duplication functions. Copy Services runs on the IBM TotalStorage DS8000 storage unit and supports open systems and zSeries environments.

Many design characteristics and advanced functions of the DS8000 contribute to protection of your data. DS8000 has a number of advanced Copy Services functions that are part of the IBM TotalStorage Resiliency family. These functions are supported also on the previous generation of storage systems called the IBM TotalStorage Enterprise Storage Server (ESS).

Copy Services include the following types of functions:
- FlashCopy, which is a point-in-time copy function
- Remote mirror and copy functions (previously known as Peer-to-Peer Remote Copy or PPRC), which includes:
  - IBM TotalStorage Metro Mirror (previously known as Synchronous PPRC)
  - IBM TotalStorage Global Copy (previously known as PPRC Extended Distance)
  - IBM TotalStorage Global Mirror (previously known as Asynchronous PPRC)
- z/OS Global Mirror (previously known as Extended Remote Copy [XRC])

You can manage Copy Services functions through a command-line interface called the IBM TotalStorage DS CLI and a new Web-based interface called the IBM TotalStorage DS Storage Manager. The DS Storage Manager allows you to set up and manage the following types of data-copy functions from any point from which network access is available:

FlashCopy

The FlashCopy feature enables you to create full volume copies of data.

When you set up a FlashCopy operation, a relationship is established between source and target volumes, and a bitmap of the source volume is created. Once this relationship and a bitmap are created, the target volume can be accessed as though all the data had been physically copied. While

a relationship between the source and target volume exists, a background process copies the tracks from the source to the target volume.

FlashCopy is an optional function. To use it, you must purchase the point-in-time 2244 function authorization model, which is 2244 Model PTC.

Remote Mirror and Copy

The remote mirror and copy feature is a flexible data mirroring technology that allows replication between volumes on two or more disk storage systems. You can also use this feature for data backup and disaster recovery.

Remote mirror and copy is an optional function. To use it, you must purchase the remote mirror and copy 2244 function authorization model, which is 2244 Model RMC.

DS8000 storage units can participate in remote mirror and copy solutions with the ESS Model 750, ESS Model 800, and DS6000 storage units.

The remote mirror and copy feature can operate in the following modes:

Metro Mirror

Provides real-time mirroring of logical volumes between two DS8000s that can be located up to 300 km from each other. It is a synchronous copy solution where write operations are completed on both copies (local and remote site) before they are considered to be completed.

Global Copy

Copies data nonsynchronously and over longer distances than is possible with Metro Mirror. When operating in Global Copy mode, the source volume sends a periodic, incremental copy of updated tracks to the target volume instead of a constant stream of updates. This causes less impact to application writes for source volumes and less demand for bandwidth resources, while allowing a more flexible use of the available bandwidth.

Global Mirror

Provides a long-distance remote copy feature across two sites using asynchronous technology. Global Mirror operations provide the following benefits:

- Support for virtually unlimited distance between the local and remote sites, with the distance typically limited only by the capabilities of the network and the channel extension technology. This ″unlimited″ distance enables you to choose your remote site location based on business needs and enables site separation to add protection from localized disasters.
- A consistent and restartable copy of the data at the remote site, created with minimal impact to applications at the local site.
- Data currency where, for many environments, the remote site lags behind the local site on an average of 3 to 5 seconds, minimizing the amount of data exposure in the event of an unplanned outage. The actual lag in data currency that you experience can depend upon a number of factors, including specific workload characteristics and bandwidth between the local and remote sites.
- Dynamic selection of the desired recovery point objective, based upon business requirements and optimization of available bandwidth.

- Session support whereby data consistency at the remote site is internally managed across up to eight DS8000 machines that are located across the local and remote sites.
- Efficient synchronization of the local and remote sites with support for failover and failback modes, helping to reduce the time that is required to switch back to the local site after a planned or unplanned outage.

z/OS Global Mirror

The z/OS Global Mirror function mirrors data on the storage unit to a remote location for disaster recovery. It protects data consistency across all volumes that you have defined for mirroring. The volumes can reside on several different storage units. The z/OS Global Mirror function can mirror the volumes over several thousand kilometers from the source site to the target recovery site. DS8000 storage complexes support z/OS Global Mirror only on zSeries hosts.

With z/OS Global Mirror, you can suspend or resume service during an outage. You do not have to end your current data-copy session. You can suspend the session, then restart it. Only data that changed during the outage needs to be resynchronized between the copies.

The z/OS Global Mirror function is an optional function. To use it, you must purchase the remote mirror for z/OS 2244 function authorization model, which is 2244 Model RMZ.

z/OS Metro/Global Mirror (3-site z/OS Global Mirror and Metro Mirror)

This mirroring capability uses z/OS Global Mirror to mirror primary site data to a location that is a long distance away and also uses Metro Mirror to mirror primary site data to a location within the metropolitan area. This enables a z/OS 3-site high availability and disaster recovery solution for even greater protection from unplanned outages.

The z/OS Metro/Global Mirror function is an optional function. To use it, you must purchase both of the following functions:

- Remote mirror for z/OS (2244 Model RMZ)
- Remote mirror and copy function (2244 Model RMC) for both the primary and secondary storage units

Related concepts

"Model 2244 function authorizations" on page 57
To establish the extent of IBM authorization for a licensed function, you purchase a 2244 function authorization model by ordering a specific feature code that indicates the size, in terabytes (TB), of the extent of IBM authorization.

"Remote mirror and copy functions (2244 Model RMC)" on page 61
The remote mirror and copy licensed function model and features establish the extent of IBM authorization for the use of the remote mirror and copy licensed functions on your storage unit.

"Remote mirror for z/OS (2244 Model RMZ)" on page 63
The remote mirror for z/OS licensed function model and features establish the extent of IBM authorization for the use of the z/OS remote mirroring licensed function on your storage unit.

Related tasks

"Ordering licensed functions" on page 59
After you decide which licensed functions to use with your storage unit, you are ready to order the functions.

FlashCopy

The IBM TotalStorage FlashCopy feature provides a point-in-time copy capability for logical volumes. FlashCopy creates a physical point-in-time copy of the data, with minimal interruption to applications, and makes it possible to access immediately both the source and target copies.

The primary objective of FlashCopy is to create a copy of a source volume on the target volume. This copy is called a point-in-time copy. When you initiate a FlashCopy operation, a FlashCopy relationship is created between the source volume and target volume. A FlashCopy relationship is a ″mapping″ of a FlashCopy source volume and a FlashCopy target volume. This mapping allows a point-in-time copy of the source volume to be copied to the target volume. The FlashCopy relationship exists between the volume pair from the time that you initiate a FlashCopy operation until the DS8000 copies all data from the source volume to the target volume or until you delete the FlashCopy relationship, if it is a persistent FlashCopy.

The point-in-time copy that is created by FlashCopy is typically used when you need a copy of the production data to be produced with minimal application downtime. It can be used for online back up, testing of new applications, or for creating a database for data-mining purposes. The copy looks exactly like the original source volume and is an instantly available, binary copy.

FlashCopy supports the following copy options:

Data Set FlashCopy
Data Set FlashCopy allows a FlashCopy of a data set in a zSeries environment.

Multiple relationship FlashCopy
Multiple relationship FlashCopy allows a source to have FlashCopy relationships with multiple targets simultaneously. This flexibility allows you to establish up to 12 FlashCopy relationships on a given logical unit number (LUN), volume, or data set, without needing to first wait for or cause previous relationships to end.

Refresh target volume (also known as incremental FlashCopy)
Refresh target volume provides the ability to ″refresh″ a LUN or volume involved in a FlashCopy relationship. When a subsequent FlashCopy operation is initiated, only data that updates the target and the source to the same point-in-time state is copied. The direction of the ″refresh″ can also be reversed. The LUN or volume that was defined as the target can now become the source for the LUN or the volume that was defined as the source (now the target).

Persistent FlashCopy
Persistent FlashCopy allows the FlashCopy relationship to remain even after the FlashCopy operation completes. You must explicitly delete the relationship.

Establish FlashCopy on existing Remote Mirror and Copy source
The establish FlashCopy on an existing Remote Mirror and Copy source volume option allows you to establish a FlashCopy relationship where the target volume is also the source of an existing remote mirror and copy source volume. This enables you to create full or incremental point-in-time copies at a local site and then use remote mirroring commands to copy the data to the remote site.

This feature is represented by the **Establish target on existing Metro Mirror source** selection in the GUI.

Consistency group commands

Consistency group commands allow the DS8000 to freeze I/O activity to a LUN or volume until you issue the FlashCopy consistency group command. Consistency groups help create a consistent point-in-time copy across multiple LUNs or volumes, and even across multiple DS8000 systems. This function is available through the use of command-line interface commands.

Inband commands over remote mirror link

In a remote mirror environment, inband commands are issued to a source volume of a remote mirror and copy volume pair on a local storage unit and sent across paths (acting as a conduit) to a remote storage unit to enable a FlashCopy pair to be established at the remote site. This eliminates the need for a network connection to the remote site solely for the management of FlashCopy. This function is available through the use of command-line interface commands.

Disaster recovery using Copy Services

One of the main reasons for using Copy Services functions is in preparation for a possible disaster by backing up, copying, and mirroring your data at the production and recovery sites.

You can create a disaster recovery solution using any of the following functions. These functions help improve a disaster recovery process by allowing a much shorter recovery time with little or no data loss.

Note: In a remote mirror and copy environment, when two storage units are set up in two geographically distinct locations, we refer to the sites as Site A (the production site) and Site B (the recovery site).

Failover and failback operations

A failover is the process of temporarily switching production to a backup facility (normally your recovery site) following a planned outage, such as a scheduled maintenance period or an unplanned outage, such as a disaster. A failback operation is the process of returning production to its original location. These operations use remote mirror and copy functions to help reduce the time that is required to synchronize volumes after sites are switched during planned or unplanned outages.

Global Mirror

The Global Mirror function provides a two-site extended distance remote copy option for disaster recovery and backup solution for the zSeries and open systems environments. This solution is based on existing Global Copy and FlashCopy functions. With Global Mirror, the data that the host writes to the storage unit at the production site is asynchronously shadowed to the storage unit at the recovery site. Global Mirror operates over high-speed, Fibre Channel communication links and is designed to maintain a consistent and restartable copy of data at a recovery site that can be located at virtually unlimited distance from the production site.

Comparison of licensed functions

A key decision that you must make in planning for a disaster is deciding which licensed functions to use to best suit your environment.

Table 2 provides a brief summary of the characteristics of the Copy Services features that are available for the storage unit.

Table 2. Comparison of licensed functions

Licensed function	Description	Advantages	Considerations
Metro Mirror	Synchronous data copy at a distance	No data loss, rapid recovery time for distances up to 300 km.	Slight performance impact.
Global Copy	Continuous copy without data consistency	Nearly unlimited distance, suitable for data migration, only limited by network and channel extenders capabilities.	Copy is normally fuzzy but can be made consistent through synchronization.
Global Mirror	Asynchronous copy	Nearly unlimited distance, scalable, and low recovery point objective (RPO). The RPO is the time needed to recover from a disaster; that is, the total system downtime.	RPO might grow when link bandwidth capability is exceeded.
z/OS Global Mirror	Asynchronous copy controlled by z/OS host software	Nearly unlimited distance, highly scalable, and very low RPO.	Additional host server hardware and software is required. The RPO might grow if bandwidth capability is exceeded or host performance might be impacted.

Parallel Access Volumes

The use of parallel access volumes (PAVs) enables a single zSeries server to simultaneously process multiple I/O operations to the same logical volume, which can help to significantly reduce device queue delays. This is achieved by defining multiple addresses per volume.

With dynamic parallel access volumes, the assignment of addresses to volumes is automatically managed to help the workload meet its performance objectives and minimize overall queuing.

You must configure both your storage unit and operating system to use PAVs. You can use the logical configuration definition to define PAV-bases, PAV-aliases, and their relationship in the storage unit hardware. This unit address relationship creates a single logical volume, allowing concurrent I/O operations.

The storage unit supports concurrent or parallel data transfer operations to or from the same volume from the same system or system image for S/390 or zSeries hosts. An S/390 with PAV software support enables multiple users and jobs to simultaneously access a logical volume. Read and write operations can be

accessed simultaneously to different domains. (The domain of an I/O operation is the specified extents to which the I/O operation applies.)

DS8000 limitations

The following list describes known limitations for the DS8000.

- The 65,520 cylinder 3390 volume is not supported with z/OS Global Mirror and z/OS Metro/Global Mirror.

- The amount of physical capacity within a 2107 system that can be logically configured for use will be enforced by the 2107 licensed machine code (LMC) to maintain compliance with the extent of IBM authorization established for licensed functions activated on the machine. The 2107 LMC will not allow the logical configuration of physical capacity beyond the extent of IBM authorization (except when activating Standby CoD capacity).

- The deactivation of an activated licensed function, or a lateral change or reduction in the license scope, is a disruptive activity and requires a machine IML (Model 921 and Model 922) or reboot of the affected image (Model 9A2). A lateral change is defined as changing the license scope from fixed block (FB) to count key data (CKD) or from CKD to FB. A reduction is defined as changing the license scope from all physical capacity (ALL) to only FB or only CKD capacity.

- The following activities are disruptive:
  - Model conversions. In addition, data may not be preserved during the model conversion.
  - Field attachment of the first Model 92E expansion unit to a Model 922.
  - Field attachment of the first Model 9AE expansion unit to a Model 9A2.
  - Removal of an expansion unit model from the base unit model. Data may not be preserved during this activity.

- Some DS8000 functions are not available or supported in all environments. You can find current information about supported environments, prerequisites, and minimum operating systems levels at the following IBM Web site:

  http://www.ibm.com/servers/storage/disk/ds8000/interop.html

  Related concepts

  "License scope" on page 58
  Licensed functions are activated and enforced within a defined license scope.

Chapter 2. Planning the physical configuration

This chapter helps you plan the physical configuration of your DS8000 storage unit.

Physical configuration planning is your responsibility. Your disk marketing specialist can help you plan and select the DS8000 physical configuration and features.

This chapter includes the following information:

- Explanations of each feature that you can order to complete the physical configuration for each DS8000 model you order.
- Feature codes to use when you order each feature.
- Configuration rules and guidelines

Overview of physical configurations

When you order your DS8000 models, you can use the DS8000 feature codes to customize the physical configuration of your model.

You must follow established configuration rules to create a valid configuration—not just for the model itself but for the storage unit of which the model is a part. A storage unit can consist of a stand-alone base model or it can contain the base model plus expansion units.

The following table provides the storage unit configuration ranges for each base model.

Storage unit configuration		Physical storage capacity (See Note 1.)	Processor memory	Power	Host adapters
Base model	Attached expansion models				
921 (See Note 2.)	(none)	1.1 - 38.4 TB	16 - 128 GB	Three-phase	2 - 16
	one 92E unit	2.2 - 115.2 TB	16 - 128 GB	Three-phase	2 - 16
922	(none)	1.1 - 38.4 TB	32 - 256 GB	Three-phase	2 - 16
	one 92E unit	2.2 - 115.2 TB	32 - 256 GB	Three-phase	2 - 32
	two 92E units	3.3 - 192 TB	32 - 256 GB	Three-phase	2 - 32
9A2	(none)	2.2 - 38.4 TB	32 - 256 GB	Three-phase	4 - 16
	one 9AE unit	3.3 - 115.2 TB	32 - 256 GB	Three-phase	4 - 32
	two 9AE units	4.4 - 192 TB	32 - 256 GB	Three-phase	4 - 32
Notes:					
1. You can order a mix of 73 GB, 146 GB, or 300 GB disk drive sets to comprise the storage unit's physical capacity. Some configuration rules apply for intermixing.					
2. You can attach only one expansion unit on a Model 921.					

Configuration notes for Model 9A2

Because Model 9A2 contains two images, some features require that you use separate feature codes to designate the feature on image 1 and the feature on image 2.

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When you order, you will specify either an A location feature or a B location feature. On Figure 6, the A physical locations correlate to image 2 and the B locations correlate to image 1.

A		A		A	
A		A		A	
B		B		B	
B		B		B	
		A		A	
		A		A	
		B		B	
		B		B	
B	B	B	B		
A	A	A	A		
9A2		9AE		9AE	

1wssid
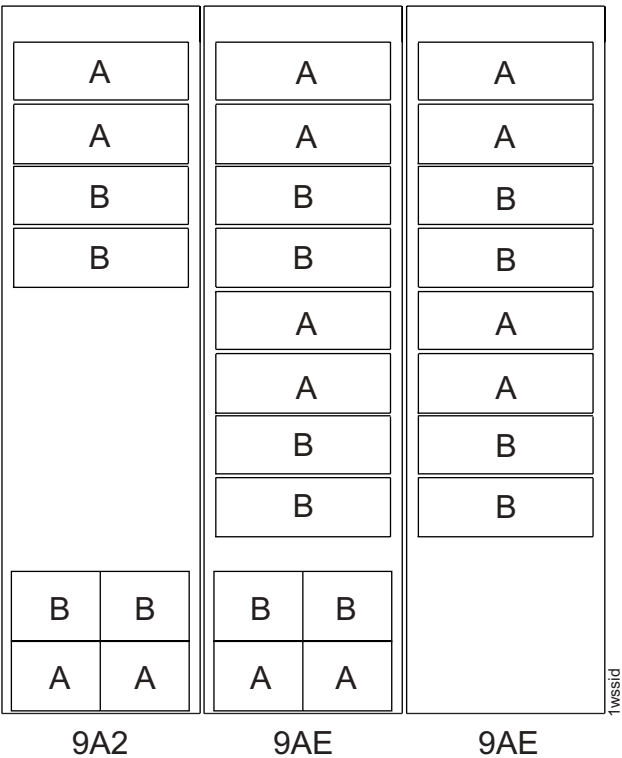
Figure 6. Physical locations A and B on a 9A2 base model and 9AE expansion models

Configuration controls

DS8000 models ship with indicator features that control the physical configuration at the storage unit level.

These indicator features are for administrative use only. They help ensure that each storage unit (the base model plus any expansion units) has a valid configuration. There is no charge for these features.

DS8000 models can include the following indicators:

- **Disk intermix indicators**

  Disk intermix indicators flag a model that contains more than one type of disk drive, where type is defined by the disk drive capacity and/or speed.

- **Expansion model position indicators**

  Expansion model position indicators flag base models that have attached expansion models. They also flag the position of each expansion model within the storage unit. For example, a position 1 indicator flags the expansion model as the first expansion unit within the storage unit, while a position 2 indicator flags the expansion model as the second expansion unit. In a valid 922 and 9A2 storage unit configuration, the first expansion unit can support more features than the second expansion unit.

- **Standby CoD indicators**

Each base model will contain a Standby CoD indicator that indicates whether the storage unit takes advantage of the Standby Capacity on Demand (Standby CoD) offering.

- **Other indicators**

    If applicable, models also include other indicators. These include operating system indicators, which indicate that the model will be used in a particular IBM eServer or Linux environment.

Determining physical configuration features

Use these steps as a general guideline for determining and then ordering the feature codes that you need to customize your storage unit.

1. Calculate your overall storage needs. Consider the licensed functions, such as FlashCopy and remote mirror and copy functions, that you must use to ensure continuous data availability and to implement the necessary disaster recover recovery requirements set by your management.

2. Determine the DS8000 models that will compose your storage unit. Consider both base and expansion models.

3. Determine the Management Console (MC) configuration that will support the storage unit using the following steps:

    a. Order one internal MC for each storage unit. The internal MC feature code must be ordered for the base model within the storage unit.

    b. Decide whether you will install an external MC for the storage unit. Adding an external MC helps to ensure that you maintain a highly available environment.

4. For each base and expansion model, determine the disk storage features that you need.

    a. Select the disk drive set feature codes and determine the amount of each feature code that you must order for each model.

    b. Select the disk enclosure feature codes and determine the amount that you must order to enclose the disk drive sets that you are ordering.

    c. Select the disk cable feature codes and determine the amount that you need of each.

5. Determine the I/O adapter features that you need for your storage unit.

    a. Select the device and host adapters feature codes to order and determine which model will contain the adapters. Remember that all base models can contain adapters, but only the first expansion models that are attached to Models 922 and 9A2 can contain adapters.

    b. For each model that will contain adapters, determine the number of each I/O enclosure feature codes that you must order.

    c. Select the cables that you must have to support the adapters.

6. Based on the disk storage and adapters that the base model and expansion models support, determine the appropriate processor memory feature code that is needed by each base model.

7. Decide which power features that you must order to support each model.

8. Review the other optional features and determine which feature codes to order.

    Related tasks

    "Ordering licensed functions" on page 59
    After you decide which licensed functions to use with your storage unit, you are ready to order the functions.

Management Console features

Management Consoles are required features for your storage unit configuration.

Customize your Management Consoles by specifying the following different features:

- An external Management Console as well as the required internal Management Console
- Management Console keyboards
- Management Console external line cords

   Related tasks

   "Determining physical configuration features" on page 25
   Use these steps as a general guideline for determining and then ordering the feature codes that you need to customize your storage unit.

   Related reference

   "Configuration rules for Management Consoles" on page 29
   You must order an internal MC each time you order a base model (Model 921, 922, or 9A2).

   "Rack specifications for the external Management Consoles" on page 93
   The external Management Console (MC) is an xSeries 335 1U model that is designed to be installed in a 19-inch rack that can accommodate devices that are 711.1 mm (28 in) deep.

Internal and external Management Consoles

Management Consoles (MCs) are the focal point for configuration, copy services management, and maintenance for a DS8000 series.

The MC is a dedicated workstation that is physically located (installed) inside your storage unit and can proactively monitor the state of your system, notifying you and IBM when service is required. It also can be connected to your network for centralized management of your system using the IBM TotalStorage DS Command Line Interface or using storage management software through the IBM TotalStorage DS Open API. An external MC is available as a optional feature and as a redundant MC for environments with high-availability requirements. If you use Copy Services, a redundant MC configuration is especially important.

Each MC feature looks similar to a laptop. It consists of a workstation processor, keyboard, monitor, modem, and Ethernet cables. The Ethernet cables included with each MC feature connect the MC to the storage unit.

The internal MC is installed (physically located) inside a base model. The external MC must be installed in an external 19-inch system rack. This rack can be an IBM rack or a non-IBM rack. The rack must conform to the required specifications. When you order an external MC, the hardware that you need to install the MC into the rack is shipped with it.

Tip: To ensure that IBM service representative can quickly and easily access an external MC, place the external MC rack within 15.2 m (50 ft.) of the storage units that are connected to it.

Notes:

- To help preserve console function, the external and the internal MCs are not available as a general purpose computing resource.

- The external MC satisfies all applicable requirements of Section 508 of the Rehabilitation Act, as long as assistive technology properly inter-operates with it.

  Related reference

  "Planning for external Management Console installation" on page 92
  If you use an external Management Console (feature code 1110), you must plan for its installation.

  "Rack specifications for the external Management Consoles" on page 93
  The external Management Console (MC) is an xSeries 335 1U model that is designed to be installed in a 19-inch rack that can accommodate devices that are 711.1 mm (28 in) deep.

  "Configuration rules for Management Consoles" on page 29
  You must order an internal MC each time you order a base model (Model 921, 922, or 9A2).

Feature codes for internal and external Management Consoles

Use the Management Console feature codes to order up to two Management Consoles (MCs) for each DS8000 storage unit.

Table 3 lists the Management Console feature codes.

Table 3. Management Console feature codes

Feature Code	Description	Comments
1100	Management Console - Internal	To be installed in a Model 921, 922, or 9A2.
1110	Management Console - External	To be installed in an external IBM or a non-IBM rack.

Management Console keyboard

You must specify the type of keyboard you want on your Management Console (MC).

For each type of MC (internal or external), you can select a keyboard that supports one of the following languages:
- U.S. English
- Japanese

  Related reference

  "Configuration rules for Management Consoles" on page 29
  You must order an internal MC each time you order a base model (Model 921, 922, or 9A2).

Feature codes for Management Console keyboards

Use the Management Console keyboard feature codes to specify the keyboard that comes with each internal and external Management Console.

Table 4 lists the keyboard feature codes.

Table 4. Management Console keyboard feature codes

Feature Code	Description	Language
9100	Keyboard for an internal MC	U.S. English
9101	Keyboard for an internal MC	Japanese
9110	Keyboard for an external MC	U.S. English

Table 4. Management Console keyboard feature codes (continued)

Feature Code	Description	Language
9111	Keyboard for an external MC	Japanese

Management Console external line cord

If using an external Management Console (MC), you must select an external line cord that is specific to your country, voltage, and amperage needs.

The line cord supplies external power to the external management console (feature #1110).

Related reference

"Configuration rules for Management Consoles" on page 29
You must order an internal MC each time you order a base model (Model 921, 922, or 9A2).

Feature codes for Management Console external line cords

Use the Management Console external line cord feature codes to specify a line cord when using an external Management Console.

Table 5 lists the external line cord feature codes.

Table 5. Management Console external line cord feature codes

Feature Code	Description (V = volts, A = amperes)	Country
1170	MC line cord standard rack	All
1171	MC line cord group 1	United States, Canada, Bahamas, Barbados, Bermuda, Bolivia, Brazil, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Guyana, Honduras, Jamaica, Japan, Japan (PDS), Korea, Mexico, Netherlands Antilles, Panama, Philippines, Saudi Arabia, Surinam, Taiwan, Trinidad, Venezuela
1172	MC line cord group 2 (250 V, 15 A)	Brazil
1173	MC line cord group 3 (250 V, 16 A)	Belgium, Finland, France, Indonesia, Korea
1174	MC line cord group 4 (250 V, 10 A)	Denmark
1175	MC line cord group 5 (250 V, 13 A)	United Kingdom
1176	MC line cord group 6 (250 V, 6 A to 16 A)	Israel
1177	MC line cord group 7 (250 V, 10 A)	Switzerland
1178	MC line cord group 8 (250 V, 16 A)	Pakistan, South Africa
1179	MC line cord group 9 (250 V, 10 A and 16 A)	Chile, Italy
1180	MC line cord group 10 (250 V, 10 A)	Argentina, Australia, New Zealand
1181	MC line cord group 11 (250 V, 15 A)	Thailand
1182	MC line cord group 12 (250 V, 10 A)	Uruguay

Feature Code	Description (V = volts, A = amperes)	Country
1183	MC line cord group 13 (250 V, 10 A)	People's Republic of China
1184	MC line cord group 14 (250 V, 10 A)	India
1185	MC line cord group 15 (250 V, 10 A)	Brazil
1186	MC line cord group 16 (250 V, 10 A)	Korea

Configuration rules for Management Consoles

You must order an internal MC each time you order a base model (Model 921, 922, or 9A2).

You can also order a second MC for the storage unit. The second MC must be an external MC.

You must specify one keyboard feature with each MC that you order. Keyboard features specify the language and whether the keyboard is installed on an internal or external MC.

When you order an internal or external MC, the necessary Ethernet cables that attach it to the storage unit are included.

Storage features

You must select the storage features that you want on your DS8000 storage units.

The storage features are separated into the following categories:

- Disk enclosure features
- Disk drive set features
- Standby Capacity on Demand features
- Disk enclosure filler features
- Disk drive cable features

Related tasks

"Determining physical configuration features" on page 25
Use these steps as a general guideline for determining and then ordering the feature codes that you need to customize your storage unit.

Related reference

"Configuration rules for storage features" on page 33
Use the following general configuration rules and ordering information to help you order storage features.

"Additional storage feature information" on page 39
To help you determine the type and number of disk drives to add to your storage unit, this section includes additional information.

Disk enclosures and disk drives

Disk enclosures and disk drives are required parts of your DS8000 storage unit configuration.

Each disk enclosure feature contains a pair (2) of disk enclosures. The pair of enclosures can hold two disk drive features. Each disk drive feature contains 16 disk drives. When installed, each disk drive feature is installed across both disk enclosures. Eight drives are installed in one enclosure and eight drives in the other enclosure.

Related reference

"Configuration rules for storage features" on page 33
Use the following general configuration rules and ordering information to help you order storage features.

"Additional storage feature information" on page 39
To help you determine the type and number of disk drives to add to your storage unit, this section includes additional information.

Feature codes for disk enclosures

Use disk enclosure feature codes to order the disk enclosures for your storage unit.

Table 6 describes the feature codes.

Table 6. Disk enclosure feature codes

Feature Code	Description (See Note)	Models	Corequisite
1210	Disk enclosure pair	921, 922, 92E	For Model 92E, feature code 1020, Power module - second pair, also is required when the quantity of feature 1210 exceeds four.
1220	Disk enclosure pair–A locations	9A2, 9AE	For Model 9A2, feature code 1020, Power module - second pair, also is required when the quantity of feature 1220 and 1230 exceeds four in any combination
1230	Disk enclosure pair–B locations	9A2, 9AE	
Note:			
• The feature codes that apply to Models 9A2 and 9AE must be used for specific physical locations within the storage unit. The A locations support image 2, while the B locations support image 1.			

Disk drive power module

A disk drive power module second pair is required when more than 128 disk drives are installed.

Table 7. Power module - second pair

Feature Code	Description	Models	Corequisite
1020	Power module - second pair	92E	Required when the quantity of feature code 1210 exceeds four.
1020	Power module - second pair	9AE	Required when the quantity of feature codes 1220 and 1230 exceeds four in any combination.

Feature codes for disk drives

Use the disk drive feature codes to order the disk drive sets for your storage unit.

Each disk drive set provides 16 disk drives. Table 8 provides the various disk drive sets that you can order (based on disk size and rpm), and the feature codes to use.

Table 8. Disk drive set feature codes

Feature Code	Size and description of disk drive set (See Note.)	Disk speed in rpm (K = 1000)	DS8000 Models
2016	73 GB	15K	921, 922, 92E
2026	73 GB–A locations	15K	9A2, 9AE
2036	73 GB–B locations	15K	9A2, 9AE
2116	146 GB	10K	921, 922, 92E
2126	146 GB–A locations	10K	9A2, 9AE
2136	146 GB–B locations	10K	9A2, 9AE
2316	300 GB	10K	921, 922, 92E
2326	300 GB–A locations	10K	9A2, 9AE
2336	300 GB–B locations	10K	9A2, 9AE
Note:			
• The feature codes that apply to Models 9A2 and 9AE must be used for specific physical locations within the storage unit. The A locations support image 2, while the B locations support image 1.			

Standby CoD disk sets

You can use the IBM Standby Capacity On Demand (Standby CoD) offering by ordering Standby CoD disk sets.

A Standby CoD disk set contains 16 disk drives of the same capacity and rpm (10 000 or 15 000 rpm).

Related reference

"Configuration rules for Standby CoD disks" on page 38
Use the following configuration rules and ordering information to help you order and activate Standby Capacity On Demand (Standby CoD) disk drive sets.

Feature codes for Standby CoD disk drives

Use the Standby Capacity On Demand (Standby CoD) feature codes to order Standby CoD disk sets for your storage unit.

Each disk set feature provides 16 Standby CoD drives. Table 9 provides the various Standby CoD disk sets that you can order (based on disk size and rpm), and the feature codes to use.

Table 9. Feature codes for Standby CoD disk drive sets (16 disk drives per set)

Feature Code	Size and description of CoD disk drive set (See Note.)	Disk speed in rpm (K = 1000)	Models
2017	73 GB	15K	921, 922, 92E
2027	73 GB–A locations	15K	9A2, 9AE
2037	73 GB–B locations	15K	9A2, 9AE
2117	146 GB	10K	921, 922, 92E

Table 9. Feature codes for Standby CoD disk drive sets (16 disk drives per set) (continued)

Feature Code	Size and description of CoD disk drive set (See Note.)	Disk speed in rpm (K = 1000)	Models
2127	146 GB–A locations	10K	9A2, 9AE
2137	146 GB–B locations	10K	9A2, 9AE
2317	300 GB	10K	921, 922, 92E
2327	300 GB–A locations	10K	9A2, 9AE
2337	300 GB–B locations	10K	9A2, 9AE
Note:			
• The feature codes that apply to Models 9A2 and 9AE must be used for specific physical locations within the storage unit. The A locations support image 2, while the B locations support image 1.			

Disk enclosure fillers

Disk enclosure fillers fill empty disk drive slots in disk enclosures.

One disk enclosure filler feature provides a set of 16 disk enclosure fillers.

> **Related reference**
>
> "Configuration rules for storage features" on page 33
> Use the following general configuration rules and ordering information to help you order storage features.

Feature code for disk enclosure fillers

Use the disk enclosure filler feature code to order filler sets for the disk enclosure when you have one regular or Standby CoD disk feature in the enclosure.

A disk enclosure filler set includes 16 fillers. The following feature code can be used on all models.

2999   Disk enclosure filler set

Disk drive cables

You must order at least one disk cable set to connect the disk drives to the device adapters.

The disk drive cable feature provides you with a complete set of fibre-channel cables to connect all the disk drives that are supported by the model to their appropriate device adapters.

> **Related reference**
>
> "Configuration rules for storage features" on page 33
> Use the following general configuration rules and ordering information to help you order storage features.

Feature codes for disk drive cables

Use the disk drive cable feature codes to order the cable groups for each DS8000 model.

Table 10 on page 33 shows the feature codes to use and the connection type that is supported by each group.

Table 10. Disk drive cable feature codes

Feature Code	Disk Drive Cable Group	Connection Type
1211	Disk drive cable group 1	Connects the disk drives to the device adapters within the same base model. Can be used for Models 921, 922, and 9A2.
1212	Disk drive cable group 2	Connects the disk drives to the device adapters within the same expansion model. Used for Models 92E and 9AE when they are the first expansion unit (position 1 expansion unit) within the storage unit.
1213	Disk drive cable group 3	Connects the disk drives from a Model 92E to the device adapters in a Model 921.
1214	Disk drive cable group 4	Connects the disk drives from a second expansion unit (position 2 expansion unit) to the base model. Specifically connects the second Model 92E to the device adapters in the base Model 922, or connects the second Model 9AE to the device adapters in the base Model 9A2.

Configuration rules for storage features

Use the following general configuration rules and ordering information to help you order storage features.

You must order at least one disk enclosure feature for each model that you order, with the exception of a Model 9A2 which requires two disk enclosure features (one for each image).

Each disk enclosure feature must contain two of the following disk features:
* Regular disk drives
* Standby CoD disk drives
* Disk enclosure fillers

If the disk enclosure contains regular or Standby CoD disk drives, the disk drive features must be of the same capacity and speed.

Table 11 provides the minimum initial configuration and the maximum configuration for the disk enclosures and disk features in your storage unit.

Table 11. Minimum and maximum disk enclosures and disk drives for model

Model	Disk Enclosures (See Note 1.)		Disk Features (See Note 1.)	
	Minimum Number of Features	Maximum Number of Features	Minimum Number of Features (See Note 2 and 3.)	Maximum Number of Features (See Note 4.)
921	1	4	1	8
922	1	4	1	8
9A2	1 per image	2 per image	1 per image	4 per image
92E	none	8	none	16
9AE	none	4 per image	none	8 per image

Table 11. Minimum and maximum disk enclosures and disk drives for model (continued)

Model	Disk Enclosures (See Note 1.)		Disk Features (See Note 1.)	
	Minimum Number of Features	Maximum Number of Features	Minimum Number of Features (See Note 2 and 3.)	Maximum Number of Features (See Note 4.)
Notes:				

1. Keep in mind the following storage installation requirements when you plan your configuration:
 	
   • Storage features are installed starting at the top of the unit and working down. Once you have filled all the slots in that base or expansion unit, you can start installing storage features in the next expansion unit. No ¨gaps¨ are allowed.
 	
   • A Model 9A2 has A and B physical locations for disk enclosures and disk drive sets. Location A corresponds to image 2 and location B corresponds to image 1. When you increase the storage capacity for a particular image, you must install the disk enclosures and disk drive sets starting at the top open location for that image.				

2. Base models (Models 921, 922, and 92A) require that you have a minimum of one (1) regular disk drive feature installed on each image. Since Models 921 and 922 have only one image, they require one regular disk drive feature per machine. Since Model 9A2 has two images, you must have at least two regular disk drive features installed on the machine (one per image).				

3. A regular disk drive feature and a Standby CoD disk drive feature can be installed on the same storage unit by using the following rules:
 	
   • If a regular and a Standby CoD disk drive features are contained within the same disk enclosure feature, they must be the same type (capacity and speed).
 	
   • The maximum number of Standby CoD disk drive features that you can have on a storage unit is four.
 	
   • You must balance the number of Standby CoD disk drive features on the storage unit with regular disk drive features. Use the following rules:
 	
     – One Standby CoD feature requires a minimum quantity of two regular disk drive features.
 	
     – Two Standby CoD features requires a minimum quantity of four regular disk drive features.
 	
     – Three Standby CoD features requires a minimum quantity of four regular disk drive features.
 	
     – Four Standby CoD features requires a minimum quantity of eight regular disk drive features.				

4. Each disk enclosure feature can contain one disk enclosure filler feature, provided that the model meets the minimum requirement of regular disk drives. Any disk enclosure filler must be removed when regular disk drive or Standby CoD disk drive features are added to the model.				

Disk drive cable groups have the following configuration guidelines:

• The minimum number of disk drive cable group features for each model is one.

• The disk drive cable groups must be ordered as follows:

  – If the disk drives connect to device adapters within the same base model, order disk drive cable group 1.

  – If the disk drives connect to device adapters within the same expansion model, use disk drive cable group 2.

  – If the disk drives are in a Model 92E that is attached to a Model 921, order disk drive cable group 3.

– If the disk drives are in a second expansion unit (position 2 expansion unit), order disk drive cable group 4.

When you initially order Standby CoD disk drive features, you must sign a Standby CoD agreement. Each subsequent order for Standby CoD features requires a supplement to the agreement.

To activate Standby CoD disk drives (and exchange them for regular disk drives), you must order a feature exchange. This results in the removal of the Standby CoD feature and the addition of the corresponding regular disk drive feature of the same capacity and speed. The transaction is invoiced at the differential price between the features removed and added.

Configuration examples for storage features

Figure 7 shows valid and invalid configurations for disk drive set features. The top disk drive set and the bottom disk drive in the enclosure pair must be the same type (capacity and speed).

A Feature 2016 - 73 GB 15K drives
B Feature 2017 - 73 GB 15K CoD drives
C Feature 2116 - 146 GB 10K drives
D Feature 2216 - 300 GB 10K drives
E Feature 2999 - disk enclosure filler
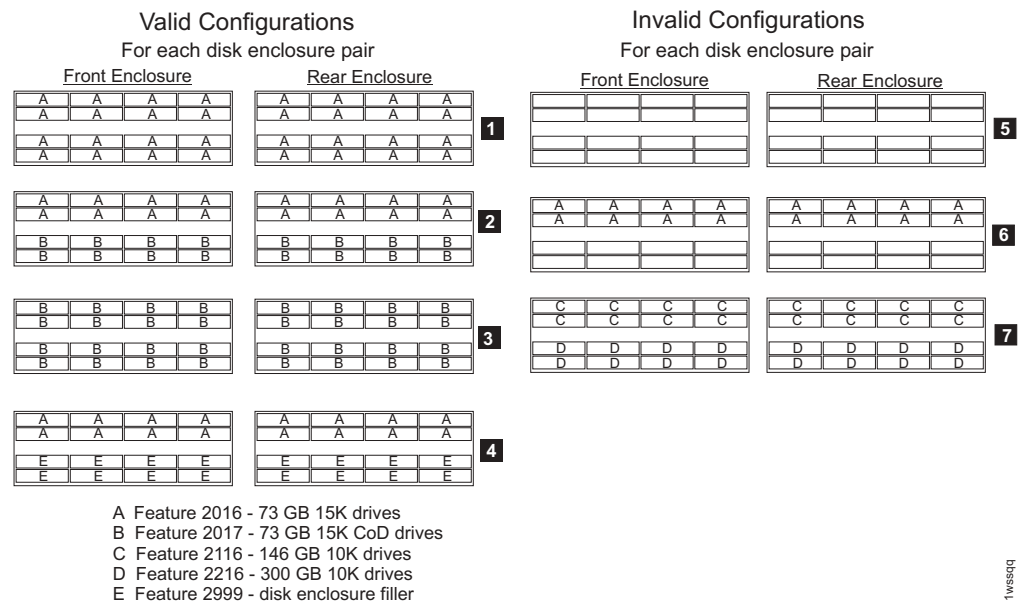
Figure 7. Valid and invalid disk drive feature configurations.

The illustrations on the left of Figure 7 (1 - 4) show valid configurations and the illustration on the right (5 - 7) show invalid configurations:

1. Two features of exactly the same type (capacity and speed) is valid.
2. One regular disk drive feature and one Standby CoD disk drive feature; both features of the same type is valid.
3. Two Standby CoD disk features of the same type is valid.
4. One regular disk drive feature and a filler feature is valid.
5. You cannot have an empty disk enclosure pair or a pair with two filler features.
6. You cannot have a disk enclosure pair that contains only one disk feature.
7. You cannot mix types of disk drive features.

Figure 8 on page 36 shows how storage features, such as disk enclosures, are installed from the top to the bottom of each base or expansion model. When a

model is filled, you can begin adding storage features to the next model in the storage unit.
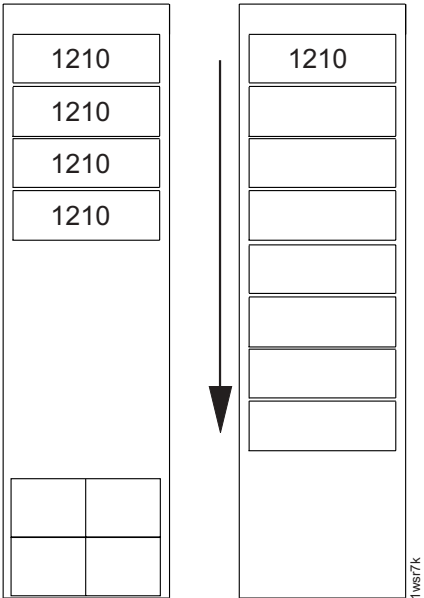
Figure 8. Storage features are installed from the top to the bottom of the model.

Figure 9 and Figure 10 on page 37 illustrate how 9A2 storage unit has A and B physical locations for storage features. For each location (A or B), you must install the storage features from the top to the bottom. For example, once all the A locations are filled on the model, you can start filling A locations on the next model within the storage unit.

In Figure 9, the images have the same storage capacity and have installed the same amount of disk enclosures.
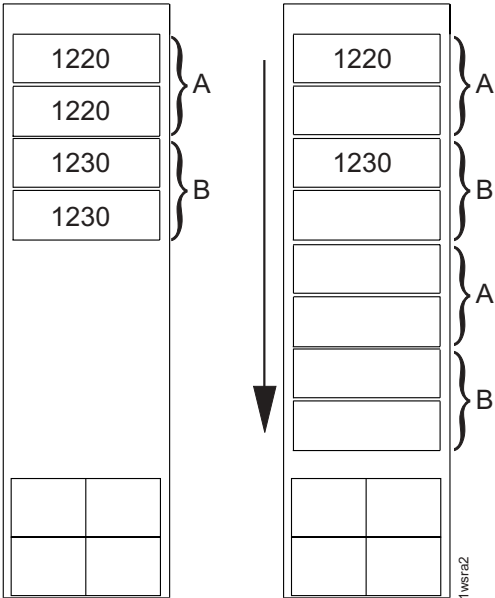
Figure 9. A Model 9A2 storage unit with equal storage capacity for both images. Physical locations A corresponds to image 2. Physical locations B corresponds to image 1.

In Figure 10, the images have a different amount of storage capacity. Image 1 (B physical locations) has filled all the B locations on the base model and the first expansion model. It has, therefore, started to fill in B locations in the second expansion model.
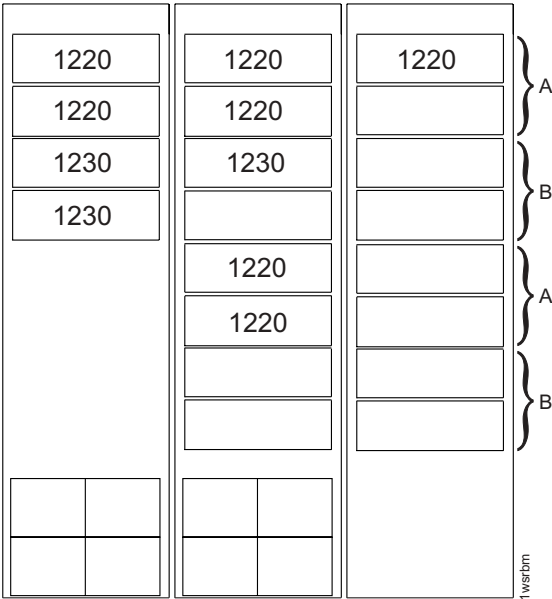
Figure 10. A Model 9A2 storage unit in which image 1 (physical locations B) has more storage capacity than image 2 (physical locations A).

Figure 11 shows how disk drive cable group 1 (1211) connects the disk drives to the device adapters within the same base model. Disk drive cable group 3 (1213) connects the disk drives from a Model 92E expansion unit to the device adapters in a Model 921 base unit.
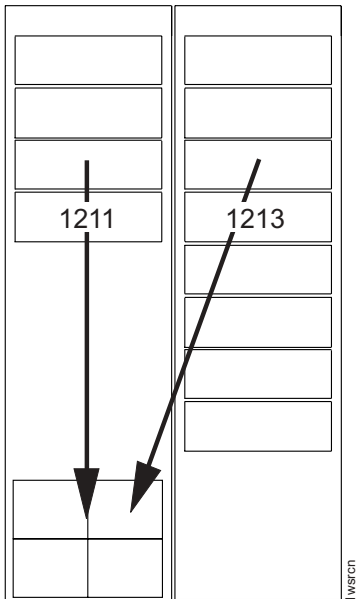
Figure 11. Disk drive cable group 1 (1211) and disk drive cable group 3 (2113) connections

Figure 12 on page 38 shows again how disk drive cable group 1 (1211) connects the disk drives to the device adapters within the same base model. Disk drive cable

group 2 (1212) connects the disk drives from the first expansion unit to the device adapters within its own unit. Disk drive cable group 4 (1214) connects the disk drives from the second expansion unit to the device adapters in the base unit. (I/O adapter features are not allowed on the second expansion unit within a storage unit, so the disk drives in the second expansion unit must connect back to the base unit.)
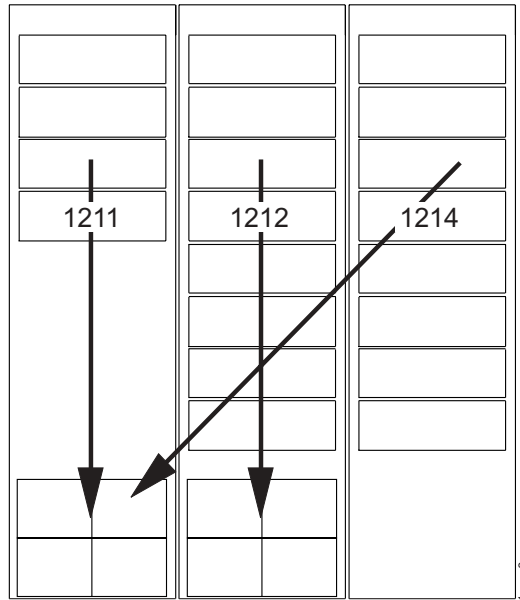
Figure 12. Disk drive cable group 1 (1211), disk drive cable group 2 (1212), and disk drive cable group 4 (1214) connections.

Configuration rules for Standby CoD disks

Use the following configuration rules and ordering information to help you order and activate Standby Capacity On Demand (Standby CoD) disk drive sets.

The following requirements apply:

- The storage unit in which the Standby CoD disk drives reside must use the IBM call home feature.
- Each 921 and 922 storage unit can have a maximum of four Standby CoD disk drive features that are installed at any one time.
- Each 9A2 storage unit can have a maximum of four Standby CoD disk drive features that are installed on each image.
- You must have twice as many regular disk drive features that are installed in the storage unit as there are Standby CoD disk drive features. For example, if you order two Standby CoD disk drive features (32 drives) for a storage unit, you must have at least four regular disk drive features (64 drives) on the storage unit.
- If you have one type of Standby CoD disk drive feature installed, you cannot order regular disk drive features of the same type without first activating (purchasing) the Standby CoD disk drives.

Standby CoD capacity must be activated within one year of purchase. When you activate Standby CoD capacity, you must order a feature conversion to convert the Standby CoD disk drive set feature to the corresponding regular disk drive set feature. You must activate all drives in the Standby CoD disk set at once. Once you activate Standby CoD disk drive features, the activation is permanent (once activated, disk capacity cannot be reduced).

Standby CoD disk drive sets are subject to the same intermix options and limitations as regular disk drive sets.

Additional storage feature information

To help you determine the type and number of disk drives to add to your storage unit, this section includes additional information.

The following additional information is provided:
- Calculating physical and effective capacity of disk drives

Calculating physical and effective capacity

To calculate the total physical capacity of a DS8000 storage unit, multiply each disk drive set feature by its total physical capacity and sum the values.

The logical configuration of your DS8000 series storage affects the effective capacity of the disk drive set.

Specifically, effective capacities depend on the following:
- Whether the physical capacity is logically configured as fixed block (FB) or count key data (CKD)

  Data for open systems must be logically configured as FB. Open systems hosts. Data for zSeries must be configured as count key data (CKD).
- How the arrays on the system are combined into ranks

  One or more arrays are combined to create a contiguous storage space called a rank. Each rank is divided into extents. The effective capacity for FB extents will be different than the capacity for CKD extents.

Table 12 describes the physical and effective capacity of a disk drive set (16 disk drives).

Table 12. Disk drive set capacity for open systems and zSeries environments

Disk size (GB)	Total physical capacity (GB) per disk drive set (See Note 1)	Fixed block (FB) or count key data (CKD)	Effective capacity in GB (Number of Extents) (See Notes 1, 2, and 3)			
			Ranks of RAID 10 arrays		Ranks of RAID 5 arrays (See Note 4)	
			3 x 3 (See Note 5)	4 x 4 (See Note 6)	6 + P (See Note 7)	7 + P (See Note 8)
73	1168	FB	206.16 (192) *	274.88 (256) *	414.46 (386) *	483.18 (450) *
		CKD	204.34 (216) *	272.45 (288) *	410.57 (434) *	479.62 (507) *
146	2336	FB	414.46 (386) *	557.27 (519)	836.44 (779)	976.03 (909)
		CKD	411.51 (435)	549.63 (581)	825.86 (873)	963.03 (1018)
300	4800	FB	842.96 (785) *	1125.28 (1048) *	1698.66 (1582)	1979.98 (1844)
		CKD	835.32 (883) *	1114.39 (1178) *	1675.38 (1771)	1954.45 (2066)

Table 12. Disk drive set capacity for open systems and zSeries environments (continued)

Disk size (GB)	Total physical capacity (GB) per disk drive set (See Note 1)	Fixed block (FB) or count key data (CKD)	Effective capacity in GB (Number of Extents) (See Notes 1, 2, and 3)			
			Ranks of RAID 10 arrays		Ranks of RAID 5 arrays (See Note 4)	
			3 x 3 (See Note 5)	4 x 4 (See Note 6)	6 + P (See Note 7)	7 + P (See Note 8)

Note:

1. Physical capacities are in decimal gigabytes (GB). One GB is one billion bytes.

2. Although disk drives sets contain 16 drives, arrays use only 8 drives. The effective capacity assumes that you have two arrays for each disk drive set.

3. Values that are calculated are marked with an asterisk (*).

4. In RAID 5 configurations, the parity information uses the capacity of one disk, but is actually distributed across all the disks within the array.

5. The array consists of 3 data drives that are mirrored to 3 copy drives. Two other drives in the disk drive set are used as spares.

6. The array consists of 4 data drives that are mirrored to 4 copy drives.

7. The array consists of 6 data drives and 1 parity drive. One other drive is used as a spare.

8. The array consists of 7 data drives and 1 parity drive.

I/O adapter features

You must select the I/O adapter features that you want on your DS8000 models.

The I/O adapter features are separated into the following categories:

- I/O enclosures
- Device adapters and cables
- Host adapters and cables

Related concepts

"Configuration rules for I/O adapter features" on page 46
To order I/O adapter features, you must follow specific configuration rules.

Related tasks

"Determining physical configuration features" on page 25
Use these steps as a general guideline for determining and then ordering the feature codes that you need to customize your storage unit.

I/O enclosures and cables

I/O enclosures are required for your storage unit configuration.

The I/O enclosures hold the I/O adapters and provide connectivity between the I/O adapters and the storage unit processors. I/O enclosures are ordered and installed in pairs.

The I/O adapters contained in the I/O enclosures can be either device or host adapters. Each I/O enclosure pair can support up to four device adapters (two pairs) and eight host adapters.

The I/O cables are RIO-G cables (Remote I/O cables) that provide the connection between the I/O enclosures and the base model processors.

Related concepts

"Configuration rules for I/O adapter features" on page 46
To order I/O adapter features, you must follow specific configuration rules.

Feature code for I/O enclosures

Use the following I/O enclosure feature code to order a minimum of two I/O enclosure pairs for your storage unit.

1300   I/O enclosure pair

Feature codes for I/O cables

Use these feature codes to order I/O cables for your storage unit.

Table 13 provides the I/O cable groups that you can order, a description of the connection that is provided by the group, the supported models, and the feature codes to use.

Table 13. I/O (RIO-G) cable feature codes

Feature Code	Cable Group	Description	Models
1312	RIO-G cable group 2	Connects device adapters in two I/O enclosure pairs on a Model 921 to the processor.	921
1313	RIO-G cable group 3	Connects device adapters in both I/O enclosure pairs on a Model 922 or a Model 9A2 to the processor.	922, 9A2
1314	RIO-G cable group 4	Connects device adapters in an I/O enclosure pair on a Model 92E to the processor on a Model 922.	92E
1315	RIO-G cable group 5	Connects device adapters in an I/O enclosure pair on a Model 9AE to the processor on a Model 9A2.	9AE
1316	RIO-G cable group 6	Connects device adapters in I/O pairs. (See Note)	922, 9A2

Note:

- Connects device adapters in both I/O enclosure pairs on a 922 or a 9A2 to the processor. Also connects device adapters in both I/O enclosure pairs on a 92E or a 9AE to the processor on a 922 or 9A2. Use this feature code instead of feature code 1313 when feature codes 0001 and 0221 are present. The first 92E or 9AE expansion unit is ordered as a factory merge with the 922 or 9A2.

Device adapters

Device adapters provide the connection between storage devices and the storage facility images through I/O ports.

Device adapters are ordered and installed in pairs. A device adapter pair supports two independent paths to all of the disk drives served by the pair. The two paths connect to two different network fabrics to provide fault tolerance and to help ensure availability. The physical links allow two read operations and two write operations to be performed simultaneously around the fabric.

Feature codes for device adapters

Use these feature codes to order device adapters for your storage unit.

Each device adapter feature includes a pair of (2) device adapters. Table 14 shows the feature codes to use and the applicable models for each feature code.

Table 14. Device adapter feature codes.

Feature Code	Device Adapter Types (See Note.)	Models
3011	Device adapter pair	921, 922, 92E
3021	Device adapter pair–A locations	9A2, 9AE
3031	Device adapter pair–B locations	9A2, 9AE
Note:		
• The feature codes that apply to Models 9A2 and 9AE must be used for specific physical locations within the storage unit. The A locations support image 2, while the B locations support image 1.		

Fibre-channel (SCSI-FCP and FICON) host adapters and cables

You can order fibre-channel host adapters for your storage unit configuration.

The fibre-channel host adapters enable the storage unit to attach to fibre-channel (SCSI-FCP) and FICON servers, and SAN fabric components. They are also used for remote mirror and copy control paths between DS8000 storage units or between a DS8000 storage unit and a DS6000 storage unit or a 2105 storage unit (Model 800 or 750). Fibre-channel host adapters are installed in an I/O enclosure.

The adapters have four ports and support 2Gb or 1Gb per second full-duplex data transfer over longwave or shortwave fibre links.

Supported protocols include the following:
• SCSI-FCP ULP (Upper Layer Protocol) on point-to-point, fabric, and arbitrated loop (private loop) topologies.
• FICON ULP on point-to-point and fabric topologies.

Note:

1. SCSI-FCP and FICON are supported simultaneously on the same adapter, but not on the same port.
2. For highest availability, it is recommended that adapters always be added in pairs.

A fibre-channel cable is required to attach each fibre channel adapter port to a server or fabric component port. Each cable has an Lucent connector (LC) at one end to attach to the fibre-channel adapter port. The cables are available with either an LC or standard connector (SC) at the other end to attach to the server or fabric component port. You can also order a conversion cable that can be used to attach the fibre-channel adapter port to a cable with an SC connector.

Related concepts

"Configuration rules for I/O adapter features" on page 46
To order I/O adapter features, you must follow specific configuration rules.

Related reference

"Host attachment communication requirements" on page 96
This list describes requirements and other considerations for connecting host attachments in your network.

Feature codes for fibre-channel host adapters

Use these feature codes when you order fibre-channel host adapters for your storage unit.

Table 15 provides a list of the types of fibre-channel adapters that you can order, their characteristics, and their feature codes.

Table 15. Fibre-channel host adapters feature codes

Feature Code	Description (See Note)	Model	Protocols	Link Speed	Receptacle Type
3111	Shortwave fibre-channel host adapter	921, 922, 92E	SCSI-FCP and FICON	2 Gb/second	LC
3121	Shortwave fibre-channel host adapter–A locations	9A2, 9AE	SCSI-FCP and FICON	2 Gb/second	LC
3131	Shortwave fibre-channel host adapter–B locations	9A2, 9AE	SCSI-FCP and FICON	2 Gb/second	LC
3211	Longwave fibre-channel host adapter	921, 922, 92E	SCSI-FCP and FICON	2 Gb/second	LC
3221	Longwave fibre-channel host adapter–A locations	Models 9A2, 9AE	SCSI-FCP and FICON	2 Gb/second	LC
3231	Longwave fibre-channel host adapter–B locations	Models 9A2, 9AE	SCSI-FCP and FICON	2 Gb/second	LC
Note:					
• Most feature codes that apply to Models 9A2 and 9AE must be used for specific physical locations within the storage unit. The A locations support image 2, while the B locations support image 1.					

Feature codes for fibre-channel cables

Use these feature codes when you order fibre-channel cables to connect fibre-channel host adapters to your storage unit.

Table 16 on page 44 provides the feature codes for the available fibre-channel cables.

Table 16. Fibre-channel cable feature codes

Feature Code	Cable Type	Connector Types		Length	Compatible Fibre-channel Host Adapter Features
		First End	**Second End**		
1410	50 micron fibre-channel cable, multimode	LC connector	LC connector	31 m (102 ft)	• Short wave fibre channel/ FICON host adapters (features 3111, 3121, and 3131) • Long wave fibre channel/ FICON adapters (features 3211, 3221, and 3231) only when the adapter is operating at a 1 Gb per second transfer rate
1411	50 micron fibre-channel cable, multimode	LC connector	SC connector	31 m (102 ft)	
1412	50 micron fibre-channel conversion cable, multimode	LC connector	SC receptacle	2 m (6.5 ft)	
1420	9 micron fibre-channel cable, single mode	LC connector	LC connector	31 m (102 ft)	• Long wave fibre channel/ FICON adapters (features 3211, 3221, and 3231)
1421	9 micron fibre-channel cable, single mode	LC connector	SC connector	31 m (102 ft)	
1422	9 micron fibre-channel conversion cable, single mode	LC connector	SC receptacle	2 m (6.5 ft)	

Note: Table information is for all DS8000 series models.

ESCON host adapters and cables

You can order ESCON host adapters for your storage unit configuration.

The ESCON host adapters enable DS8000 storage units to attach to ESCON channels on zSeries and S/390 servers, or ESCON directors. ESCON host adapter are installed in an I/O enclosure.

Note: Remote mirror and copy functions are not supported by ESCON adapters. If you use these functions, use Fibre-channel host adapters instead.

Each 64-bit ESCON host adapter has two ports. Each port supports two ESCON links and up to 64 logical paths (a total of 128 logical paths per adapter). The ports use a light emitting diode (LED) as the optical transceiver.

Note: For highest availability, it is recommended that adapters always be added in pairs.

Each ESCON host adapter port requires a 62.5-micron multimode fiber-optic ESCON cable to connect the ports to a server or fabric port. These cables have a small form factor, industry standard MT-RJ connector at one end for attachment to

the ESCON adapter port. The other cable end, which connects to the server or fabric port, can be either an MT-RJ or ESCON Duplex connector. You can also order a conversion cable that can be used to attach the ESCON adapter port to a cable with an ESCON Duplex connector.

Related concepts

"Configuration rules for I/O adapter features" on page 46
To order I/O adapter features, you must follow specific configuration rules.

Related reference

"Host attachment communication requirements" on page 96
This list describes requirements and other considerations for connecting host attachments in your network.

Feature codes for ESCON host adapters

Use these feature codes when you order ESCON host adapters for your storage unit.

Table 17 provides the host adapter feature codes to use, based on the model where the host adapter will be installed.

Table 17. ESCON host adapter feature codes

Feature Code	Description (See Note.)	Model
3311	ESCON host adapter	921, 922, 92E
3321	ESCON host adapter–A locations	9A2, 9AE
3331	ESCON host adapter–B locations	9A2, 9AE
Note:		
• The feature codes that apply to Models 9A2 and 9AE must be used for specific physical locations within the storage unit. The A locations support image 2, while the B locations support image 1.		

Feature codes for ESCON cables

Use these feature codes when you order ESCON cables to attach your ESCON host adapters to your storage unit.

Table 18 provides the ESCON cable feature codes.

Table 18. ESCON cable feature codes

Feature Code	Cable Type	Connector Types		Length	DS8000 Models
		First End	**Second End**		
1430	62.5 micron ESCON cable	MT-RJ connector	MT-RJ connector	31 m (102 ft)	All models
1431	62.5 micron ESCON cable	MT-RJ connector	ESCON Duplex connector	31 m (102 ft)	All models
1432	62.5 micron ESCON conversion cable	MT-RJ connector	ESCON Duplex receptacle	2 m (6.5 ft)	All models
1440	62.5 micron ESCON cable, plenum-rated	MT-RJ connector	MT-RJ connector	31 m (102 ft)	All models

Table 18. ESCON cable feature codes (continued)

Feature Code	Cable Type	Connector Types		Length	DS8000 Models
		First End	Second End		
1441	62.5 micron ESCON cable, plenum-rated	MT-RJ connector	ESCON Duplex connector	31 m (102 ft)	All models

Configuration rules for I/O adapter features

To order I/O adapter features, you must follow specific configuration rules.

The following configuration rules affect I/O adapter features:
- Configuration rules for I/O enclosures, I/O cables, and device adapters
- Configuration rules for host adapters and host adapter cables

Configuration rules for I/O enclosures, I/O cables, and device adapters

Use these configuration rules and ordering information to help you order I/O enclosures, I/O cables, and device adapters.

You must consider the entire storage system (base model and any attached expansion units) when you order.

Use Table 19 to determine the number of I/O enclosures and device adapters features that you need in various storage unit configurations. To use this table, find the rows that contain the type of storage unit you are configuring. Then find the row that represents the number of disk enclosures that are installed on that storage unit. Look in the last two columns to find the number of I/O enclosures and device adapters that you need on the storage unit.

Table 19. Required I/O enclosures and device adapters (based on disk enclosures)

Storage Unit Type	Storage Unit Configuration	Disk Enclosure Features (12x0)	Required Device Adapter Features (30x1) (Note 1 and 2)	Required I/O Enclosure Features (1300)
921 storage unit	Base model (standalone)	1 - 2	1	2
		3 - 4	2	2
	Base model +1 expansion model	5 - 6	3	2
		7 - 12	4	2

Table 19. Required I/O enclosures and device adapters (based on disk enclosures) (continued)

Storage Unit Type	Storage Unit Configuration	Disk Enclosure Features (12x0)	Required Device Adapter Features (30x1) (Note 1 and 2)	Required I/O Enclosure Features (1300)
922 storage unit	Base model (standalone)	1 - 2	1	2
		3 - 4	2	2
	Base model +1 expansion model	5 - 6	3 (2 in base model; 1 in first expansion model)	4 (2 in base model; 2 in first expansion model)
		7 - 8	4 (2 in base model; 2 in first expansion model)	4 (2 in base model; 2 in first expansion model)
		9 - 10	5 (2 in base model; 3 in first expansion model)	4 (2 in base model; 2 in first expansion model)
		11 - 12	6 (2 in base model; 4 in first expansion model)	4 (2 in base model; 2 in first expansion model)
	Base model +2 expansion models	13 - 14	7 (3 in base model; 4 in first expansion model)	4 (2 in base model; 2 in first expansion model)
		15 - 20	8 (4 in base model; 4 in first expansion model)	4 (2 in base model; 2 in first expansion model)
9A2 storage unit -A locations	Base model (standalone)	1 - 2	1	2
	Base model +1 expansion model	3 - 4	2 (1 in base model; 1 in first expansion model)	2 (1 in base model; 1 in first expansion model)
		5 - 6	3 (1 in base model; 2 in first expansion model)	2 (1 in base model; 1 in first expansion model)
	Base model +2 expansion models	7 - 10	4 (2 in base model; 2 in first expansion model)	2 (1 in base model; 1 in first expansion model)

Table 19. Required I/O enclosures and device adapters (based on disk enclosures) (continued)

Storage Unit Type	Storage Unit Configuration	Disk Enclosure Features (12x0)	Required Device Adapter Features (30x1) (Note 1 and 2)	Required I/O Enclosure Features (1300)
9A2 storage unit -B locations	Base model (standalone)	1 - 2	1	2
	Base model +1 expansion model	3 - 4	2 (1 in base model; 1 in first expansion model)	2 (1 in base model; 1 in first expansion model)
		5 - 6	3 (1 in base model; 2 in first expansion model)	2 (1 in base model; 1 in first expansion model)
	Base model +2 expansion models	7 - 10	4 (2 in base model; 2 in first expansion model)	2 (1 in base model; 1 in first expansion model)

Notes:

1. Each device adapter feature code represents one device adapter pair.
2. The maximum quantity is two device adapter features for each I/O enclosure feature in the storage unit .
3. Each I/O enclosure feature represents one I/O enclosure pair.

You must order I/O cables when you order one of the base models (921, 922, or 9A2).

I/O cables have the following configuration guidelines:
- You must order an I/O cable feature for every model that contains I/O enclosures.
- The I/O cable feature groups must be ordered as follows:
  - For each Model 921, order RIO-G cable group 2.
  - For each Model 922 or 9A2, order RIO-G cable group 3.
  - For each Model 92E that contains I/O enclosures, order RIO-G cable group 4.
  - For each Model 9AE that contains I/O enclosures, order RIO-G cable group 5.

Configuration rules for host adapters and cables

Use the following configuration rules and ordering information to help you order host adapters and cables.

You can include a combination of fibre-channel and ESCON host adapters in one I/O enclosure. Table 20 on page 49 provides the minimum and maximum numbers of host adapter features that each type of storage unit configuration can contain.

Table 20. Minimum and maximum host adapter features

Storage Unit Type	Storage Unit Configuration	Minimum Number of Host Adapter Features for the Base Model (See Notes 1 and 2)	Maximum Number of Host Adapter Features for the Storage Unit (See Notes 1, 2, 3)
921	Base model (stand-alone)	2	16
	Base model + 1 expansion model	2	16
922	Base model (stand-alone)	2	16
	Base model + 1 expansion model	2	32
	Base model + 2 expansion models	2	32
9A2	Base model (stand-alone)	4	16
	Base model + 1 expansion model	4	32
	Base model + 2 expansion models	4	32

Notes:

1. The minimum number of host adapters applies only to the base model within the storage unit. Expansion models have no minimum requirement. The maximum number applies to the entire storage system.

2. The first four (4) host adapters in a 9A2 storage unit are installed so they are balanced. For example, one image (LPAR) could have 2 ShortWave adapters and an open host with fixed-block data, and the second LPAR could have 2 LongWave adapters with 390/CKD data.

3. The maximum number of host adapters for any one model cannot exceed 16. Note that you can add host adapters only to the base model in a 921 storage unit.

After you have met the initial minimum order requirement, you can order one host adapter at a time. However, to ensure the highest availability of your data, always add host adapters (of the same type) in pairs.

Feature conversions are available to exchange installed adapters when purchasing new adapters of a different type.

Note: Although one 4-port adapter can provide redundant pathing, keep in mind that if you install only one 4-port adapter and if there is a failure or service action affecting that adapter, you will lose access to the data through that adapter.

For each host adapter, you must also order the appropriate host adapter cables. Typically, to connect fibre-channel host adapters to a server or fabric port, you order the following cables:

- For shortwave fibre-channel host adapters, order one of the 50 micron multimode fiber-optic cables terminated with an LC connector.
- For longwave fibre-channel host adapters, you can order either the 9 micron singlemode that is terminated with an LC connector or one of the 50 micron multimode fiber-optic cables terminated with an LC connector. Only the 9 micron cable is supported when the adapter feature is operating at a 2 Gb per second transfer rate.

IBM Global Services Networking Services can provide assistance for any unique cabling and installation requirements.

Processor memory features

These features specify the amount of memory you want for the processors on your model.

Related concepts

"Processor memory" on page 15
The DS8100 Model 921 offers up to 128 GB of processor memory and the DS8300 Models 922 and 9A2 offer up to 256 GB of processor memory. The Non-Volatile Storage (NVS) scales to the selected processor memory size, which can also help optimize performance.

Related tasks

"Determining physical configuration features" on page 25
Use these steps as a general guideline for determining and then ordering the feature codes that you need to customize your storage unit.

Feature codes for processor memory

Use these feature codes when you order processor memory (cache) for your storage unit configuration.

Table 21 provides the processor memory feature codes for the DS8000 models.

Table 21. Processor memory feature codes

Feature Code	Description	Models
4001	16 GB processor memory	921
4002	32 GB processor memory	921
4003	64 GB processor memory	921
4004	128 GB processor memory	921
4102	32 GB processor memory	922, 9A2
4103	64 GB processor memory	922, 9A2
4104	128 GB processor memory	922, 9A2
4105	256 GB processor memory	922, 9A2

Configuration rules for processor memory

Use the following configuration rules and ordering information to help you order processor memory.

You must order one processor memory feature for the configuration of each base model (Models 921, 922, or 9A2).

You can select from 16 to 128 GB in processor memory for Model 921, and from 32 to 256 GB processor memory for Model 922 and Model 9A2.

Power features

You must specify the power features to include on your DS8000 models.

The power features are separated into the following categories:
- Power line cords
- Input voltage
- Battery assemblies

Related tasks

"Determining physical configuration features" on page 25
Use these steps as a general guideline for determining and then ordering the feature codes that you need to customize your storage unit.

Related reference

"Configuration rules for power features" on page 53
Use the following configuration rules and ordering information to help you order power features.

"Planning for power requirements" on page 79
You must select a DS8000 storage complex location that meets specific power requirements.

Power line cords

A pair of power line cords is required for each base or expansion model. (Power line cords are also known as power cable.)

Each power line cord feature provides two three-phase line cords to supply external power to the machine. These features can be used to order replacement line cords.

Related reference

"Configuration rules for power features" on page 53
Use the following configuration rules and ordering information to help you order power features.

"Power connector requirements" on page 82
Ensure that the site where you plan to install the DS8000 storage units meets the power connector requirements.

Feature codes for power line cords

Use these feature codes when you order power line cords for your base or expansion model. Each feature code represents two line cords.

Table 22 provides the power line cord feature codes and associated wire gauges for the DS8000 models.

Table 22. Power line cord feature codes

Feature Code	Power Line Cord Type	Wire Gauge
1090	Line cord pair for U.S., Canada, Latin America, and Asia Pacific	10 mm²
1091	Line cord pair for Europe, the Middle East, and Africa (EMEA)	6 mm²
1092	Line cord pair for Japan	10 mm²

Table 22. Power line cord feature codes (continued)

Feature Code	Power Line Cord Type	Wire Gauge
1093	Line cord pair for Chicago (U.S.)	10 mm²

Note: All cords are three-phase power cords.

Input voltage

Due to different power requirements across the world, you must specify the nominal AC voltage (phase to phase) that is supported by the power supply that is installed on the model.

This feature can be changed on an installed machine by submitting a Request for Price Quotation (RPQ).

Related reference

"Configuration rules for power features" on page 53
Use the following configuration rules and ordering information to help you order power features.

"Input voltage requirements" on page 81
When you plan for the power requirements of the DS8000, consider the input voltage requirements.

"Power outlet requirements" on page 81
Plan for the required power outlets when planning for the installation of your storage units.

Feature codes for input voltage

Use these feature codes when you specify the input voltage for your base or expansion model.

9090   AC input voltage: 200 V to 240 V

9091   AC input voltage: 380 V to 480 V

Battery assemblies

For any model that includes an I/O enclosure feature or an extended power line disturbance feature, you must order battery assembly features for it.

This feature provides a battery assembly to power the machine when the external power source is lost.

Related reference

"Extended power line disturbance" on page 54
The extended power line disturbance (PLD) feature allows your storage unit to be protected for several seconds, rather than only milliseconds, from a power line disturbance. This feature is optional for your storage unit configuration.

"Configuration rules for power features" on page 53
Use the following configuration rules and ordering information to help you order power features.

Feature codes for battery assemblies

Use this feature code to order battery assemblies for your base or expansion model.

The following feature codes applies to all models.

1050   Battery assembly

Configuration rules for power features

Use the following configuration rules and ordering information to help you order power features.

When you order power line cord features, the following rules apply:

- You must order a minimum of one line cord feature for each model. Each feature code represents a pair of power line cords (2 cords).
- You must select the power line cord that is appropriate to the geographic region where the storage unit is located.
- You must also specify the appropriate input voltage feature.

You must specify an input voltage feature each time you order a power line cord. Table 23 shows the input voltage feature code to select for each power line cord feature code.

Table 23. Corequisite power line cord and input voltage feature codes

Power Line Cord Feature Code		Corequisite Input Voltage Feature Code	
Feature code	Geographic region supported	Feature code	AC input voltage
1090	U.S., Canada, Latin America, and Asia Pacific	9090 (or 9091)	200 V to 240 V (or 380 V to 480 V)
1091	Europe, the Middle East, and Africa (EMEA)	9091	380 V to 480 V
1092	Japan	9090	200 V to 240 V
1093	Chicago (U.S.)	9090	200 V to 240 V

For battery assemblies, the following rules apply:

- You must order battery assembly features for each model that contains an I/O enclosure feature (feature 1300) or an extended PLD feature (feature 1055).
- On 921 base models, you must order two battery assembly features. (This is both the minimum and the maximum.)
- On 922 and 9A2 base models, you must order three battery assembly features. (This is both the minimum and the maximum.)
- There is no minimum order required for 92E and 9A2 expansion models, unless the expansion model contains an I/O enclosure feature or an extended PLD feature. If either of these features is installed, you must order three battery assembly features for the expansion model.

Other configuration features

This section includes information about the following other feature codes that you can specify to customize or to receive your DS8000 storage unit:

- Extended power line disturbance (PLD) option
- Remote zSeries power control option
- Shipping weight reduction option

   Related tasks

"Determining physical configuration features" on page 25
Use these steps as a general guideline for determining and then ordering the
feature codes that you need to customize your storage unit.

Extended power line disturbance

The extended power line disturbance (PLD) feature allows your storage unit to be
protected for several seconds, rather than only milliseconds, from a power line
disturbance. This feature is optional for your storage unit configuration.

Without the extended PLD feature, a standard DS8000 storage unit offers you
about 30 milliseconds of protection from power line disturbances. Adding this
feature increases your protection to between 17 and 50 seconds.

If you order the extended PLD feature for an expansion model, the expansion
model must contain three battery assemblies.

Related reference

"Feature codes for battery assemblies" on page 52
Use this feature code to order battery assemblies for your base or expansion
model.

Extended power line disturbance feature code

Use this feature code when you order the extended power line disturbance feature
for your storage unit.

You can order this feature with the following feature code:

1055   Extended power line disturbance (all models)

Remote zSeries power control

The optional remote zSeries power control feature adds a logic card that allows one
or more attached S/390 units to control the power on and power off sequences for
your storage unit.

When you use this feature, you must specify the **zSeries power control** setting in
the DS Storage Manager (running on the Management Console).

This feature includes the cables necessary to connect the logic card.

Related concepts

"Overview of DS8000 power controls" on page 80
The DS8000 provides power controls on the model racks and through the
Management Console.

Related reference

Appendix F, "Power control work sheet," on page 129
The power control work sheet allows you to specify the power mode for your
DS8000 storage unit.

Feature code for remote zSeries power control

Use this feature code when you order the remote zSeries power control feature for
your storage unit.

1000   Remote zSeries power control

Shipping weight reduction

The shipping weight reduction option allows you to receive delivery of a DS8000 model in multiple shipments.

If your site has delivery weight constraints, IBM offers a shipping weight reduction option that ensures the maximum shipping weight of the initial model shipment does not exceed 909 kg (2000 lb). The model weight is reduced by removing selected components, which will be shipped separately.

The IBM service representative installs the components that were shipped separately during the storage unit installation. This feature increases storage unit installation time, so order it only if it is required.

Shipping weight reduction feature code

Use this feature code when you order the shipping weight reduction option for a DS8000 model.

0200   This feature ensures that the maximum shipping weight of any DS8000 base model or expansion model does not exceed 909 kilograms (2000 lb) each. Packaging adds 120 kilograms (265 lb).

Chapter 3. Planning use of licensed functions

Licensed functions are the storage unit system operating system and functions. These include both required features and optional features.

Table 24 provides the licensed functions that are available on the DS8000 series:

Table 24. Licensed functions on the DS8000 series

Licensed Function	Description
Operation environment	• IBM TotalStorage DS Operating Environment
Point-in-time copy	• IBM TotalStorage FlashCopy
Remote mirror and copy	• IBM TotalStorage Metro Mirror • IBM TotalStorage Global Mirror • IBM TotalStorage Global Copy
Remote mirror for z/OS	• IBM TotalStorage z/OS Global Mirror
Parallel access volumes	• Parallel access volumes

Note: The extent of IBM authorization for licensed functions are purchased as 2244 machine function authorizations and the license functions are actually machine models. For example, the operating environment license (OEL) licensed function is listed as a 2244 Model OEL. The 2244 function authorization models and features are for billing purposes only.

Model 2244 function authorizations

To establish the extent of IBM authorization for a licensed function, you purchase a 2244 function authorization model by ordering a specific feature code that indicates the size, in terabytes (TB), of the extent of IBM authorization.

The Model 2244 function authorization size (or level) represents physical capacity, where one TB equals one trillion bytes. The total authorization level for a given licensed function is the sum of the TBs associated with all the purchased feature numbers.

Function authorizations are purchased for the DS8000 base model and they establish the authorization level for the entire storage unit (base model plus any expansion models). The 2244 Model OEL function (operating environment license) must be authorized for the full physical capacity of the storage unit. If the 2244 Model OEL is for a Model 9A2 storage unit, the function authorization must cover both images. When you order optional licensed functions, you purchase a license for a specific authorization level (a specific number of TBs) for the storage unit.

After you purchase the function authorizations, you manage and activate the functions through the following IBM Disk Storage Feature Activation (DSFA) Web site:

http://www.ibm.com/storage/dsfa

Licensed function indicators

Each licensed function indicator feature selected on a DS8000 (2107) base unit enables that function at the system level.

These features enable a licensed function subject to you applying a feature activation code made available by IBM. They are also used for maintenance billing purposes.

DS8000 Series Function Authorization (machine type 2244) feature numbers must be purchased to establish the extent of IBM authorization for the licensed function before the feature activation code is provided by IBM.

Note: You do not select these features for any attached 2107 expansion units in the storage unit.

Table 25 provides the appropriate licensed function indicators for each licensed function.

Table 25. Licensed function indicators

Licensed Function	IBM 2107 indicator feature number	IBM 2244 function authorization models and features
Operating environment	0700	Model OEL 70*xx*
Point in time copy	0720	Model PTC 72*xx*
Remote mirror and copy	0740	Model RMC 74*xx*
Remote mirror for z/OS	0760	Model RMZ 76*xx*
Parallel access volumes	0780	Model PAV 78*xx*

License scope

Licensed functions are activated and enforced within a defined license scope.

License scope refers to the following types of storage, and types of servers with which the function can be used:

Fixed block (FB)
   The function can be used only with data from fibre channel-attached servers.

Count key data (CKD)
   The function can be used only with data from FICON-attached servers.

Both FB and CKD (ALL)
   The function can be used with data from all attached servers.

Some licensed functions have multiple license scope options, while other functions have only a single license scope. Table 26 provides the license scope options for each licensed function.

Table 26. License scope for each DS8000 licensed function

Licensed Function	License Scope Options
Operating environment	ALL
Point-in-time copy	FB, CKD, or ALL

Table 26. License scope for each DS8000 licensed function (continued)

Licensed Function	License Scope Options
Remote mirror and copy	FB, CKD, or ALL
Remote mirror for z/OS	CKD
Parallel access volumes	CKD

You do not specify the license scope when you order function authorization feature numbers. Feature numbers establish only the extent of the IBM authorization (in terms of physical capacity), regardless of the storage type. However, if a licensed function has multiple license scope options, you must select a license scope when you initially retrieve the feature activation codes for your storage unit. This activity is performed using the Disk Storage Feature Activation (DSFA) Web site:

http://www.ibm.com/storage/dsfa

Note: Retrieving feature activation codes is part of managing and activating your licenses. Before you can logically configure your storage unit, you must first manage and activate your licenses.

At the DSFA Web site, you manage and activate the function authorizations on a per-image basis. Since Model 921 and 922 storage units contain only one image, your management and activation tasks actually apply to the entire storage unit. However, when you are managing or activating your Model 9A2 function authorization, the license scope can be different for each image. For example, if you purchase a 30 TB point-in-time function authorization (2244 Model PTC), you can choose to apply the entire 30 TB to one image or you can split the 30 TB as you want between the images. You can also select different license scope options for each image. You could select a license scope of FB for image 1 and a license scope of ALL for image 2. If your needs change later, you can go to the DSFA Web site and allocate your license scope differently between your images.

When you use the DSFA Web site to change the license scope after a licensed function has been activated, a new feature activation code is generated. When you install the new feature activation code into the machine, the function is activated and enforced using the newly selected license scope. Only an increase in the license scope (changing FB or CKD to ALL) is a nondisruptive activity. A lateral change (changing FB to CKD or changing CKD to FB) or a reduction of the license scope (changing ALL to FB or CKD) is a disruptive activity and requires a machine IML. On a Model 9A2, if the license scope change is disruptive, but affects only one image, you need to reboot only the affected image.

Related concepts

Chapter 7, "Managing and activating licenses," on page 105
Managing and activating licensed functions is your responsibility.

Ordering licensed functions

After you decide which licensed functions to use with your storage unit, you are ready to order the functions.

Licensed functions are purchased as DS8000 function authorizations (2244 Model function authorization) features. To order licensed functions, use the following general steps:

1. Order the operating environment license (OEL) features that support the total physical capacity of your storage unit.
2. Order optional licensed functions for your storage unit.

   Related concepts

   Chapter 7, "Managing and activating licenses," on page 105
   Managing and activating licensed functions is your responsibility.

Operating environment license (2244 Model OEL)

The operating environment model and features establish the extent of IBM authorization for the use of the IBM TotalStorage DS Operating Environment.

For every storage unit, you must order operating environment license (OEL). This operating environment license support function is called the 2244 Model OEL.The OEL licenses the operating environment and is based on the total physical capacity of the storage unit (base model plus any expansion models). It authorizes you to use the model configuration at a given capacity level. Once the OEL has been technically activated for the storage unit, you can configure the storage unit. Activating the OEL means that you have obtained the feature activation key from the DSFA Web site and entered it into the DS Storage Manager.

Related reference

"Ordering rules for licensed functions" on page 65
An operating environment license (OEL) is required for every DS8000 base unit (Models 921, 922, and 9A2). All other licensed functions are optional.

Feature codes for the operating environment license

You must order an operating environment license (OEL) feature for every storage unit.

Table 27 provides the feature codes for the operating environment license.

Table 27. Operating environment license feature codes

Feature code	Description	Models
7000	OEL—Inactive	921, 922, 9A2
7001	OEL—1 TB unit	921, 922, 9A2
7002	OEL—5 TB unit	921, 922, 9A2
7003	OEL—10 TB unit	921, 922, 9A2
7004	OEL—25 TB unit	921, 922, 9A2
7005	OEL—50 TB unit	921, 922, 9A2
7010	OEL—100 TB unit	921, 922, 9A2

Point-in-time copy function (2244 Model PTC)

The point-in-time copy licensed function model and features establish the extent of IBM authorization for the use of the point-in-time copy licensed function on your storage unit.

The following function is a point-in-time licensed function:

• IBM TotalStorage FlashCopy

   Related concepts

"FlashCopy" on page 19

The IBM TotalStorage FlashCopy feature provides a point-in-time copy capability for logical volumes. FlashCopy creates a physical point-in-time copy of the data, with minimal interruption to applications, and makes it possible to access immediately both the source and target copies.

Related reference

"Ordering rules for licensed functions" on page 65

An operating environment license (OEL) is required for every DS8000 base unit (Models 921, 922, and 9A2). All other licensed functions are optional.

Feature codes for point-in-time copy

When you order point-in-time copy functions, you specify the feature code that represents the physical capacity you want to authorize for the function.

You can combine feature codes to order the exact capacity that you need. For example, if you determine that you need 23 TB of point-in-time capacity, you can order two 7203 features and three 7200 features.

Note: If you have a 9A2 storage unit, you can later activate and manage the function authorization on a per-image basis. For example, if you ordered 23 TB, you could activate 10 TB on one image and 13 TB on the other image. You will activate your licenses on the IBM Disk Storage Feature Activation (DSFA) Web site after you receive the serial number for your ordered function authorization.

Table 28 provides the feature codes for the point-in-time copy function.

Note: When you currently have an active point-in-time feature and replace it with the inactive feature, you must later repurchase the feature if you decide to use it again. Instead, you can use the IBM Disk Storage Feature Activation (DSFA) Web site to change the assigned value from the current number of terabytes (TB) that you have now assigned to "0 TB". The latter method allows you use the function again by simply changing the value back to the level you have authorized for the function.

Table 28. Point-in-time copy (PTC) feature codes

Feature code	Description	Models
7200	PTC—Inactive	921, 922, 9A2
7201	PTC—1 TB unit	921, 922, 9A2
7202	PTC—5 TB unit	921, 922, 9A2
7203	PTC—10 TB unit	921, 922, 9A2
7204	PTC—25 TB unit	921, 922, 9A2
7205	PTC—50 TB unit	921, 922, 9A2
7210	PTC—100 TB unit	921, 922, 9A2

Remote mirror and copy functions (2244 Model RMC)

The remote mirror and copy licensed function model and features establish the extent of IBM authorization for the use of the remote mirror and copy licensed functions on your storage unit.

The following functions are remote mirror and copy licensed functions:

- Metro Mirror (Synchronous PPRC)
- Global Mirror (Asynchronous PPRC)
- Global Copy (PPRC Extended Distance)

   Related concepts

   "Copy Services" on page 16
   Copy Services is a collection of functions that provides disaster recovery, data migration, and data duplication functions. Copy Services runs on the IBM TotalStorage DS8000 storage unit and supports open systems and zSeries environments.

   Related reference

   "Ordering rules for licensed functions" on page 65
   An operating environment license (OEL) is required for every DS8000 base unit (Models 921, 922, and 9A2). All other licensed functions are optional.

Feature codes for remote mirror and copy

When you order remote mirror and copy functions, you specify the feature code that represents the physical capacity to authorize for the function.

You can combine feature codes to order the exact capacity that you need. For example, if you determine that you need a function authorization for 28 TB of remote mirror and copy capacity, you would order one 7404 feature and three 7401 features.

Note: If you have a 9A2 storage unit, you can later activate and manage the function authorization on a per-image basis. For example, if you ordered 28 TB, you could activate 10 TB on one image and 18 TB on the other image. You will activate your licenses on the IBM Disk Storage Feature Activation (DSFA) Web site after you receive the serial number for your ordered function authorization.

Table 29 provides the feature codes for the remote mirror and copy functions.

Note: When you currently have an active remote mirror and copy feature and replace it with the inactive feature, you must later repurchase the feature if you decide to use it again. Instead, you can use the IBM Disk Storage Feature Activation (DSFA) Web site to change the assigned value from the current number of terabytes (TB) that you have now assigned to "0 TB". The latter method allows you use the function again by simply changing the value back to the level you have authorized for the function.

Table 29. Remote mirror and copy (RMC) feature codes

Feature code	Description	Models
7400	RMC—Inactive	921, 922, 9A2
7401	RMC—1 TB unit	921, 922, 9A2
7402	RMC—5 TB unit	921, 922, 9A2
7403	RMC—10 TB unit	921, 922, 9A2
7404	RMC—25 TB unit	921, 922, 9A2
7405	RMC—50 TB unit	921, 922, 9A2
7410	RMC—100 TB unit	921, 922, 9A2

Remote mirror for z/OS (2244 Model RMZ)

The remote mirror for z/OS licensed function model and features establish the extent of IBM authorization for the use of the z/OS remote mirroring licensed function on your storage unit.

The following function is a z/OS remote mirroring licensed function:

- IBM TotalStorage z/OS Global Mirror

   Related concepts

   "Copy Services" on page 16
   Copy Services is a collection of functions that provides disaster recovery, data migration, and data duplication functions. Copy Services runs on the IBM TotalStorage DS8000 storage unit and supports open systems and zSeries environments.

   Related reference

   "Ordering rules for licensed functions" on page 65
   An operating environment license (OEL) is required for every DS8000 base unit (Models 921, 922, and 9A2). All other licensed functions are optional.

Feature codes for z/OS Global Mirror

When you order the z/OS Global Mirror function, you specify the feature code that represents the physical capacity to authorize for the function.

You can combine feature codes to order the exact capacity that you need. For example, if you determine that you need 30 TB of capacity, you would order one 7604 feature and one 7602 feature.

Note:

1. If you have a 9A2 storage unit, you can later activate and manage the function authorization on a per-image basis. For example, if you ordered 30 TB, you could activate 20 TB on one image and 10 TB on the other image. You will activate your licenses on the IBM Disk Storage Feature Activation (DSFA) Web site after you receive the serial number for your ordered function authorization.

2. When you currently have an active z/OS Global Mirror feature and replace it with the inactive feature, you must later repurchase the feature if you decide to use it again. Instead, you can use the IBM Disk Storage Feature Activation (DSFA) Web site to change the assigned value from the current number of terabytes (TB) that you have now assigned to "0 TB". The latter method allows you use the function again by simply changing the value back to the level you have authorized for the function.

Table 30 provides the feature codes for remote mirror for zSeries functions.

Table 30. Remote mirror for zSeries (RMZ) feature codes

Feature code	Description	Models
7600	RMZ—Inactive	921, 922, 9A2
7601	RMZ—1 TB unit	921, 922, 9A2
7602	RMZ—5 TB unit	921, 922, 9A2
7603	RMZ—10 TB unit	921, 922, 9A2
7604	RMZ—25 TB unit	921, 922, 9A2

Table 30. Remote mirror for zSeries (RMZ) feature codes (continued)

Feature code	Description	Models
7605	RMZ—50 TB unit	921, 922, 9A2
7610	RMZ—100 TB unit	921, 922, 9A2

Parallel access volumes (2244 Model PAV)

The parallel access volumes model and features establish the extent of IBM authorization for the use of the parallel access volumes licensed function.

Related concepts

"Parallel Access Volumes" on page 21
The use of parallel access volumes (PAVs) enables a single zSeries server to simultaneously process multiple I/O operations to the same logical volume, which can help to significantly reduce device queue delays. This is achieved by defining multiple addresses per volume.

Related reference

"Ordering rules for licensed functions" on page 65
An operating environment license (OEL) is required for every DS8000 base unit (Models 921, 922, and 9A2). All other licensed functions are optional.

Feature codes for parallel access volume

When you order the parallel access volume (PAV) function, you specify the feature code that represents the physical capacity allowed for the function.

A license is required for the total physical capacity in the storage unit that is configured as count key data.

Table 31 provides the feature codes for the PAV function.

Note: When you currently have an active PAV feature and replace it with the inactive feature, you must later repurchase the feature if you decide to use it again. Instead, you can use the IBM Disk Storage Feature Activation (DSFA) Web site to change the assigned value from the current number of terabytes (TB) that you have now assigned to "0 TB". The latter method allows you use the function again by simply changing the value back to the level you have authorized for the function.

Table 31. Parallel access volume (PAV) feature codes

Feature code	Description	Models
7800	PAV—Disable	921, 922, 9A2
7801	PAV—1 TB unit	921, 922, 9A2
7802	PAV—5 TB unit	921, 922, 9A2
7803	PAV—10 TB unit	921, 922, 9A2
7804	PAV—25 TB unit	921, 922, 9A2
7805	PAV—50 TB unit	921, 922, 9A2
7810	PAV—100 TB unit	921, 922, 9A2

Ordering rules for licensed functions

An operating environment license (OEL) is required for every DS8000 base unit (Models 921, 922, and 9A2). All other licensed functions are optional.

For all licensed functions, you can combine feature codes to order the exact capacity that you need. For example, if you determine that you need 23 TB of point-in-time capacity, you can order two 7203 features (10 TB each) and three 7200 features (1 TB each).

When you calculate physical capacity, consider the capacity across the entire storage unit, including the base model and any expansion models. To calculate the physical capacity, use Table 32 to determine the total size of each regular disk drive feature on your storage unit, and then add all the values.

Note: Standby CoD disk drive features do not count toward the physical capacity.

Table 32. Total physical capacity of each type of disk drive feature

Size of Disk Drives	Total Size of One Disk Drive Feature (16 Drives)
73 GB	1168 GB
146 GB	2336 GB
300 GB	4800 GB

Rules specific to 2244 Model OEL

The operating environment license (OEL) must cover the full physical capacity of your storage unit, which includes the physical capacity of any Model 92E or 9AE expansion frames within the storage unit. The license must cover both open systems data (fixed block data) and zSeries data (count key data). Standby CoD drives are not included in this calculation.

Note: Your storage unit cannot be logically configured until you have activated the OEL for it. Upon activation, disk drives can be logically configured up to the extent of the IBM OEL authorization level.

You can combine feature codes to order the exact capacity that you need. For example, if you determine that you need 23 TB of point-in-time capacity, you can order two 7203 features (10 TB each) and three 7200 features (1 TB each).

As you add additional disk drives to your storage unit, you must increase the OEL authorization level for the storage unit by purchasing additional 2244 Model OEL features. (Otherwise, you cannot logically configure the additional disk drives for use.)

When you activate Standby CoD disk drives, you must also increase the OEL authorization to cover the activated Standby CoD capacity.

Rules specific to optional licensed functions

The following ordering rules apply when you order point-in-time (PTC) licenses for FlashCopy or remote mirror and copy (RMC) licenses:
- If the function is used with only open systems data, a license is required for only the total physical capacity that is logically configured as fixed block (FB).

- If the function is used with only zSeries data, a license is required for only the total physical capacity that is logically configured as count key data (CKD).
- If the function is used for both open systems and zSeries data, a license is required for the total configured capacity.

The following ordering rules apply when you order remote mirror and copy (RMC) licenses:
- If the function is used with only open systems data, a license is required for only the total physical capacity that is logically configured as fixed block (FB).
- If the function is used with only zSeries data, a license is required for only the total physical capacity that is logically configured as count key data (CKD).
- If the function is used for both open systems and zSeries data, a license is required for the total configured capacity.
- You must use fibre-channel host adapters with remote mirror and copy functions. ESCON adapters do not support these functions. To see a current list of environments, configurations, networks, and products that support remote mirror and copy functions, click **Interoperability Matrix** at the following DS8000 web site:

  http://www.ibm.com/servers/storage/disk/ds8000/interop.html
- You must purchase features for both the source (primary) and target (secondary) DS8000 storage units.
- If you use Global Mirror, you must use the following additional rules:
  - A point-in-time copy function authorization (2244 Model PTC) must be purchased for the secondary storage unit.
  - If Global Mirror will be used during failback on the secondary storage unit, a point-in-time copy function authorization must also be purchased on the primary system.

The following ordering rule applies to remote mirror for z/OS (RMZ) licenses:
- A license is required for only the total physical capacity that is logically configured as count key data (CKD) volumes for use with zSeries servers.
- When failback from the secondary storage unit to the primary storage unit is required, the remote mirror for z/OS function authorization (2244 Model RMZ) must be purchased for both systems.

The following ordering rule applies to parallel access volumes (PAV):
- A license is required for only the total physical capacity that is logically configured as count key data (CKD) volumes for use with zSeries servers.

The initial enablement of any optional DS8000 licensed function is a concurrent activity (assuming the appropriate level of microcode is installed on the machine for the given function). The removal of a DS8000 licensed function to deactivate the function is a disruptive activity and requires a machine IML.

If you have an active optional function, and no longer want to use it, you can deactivate the function in one of the following ways:
- Order an inactive or disabled license and replace the active license activation key with the new inactive license activation key at the IBM Disk Storage Feature Activation (DSFA) Web site.
- Go to the DSFA Web site and change the assigned value from the current number of terabytes (TB) that you have now assigned to "0 TB". This, in effect,

makes the feature inactive. If you do this, you can later go back to DSFA and reactivate the feature up to the previously purchased level without having to repurchase the feature.

Regardless of which method is used, the deactivation of a licensed function is a disruptive activity and requires a machine IML (on Models 921 and 922) or a reboot of the affected image (on Model 9A2).

On a Model 9A2 storage unit, plan for each image separately when you order optional function licenses. For example, let's say that you order a remote mirror and copy, and you want to one image to be used only for zSeries data and the other image license to be used with both open systems and zSeries data. In this case, you must order a license the covers the following:

- The total physical capacity on image 1 that is logically configured as CKD
- The total physical capacity on image 2

Note: Although you don't need to specify how the license will be applied when you order, you must allocate the licenses to each image when you obtain your license keys on the IBM Disk Storage Feature Activation (DSFA) Web site.

Chapter 4. Meeting DS8000 delivery and installation requirements

Delivery and installation planning is your responsibility.

This chapter provides the following planning information for the delivery and installation of your DS8000 storage unit:

- Planning for delivery of your storage unit
- Planning the physical installation site
- Planning for power requirements
- Planning for network and communication requirements
- Energy savings

Delivery requirements

Before you receive your DS8000 shipment, ensure that you meet all delivery requirements.

The topics in this section will help you ensure that you select a site that meets all requirements.

Related concepts

Appendix A, "IBM-provided DS8000 equipment and documents," on page 111 These topics list the main equipment and documents that IBM ships with your DS8000 models.

Receiving delivery

The shipping carrier is responsible for delivering and unloading the DS8000 as close to its final destination as possible. You must ensure that your loading ramp and your receiving area can accommodate your DS8000 shipment.

Use the following steps to ensure that your receiving area and loading ramp can safely accommodate the delivery of your storage unit:

1. Find out the packaged weight and dimensions of the DS8000 container and other containers that you will receive.
2. Ensure that your loading dock, receiving area, and elevators can safely support the packaged weight and dimensions of the shipping containers.

   Note: You can order a weight-reduced shipment of a DS8000 model when a configured model exceeds the weight capability of the receiving area at your site.

3. To compensate for the weight of the DS8000 shipment, ensure that the loading ramp at your site does not exceed an angle of 10°. (See Figure 13 on page 70.)
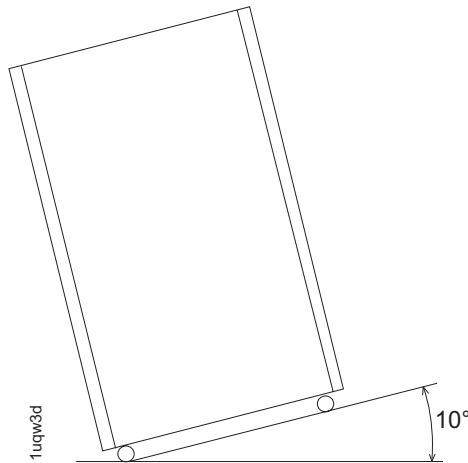
Figure 13. Maximum tilt for a packed unit is 10°

Shipment weights and dimensions

To help you plan for the delivery of your storage unit, you must ensure that your loading dock and receiving area can support the weight and dimensions of the packaged DS8000 shipments.

You receive at least two, and up to three, shipping containers for each DS8000 model that you order. You always receive the following items:

- A container with the DS8000 model. In People's Republic of China (including Hong Kong S.A.R. of China), India, and Brazil, this container is a wooden crate. In all other countries, this container is a pallet covered by a corrugated fiberboard (cardboard) cover.
- A container with the remaining ship group items, such as power cords, CDs, and other ordered features or peripherals for your model.

If ordered, you also receive the following container:

- A container with the external Management Consoles (MC).

Table 33 on page 71 shows the final packaged dimensions and maximum packaged weight of the storage unit shipments.

To calculate the weight of your total shipment, add the weight of each model container that you will receive and the weight of one ship group container for each model. If you ordered any external MCs, add the weight of those containers, as well.

Table 33. Packaged dimensions and weight for DS8000 models (all countries)

Shipping container	Packaged dimensions (in centimeters and inches)		Maximum packaged weight (in kilograms and pounds)
Model 921 pallet or crate	Height	207.5 cm (81.7 in.)	1309 kg (2886 lb)
	Width	101.5 cm (40 in.)	
	Depth	137.5 cm (54.2 in.)	
Model 922 pallet or crate	Height	207.5 cm (81.7 in.)	1368 kg (3016 lb)
	Width	101.5 cm (40 in.)	
	Depth	137.5 cm (54.2 in.)	
Model 9A2 pallet or crate	Height	207.5 cm (81.7 in.)	1368 kg (3016 lb)
	Width	101.5 cm (40 in.)	
	Depth	137.5 cm (54.2 in.)	
Model 92E (expansion unit) pallet or crate	Height	207.5 cm (81.7 in.)	1209 kg (2665 lb)
	Width	101.5 cm (40 in.)	
	Depth	137.5 cm (54.2 in.)	
Model 9AE (expansion unit) pallet or crate	Height	207.5 cm (81.7 in.)	1209 kg (2665 lb)
	Width	101.5 cm (40 in.)	
	Depth	137.5 cm (54.2 in.)	

Table 33. Packaged dimensions and weight for DS8000 models (all countries) (continued)

Shipping container	Packaged dimensions (in centimeters and inches)		Maximum packaged weight (in kilograms and pounds)
External MC container (If ordered)	**Height**	69.0 cm (27.2 in.)	75 kg (165 lb)
	Width	80.0 cm (31.5 in.)	
	Depth	120.0 cm (47.3 in.)	

CAUTION:
A fully configured model in the packaging can weigh over 1406 kg (3100 lb). Use of less than three persons to move it can result in injury.

Installation site requirements

You must ensure that the location where you plan to install your DS8000 storage units meets all requirements.

The topics in this section will help you ensure that you select a site that meets all requirements.

Planning for floor and space requirements

You must ensure that the location of your DS8000 storage units meets space and floor requirements.

When you are planning the location of your storage units, you must answer the following questions that relate to floor types, floor loads, and space:

- Will you install on a raised or nonraised floor?
- If the planned location has a raised floor, does the floor require preparation (such as cutting out tiles) to accommodate cable entry into the units?
- Does the floor of the location meet floor load requirements?
- Can the location accommodate the amount of space that is required by the storage units, and does the space size meet the following criteria?
  - Weight distribution area that is needed to meet floor load requirements
  - Service clearance requirements

Use the following steps to ensure that your planned installation location meets space and floor load requirements:

1. Identify the base models and expansion models that are included in your storage units. If your storage units use external Management Consoles (MCs), include the racks containing the external MCs.
2. Decide whether the storage units will be installed on a raised or nonraised floor.
   a. If the location has a raised floor, plan where the floor tiles must be cut to accommodate the cables.
   b. If the location has a nonraised floor, resolve any safety problems caused by the location of cable exits and routing.

3. Determine whether the floor of the location meets the floor load requirements for the storage units.
4. Calculate the amount of space that the storage units will use.
    a. Identify the total amount of space that is needed for the storage units using the dimensions of models and the weight distribution areas calculated in step 3.
    b. Ensure that the area around each stand-alone model and each storage unit meets the service clearance requirements.

Note: Any expansion units within the storage unit must be attached to the base model on the right side (as you face the front of the units).

Related reference
"DS8000 physical footprint" on page 6
The physical footprint dimensions, caster locations, and cable openings for a DS8000 unit help you plan your installation site.

Installing on raised or nonraised floors
You can install your DS8000 storage units on a raised or nonraised floor.

However, installing the models on a raised floor provides the following benefits:
- Improves operational efficiency and allows greater flexibility in the arrangement of equipment.
- Increases air circulation for better cooling.
- Protects the interconnecting cables and power receptacles.
- Prevents tripping hazards because cables can be routed underneath the raised floor.

When you install a raised floor, consider the following factors:
- The raised floor should be constructed of fire-resistant or noncombustible material.
- No metal or highly-conductive material that might be at ground potential should be exposed to the walking surface when a metallic raised floor structure is used. Such exposure is considered an electrical safety hazard.
- The raised floor height should be between 30.5 cm (12 in.) and 75.0 cm (30 in.). For processors with multiple channels, a minimum raised floor height of 45.7 cm (18 in.) is recommended. Clearance must be adequate to accommodate interconnecting cables, fibre-channel cable raceways, power distribution, and any piping that is present under the floor. Floors with greater raised floor heights allow for better equipment cooling.
- When a raised floor panel is cut for cable entry or air supply, an additional panel support (pedestal) might be required to restore the structural integrity of the panel to the above requirement.
- Protective covering (such as plywood, tempered masonite, or plyron panels) should be used to prevent damage to floor tiles, carpeting, and panels while equipment is being moved into or is relocated within the installation. When the equipment is moved, the dynamic load on the casters is significantly greater than when the equipment is stationary.
- Concrete subfloors require treatment to prevent the release of dust.
- Use noncombustible protective molding to eliminate sharp edges on all floor cutouts, to prevent damage to cables and hoses, and to prevent casters from rolling into the floor cutout.

- Seal raised floor cable openings to prevent chilled air that is not used to directly cool the equipment from escaping.
- Pedestals must be firmly attached to the structural (concrete) floor using an adhesive.

Accommodating cables

You must ensure that the location and dimensions of the cable cutouts for the models can be accommodated by the installation location.

Use the following steps to ensure that you prepare for cabling for each unit:

1. Based on your planned storage unit layout, ensure that you can accommodate the locations of the cables exiting each unit. See Figure 14 for the location of the cable cutouts.

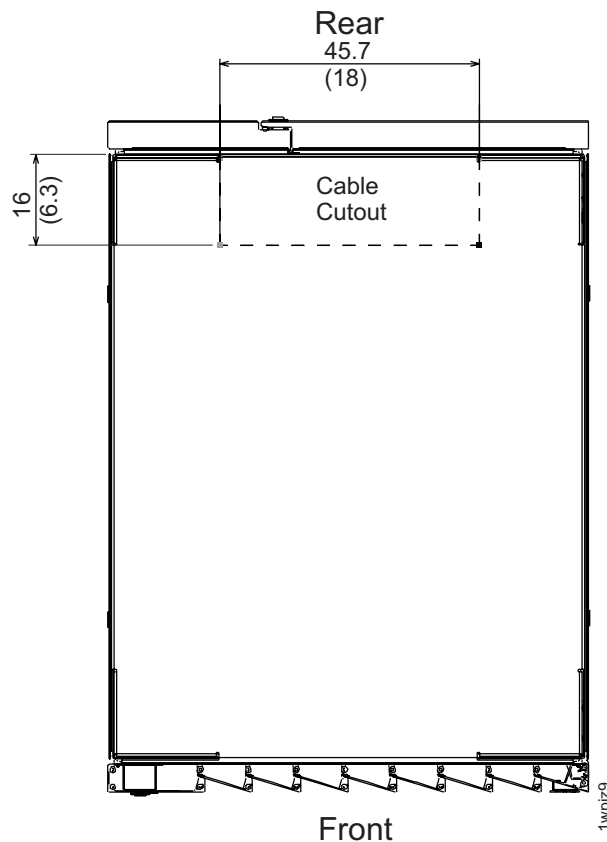*Figure 14. Cable cutouts for a DS8000 unit.*

2. If you install the storage units on a raised floor, use the following measurements when you cut the floor tile for the cabling:
   - Width: 45.7 cm (18.0 in.)
   - Depth: 16 cm (6.3 in.)

   Note: Raised floors are recommended. You can better support the cabling needed by the storage units, and you ensure more efficient cooling for your units.

Meeting floor load requirements

It is very important that your location meet floor load requirements.

Use the following steps to ensure that your location meets the floor load requirements and to determine the weight distribution area required for the floor load:

1. Find out the floor load rating of the location where you plan to install the storage units.

    Important: If you do not know or are not certain about the floor load rating of the installation site, be sure to check with the building engineer or another appropriate person.

2. Determine whether the floor load rating of the location meets the following requirements:
    *   The minimum floor load rating used by IBM is 342 kg per m² (70 lb per ft²).
    *   When you install a storage unit, which includes both base models and expansion models, the minimum floor load rating is 361 kg per m² (74 lb per ft²). At 342 kg per m² (70 lb per ft²), the side dimension for the weight distribution area exceeds the 76.2 cm (30 in.) allowed maximum.
    *   The per caster transferred weight to a raised floor panel is 450 kg (1000 lb).

3. Using Table 34, perform the following steps for each storage unit:
    a. Find the rows that are associated with the storage unit.
    b. Locate the configuration row that corresponds with the floor load rating of the site.
    c. Identify the weight distribution area needed for that storage unit and floor load rating.

Table 34. Floor load ratings and required weight distribution areas

Configuration of storage unit (Note 1)	Total weight of configuration (Note 2)	Floor Load Rating, kg per m² (lb per ft²)	Weight Distribution Areas (Notes 3, 4, and 5)		
			Sides cm (in.)	Front cm (in.)	Rear cm (in.)
Model 921 (base model only)	1189 kg (2620 lb)	610 (125)	2.5 (1)	76.2 (30)	76.2 (30)
		488 (100)	17.8 (7)	76.2 (30)	76.2 (30)
		439 (90)	28 (11)	76.2 (30)	76.2 (30)
		342 (70)	55.9 (22)	76.2 (30)	76.2 (30)
Model 921 and one 92E expansion model	2055 kg (4530 lb)	610 (125)	0 (0)	61.0 (24)	61.0 (24)
		488 (100)	15.3 (6)	76.2 (30)	76.2 (30)
		439 (90)	30.5 (12)	76.2 (30)	76.2 (30)
		342 (70)	Not recommended		
Model 922 (base model only)	1248 kg (2750 lb)	610 (125)	5.1 (2)	76.2 (30)	76.2 (30)
		488 (100)	20.3 (8)	76.2 (30)	76.2 (30)
		439 (90)	30.48 (12)	76.2 (30)	76.2 (30)
		342 (70)	61.0 (24)	76.2 (30)	76.2 (30)
Model 922 and one 92E expansion model	2336 kg (5150 lb)	610 (125)	2.6 (2)	76.2 (30)	76.2 (30)
		488 (100)	30.5 (12)	76.2 (30)	76.2 (30)
		439 (90)	48.3 (19)	76.2 (30)	76.2 (30)
		342 (70)	Not recommended		

Table 34. Floor load ratings and required weight distribution areas (continued)

Configuration of storage unit (Note 1)	Total weight of configuration (Note 2)	Floor Load Rating, kg per m² (lb per ft²)	Weight Distribution Areas (Notes 3, 4, and 5)		
			Sides cm (in.)	Front cm (in.)	Rear cm (in.)
Model 922 and two 92E expansion models	3,203 kg (7060 lb)	610 (125)	0 (0)	66.1 (26)	66.1 (26)
		488 (100)	30.5 (12)	76.2 (30)	76.2 (30)
		439 (90)	50.8 (20)	76.2 (30)	76.2 (30)
		342 (70)	Not recommended		
Model 9A2 (base model only)	1248 kg (2750 lb)	610 (125)	5.1 (2)	76.2 (30)	76.2 (30)
		488 (100)	20.3 (8)	76.2 (30)	76.2 (30)
		439 (90)	30.48 (12)	76.2 (30)	76.2 (30)
		342 (70)	61.0 (24)	76.2 (30)	76.2 (30)
Model 9A2 and one 9AE expansion model	2336 kg (5150 lb)	610 (125)	2.6 (2)	76.2 (30)	76.2 (30)
		488 (100)	30.5 (12)	76.2 (30)	76.2 (30)
		439 (90)	48.3 (19)	76.2 (30)	76.2 (30)
		342 (70)	Not recommended		
Model 9A2 and two 9AE expansion models	3,203 kg (7060 lb)	610 (125)	0 (0)	66.1 (26)	66.1 (26)
		488 (100)	30.5 (12)	76.2 (30)	76.2 (30)
		439 (90)	50.8 (20)	76.2 (30)	76.2 (30)
		342 (70)	Not recommended		

Notes:

1. A storage unit contains a base model and any expansion models associated with it.

2. The first expansion units for Models 922 and 9A2 can be fully-configured expansion units, which contain I/O enclosures. These expansion units are heavier and weigh 1089 kg (2400 lb). The expansion unit that attaches to a Model 921 and the second expansion units for Models 922 and 9A2 do not contain I/O enclosures. These lighter expansion units weigh 867 kg (1910 lb).

3. Weight distribution areas cannot overlap.

4. Weight distribution areas are calculated for maximum weight of the models.

5. The base and expansion models of each storage unit are bolted to each other with 5-cm (2-in.) spacers. Move one side cover and mounting brackets from the base model to the side of the expansion model. Side clearance for racks that are bolted together applies to both sides of the assembled racks.

Note: Consult a structural engineer if you are unsure about the correct placement and weight distribution areas for your units.

Calculating space requirements

When you planning the installation location, you must first calculate the total amount of space that is needed for the storage units. Use these steps to calculate enough space for your storage units.

1. Determine the dimensions of each model configuration in your storage units.

2. Calculate the total area that is needed for model configuration by adding the weight distribution area to the dimensions determined from Table 34 on page 75.

3. Determine the total space that is needed for the storage units by planning where you will place each model configuration in the storage units and how much area each configuration will need based on step 2 on page 76.
4. Verify that the planned space and layout also meets the service clearance requirements for each unit and system.

Dimensions and weight of individual models

When you are planning the floor and space requirements for your storage units, consider the dimensions and weights of the models that compose your storage units.

Table 35 provides the dimensions and weights of the DS8000 models.

Table 35. DS8000 dimensions and weights

Model	Dimensions (See Note 1.)		Maximum weight of fully-configured base models and expansion models (See Notes 2 and 3.)	Maximum weight of second expansion units (See Notes 2 and 4.)
Model 921	Height	193 cm (76 in.)	1189 kg (2620 lb)	(Not applicable)
	Width	84.7 cm (33.35 in.)		
	Depth	118.3 (46.6 in.)		
Model 922	Height	193 cm (76 in.)	1248 kg (2750 lb)	(Not applicable)
	Width	84.7 cm (33.35 in.)		
	Depth	118.3 (46.6 in.)		
Model 9A2	Height	193 cm (76 in.)	1248 kg (2750 lb)	(Not applicable)
	Width	84.7 cm (33.35 in.)		
	Depth	118.3 (46.6 in.)		
Model 92E (expansion unit)	Height	193 cm (76 in.)	1089 kg (2400 lb)	867 kg (1910 lb)
	Width	84.7 cm (33.35 in.)		
	Depth	118.3 (46.6 in.)		

Table 35. DS8000 dimensions and weights (continued)

Model	Dimensions (See Note 1.)		Maximum weight of fully-configured base models and expansion models (See Notes 2 and 3.)	Maximum weight of second expansion units (See Notes 2 and 4.)
Model 9AE (expansion unit)	**Height**	193 cm (76 in.)	1089 kg (2400 lb)	867 kg (1910 lb)
	Width	84.7 cm (33.35 in.)		
	Depth	118.3 (46.6 in.)		

Notes:

1. These dimensions include casters and covers. (The casters are recessed and do not require extra clearance.)

2. Weight is in kilograms (kg) and pounds (lb).

3. Use this column for all base models and for any expansions models that can be fully configured with I/O enclosures and adapters. Expansion models can be fully configured only if they attach to a 922 or 9A2 base model, and if they are the first expansion model attached. Any expansion model that attaches to a 921 base model and any second expansion model attached to a 922 or 9A2 base model cannot include I/O enclosures and adapters.

4. Use this column for the second expansion models attached to 922 or 9A2 base models.

Service clearance requirements

The service clearance area is the area around the storage unit that IBM service representatives need to service the unit.

For DS8000 models, IBM services representatives must open the front and rear covers to service the unit. Use the following minimum service clearances. (These dimensions are also shown on Figure 15 on page 79.)

- For the front of the unit, allow a minimum of 121.9 cm (48 in.) for the service clearance.
- For the rear of the unit, allow a minimum of 76.2 cm (30 in.) for the service clearance.
- For the sides of the unit, allow a minimum of 5.1 cm (2 in.) for the service clearance.
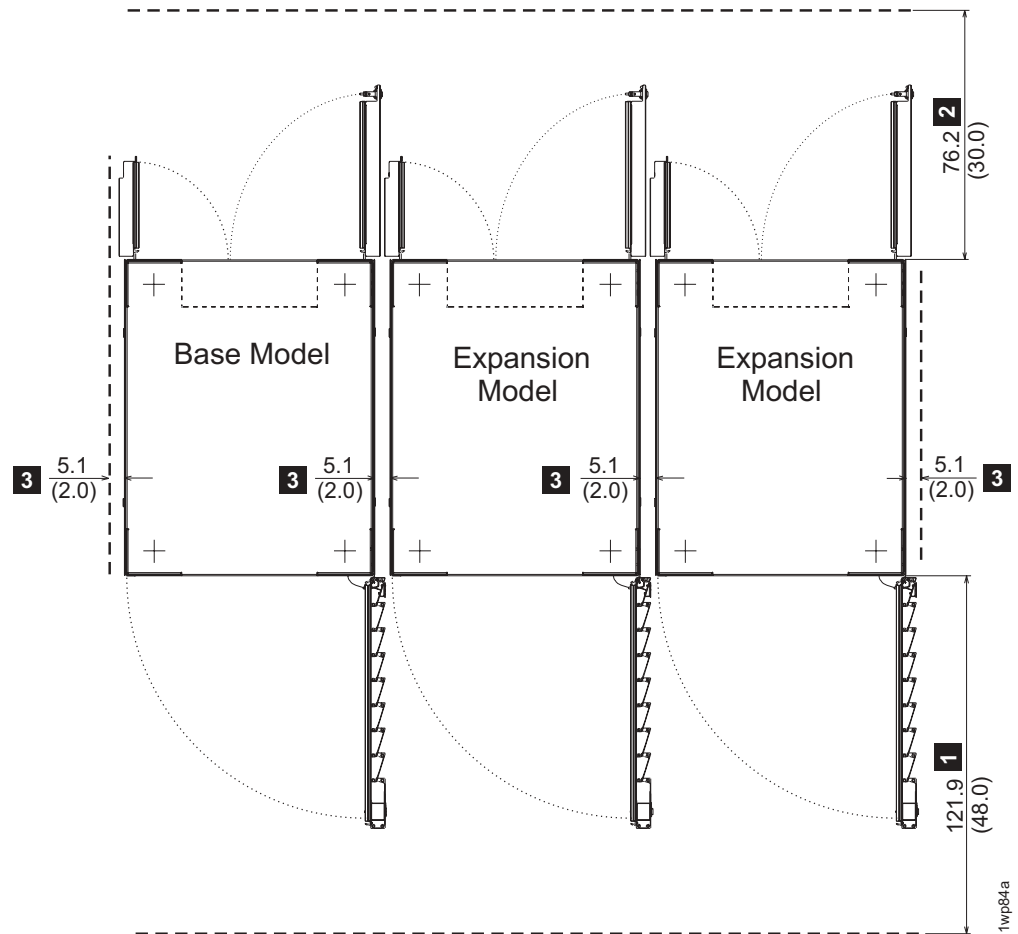
Figure 15. Service clearance requirements

Unlike weight distribution areas that are required to handle floor loading, keep in mind that service clearances of adjacent unrelated storage units can overlap.

Note: The terms service clearance and weight distribution area are often confused with each other. The service clearance is the area that is required to open the service covers and to pull out components for servicing. The weight distribution area is the area that is required to distribute the weight of the storage unit.

Planning for power requirements

You must select a DS8000 storage complex location that meets specific power requirements.

When you consider the DS8000 storage complex location, consider the following issues:

- Power control selections
- Power outlet requirements
- Input voltage requirements
- Power connector requirements
- Remote force power off switch requirements
- Power consumption and environment

IBM cannot install the DS8000 if your site does not meet these power requirements.

Overview of DS8000 power controls

The DS8000 provides power controls on the model racks and through the Management Console.

The DS8000 models have these following manual power controls in the form of physical switches on the racks:

- **Remote force power off (Remote FPO) switch**

  (Available on base models) The remote FPO switch causes the base model in the storage unit (which includes the base model plus any connected expansion models) to initiate a power off sequence that completes within five minutes. Use this switch only in the case where an emergency power off is required. During the power off sequence, the processors attempt to save any data held in memory so that it is not lost. However, once the unit completes the power off sequence, the storage unit powers off in less than five minutes, whether the data in the memory is completely saved or not. After the remote FPO switch is activated, you must deactivate this switch to restore power to the storage unit. This switch operates independently from the local/remote switch setting. When activated, this switch overrides all other power controls except the UEPO switch. **Planning requirements:** To use this feature, you must supply a remote force power off circuit.

- **Local/remote switch**

  (Available on base models) The local/remote switch setting determines whether you will use local or remote power controls. When you set the switch to local, the local power on/local force power off switch controls power in the storage unit. You can access this switch by opening the rear cover of the unit. When the local/remote switch is set to remote, the power for the storage unit is controlled by remote power control settings that are entered in the DS Storage Manager. **Planning requirements:** None.

- **Local power on/local force power off switch**

  (Available on base models) The local power on/local force power off switch initiates a storage unit power on sequence or a storage unit force power off sequence. This switch is applicable only when the local/remote switch is set to local. You can access this switch by opening the rear cover of the unit. **Planning requirements:** None.

- **Unit emergency power off switch**

  (Available on all models) *Use this switch only in extreme emergencies. Using this switch often results in data loss.* If activated, the unit emergency power off (UEPO) switch causes the individual model rack to immediately drop all power, including any power that is provided by the battery system. When active, this switch overrides all other power controls for the specific rack. This switch is located on the front of each model rack. **Planning requirements:** None.

You can use the following power controls through the DS Storage Manager (running on the Management Console):

- **Local power control mode**

  (Visible in the DS Storage Manager) You cannot change this setting in the DS Storage Manager. This mode is enabled when the local/remote switch on the storage unit is in the local position. When this setting is used, the local power on/local force power off switch on the storage unit controls the power. **Planning requirements:** None.

- **Remote power control mode**

(Visible in the DS Storage Manager) If you select the **Remote** power control mode, you choose one of the following remote mode options. **Planning requirements:** If you choose the **Remote zSeries Power Control** options, you must have the remote zSeries power control feature. There are no requirements for the other options.

– **Remote Management Console, Manual**: Your use of the DS Storage Manager power on/off page controls when the unit powers on and off.

– **Remote Management Console, Scheduled**: A schedule, which you set up, controls when the unit powers on and off.

– **Remote Management Console, Auto**: This setting applies only in situations in which input power is lost. In those situations, the unit powers on as soon as external power becomes available again.

– **Remote Auto/Scheduled**: A schedule, which you set up, controls when the unit powers on and off. A power on sequence is also initiated if the unit was powered off due to an external power loss during the time that the units are scheduled to be on and external power becomes available again.

– **Remote zSeries Power Control**: One or more attached zSeries units control the power on and power off sequences.

Related concepts

"Power control settings" on page 99
The power control work sheet enables you to select and control the various power modes for the storage complex.

Related reference

"Remote zSeries power control" on page 54
The optional remote zSeries power control feature adds a logic card that allows one or more attached S/390 units to control the power on and power off sequences for your storage unit.

Appendix F, "Power control work sheet," on page 129
The power control work sheet allows you to specify the power mode for your DS8000 storage unit.

"Connecting to a remote FPO room switch" on page 83
You can connect your DS8000 storage unit (base model plus any expansion models) to a room remote force power off (remote FPO) switch, which is used when a complete loss of external power is likely.

Power outlet requirements

Plan for the required power outlets when planning for the installation of your storage units.

The following power outlets are required:

- Two independent power outlets for the two DS8000 power line cords needed by each base model and expansion model.

    Important: To eliminate a single point of failure, the outlets must be independent. This means that each outlet must use a separate power source and each power source must have its own wall circuit breaker.

- Two outlets that are within 3.1 m (10 ft) of the external Management Console (MC). Typically, these outlets will be in a rack that you provide.

Input voltage requirements

When you plan for the power requirements of the DS8000, consider the input voltage requirements.

Table 36 provides the input voltages and frequencies that the DS8000 storage units support. Inputs are balanced three phase.

Note: The DS8000 storage units can support voltages that range from 200 V ac to 480 V ac nominal (180 V ac to 508 V ac).

Table 36. DS8000 input voltages and frequencies

Characteristic	Low Voltage (Feature 9090)	High voltage feature (Feature 9091)
Nominal input voltages	200, 208, 220, or 240 RMS V ac	380, 400, 415, or 480 RMS V ac
Nominal input current (3-ph)	30 Amps	15 Amps
Minimum input voltage	180 RMS V ac	333 RMS V ac
Maximum input voltage	264 RMS V ac	508 RMS V ac
Steady-state input frequencies	50 ± 3 or 60 ± 3.0 Hz	50 ± 3 or 60 ± 3.0 Hz
PLD input frequencies (<10 seconds)	50 ± 3 or 60 ± 3.0 Hz	50 ± 3 or 60 ± 3.0 Hz

Related reference

"Input voltage" on page 52
Due to different power requirements across the world, you must specify the nominal AC voltage (phase to phase) that is supported by the power supply that is installed on the model.

Power connector requirements

Ensure that the site where you plan to install the DS8000 storage units meets the power connector requirements.

Table 37 provides the power line cords and the inline connectors and receptacles types that they support. Find the power line cord row that is appropriate for your site and ensure that the site where you plan to install the DS8000 storage units meets the power connector requirements that are shown in that row.

Phase rotation on three-phase power-cable connectors is counterclockwise as you look at the power line cord plug. Phase rotation is clockwise as you look at the face of the power receptacle at your installation site.

Table 37. DS8000 power line cords

Power Line Cord Feature Code	Power Line Cord Description	Inline Connector	Receptacle
1090 (See Notes 1, 2, 3, 5, and 8.)	Line cord for U.S., Canada, LA, and AP: Three phase 50 or 60 Hz 60 amperes	7428-78	7324-78
1091 (See Note 1, 2, 5, and 9.)	Line cord for EMEA: Three phase 50 Hz 35 amperes	Not applicable	Hard-wired

Table 37. DS8000 power line cords (continued)

Power Line Cord Feature Code	Power Line Cord Description	Inline Connector	Receptacle
1092 (See Notes 1, 2, 4, 5, 7, and 8.)	Line cord for Japan: Three phase 50 or 60 Hz 60 amperes	HBL460C9W	HBL460R9W
1093 (See Notes 1, 2, 3, 6, and 8.)	Line cords for Chicago: Three phase 50 or 60 Hz 60 amperes	7428-78	7324-78

Note:

1. All power line cords are rated at 600 V ac, except line cords for Japan, which are 250 V ac. Each cord has 3 poles and 4 wires.

2. The conductor size for non-EMEA and Japan line cords is 6 awg. The conductor size for EMEA cords is 6 mm².

3. Connectors and receptacles are supplied by Russellstoll.

4. Preferred connectors and receptacles are supplied by Hubbell.

5. With the exception of the Chicago line cord, all line cords extend 4.2 m (14 ft.) from lowest point where they exit the frame to the mating face of the plug or bare leads.

6. Chicago line cords extend 1.8 m (6 ft.) from lowest point where they exit the frame to the mating face of the plug connector or bare leads.

7. The IEC309 receptacle must be installed in a metal-backed box with the green wire ground-connected to the grounding lug within the box. Ensure continuity between the box and the metallic shielding of the liquid-tight conduit.

8. Low-voltage, three-phase installations (200 - 240 V) require wall circuit breakers that have a rating of 50 to 60 A. Do not exceed the wire rating of the facility.

9. High-voltage, three-phase installations (380 - 480 V) require wall circuit breakers that have a rating of 30 to 35 A. Do not exceed the wire rating of the facility.

Amperage ratings of the power connector for the expansion unit must match the ratings that are used in the base model. For example, because a Model 922 uses a 60 A connector, any Model 92E expansion model that is attached to that base model must use a 60 A connector.

Connecting to a remote FPO room switch

You can connect your DS8000 storage unit (base model plus any expansion models) to a room remote force power off (remote FPO) switch, which is used when a complete loss of external power is likely.

Note: Use the remote FPO switch or remove power from the storage units only when an emergency power off is required. DS8000 storage units are designed to save data when the remote FPO switch is used or an external loss of power is detected.

If you set up a remote FPO switch at your installation location, the storage unit immediately initiates an emergency power off sequence that completes within five minutes when the remote FPO switch is activated. During the power off sequence, the processors attempt to save any data held in memory. The storage unit does not use its batteries to complete the power off sequence (as long as there is still power available). Instead the storage unit uses the available power to complete the

sequence. After the sequence completes, the storage unit enters a standby mode. The storage unit is not completely powered off in standby mode, but is ready for any full loss of power.

The remote FPO power off sequence is the same sequence used by DS8000 storage units whenever the rack power control (RPC) cards on the storage unit detect a full loss of power in the room. However, when you use a remote FPO switch, the storage unit can power back up almost as soon as the remote FPO switch is deactivated. This is because the batteries were never used for the emergency power off and they continue to be charged. Without the remote FPO, the storage unit must rely on its batteries to complete the power off sequence. This means that when power is available again, the storage unit must first recharge the batteries before it can fully power on.

Note: The DS8000 storage units maintain protection for any sudden data loss by requiring that the backup batteries are fully charged before you can use the storage unit again.

When you activate a remote FPO switch, this switch overrides all other power controls except the UEPO switch located on the storage unit rack.

When you set up a remote FPO switch, the switch and its cables must meet the following requirements:
- The remote FPO switch must consist of a parallel set of simple normally open contacts or switches (for example, a DPST switch) with a separate contact for each of the two RPC cards that are on the DS8000 base model within the storage unit.
- Two cables, which you supply, must connect the remote FPO switch to the RPC cards on the DS8000 base model. One cable attaches to the J216 receptacle on one RPC card and the other cable attaches to the J216 receptacle on the other RPC card. The cables must meet the following requirements:
    - The cables must have an RJ-45 plug at the end.
    - The cables must contain four conductors.
    - The cable must be shielded with the shield tied to the facility ground at the your connection.
    - The maximum resistance of the cable, connections, and contacts is 5 Ohms Maximum (~200' of #24 AWG).
    - It must have the pins shown on Table 38.

Table 38. Required pins for the remote force power off circuit

Pin number	Description	Type	Level
1	+5 V remote FPO send	Output	0 V to +5 V
2	+5 V remote FPO return	Input	0 V to +5 V
3	No connection	Ground	(not applicable)
4	No connection	Ground	(not applicable)
5	Frame ground	Frame ground	(not applicable)
6	Frame ground	Frame ground	(not applicable)
7	No connect	Reserved	(not applicable)
8	No connect	Reserved	(not applicable)

When you connect the cable to the remote force power off circuit, you connect the pins as follows:

- Connect pin 1 to one side of the contact or switch.
- Connect pin 2 to the other side of the contact or switch.
- Leave pins 3 or 4 unconnected.
- Connect the cable shield to pins 5 or 6, or to both.

Power consumption and environmental information

When you are planning to meet the power requirements for the DS8000, consider the power consumption and other environmental points of the storage unit.

Table 39 provides this power consumption and environmental information for the various DS8000 models.

Table 39. Power consumption and environmental information for the DS8000

Measurement	Units	Model 921	Model 922	Model 9A2	Expansion Models	
					Model 92E	Model 9AE
Peak electric power (See Note 1 on page 86.)	kilovolt amperes (kVA)	5.5	7.0	7.0	6.0	6.0
Thermal load	British thermal units (BTU) per hour	18 772	23 891	23 891	20 478	20 478
Capacity of exhaust	cubic meters per minute (cubic feet per minute or CFM)	32.5 (1150)	32.5 (1150)	32.5 (1150)	35.4 (1250)	35.4 (1250)
Ground leakage current	milliamperes (mA)	60	60	60	60	60
Startup current	amperes (A or amp)	<= 100	<= 100	<= 100	<= 100	<= 100
Startup current duration	microseconds (μs or μsec)	< 200	< 200	< 200	< 200	< 200
Idle and operating sound power level, LWAd (See Note 2 on page 86.)	A-weighted bels (B)	7.5	7.5	7.5	7.5	7.5

Table 39. Power consumption and environmental information for the DS8000 (continued)

Notes:
1. These power values represent data obtained during preliminary testing. These measurement represent the peak power usage by the models when they are configured as follows: • Base models (921, 922, and 9A2) that contain eight 146 GB disk drive sets (128 disk drives) and fibre-channel adapters. • Expansion models (92E and 9AE) that contain sixteen 146 GB disk drive sets (256 disk drives). 2. LWAd is the statistical upper-limit A-weighted sound power level, expressed in bels, declared in conformance with ISO 9296. The values correspond to DS8000 models that contain 128 disk drives. The values represent data obtained during preliminary testing. Bels relate to decibels (dB) as follows: *1 B = 10 dB*. The ratings are rounded to the nearest 0.1 B. Measurements are in conformance with ISO 7779.

Acoustic declaration for the DS8000 series

Table 40 describes the acoustic declaration information for the DS8000 series.

Table 40. Acoustic declaration for the DS8000 series

Product Description	Declared A-Weighted Sound Power Level, LWAd (B)		Declared A-Weighted Sound Pressure Level, LpAm (dB)	
	Operating	Idling	Operating	Idling
DS8000 with 128 hard disk drives	7.5	7.5	56	56
Note: • LWAd is the statistical upper-limit A-weighted sound power level (rounded to the nearest 0.1 B). • LpAm is the mean A-weighted emission sound pressure level measured at the 1-meter bystander positions (rounded to the nearest dB). • 10 dB (decibel) = 1 B (bel). • Preliminary data subject to change. • All measurements made in conformance with ISO 7779 and declared in conformance with ISO 9296.				

Planning for environmental requirements

You must install your storage unit in a location that meets the operating environment requirements to properly maintain your DS8000 storage unit.

Take the following steps to ensure that you meet these requirements:

1. Note where air intake locations are on the models that compose your storage unit.
2. Verify that you can meet the environmental operating requirements at the air intake locations.
3. Consider optimizing the air circulation and cooling for the storage unit by using a raised floor, adjusting the floor layout, and adding perforated tiles around the air intake areas.

Fans and air intake areas

The DS8000 models provide air circulation through various fans throughout the frame. You must maintain the correct operating environment requirements for your models at each air intake location.

Table 41 summarizes fan, intake, and exhaust locations.

Table 41. Machine fan location

DS8000 Fan Location	Machine Location	Intake Location	Exhaust Location
Lower part of machine	Lower	Front covers	Rear covers
Power complex	Left-side	Front covers	Rear covers
Disk drive section	Upper part of machine for base models; Upper 3/4 of the machine for expansion models	Front and rear covers	Top of machine

Operating environment requirements

You must meet specific operating environment requirements at all the air intake locations of your models.

The operating points vary depending on the state of the model. The models can be in the following states:

- Powered on
- Powered off
- In storage

  Related tasks

  "Cooling the storage complex" on page 88
  You can take steps to optimize the air circulation and cooling for your storage units.

Powered on:

Plan for the DS8000 operating ranges and recommended operating points when the storage unit is on.

Table 42 provides the operating ranges for your storage unit when the power is on.

Table 42. Operating extremes with the power on

Altitude	0 - 2133 m (0 - 7000 ft)
Dry bulb temperature	16 - 32°C (60 - 90°F)
Relative humidity	20 - 80%
Wet bulb temperature (maximum)	23°C (73°F)

Table 43 provides the operating points that IBM recommends for your storage unit with the power on.

Table 43. Recommended operating points with the power on

Temperature	22°C (72°F)
Relative humidity	45%

Table 44 provides the operating ranges that IBM recommends for a storage unit with the power on.

Table 44. Recommended operating ranges with the power on

Temperature	20 - 25°C (68 - 77°F)
Relative humidity	40 - 50%

Powered off:

Plan for the required DS8000 temperature and humidity ranges when the storage unit is off.

Table 45 provides the temperatures and humidity requirements for your storage unit when the power is off.

Table 45. Temperatures and humidity with the power off

Temperature	10 - 43°C (50 - 110°F)
Relative humidity	8 - 80%
Wet bulb temperature (maximum)	27°C (80°F)

In storage:

Plan for the required DS8000 temperature and humidity ranges when the storage unit is in storage.

Table 46 provides the temperatures and humidity requirements for storing your storage unit.

Table 46. Temperatures and humidity while in storage

Temperature	1 - 60°C (34 - 140°F)
Relative humidity	5 - 80%
Wet bulb temperature (maximum)	29°C (84°F)

Cooling the storage complex

You can take steps to optimize the air circulation and cooling for your storage units.

To optimize the cooling around your storage images, prepare the location of your storage images as recommended in the following steps.

1. Install the storage image on a raised floor. Although you can install the storage image on a non-raised floor, installing the storage image on a raised floor provides increased air circulation for better cooling.
2. Install perforated tiles in the front and back of each base model and expansion model as follows:
   a. For a standalone base model, install two fully perforated tiles in front of each base model and one partially perforated tile at the back of each base model, as shown in Figure 16 on page 89 in the single-machine examples (1 and 2 in the figure).
   b. For a row of machines, install a row of perforated tiles in front of the machines and one or two fully perforated tiles at the back of each two machines, as shown in Figure 16 on page 89 (3 and 4 in the figure).
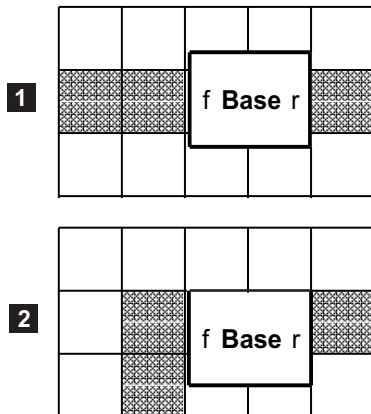
c. For groupings of machines, where a hot aisle/cold aisle layout is used, use a cold aisle row of perforated tiles in front of all machines. For hot aisles, install a perforated tile per pair of machines. A possible minimal configuration is shown in Figure 16 (5 in the figure).

Note: Keep in mind that the dimensions represented in Figure 16 might not be adequate for floor-load requirements.
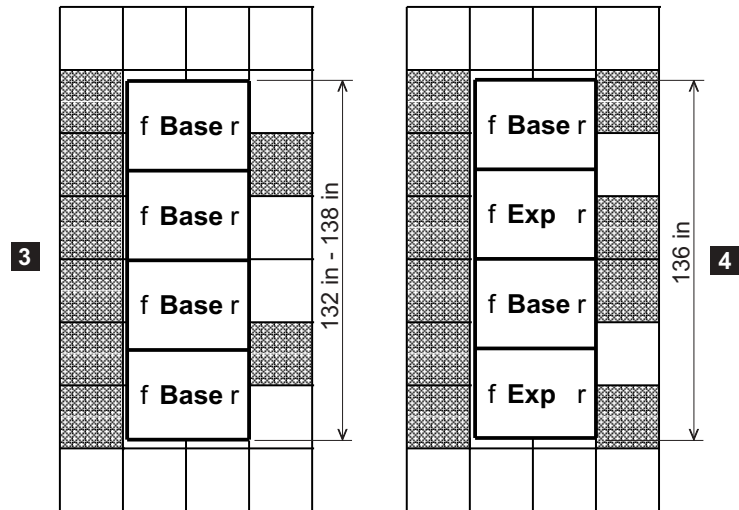
f = front   2 ft tile   2 ft perforated tile
r = rear

Single Machine - 2 examples   **Row of Machines - 2 examples**

Hot Aisle / Cold Aisle installation
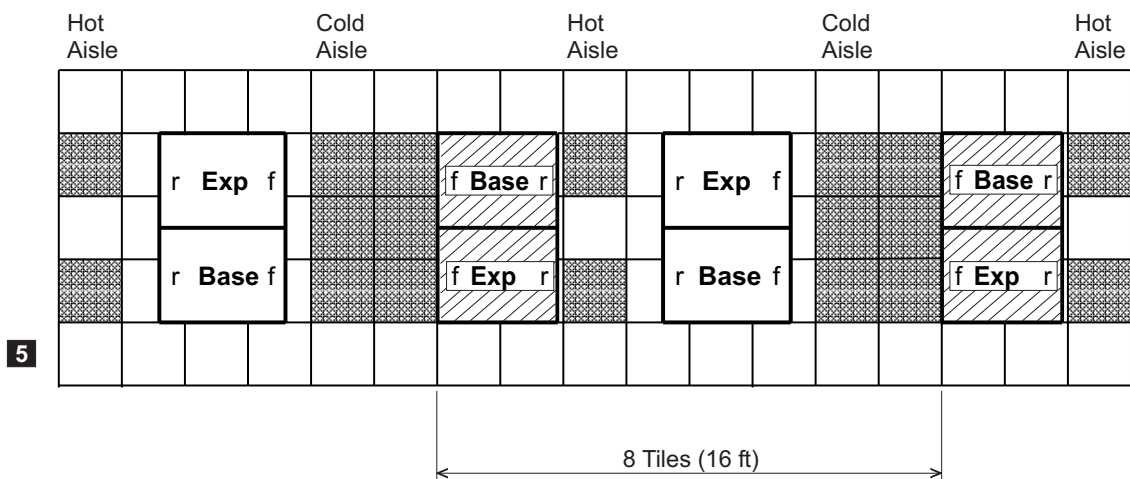
Figure 16. DS8000 layouts and tile setups for cooling

Related tasks

"Meeting floor load requirements" on page 75
It is very important that your location meet floor load requirements.

Related reference

"Service clearance requirements" on page 78
The service clearance area is the area around the storage unit that IBM service representatives need to service the unit.

Considering safety issues

You must consider various safety issues when you plan your DS8000 series location.

The following list identifies some of the safety issues you must consider:
- Fire suppression
- Earthquake safety

Providing a fire-suppression system

You are responsible for providing a fire suppression system for your DS8000 series.

IBM designs and manufactures equipment to internal and external standards that require certain environments for reliable operation. Because IBM does not test any equipment for compatibility with fire-suppression systems, IBM does not make compatibility claims of any kind. IBM does not provide recommendations on fire-suppression systems.

1. Consult your insurance underwriter, local fire marshal, or local building inspector about selecting a fire-suppression system that provides the proper level of coverage and protection.
2. See "Planning for environmental requirements" on page 86 for the temperature and cooling requirements for your DS8000 storage unit.

Considering earthquake preparedness alternatives

If you are installing your DS8000 series in an area that is prone to earthquakes, plan for special installation methods to minimize earthquake damage to your system.

An unsecured storage unit or expansion unit can topple or be thrown around during an earthquake. This places both the unit and your personnel in danger. To help prevent damage, restrain your storage unit using one of the following two methods:

Restraint method
> Allows some system movement and provides for both personnel safety and protection of your storage unit.

Hard mounting
> Physically attaches your system to the floor. This method increases the safety of personnel during an earthquake. However, it also causes the most damage to the storage unit because the unit absorbs most of the shock. IBM does not support hard mounting.

Hard mounting your storage unit:

If you decide to hard mount your storage unit (physically attach the unit to the floor), use these guidelines.

1. Take the following criteria into consideration when you hard mount the unit:

    Weight and dimensions of your storage unit
    > See "Dimensions and weight of individual models" on page 77.

Center of gravity

Based on rear side orientation, the center of gravity is estimated to be approximately 101.6 cm (40 in.) up from the floor.

Fundamental natural frequency

The measured vertical resonance frequency is 11.81 Hz, on top of a horizontal frame member adjacent to one of the casters.

Caster locations and cable openings

Four casters are located under each corner of the frame. Each caster is located as follows:

- 9.37 cm (3.7 in.) from the front or rear edge of the frame
- 8.55 cm (3.4 in.) from the side frame

The cable opening is centered in bottom, rear of the frame. The opening dimensions are as follows:

- 16 cm (6.3 in.) high
- 45.7 cm (18.0 in.) wide

2. Consider using the four M12 threaded holes on the underside of the model frame or expansion unit frame (see Figure 17 on page 92). IBM uses the holes to fasten the frame to shipping containers during shipment from the assembly factory to the installation site. You might use these holes to fasten the unit to the floor. Keep in mind that IBM has not performed any earthquake testing using any hard mounting method or the use of these holes to fasten a unit to the floor. Before you use these holes for earthquake stability, contact a registered structural engineer or earthquake consultant to review such use.

Figure 17. Underside of a DS8000 unit (dimensions are in mm)
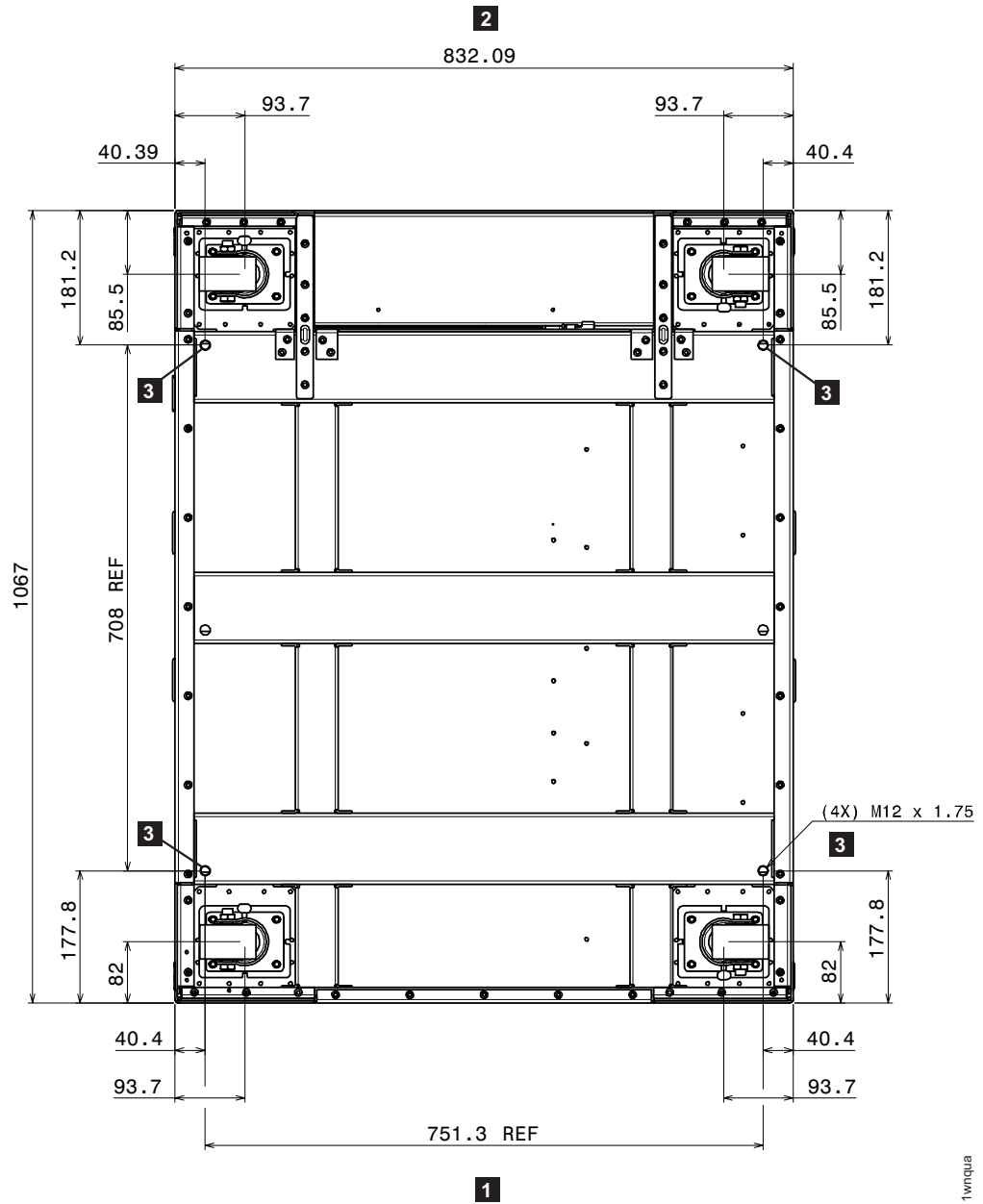
Legend:

- **1**: Front of the unit
- **2**: Rear of the unit
- **3**: Four M12 threaded holes

Planning for external Management Console installation

If you use an external Management Console (feature code 1110), you must plan for its installation.

IBM provides the power cables for the external Management Console (MC). You must provide the following for installation of the external MC:

- A location for the external MC that is within 15.2 m (50 ft) of the storage unit. The length of the various cables that interconnect the components dictates the distance of 15 m (50 ft) between components.
- A rack in which to mount the MC. This rack can be an IBM rack or a non-IBM rack, but it must meet specifications.
- Two outlets that are within 3.1 m (10 ft) of the external MC. Typically, these outlets will be in the rack that you provide. The outlets are used by the country-specific line cords that you select when you order the external MC.

Both the internal and external MCs are xSeries servers that have a monitor and a keyboard.

> **Related reference**
>
> "Internal and external Management Consoles" on page 26
> Management Consoles (MCs) are the focal point for configuration, copy services management, and maintenance for a DS8000 series.

Rack specifications for the external Management Consoles

The external Management Console (MC) is an xSeries 335 1U model that is designed to be installed in a 19-inch rack that can accommodate devices that are 711.1 mm (28 in) deep.

IBM racks that support the MC are racks such as the NetBAY42U ER and NetBAY42U SR. Installation into some of the older Netfinity racks (9306900, 9306910, 9306200) require a rack extension kit for proper cable bend radius and cooling.

If you install your external MC in a non-IBM rack, be sure the rack satisfies the required specifications. The following specifications are required for a non-IBM rack:

- The rack must meet EIA-310-D standards for mounting flanges and hole locations.
- The front to rear distance of the mounting flanges must be 720 mm (28.3 in.).
- The thickness of the mounting flanges must be between 1.9 and 3.3 mm (0.08 and 1.3 in.).
- The mounting flanges must have either 7.1-mm (0.28-in.) diameter holes or 9.6-mm (0.38-in.) square holes on the standard EIA hole spacing.
- The rack must have a minimum depth of 70 mm (2.76 in.) between the front mounting flange and inside of the front door for appropriate cooling.
- The rack must have a minimum depth of 157 mm (6.2 in.) between the rear mounting flange and inside of the rear door to install the external MC and provide cable management space.
- The minimum side-to-side clearance in the rack between the front and rear mounting flanges must be of 467 mm (18.2 in.) to accommodate the width of the server and the slide mounting brackets.
- The front edge of the keyboard/display tray is 19″ in width including the tabs for the front thumbscrews. To use the tray, it must be extended out fully on its rails. If the rack is equipped with front covers, ensure they are hinged in such a way that in their fully open position they allow the keyboard/display tray to be fully extended.
- The rack must include perforated front and rear doors and must not prevent the flow of cool air into or out of the rack.

- The weight-handling capacity of the rack must be able to support the maximum rack configuration, including all servers, external cables, PDUs, and so on.
- The rack must provide proper stabilization so that the rack does not become unstable when the external MC or other equipment are pulled out for use or for service.

   Related reference

   "Internal and external Management Consoles" on page 26
   Management Consoles (MCs) are the focal point for configuration, copy services management, and maintenance for a DS8000 series.

Planning for network and communications requirements

You must locate your DS8000 storage units in a location that meets the network and communications requirements.

Keep in mind the following network and communications issues when you plan the location and interoperability of your storage units:
- Management Console network requirements
- Remote support connection requirements
- Remote power control requirements
- Host attachment requirements
- SAN considerations

   Related concepts

   "Remote support connection requirements"
   You must meet the requirements for the modem and for an outside connection if you will use remote support.

   Related reference

   "Management Console network requirements"
   You must plan for the network requirements of the Management Console.

   "Host attachment communication requirements" on page 96
   This list describes requirements and other considerations for connecting host attachments in your network.

   "SAN requirements and considerations" on page 95
   These requirements and considerations can help you plan for a DS8000 series that attaches to a SAN.

   Related information

   "Remote power control requirements" on page 95
   Remote power control allows you to control the power of your storage complex through the DS Storage Manager (running on the Management Console).

Management Console network requirements

You must plan for the network requirements of the Management Console.

Each Management Console requires a dedicated connection to the network.

Note: If you will be accessing CLI or the Storage Manager and have a firewall between the Management Console and your network, you need to open the following TCP/IP ports prior to installation: 1718, 1720, 1722, 1750, 1755 and 8451-8455.

Remote support connection requirements

You must meet the requirements for the modem and for an outside connection if you will use remote support.

Your DS8000 Management Console (MC) contains a modem to take advantage of remote support, which can include outbound support (call home) or inbound support (remote service performed by an IBM next level support representative). For each MC, you must provide the following equipment close enough to the MC to support the modem connection:

- One analog telephone line for initial setup
- A telephone cable to connect the modem to a telephone jack

In order to enable remote support you must allow an external connection, such as one of the following:

- A telephone line
- An internet connection through your firewall that allows IBM to use a VPN connection to your MC

The DS8000 modems support worldwide use, and they meet all required standards.

Remote power control requirements

Remote power control allows you to control the power of your storage complex through the DS Storage Manager (running on the Management Console).

There are several settings for remote power control. Only the remote zSeries power control setting requires planning on your part.

The remote zSeries power control setting allows you to power on and off a room from one zSeries interface. If you use the remote zSeries power control setting, you must meet the following requirements:

- You must order the remote zSeries power control feature.
- You can allow up to four zSeries remote power-control interfaces.

See the *IBM TotalStorage DS8000 User's Guide* for additional information about DS8000 remote power control settings.

SAN requirements and considerations

These requirements and considerations can help you plan for a DS8000 series that attaches to a SAN.

A fibre-channel storage area network (SAN) is a specialized, high-speed network that attaches servers and storage devices. With a SAN, you can perform an any-to-any connection across the network using interconnect elements such as routers, gateways, hubs, and switches.

For a DS8000 series configuration, you can use SANs to attach storage unit disks and to attach hosts to the storage unit.

When you connect your DS8000 storage units to a SAN, you must meet the following requirements:

- When a SAN is used to attach both disks and hosts to the storage unit, any storage device that is managed by the storage unit must be visible to the host systems.
- When concurrent device adapters and I/O adapter operations are supported through the same I/O port, the SAN attached to the port must provide both host and device access.

- Fibre-channel I/O adapters must be configured to operate in a point-to-point mode fabric topology. See the *IBM TotalStorage DS8000 Host Systems Attachment Guide*, for more information.

You can also keep the following considerations in mind:
- Fibre-channel SANs can provide the capability to interconnect open systems and storage in the same network as S/390 and zSeries host systems and storage.
- A single fibre-channel I/O adapter can have physical access to multiple fibre-channel ports on the storage unit.

Host attachment communication requirements

This list describes requirements and other considerations for connecting host attachments in your network.
- You must use worldwide port names to uniquely identify fibre-channel adapter cards that are installed in your host system.
- For open-system hosts with fibre-channel adapters, keep in mind that fibre-channel architecture provides a variety of communication protocols. Each interconnected storage unit within the architecture is referred to as a node, and each host is also a node. Each node corresponds to one or more ports. (In the case of fibre-channel I/O adapters, these ports are fibre-channel ports.) Each port attaches to a serial-transmission medium that provides duplex communication with the node at the other end of the medium. You can configure your network structure based on one of three basic interconnection topologies (network structures):
  - Point-to-point
  - Switched fabric
  - Arbitrated loop

  See the *IBM TotalStorage DS8000 Host Systems Attachment Guide*, for more information about these supported topologies.
- The maximum distance between a host fibre-channel port and the following network components is 11 km (6 mi):
  - Fabric switches
  - Fabric hubs
  - Link extenders
  - Storage unit fibre-channel port

  The maximum distance might be greater than 11 km (6 mi) when a link extender provides target initiator functions or controller emulation functions.

  Note: Do not use link extenders with emulation functions on links over which remote mirror and copy operations are performed. This is because of the additional path delay that is introduced by these units.
- Because the fibre-channel architecture allows any fibre-channel initiator to access any fibre-channel device, without access restrictions, this can represent a security exposure. Have your IBM service representative set the fibre-channel access modes to the proper setting. See the *IBM TotalStorage DS8000 Host Systems Attachment Guide*, for more information about fibre-channel access modes.
- DS8000 storage units can connect to IBM SAN Volume Controller host systems. See the *IBM TotalStorage DS8000 Host Systems Attachment Guide* for more information.

Chapter 5. Planning your DS8000 storage complex setup

During installation, IBM customizes the setup of your storage complex based on information that you provide in the customization work sheets.

Each time you install a new storage unit or Management Console, you must complete the customization work sheets before the IBM service representatives can perform the installation.

The customization work sheets allow you to specify the initial setup for the following:
- Company information
- Management Console network settings
- Remote support (includes call home and remote service settings)
- Notifications (includes SNMP trap and e-mail notification settings)
- Power control
- Control Switch settings

Important: IBM service representatives cannot install a storage unit or Management Console until you provide them with the completed customization work sheets.

Company information

The company information work sheet allows you to specify any company information that enables IBM service personnel (or your service provider) to contact you as quickly as possible and to access your storage complex.

This information includes the following:
- General company information, such as company name and telephone number
- Administrator contact information
- Storage complex location and modem numbers

You must complete this work sheet for all installations that include an MC.

Related reference

Appendix B, "Company information work sheet," on page 113
This work sheet allows you to provide basic information about your company and administrator as well as general system information.

Management Console network settings

The Management Console network setting work sheet enables you to specify the IP address and LAN settings for your Management Console (MC).

The MC network settings include the following:
- MC network identification
- Ethernet settings, if you want the MC to connect to your LAN
- DNS settings, if you plan to use a domain name server to resolve network names
- Routings, if you want to specify a default gateway for routing

Note: IBM will attach your LAN after the storage complex is installed and in operation.

You must complete this work sheet for all installations that include an MC.

> **Related reference**
>
> Appendix C, "Management console network settings work sheet," on page 115
> This work sheet allows you to specify basic network information such as the management console identification, Ethernet settings, and DNS settings.

Remote support settings

The remote support work sheets enable you to specify whether you want outbound (call home) or inbound (remote services) remote support.

IBM recommends that you enable both outbound and inbound support to help you maintain the highest availability of your data.

When you enable outbound (call home) support, your Management Console sends an electronic call home record to IBM support when there is a problem within the storage complex. In the header of each call-home record, a call-back password appears. If inbound remote services is also enabled, this password enables IBM service representatives to remotely sign on to the Management Console in response to the service call. If outbound support is enabled, but inbound remote services is not enabled, the IBM service representative must physically come out to your location to troubleshoot and service the storage complex.

When inbound remote services are enabled, service representatives can perform service tasks remotely. They can view error logs and problem logs, and initiate trace or dump retrievals.

You must complete this work sheet for all installations that include an MC.

> **Related concepts**
>
> Appendix D, "Remote support work sheets," on page 119
> These work sheets allow you to specify the outbound (call home) and inbound (remote services) settings.

Notification settings

The notification work sheets allow you specify the types of notifications that you want you and others to receive.

Notifications contain information about your storage complex, such as serviceable events.

You can receive notifications through the following methods:

- Simple Network Management Protocol (SNMP) traps
- E-mail

You can choose one or both notification methods.

When you choose to have your storage complex generate Simple Network Management Protocol (SNMP) traps, you can monitor the storage complex over your network. You can control whether management information base (MIB)

information is accessible and what type of SNMP traps to send. You can also specify the maximum number of traps sent for each event and where to send the traps.

Note: If you have open-systems hosts and remote mirror and copy functions, you must enable SNMP notifications for status reporting.

When you choose to enable e-mail notifications, e-mail messages are sent to all the e-mail addresses that you specify on the work sheet when the storage complex encounters a serviceable event or must alert you to other information.

You must complete this work sheet for all installations that include an MC.

> **Related concepts**
>
> Appendix E, "Notification work sheets," on page 125
> These work sheets allow you to specify how you will be notified about serviceable events.

Power control settings

The power control work sheet enables you to select and control the various power modes for the storage complex.

If you use the remote zSeries power control feature, you must specify that on the power control work sheet, so the power mode can be set up to support that feature.

You can also specify whether power turns on and off automatically or uses a schedule. If you want to use a scheduled power mode, you must enter the schedule on the work sheet.

You must complete this work sheet for *all installations*.

> **Related reference**
>
> Appendix F, "Power control work sheet," on page 129
> The power control work sheet allows you to specify the power mode for your DS8000 storage unit.

Control switch settings

Control switch settings allow you to specify certain DS8000 settings that affect host connectivity. You are asked to enter these choices on the control switch settings work sheet so that the service representative can set them during the installation of your DS8000.

AS/400 LUN or iSeries serial number setting

Use this control switch setting when you attach more than one DS8000 to an AS/400 or iSeries host *and* the last 3 digits of the DS8000 serial number happen to be the same in each case. Setting this serial number is optional.

For example, the serial number for the first DS8000 is 2107-13-**14321** and the serial number for the second DS8000 is 2107-13-**15321**. Because the original LUN serial number is used for identification, the AS/400 does not use the second LUN. Specifying a new serial number base for the second DS8000 prevents this problem. IBM service personnel enters the control-switch setting for the new serial number base that you specify for this field.

Note: The probability of receiving two DS8000 with the same last three serial numbers is unlikely, but possible.

Fibre LUN access number settings

This control switch setting on the DS8000 determines whether hosts have access to all LUNs over fibre channels or whether access is restricted. Restricted access is based on the worldwide ID (WWID) of the adapter port in the host system. Access also depends on the logical configuration that is defined for that host port WWID.

Control-unit initiated reconfiguration (CUIR) settings

Control-unit initiated reconfiguration (CUIR) allows automation of channel path quiesce and resume actions during certain service actions. This eliminates the requirement for manual actions from the host. CUIR relies on a combination of host software and DS8000 firmware.

The CUIR setting on the control switch setting work sheet enables you to indicate whether this option can be enabled. The CUIR setting applies to IBM zSeries and S/390 environments only.

Chapter 6. Planning data migration

Use these data migration considerations to formulate your data migration plan.

There are three levels of considerations to keep in mind when selecting the best method for your environment. At the first level, you consider broad questions about your environment to create a generic profile of your needs. At the second level you compare which migration methods fit into your generic profile. The level is to review a set of hints and other guidelines that apply to specific environments or that may help you take advantage of a migration to optimize your environment.

The following are some key questions to use to define your generic migration environment
- Why is the data migrating?
- How much data is migrating?
- How quickly must the migration be performed?
- What duration of service outage can be tolerated?
- Is the data migration to/from the same type storage?
- What resources are available for the migration?

If you will be performing any of the following, you might need to allow for more time or resources:
- Creating new logical volumes or file systems
- Modifying configuration files
- Receiving integrity checks

After determining general answers to the considerations listed above, a better understanding of some of the migration options along with their advantages and disadvantages will help frame your generic profile into a subset of acceptable migration options. Table 47 compares the data migration options.

Table 47. Comparison of data migration options

Type	Example	Advantages	Disadvantages
OS / LVM Mirroring	Logical Volume Managers, (LVM) Veritas Volume Manager (VxVM), Windows Disk Administrator	Little or no application service disruption	Potential application delays
UNIX or Windows Commands	cpio, cplv, dd, tar, backup restore; copy, scopy, xcopy, drag and drop	Common, easy to use, tested	Length of service interruption varies; scripting prone to errors and additional testing
Remote Copy	Synchronous Mirror (Metro Mirror); Asynchronous Mirroring (Global Mirror and Global Copy)	Operating system independent	Like storage device types needed
Third party software packages	Data Migration (Softek, XoSoft); Backup /Restore (Tivoli, Legato, Veritas)	Some have little application service interruption, standard utilities	Cost of software; some have high application service interruption

Table 47. Comparison of data migration options (continued)

Type	Example	Advantages	Disadvantages
Third party migration appliances	IGS Piper Service Offerings, IBM San Volume Controller, DataCore SANsymphony	Multiple heterogeneous storage venders supported; migration cycles offloaded to appliance	Cost of migration appliance / service, application disruption to install / remove appliance

Besides these two sets of general considerations, there are a few more specific considerations and hints to review before finalizing your data migration method. Some will apply to your environment and some will not. **As well, you should review each of the methods in more detail, as described in the** *IBM TotalStorage DS8000 User's Guide*. Also keep in mind that data migration is a service offered through IBM Global Services. Contact your IBM Representative for more information.

Select a migration method by your operating system:
- Is it UNIX based? You will probably use some variation of a logical volume manger.
- Is it a zSeries or S/390? You will probably use IBM TotalStorage Global Mirror, Remote Mirror and Copy (when available).
- Is it z/OS? You will probably use DFDSS, though there are many choices.
- Is it VM? You might use DASD Dump Restore or PTAPE.
- Is it VSE? You might use the VSE fastcopy or ditto commands.

Notes:
- AIX and HP-UX 10.xx ship with logical volume management (LVM) software as part of the base operating system. LVM provides complete control over all disks and file systems that exist on an AIX system. HP-UX has similar volume management software.
- Sun Microsystems has a basic volume management product called Solstice, which is available for the Solaris systems. You can also purchase the Veritas Volume Manager (VxVM) and Veritas File System (VxFS) as optional products for Solaris.
- Linux systems also use the LVM

When replacing existing storage, you should partition the storage so that its virtual disks are similar in configuration to the disk drives that they are replacing. New configurations must be large enough to accommodate the existing data.

You might want to take advantage of this opportunity to do some remapping. The allocation and distribution of data does not have to be a straight one-to-one relationship, although that is possible. For instance, you can take advantage of using a maximum of 255 logical subsystems whereas the prior limitation was 32 logical subsystems.

To provide integrity checking of data and to allow different operating systems to use the storage unit, IBM formats the disks to a 524-byte sector. The 524-byte sector replaces the traditional 512-byte sector of fixed-block architecture DDMs. The 524-byte sector format requires that you reformat all disks that you are migrating to the storage unit. Because reformatting erases any data that is already contained on the drives, you must back up the data to some form of temporary storage. You can

use these drives for either direct migration of data or as temporary storage while the existing drives are moved. If this is not possible, use a removable media device, such as a tape drive, to temporarily store the data while you reformat the drives.

Chapter 7. Managing and activating licenses

Managing and activating licensed functions is your responsibility.

Management refers to the use of the IBM Disk Storage Feature Activation (DSFA) Web site to select a license scope and to assign a license value. You will perform these activities and then activate the function.

Activation refers to the retrieval and installation of the feature activation code into the DS8000 system. The feature activation code is obtained using the DSFA Web site and is based on the license scope and license value.

You perform these activities at the following times:
- After the IBM service representative has installed your storage unit and before you configure it
- When you increase the extent of the function authorization for a licensed functions (i.e., you add additional capacity to your license)
- When you reallocate function authorizations between images on a Model 9A2

To perform these activities, you must access the DSFA Web site at

http://www.ibm.com/storage/dsfa

When you access DSFA, you must enter information about your DS8000 storage unit so the Web application can access the correct function authorization records. You can find the information you must enter into DSFA on the Storage Unit General Properties page in the IBM TotalStorage DS Storage Manager application.

Activating licenses

After the IBM service representatives have completed your DS8000 storage complex installation, your first step is to activate your licenses.

To activate your licenses, you must perform the following actions:
- Obtain your feature activation codes.
- Apply the activation codes to your storage unit. You can apply the activation codes by importing a file that you download from the IBM Disk Storage Feature Activation (DSFA) Web site.

The initial enablement of any optional DS8000 licensed function is a concurrent activity (assuming the appropriate level of microcode is installed on the machine for the given function).

Note: The following activating activities are disruptive and require a machine IML (Model 921 and Model 922) or reboot of the affected image (Model 9A2):
- Removal of a DS8000 licensed function to deactivate the function.
- A lateral change or reduction in the license scope. A lateral change is defined as changing the license scope from fixed block (FB) to count key data (CKD) or from CKD to FB. A reduction is defined as changing the license scope from all physical capacity (ALL) to only FB or only CKD capacity.

Obtaining activation codes

To obtain your feature activation codes for the licensed features for each storage unit, you must connect to the IBM Disk Storage Feature Activation (DSFA) Web site.

Before connecting to the site, ensure that you have the following items:

- The IBM License Function Authorization documents. If you are activating codes for a new storage unit, these documents are included in the shipment of the storage unit. If you are activating codes for an existing storage unit, IBM sends these documents to you in an envelope.
- A diskette for downloading your activation codes into a file if you cannot access the IBM TotalStorage DS Storage Manager from the system that you are using to access the DSFA Web site. Instead of using a diskette, you can also write down the activation codes and then go over to the system that runs the DS Storage Manager and manually enter them.

1. Start the DS Storage Manager application.
2. In the navigation panel select **Real-time Manager** → **Manage Hardware**, then select **Storage Units**.
3. In the storage unit main page select the storage unit, click **Properties** in the **Select Action** drop-down list, and then click **Go**. The properties page displays for the storage unit.
4. Click the **General** tab, and the general properties display in the panel. Gather the following information about your storage unit. You must enter this information at the IBM Web site in the next step of this task. You can use the following table to document this information.
   - From the **MTMS** field, note the machine's serial number, and the model number. The Machine Type - Model Number - Serial Number (MTMS) is a string that contains the machine type, model number, and serial number. Only the last seven characters of the string are the machine's serial number.
   - From the **Machine signature** field, note the machine signature.

Property	Your Storage Unit's Information
Machine's serial number	
Model number	
Machine signature	

5. At a computer with an Internet connection and a browser, connect to the IBM Disk Storage Feature Activation (DSFA) Web site at http://www.ibm.com/storage/dsfa.
6. The DSFA application displays in the browser. Use the application to obtain the activation codes and follow the instructions on the screen.

   Note: In most situations, the DSFA application can locate your 2244 license authorization record when you enter the DS8000 (2107) serial number and signature. However, if the 2244 license authorization record is not attached to the 2107 record, you must assign it to the 2107 record in the DSFA application. In this situation, you will need the 2244 serial number (which you can find on the License Function Authorization document).

Applying activation codes

Use this process to apply the activation codes that enable you to begin configuring storage on a storage image.

You cannot have both the Apply activation codes page and the Import activation codes page open at the same time. You must close one in order to access the other.

Note: Before you begin this task, you must resolve any current DS8000 problems. Contact IBM Support for assistance in resolving these problems.

The easiest way to apply the feature activation codes is to download the activation codes from the IBM Disk Storage Feature Activation (DSFA) Web site to your local computer and then to import the file into the DS Storage Manager. If you cannot access the DS Storage Manager from the same computer that you used to access the DSFA Web site, you can download the file to a diskette or write down the information. If you are using either of these latter methods, ensure that you have your diskette containing the downloaded activation codes file or your paper that contains the written activation codes before you begin the following steps.

1. In the navigation panel, select, in order, **Real-time Manager**, **Manage Hardware**, and **Storage images**. In Storage images — Main Page, select a Storage image. Then select **Apply activation codes** in the **Select Action** drop-down list. Then click **Go**. The Apply activation codes page is displayed.

   a. If you already imported your activation codes from a file or retrieved existing codes from the storage unit, the values are displayed in the fields and you can modify or overwrite them, as appropriate.

   b. If you are importing your activation codes from a file that you downloaded from the DSFA Web site, click **Import key file**. Once you complete the import process, the data from the file is displayed.

   c. If you did not download your activation codes into a file, enter the codes into the appropriate fields.

   Note: For model 9A2, you need to perform this process for both images, one image at a time.

   Note: The **Capacity** and **Storage type** fields are populated based on the information contained within the activation codes.

2. Click **Apply**, then **OK** to complete the process.

Importing activation codes

Use this process to import the activation codes that must be applied before you can begin configuring storage on a storage image.

Note: Before you begin this task, you must resolve any current DS8000 problems. Contact IBM Support for assistance in resolving these problems.

1. In the navigation panel, under Manage Hardware, select Storage images. In Storage images — Main Page, select a Storage image. Then select **Apply activation codes** in the **Select Action** drop-down list. Then click **Go**. The Apply activation codes page is displayed.

2. Click **Import key file**. The Import page is displayed.

3. In the **Select file to import** field, specify the target file. Use the **Browse** button to navigate to the appropriate directory.

4. After you have specified the code file, click **OK** to complete the process.

Scenarios for managing licensing

These topics provide scenarios for managing your DS8000 licenses after you have initially activated them.

The following scenarios are provided:
- Adding storage capacity to an existing machine
- Reallocating a license between storage images

Note: Additional scenarios may be on the IBM TotalStorage DS8000 Information Center.

Adding storage to your machine

This scenario describes how to add storage (in terabytes) to an existing licensed feature such as the point-in-time copy.

For this scenario, assume you initially purchased a 2244 point-in-time feature (2244–PTC) for 25 terabytes (TB). After several months, you need an additional 20 TB for your point-in-time copy operations. To increase storage, you must purchase and activate a larger license. This is a nondisruptive activity and does not require that you reboot your machine.

1. You order two of feature 7203 (10 TB each of 2244–PTC) against the serial number of the 2244 Model PTC license currently on your machine. These features will be the additional 2244 features that will increase your point-in-time copy authorization level.

2. After you have ordered the features, you receive confirmation from IBM that these new features have been processed.

3. Connect to the IBM-supported Disk Storage Feature Activation (DSFA) Web site at http://www.ibm.com/storage/dsfa to retrieve an activation code for the licensed feature. This new code represents the total capacity that you now have licensed (or 45 TB). It licenses the original 25 TB plus the additional 20 TB that you just ordered.

4. After you obtain the activation codes for the licensed feature, enter it into the Web-based DS Storage Manager. You replace the existing activation code with the new activation code.

5. After the activation code is installed successfully, you now have 45 TB of 2244–PTC capacity.

Reallocating a license between storage images

This scenario describes how to reallocate a license between storage images when you have a Model 9A2 storage unit.

For this scenario, assume that you have a Model 9A2 storage unit and a 5 TB point-in-time copy feature that is allocated to storage image 1. Later, you decide you want to start using the point-in-time copy feature on storage image 2 instead. (Keep in mind that deactivating a function and then reactivating it can be disruptive to your system and might require that you reboot your machine.)

Use the following steps for this scenario:

1. Connect to the DSFA Web site at http://www.ibm.com/storage/dsfa to initiate a request to reallocate a license between storage images.

2. Reduce the allocation value of the point-in-time copy feature for storage image 1 from 5 TB to 0 TB. Increase the point-in-time copy allocation value for storage

image 2 from 0 TB to 5 TB. Click **Submit** to apply changes. After submitting allocation changes, retrieve the activation codes by selecting **View Activation Codes** in the upper left panel. The new point-in-time feature activation codes for the storage images are generated and displayed on the screen.

3. In the DS Storage Manager, apply the new activation codes to storage images 1 and 2.

4. Reboot storage image 1. When you reduce a license down to 0 TB, you must reboot the image.

Appendix A. IBM-provided DS8000 equipment and documents

These topics list the main equipment and documents that IBM ships with your DS8000 models.

The equipment that you receive can be grouped as follows:

- Components that must stay with the shipment because they are needed for installation
- Components that are for customer use
- Components that must stay with the storage unit after installation because they are needed by service representatives

Note: These lists are not intended to be a comprehensive lists. They describe only the main shipped components.

Installation components

Your shipment includes all the equipment that is needed for the installation of your storage units.

The following installation components are included with your shipment:

- **Storage unit**

  You will receive the models that you ordered:
  - Model 921
  - Model 922
  - Model 9A2
  - Model 92E
  - Model 9AE

  When your models arrive, they contain any ordered I/O enclosures, device adapters, disk enclosures, disk drives, and the appropriate cables to support those components. IBM installs these components at the factory.

  A shipment of Model 921, 922 or 9A2 will include two 31 meter Ethernet cables.

- **IBM TotalStorage Management Console**

  You will receive at least one Management Console (MC) with every Model 921, 922, and 9A2 Model.

  If you order an external MC, you receive this separate workstation, the necessary Ethernet cables, and any required installation hardware to install the external MC to the rack that you provide. The IBM service representatives install the external MC into an IBM or a non-IBM rack when they install your storage unit.

- **ESCON and fibre-channel I/O adapters and cables**

  Your shipment includes all ordered ESCON and fibre channel I/O adapters and the ordered cable for each I/O adapter.

- **Power line cords**

  You will receive the country or region-specific power line cord that you ordered. See "Power line cords" on page 51 for information about the power line cords that are available.

- **Various media**

  IBM ships the following media (typically CDs), which are used during the installation of your storage units:

- – I/O adapter media
- – Installation media, which includes installation scripts for the I/O attachment for AIX and HP-UX, IBM TotalStorage DS CLI (command-line interface) software, and IBM Multi-path Subsystem Device Driver installation instructions and software
- – Licensed machine code (LMC) media for the MC
- – Operating system media
- – LMC media for the 2107
- **Hardcopy installation instructions**

  Your shipment includes hardcopy installation instructions for the IBM service representatives who install your storage unit.
- **Engineering changes (if applicable)**

  IBM occasionally releases engineering changes (ECs) to correct problems or provide additional support. If released, these ECs are included in your shipment for the IBM service representative to install.

Customer components

IBM ships DS8000 media and documents that are intended for you to keep.

You can keep the following items at your desk or any other convenient location. They do not need to be located near the storage unit.
- **IBM Agreement for Licensed Machine Code (LMC)**

  Read this LMC agreement to understand IBM DS8000 licensing policies.
- **Warranty forms**

  IBM ships the following warranty forms. Keep these warranties in a safe place.
  - – Statement of Limited Warranty
  - – Machine Specific Warranty Information
  - – Other important warranty information
- **DS8000 customer publications CD**

  This CD includes a softcopy of the DS8000 customer publications.

Service components

IBM ships service-related media and documents with your DS8000 shipment.

Keep the following components with your storage unit so that IBM service representatives can use them when they service your storage unit.
- **Service media**

  Your delivery includes the following media for IBM service representatives to use:
  - – Management Console (MC) media:
    - - MC critical backup CDs
    - - Dump, trace, state-save CDs, which IBM service representatives use for extracting state-save information during service
  - – DS8000 customer publications CD
  - – A program temporary fix (PTF) CD for the operating system
  - – Service documents CD, which includes the following documentation: DS8000 service guides, DS8000 parts catalog, and the DS8000 customer publications
- **Operating system media**

Appendix B. Company information work sheet

This work sheet allows you to provide basic information about your company and administrator as well as general system information.

Purpose

IBM service representatives use the information that is provided on the company information work sheet to customize your IBM storage complex. When you use any of the remote support features, the Management Console (MC) sends this information to IBM so an IBM service representative can contact you.

You must complete this work sheet for all installations that include an MC.

Item or setting	Instructions	Your information
Company name	Provide the name of your company. IBM service representatives use this information to identify your company when they receive call home reports from your IBM storage system. Ensure that the company name that is provided here is consistent with all other machines that correspond to your IBM customer account.	
Customer number	Provide the customer number that is assigned by IBM to your company.	
Administrator information Provide information about your storage system administrator in the following section.		
Administrator name	Provide the name of the individual at your site who service representatives can contact about IBM storage system service matters.	
Administrator e-mail address	Provide the e-mail address that can be used to contact the administrator.	
Administrator telephone number	Provide the primary telephone number for service personnel to use to contact the storage system administrator. Include the area code and the country code, if appropriate.	
Alternate telephone number	Provide an alternate or off-shift telephone number that IBM service representatives can use to contact the storage system administrator. Include the area code and the country code, if appropriate.	

Item or setting	Instructions	Your information
Fax number	Provide the primary fax number that IBM service representatives can use when they must fax documents to the storage system administrator. Include the area code and the country code, if appropriate.	
Alternate fax number	Provide an alternate fax number that service personnel can use when they must fax documents to the storage system administrator. Include the area code and the country code, if appropriate.	
Administrator's mailing address	Provide the mailing address for the administrator. Specify the complete address, including the street address, building (if appropriate), city or locality, state or province, and postal or zip code.	
Storage system information Provide basic information about your storage system and the Management Console (MC) in the following section.		
System location	If different than the administrator's address, provide the full address where the storage unit is located. Include the street address, building (if appropriate), city or locality, state or province, and postal or zip code.	
Modem number (MC1)	For the first MC to take advantage of inbound remote services, Provide the telephone number to the modem of the first MC in the storage complex. Include the area code and the country code, if appropriate.	
Modem number (MC2, if installed)	For a second MC to take advantage of inbound remote services, provide the telephone number to the modem of the second MC. Include the area code and the country code, if appropriate.	

Appendix C. Management console network settings work sheet

This work sheet allows you to specify basic network information such as the management console identification, Ethernet settings, and DNS settings.

When your storage unit sends IBM any call home information through VPN or sends you notices about serviceable events (using SNMP trap or e-mail), these settings will be included in the information to identify and provide important information about the management console that has sent a service request.

Work sheet purpose

IBM service representatives use the information you provide on the MC network settings work sheet to set up the network settings that support your management console.

You must complete this work sheet for all installations that include a management console.

Work sheet and instructions

The IP addresses and name server information shown on this work sheet are examples only. They do not function. Contact your IBM service representative for the correct IP addresses and name servers that function with your DS8000 system.

Item or Setting	Instructions	MC1	MC2 (if applicable)
MC name (host name)	Record the console or host name that you want to assign to the management console workstation (for example, **dsmc1**). The console name and the domain are used to identify the MC to the network.		
Domain name	Provide the domain name that you are assigning to the MC workstation (for example, **medina.xyz.it**).		

Item or Setting	Instructions	MC1	MC2 (if applicable)
MC time and time zone	Check **Use local time and time zone** to set the MC to the local time and time zone (local to where the MC physically resides). If you want to use a different time zone, check **Use the following time zone** and specify the time zone to use (for example, **Central European Time** or **US Pacific Time**).	[ ] Use local time and time zone [ ] Use the following time zone: _____	[ ] Use local time and time zone [ ] Use the following time zone: _____
Ethernet settings Complete the LAN Adapter Details section when the MC connects to your LAN.			
Media speed (Ethernet)	Check **Autodetection** or the media speed of the Ethernet adapter. Tip: If you check **Autodetection**, the MC can automatically select the media speed appropriate for your configuration.	[ ] **Autodetection** [ ] 10Mpbs Half Duplex [ ] 10Mpbs Full Duplex [ ] 100Mpbs Half Duplx [ ] 100Mpbs Full Duplx [ ] 1000Mpbs Half Duplx [ ] 1000Mpbs Full Duplx	[ ] **Autodetection** [ ] 10Mpbs Half Duplex [ ] 10Mpbs Full Duplex [ ] 100Mpbs Half Duplx [ ] 100Mpbs Full Duplx [ ] 1000Mpbs Half Duplx [ ] 1000Mpbs Full Duplx
TCP/IP interface address	Specify the dotted decimal address that you are assigning to the MC (for example, **7.127.152.14**).		
TCP/IP interface network mask	Record the dotted decimal network mask that you want to apply to the TCP/IP address (for example, **127.123.546.0**).		
DNS settings Complete this section if you plan to use a domain name server (DNS) to resolve network names.			

Item or Setting	Instructions	MC1	MC2 (if applicable)
Name server (DNS) internet address 1	Provide the dotted decimal address of the name server that the MC workstation will access (for example, **5.127.42.250**).		
Name server domain name	Provide the domain name of the name server (for example, **medina.xyz.it**).		
Name server (DNS) internet address 2 (Optional)	Provide the dotted decimal address of the second name server that this workstation can access (for example, **5.127.42.252**). **Tip:** Although this is optional, you can specify a second name server when you configure a backup or secondary server for Copy Services.		
Name server domain name 2	If you have a second name server, provide the domain name of the second name server (for example, **medina2.xyz.it**).		
Routing settings Complete the following section if you want to specify a default gateway for routing. (See Note following this table) **Note:**			
Gateway address	Confirm and record the dotted decimal or symbolic name address of the gateway (for example, **8.127.155.254** or **londongate**).		

Item or Setting	Instructions	MC1	MC2 (if applicable)
Note:			

Note:

- Bolded options in the MC1 and MC2 columns indicate default settings. Management console is abbreviated to MC in this table.
- The TCP/IP address should not be in the listed ranges. If the address assigned must be in this range, contact your next level of support for development help. Do not continue the management console installation until this is resolved.
-
    TCP/IP addresses should not be in these ranges

    172.16.0.0 - 172.16.0.255

    172.17.0.0 - 172.17.0.255

    172.16.1.0 - 172.16.1.255

    172.17.1.0 - 172.17.1.255
- If you use a TCP/IP network address between the ranges of 172.16.2.0 - 172.16.255.255, or 172.17.2.0 - 172.17.255.255, each of your network nodes (gateway, snmp, server, smtp server, name server) must have a host route configured on the management console. Contact your next level of support for adding additional host routes.

Appendix D. Remote support work sheets

These work sheets allow you to specify the outbound (call home) and inbound (remote services) settings.

The remote support work sheets allow you to specify the settings to use for outbound and inbound remote support.

There are two remote support work sheets:
- Outbound (call home) work sheet
- Inbound (remote services) work sheet

Outbound (call home) work sheet

The outbound (call home) work sheet allows you to specify the settings for the IBM call home feature.

Setting up IBM call home allows the storage system to automatically request service from an IBM service representative when the system identifies a serviceable event.

The call home feature helps you quickly resolve serviceable events because it automatically reports hardware problems to IBM so that IBM service representatives can start looking into the problem without you having to alert them.

Tip: You must set up the call home feature if you participate in the Standby Capacity On Demand program.

Work sheet purpose

IBM service representatives use the information that is provided on the outbound (call home) work sheet to customize your storage system to use or disable the call home feature.

You must complete this work sheet for all installations that include an MC.

Work sheet and instructions

Note: Bold options in the MC1 and MC2 columns indicate default settings.

Item or Setting	Instructions	MC1	MC2 (if applicable)

Enable Call Home feature?	If you want IBM to enable the call home feature, check **Yes** and then check the modes to use for call home. (You can select both modes.) If you choose not to enable IBM call home, check **No**. If you select **No**, you have completed this work sheet.	[ ] **Yes**
		      Modes:
		   [ ] By modem
		   [ ] By VPN[1]
		[ ] No
			[ ] **Yes**
			      Modes:
			   [ ] By modem
			   [ ] By VPN[1]
			[ ] No

Item or Setting	Instructions	MC1	MC2 (if applicable)
[1] Selecting **By VPN** means that you allow your MC to use VPN over an internet connection when a connection is established to the IBM service center. If you use VPN, the MC must have access through your internet firewall to the following: • **IBM Boulder VPN server** • **IBM Rochester VPN server** • **IBM Boulder test VPN server** Your IBM service representative will provide the correct IP addresses for these servers. You also must enable access to the following ports and protocols: • Port 500 UDP • Port 500 ESP • Port 4500 UDP			
Modem settings Complete the following section if you are enabling call home using a modem.			
Dialing mode used by modem	Check the box that indicates whether your local modem uses tone or pulse dialing.	[ ] **Tone** [ ] Pulse	[ ] **Tone** [ ] Pulse
Wait for dial tone?	If the MC modem waits for a dial tone before dialing a telephone number, check **Yes**. If the modem dials without checking for the dial tone, check **No**.	[ ] Yes [ ] No	[ ] Yes [ ] No
Dial-out prefix	If the modem must dial a prefix to access an outside line, check **Prefixes** and provide the prefix numbers. If no prefix is necessary, check **N/A**.	[ ] Prefixes: _____ [ ] N/A	[ ] Prefixes: _____ [ ] N/A
Dumps and traces Complete the following section to specify how you want to send trace or dump files to the IBM service center.			

Item or Setting	Instructions	MC1	MC2 (if applicable)
Delivery method for dumps and traces	Check **Use the call home setup** if you want the MC to use the call home settings for dump and trace call-home transmissions. Check **Use FTP** if you want to send dumps and traces directly to the IBM FTP data repository server. (To use FTP, you must connect the MC to your LAN.) If you check **Use the call home setup**, you have completed this work sheet.	[ ] **Use the call home setup** [ ] Use FTP	[ ] **Use the call home setup** [ ] Use FTP
Do you use an FTP firewall?	If you are using FTP to deliver dump and trace call-home transmissions, check **Yes** if your dump and trace files cross a firewall that filters FTP traffic. Check **No** if no FTP firewall filters the transmissions. If you check **Yes**, complete the remaining work sheet items. If you check **No**, you have completed this work sheet.	[ ] Yes [ ] No	[ ] Yes [ ] No
FTP firewall settings Complete this section if you use FTP to send dumps and traces to the IBM service center and if the dumps and traces pass through an FTP firewall.			
FTP firewall type	Check the type of firewall that you use.	[ ] Proxy [ ] Relay	[ ] Proxy [ ] Relay
FTP firewall server (host name)	Provide the FTP firewall server name.		
FTP firewall user name	Provide the user name to use to gain access through the FTP firewall.		
FTP firewall password	Provide the password to use to gain access through the FTP firewall.		
FTP firewall command	Provide the command to use to gain access through the FTP firewall.		

Item or Setting	Instructions	MC1	MC2 (if applicable)
FTP firewall port	Provide the port of the FTP firewall.		

Inbound (remote services) work sheet

The inbound (remote services) work sheet allows you to specify whether you want to allow unattended inbound remote services, and which settings to use if you allow unattended sessions.

If you choose not to allow unattended service sessions during the initial configuration and you later want to have your storage unit serviced remotely, you must make specific scheduling arrangements with IBM service representatives. You then can either configure the Management Console (MC) to allow unattended remote services temporarily (specifying a start and stop date) or appoint an on-site person to manually enable the inbound call from the service representative and to remain at the MC during the service session.

Work sheet purpose

IBM service representatives use the information on the inbound remote services work sheet to customize your storage system to allow or prohibit authorized IBM service representatives the ability to dial into your MC and launch unattended sessions to further analyze and resolve serviceable events.

You must complete this work sheet for all installations that include an MC.

Work sheet and instructions

Note: Bold options in the MC1 and MC2 columns indicate default settings.

Item or Setting	Instructions	MC1	MC2 (if applicable)
Allow unattended remote sessions?	Check **Yes** if you want to allow authorized IBM service representatives to initiate unattended remote service sessions on your storage unit. Check **No** if you do not want to allow unattended remote services. If you check **No**, you have completed this work sheet.	[ ] **Yes** [ ] No	[ ] **Yes** [ ] No
Unattended remote session settings Complete the following section if you selected **Yes** above (to allow unattended remote sessions).			

Item or Setting	Instructions	MC1	MC2 (if applicable)
Remote service mode	Check the mode that indicates when to allow unattended sessions. Select **Always on** to enable inbound remote service at any time. Select **Automatic** to allow inbound calls for a specified number of days following a failure on the storage complex.	[ ] **Always on** [ ] Automatic	[ ] **Always on** [ ] Automatic
Number of days for Automatic mode	If you selected the **Automatic** mode, specify the number of days to allow an unattended service session after any failure on the storage complex.		

Appendix E. Notification work sheets

These work sheets allow you to specify how you will be notified about serviceable events.

The notification work sheets allow you to specify the settings to use when you want the storage system to notify you or other people in our organization when you have serviceable events.

There are two notification work sheets:
- SNMP trap notification work sheet
- E-mail notification work sheet

SNMP trap notification work sheet

This work sheet allows you to specify the setting for SNMP trap notifications.

The SNMP trap notification work sheet allows you to indicate whether you want to receive Simple Network Management Protocol (SNMP) trap notifications when a Management Console (MC) encounters serviceable events.

The storage unit generates SNMP traps and supports a read-only management information base (MIB) to allow monitoring by your network.

Note: Remote copy status reporting for Copy Services requires SNMP for open-systems hosts.

Work sheet purpose

IBM service representatives use the information on the SNMP trap notification work sheet to customize your storage system for SNMP trap notifications.

You must complete this work sheet for all installations that include an MC.

Work sheet and instructions

Note: Bolded options in the MC1 and MC2 columns indicate default settings.

Item or Setting	Instructions	MC1	MC2 (if applicable)
Enable SNMP trap notifications?	Check **Yes** to allow the storage unit to generate and send SNMP trap notifications when the system encounters problems. Check **No** if you do not want the storage unit to send SNMP trap notifications. If you check **No**, you have completed this work sheet.	[ ] Yes [ ] No	[ ] Yes [ ] No
SNMP trap notification settings Complete the following section if you checked **Yes** to enable SNMP trap notifications. Do not use the IP address shown in the example in this work sheet. It is used in the example only and will not function. Your IBM service representative will provide the correct IP address.			

Item or Setting	Instructions	MC1	MC2 (if applicable)
Allow MIB access?	The storage unit provides access to a management information base (MIB). Check **Read only** to allow read access to this information. Check **None** to deny read access to this information.	[ ] Read only [ ] **None**	[ ] Read only [ ] **None**
SNMP trap destinations	Provide the host names or the dotted decimal addresses of the destinations that are to receive SNMP traps (for example, **host.com** or **9.127.152.254**).		

E-mail notification work sheet

This work sheet allows you to specify the setting for e-mail notifications.

The e-mail notification work sheet allows you to specify whether you want to receive e-mail notifications when an MC encounters serviceable events.

Restriction: To receive e-mail notifications, the MC must be connected to your LAN.

Work sheet purpose

IBM service representatives use the information on this work sheet to customize your storage system for e-mail notifications. If you choose to use e-mail notifications, the notification settings are customized so that the specified people in your organization receive e-mails when there is general or error information to send about the storage complex.

You must complete this work sheet for all installations that include an MC.

Work sheet and instructions

Note: Bold options in the MC1 and MC2 columns indicate default settings.

Item or Setting	Instructions	MC1	MC2 (if applicable)
Enable e-mail notifications?	Check **Yes** to allow the MC to generate and send e-mails when the system encounters problems. Check **No** if you do not want the MC to send e-mail notifications. If you check **No**, you have completed this work sheet.	[ ] Yes [ ] No	[ ] Yes [ ] No
E-mail notification settings Complete the following section if you previously checked **Yes** (to enable e-mail notifications).			

Item or Setting	Instructions	MC1	MC2 (if applicable)
Host name or network address of smart relay host (Optional)	To use a smart relay host, provide the host name or network address for the smart relay host. **Tip:** You can enable a smart relay host if either: • Your e-mail is sent from a UNIX-based system on which you have specified a mail relay or mail gateway, or • You have installed a message-transfer agent on your mail server.		
E-mail destinations	Provide the full e-mail addresses that you want to receive the notifications (for example, **maria@host.com**). Check the notification setting that indicates the type of notifications to send to the e-mail address. This work sheet provides spaces for three e-mail addresses, but you can specify more, if necessary.	1. E-mail address: _____ Notifications: [ ] Only call home problem events [ ] All problem events 2. E-mail address: _____ Notifications: [ ] Only call home problem events [ ] All problem events 3. E-mail address: _____ Notifications: [ ] Only call home problem events [ ] All problem events	1. E-mail address: _____ Notifications: [ ] Only call home problem events [ ] All problem events 2. E-mail address: _____ Notifications: [ ] Only call home problem events [ ] All problem events 3. E-mail address: _____ Notifications: [ ] Only call home problem events [ ] All problem events

Appendix F. Power control work sheet

The power control work sheet allows you to specify the power mode for your DS8000 storage unit.

You can choose to:
- Use attached zSeries machines to power on and power off the storage unit. (This option is available only if you have the remote zSeries power control feature installed.)
- Automatically power on and power off the storage unit.
- Use a specified schedule to power on and power off the storage unit.
- Manually power on and power off the storage unit, using the Power on/off page in the DS Storage Manager.

Work sheet purpose

IBM service representatives use the information on the power control work sheet to customize the power mode for your storage unit.

You must complete this work sheet for all installations.

Work sheet and instructions

Note: Bold options in the "Your information" column indicate default settings.

Item or Setting	Instructions	Your information
Enable remote zSeries power control?	If you will use the remote zSeries power control feature, check **Yes**. If you check **Yes**, the zSeries power mode will be used and this will enable up to four zSeries machines to control the power on and power off sequences. If you check **Yes**, you have completed this work sheet. Check **No** if you choose not to use the remote zSeries power control feature. If you check **No**, you must complete the rest of this work sheet.	[ ] Yes [ ] No
Disabled remote zSeries power control Complete the following section if you checked **No** above (to not use the remote zSeries power control).		

Item or Setting	Instructions	Your information
Power mode	Check **Automatic** if you want the storage unit to power on automatically whenever external power is restored, if the unit was originally on. (The **Automatic** power mode automatically powers on the unit when, for example, power is restored after a power outage.) Check **Scheduled** if you want the storage unit to power on and off according to a specified scheduled. Check **Scheduled automatic** to schedule the power on and power off of your storage unit and enable the unit to automatically power on if power is restored during the time that the unit is scheduled to be on. Check **Manual** if you want to manually power on and power off your unit using the Power on/off page in the DS Storage Manager.	[ ] **Automatic** [ ] Scheduled (not automatic) [ ] Scheduled automatic [ ] Manual
Schedule If you selected one of the scheduled power modes, **Scheduled** or **Scheduled automatic**, specify the power on and power off schedule below.		
Schedule	Check the option that indicates whether the storage unit will use the same power on and power off schedule every day or whether the schedule will vary by day. Specify the on and off times for the unit in the appropriate section.	[ ] Same schedule all days: On _____ Off _____ [ ] Varying schedule: Monday: On _____ Off _____ Tuesday: On _____ Off _____ Wednesday: On _____ Off _____ Thursday: On _____ Off _____ Friday: On _____ Off _____ Saturday: On _____ Off _____ Sunday: On _____ Off _____

Appendix G. Control switch settings work sheet

Complete the control switch settings work sheet to indicate whether the particular option should be enabled or disabled. Your DS8000 may include two or more storage images; consequently, you many need to indicate your individual choice for each.

AS/400 LUN Serial Suffix number settings

This optional control switch setting is used when you attach a second DS8000 to an AS/400 or iSeries host with the same three-character suffix as the first DS8000. Changing a DS8000 serial number also changes the current LUN serial number, which uses the last three digits of an ESS serial number.

Work sheet instructions

Enter a three-digit number as a new serial number base for the DS8000.

Fibre LUN Access number settings

This control switch on the DS8000 determines whether hosts have access to all LUNs over fibre channels or whether access is restricted. Restricted access is based on the worldwide ID (WWID) of the adapter port in the host system. Access also depends on the logical configuration that is defined for that host port WWID.

Work sheet instructions

Check one of the two switch settings:

Check **Restricted** if you want to limit access to LUNs to those hosts that you define in the interface. Restricted is the default setting.

Check **Any** if all hosts are to have access to all LUNs.

Control-unit Initiated Reconfiguration settings

For zSeries and S/390 environments, complete the control-unit initiated reconfiguration (CUIR) setting work sheet to indicate whether subsystems will be enabled or disabled. The host systems would be affected during host adapter repair or I/O enclosure repair.

Work sheet instructions

Enter the appropriate response into the Your information column.

Control Switch Setting	Default	Your information
AS/400 LUN Serial Suffix number	0 (Off)	_____ Enter the last three digits of the new DS8000 serial number
Fibre LUN Access Control	0 (Off)	[ ] Restricted [ ] Any
CUIR support	0 (Disable)	[ ] Enable [ ] Disable

Accessibility

Accessibility features provide users who have disabilities with the ability to successfully access information and use technology.

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products successfully.

Features

These are the major accessibility features in the IBM TotalStorage DS8000 information:

- You can use screen-reader software and a digital speech synthesizer to hear what is displayed on the screen. IBM Home Page Reader version 3.0 has been tested.
- You can operate features using the keyboard instead of the mouse.

Navigating by keyboard

You can use keys or key combinations to perform operations and initiate menu actions that can also be done through mouse actions. You can navigate the IBM TotalStorage DS8000 information from the keyboard by using the shortcut keys for your browser or Home Page Reader. See your browser Help for a list of shortcut keys that it supports. See the following Web site for a list of shortcut keys supported by Home Page Reader: http://www-306.ibm.com/able/solution_offerings/keyshort.html

Accessing the publications

You can find HTML versions of the IBM TotalStorage DS8000 information at the following Web site:
http://www.ehone.ibm.com/public/applications/publications/cgibin/pbi.cgi

You can access the information using IBM Home Page Reader 3.0.

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Dieses Geraet ist berechtigt, in Uebereinstimmung mit dem deutschen EMVG das EG-Konformitaetszeichen - CE - zu fuehren.

Der Aussteller der Konformitaetserklaeung ist die IBM Deutschland.

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```
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```
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EMVG, Paragraph 3, Abs.4)
```

```
Dieses Genehmigungsverfahren ist nach Paragraph 9 EMVG in Verbindung
mit der entsprechenden Kostenverordnung (Amtsblatt 14/93)
kostenpflichtig.
```

Nach der EN 55022:

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```

Anmerkung:

```
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Glossary

This glossary includes terms for the IBM TotalStorage and other Resiliency Family products.

This glossary includes selected terms and definitions from:

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This glossary uses the following cross-reference forms:

See   Refers the reader to one of two kinds of related information:

- A term that is the expanded form of an abbreviation or acronym. This expanded form of the term contains the full definition.
- A synonym or more preferred term

See also
Refers the reader to one or more related terms.

Contrast with
Refers the reader to a term that has an opposite or substantively different meaning.

Numerics

750   A model of the Enterprise Storage Server featuring a 2-way processor with limited physical storage capacity. This model can be updated to the model 800.

800   A model of the Enterprise Storage Server featuring a standard processor or an optional Turbo processor. The Model 800 supports RAID 5, RAID 10, and 15000 rpm drives. Model 800 supersedes Model F20.

1750   The machine type for the IBM TotalStorage DS6000 series. Models for the DS6000 include the 511 and EX1.

2105   The machine number for the IBM TotalStorage Enterprise Storage Server. Models of the Enterprise Storage Server are expressed as the number 2105 followed by "Model <*xxx*>", such as 2105 Model 800. The 2105 Model 100 is an Enterprise Storage Server expansion enclosure that is typically referred to simply as the Model 100.

2107   The machine type for the IBM TotalStorage DS8000 series. Models for the DS8000 series include the base units 921, 922 and 9A2 and expansion units 92E and 9AE.

3390   The machine number of an IBM disk storage system. The Enterprise Storage Server, when interfaced to IBM zSeries hosts, is set up to appear as one or more 3390 devices, with a choice of 3390-2, 3390-3, or 3390-9 track formats.

3990   The machine number of an IBM control unit.

7133   The machine number of an IBM disk storage system. The Model D40 and 020 drawers of the 7133 can be installed in the 2105-100 expansion enclosure of the ESS.

A

access

    1) To obtain the use of a computer resource.

    2) In computer security, a specific type of interaction between a subject and an object that results in flow of information from one to the other.

access-any mode

    One of the two access modes that can be set for the storage unit during initial configuration. It enables all fibre-channel-attached host systems with no defined access profile to access all logical volumes on the storage unit. With a profile defined in DS Storage Manager for a particular host, that host has access only to volumes that are assigned to the WWPN for that host. See also *pseudo host* and *worldwide port name*.

ACK   See *request for acknowledgment and acknowledgment*.

agent   A program that automatically performs some service without user intervention or on a regular schedule. See also *subagent*.

alert   A message or log that a storage unit generates as the result of error event collection and analysis. An alert indicates that a service action is required.

allegiance

    For zSeries, a relationship that is created between a device and one or more channel paths during the processing of certain conditions. See also *implicit allegiance*, *contingent allegiance*, and *reserved allegiance*.

allocated storage

    The space that is allocated to volumes but not yet assigned. Contrast with *assigned storage*.

American National Standards Institute (ANSI)

    An organization of producers, consumers, and general interest groups that establishes the procedures by which accredited organizations create and maintain voluntary industry standards in the United States. (A)

Anonymous

    In the DS Storage Manager, the label on an icon that represents all connections that are using fibre-channel adapters between the storage unit and hosts but are not completely defined to the storage unit. See also *anonymous host*, *pseudo host*, and *access-any mode*.

anonymous host

    Synonym for *pseudo host*. Contrast with *Anonymous* and *pseudo host*.

ANSI   See *American National Standards Institute*.

APAR   See *authorized program analysis report*. (GC)

API   See *application programming interface*.

application programming interface

    An interface that allows an application program that is written in a high-level language to use specific data or functions of the operating system or another program.

arbitrated loop

    A fibre-channel topology that enables the interconnection of a set of nodes. See also *point-to-point connection* and *switched fabric*.

array   An ordered collection, or group, of physical devices (disk drive modules) that is used to define logical volumes or devices. In the storage unit, an array is a group of disks that the user designates to be managed by the RAID technique. See also *redundant array of independent disks*.

ASCII   (American National Standard Code for Information Interchange) The standard code, using a coded character set consisting of 7-bit coded characters (8 bits including parity check), that is used for information interchange among data processing systems, data communication systems, and associated equipment. The ASCII set consists of control characters and graphic characters. (A) Some organizations, including IBM, have used the parity bit to expand the basic code set.

assigned storage

    The space that is allocated to a volume and that is assigned to a port.

authorized program analysis report (APAR)

    A request for correction of a defect in a current release of an IBM-supplied program. (GC)

availability
The degree to which a system or resource is capable of performing its normal function. See *data availability*.

B

bay
The physical space that is used for installing SCSI, ESCON, and fibre-channel host adapter cards. The DS8000 has four bays, two in each cluster. See also *service boundary*.

bit
1) Either of the digits 0 or 1 when used in the binary numeration system. (T)

2) The storage medium required to store a single binary digit. See also *byte*.

block
A string of data elements recorded or transmitted as a unit. The elements may be characters, words, or physical records. (T)

A group of consecutive bytes used as the basic storage unit in fixed-block architecture (FBA). All blocks on the storage device are the same size (fixed size). See also *fixed-block architecture* and *data record*.

byte
1) A group of eight adjacent binary digits that represent one EBCDIC character.

2) The storage medium required to store eight bits. See also *bit*.

C

cache
A special-purpose buffer storage, smaller and faster than main storage, used to hold a copy of instructions and data obtained from main storage and likely to be needed next by the processor. (T)

cache fast write
A form of the fast-write operation in which the storage server writes the data directly to cache, where it is available for later destaging.

cache hit
An event that occurs when a read operation is sent to the cluster, and the requested data is found in cache. Contrast with *cache miss*.

cache memory
Memory, typically volatile memory, that a storage server uses to improve access times to instructions or data. The cache memory is typically smaller and faster than the primary memory or storage medium. In addition to residing in cache memory, the same data also resides on the storage devices in the storage unit.

cache miss
An event that occurs when a read operation is sent to the cluster, but the data is not found in cache. Contrast with *cache hit*.

call home
A communication link established between the DS8000 and a service provider. The DS8000 can use this link to place a call to IBM or to another service provider when it requires service. With access to the machine, service personnel can perform service tasks, such as viewing error logs and problem logs or initiating trace and dump retrievals. See also *heartbeat* and *remote technical assistance information network*.

cascading
1) Connecting network controllers to each other in a succession of levels to concentrate many more lines than a single level permits.

2) In high-availability cluster multiprocessing (HACMP), cascading pertains to a cluster configuration in which the cluster node with the highest priority for a particular resource acquires the resource if the primary node fails. The cluster node relinquishes the resource to the primary node upon reintegration of the primary node into the cluster.

catcher
A server that service personnel use to collect and retain status data that an DS8000 sends to it.

CCR
See *channel command retry*.

CCW
See *channel command word*.

CD
See *compact disc*.

CEC
See *computer-electronic complex*.

channel
For zSeries, the part of a channel subsystem that manages a single I/O interface between a channel subsystem and a set of control units.

channel command retry (CCR)
For zSeries, the protocol used between a channel and a control unit that enables the control unit to request that the channel reissue the current command.

channel command word (CCW)
For zSeries, a data structure that specifies an I/O operation to the channel subsystem.

channel path
For zSeries, the interconnection between a channel and its associated control units.

channel subsystem
For zSeries, the part of a host computer that manages I/O communication between the program and any attached control units.

channel-subsystem image
For zSeries, the logical functions that a system requires to perform the function of a channel subsystem. With ESCON multiple image facility (EMIF), one channel subsystem image exists in the channel subsystem for each logical partition (LPAR). Each image appears to be an independent channel subsystem program, but all images share a common set of hardware facilities.

CKD See *count key data*.

CLI See *command-line interface*. See also *Copy Services command-line interface*.

cluster
1) A partition capable of performing all DS8000 functions. With two clusters in the DS8000, any operational cluster can take over the processing of a failing cluster.

2) In the AIX operating system, a group of nodes within a complex.

cluster processor complex (CPC)
The unit within a cluster that provides the management function for the DS8000. It consists of cluster processors, cluster memory, and related logic.

command-line interface (CLI)
An interface provided by an operating system that defines a set of commands and enables a user (or a script-like language) to issue these commands by typing text in response to the command prompt (for example, DOS commands or

UNIX shell commands). See also *Copy Services command-line interface*.

compact disc
An optically read disc, typically storing approximately 660 MB. CD-ROM (compact disc read-only memory) refers to the read-only format used to distribute DS8000 code and documentation.

compression
1) The process of eliminating gaps, empty fields, redundancies, and unnecessary data to shorten the length of records or blocks.

2) Any encoding that reduces the number of bits used to represent a given message or record. (GC)

computer-electronic complex (CEC)
The set of hardware facilities associated with a host computer.

concurrent copy
A facility on a storage server that enables a program to make a backup of a data set while the logical volume remains available for subsequent processing. The data in the backup copy is frozen at the point in time that the server responds to the request.

concurrent installation of licensed internal code Process of installing licensed internal code on a DS8000 while applications continue to run.

concurrent maintenance
Service that is performed on a unit while it is operational.

concurrent media maintenance
Service performed on a disk drive module (DDM) without losing access to the data.

configure
In storage, to define the logical and physical configuration of the input/output (I/O) subsystem through the user interface that the storage unit provides for this function.

consistency group
A group of volumes participating in FlashCopy relationships in a logical subsystem, across logical subsystems, or across multiple storage units that must be kept in a consistent state to ensure data integrity.

consistency group interval time
The value in seconds that indicates the length of time between the formation of consistency groups.

consistent copy
A copy of a data entity (a logical volume, for example) that contains the contents of the entire data entity at a single instant in time.

console
A user interface to a server, for example, the interface provided on a personal computer. See also *IBM TotalStorage Management Console*.

contingent allegiance
For zSeries, a relationship that is created in a control unit between a device and a channel when the channel accepts unit-check status. The allegiance causes the control unit to guarantee access; the control unit does not present the busy status to the device. The allegiance enables the channel to retrieve sense data that is associated with the unit-check status on the channel path associated with the allegiance.

control path
The route that is established from the master storage unit to the subordinate storage unit when more than one storage unit participates in a Global Mirror session. If there is only one storage unit (the master) in the Global Mirror session, no control path is required.

control unit (CU)
1) A device that coordinates and controls the operation of one or more input/output devices, and synchronizes the operation of such devices with the operation of the system as a whole.

2) For zSeries, a storage server with ESCON or OEMI interfaces. The control unit adapts a native device interface to an I/O interface that a zSeries host system supports.

3) The portion of the storage unit that supports the attachment of emulated count key data devices over ESCON, FICON, or OEMI interfaces. See also *cluster*.

control-unit image
For zSeries, a logical subsystem that is

accessed through an ESCON I/O interface. One or more control-unit images exist in each control unit. Each image appears as an independent control unit, but all control-unit images share a common set of hardware facilities. The DS8000 can emulate 3990-3, TPF, 3990-6, or 2105 control units.

control-unit-initiated reconfiguration (CUIR)
A software mechanism that the DS8000 uses to request that an operating system of a zSeries host verify that one or more subsystem resources can be taken offline for service. The DS8000 can use this process to automatically vary channel paths offline and online to facilitate bay service or concurrent code installation. Depending on the operating system, support for this process might be model dependent, might depend on the IBM TotalStorage Enterprise Storage Server Subsystem Device Driver, or might not exist.

Coordinated Universal Time (UTC)
The international standard of time that is kept by atomic clocks around the world.

Copy Services
A collection of optional software features, with a Web-browser interface, used for configuring, managing, and monitoring data-copy functions.

Copy Services CLI
See *Copy Services command-line interface*.

Copy Services client
Software that runs on each DS8000 cluster in the Copy Services server group and that performs the following functions:

- Communicates configuration, status and connectivity information to the Copy Services server
- Performs data-copy functions on behalf of the Copy Services server

Copy Services command-line interface (Copy Services CLI)
The command-line interface software that is provided with DS8000 Copy Services and used for invoking Copy Services functions from host systems attached to the DS8000. See also *command-line interface*.

Copy Services server

A cluster that the Copy Services administrator designates to perform the DS8000 Copy Services functions.

Copy Services server group

A collection of user-designated DS8000 clusters participating in Copy Services functions that a designated, active, Copy Services server manages. A Copy Services server group is also called a Copy Services domain.

count field

The first field of a count key data (CKD) record. This eight-byte field contains a four-byte track address (CCHH). It defines the cylinder and head that are associated with the track, and a one-byte record number (R) that identifies the record on the track. It defines a one-byte key length that specifies the length of the record's key field (0 means no key field). It defines a two-byte data length that specifies the length of the record's data field (0 means no data field). Only the end-of-file record has a data length of zero.

count key data (CKD)

For zSeries, a data-record format employing self-defining record formats in which each record is represented by up to three fields: a *count* field that identifies the record and specifies its format, an optional *key* field that identifies the data area contents, and an optional *data* field that typically contains the user data. For CKD records on the storage unit, the logical volume size is defined in terms of the device emulation mode (3390 or 3380 track format). The count field is always 8 bytes long and contains the lengths of the key and data fields, the key field has a length of 0 to 255 bytes, and the data field has a length of 0 to 65 535 or the maximum that will fit on the track. See also *data record*.

CPC See *cluster processor complex*.

CRC See *cyclic redundancy check*.

CU See *control unit*.

CUIR See *control-unit initiated reconfiguration*.

custom volume

A volume in count-key-data (CKD) format that is not a standard volume, which means that it does not necessarily present the same number of cylinders and capacity to its assigned logical control unit as provided by one of the following standard zSeries volume types: 3390-2, 3390-3, 3390-9, 3390-2 (3380-track mode), or 3390-3 (3380-track mode). See also *count-key-data*, *interleave*, *standard volume*, and *volume*.

CUT See *Coordinated Universal Time*.

cyclic redundancy check (CRC)

A redundancy check in which the check key is generated by a cyclic algorithm. (T)

cylinder

A unit of storage on a CKD device with a fixed number of tracks.

D

DA See *device adapter*. See also *IBM Serial Storage adapter*.

daisy chain

See *serial connection*.

DASD See *direct access storage device*.

DASD fast write (DFW)

A function of a storage server in which active write data is stored in nonvolatile cache, thus avoiding exposure to data loss.

data availability

The degree to which data is available when needed, typically measured as a percentage of time that the system would be capable of responding to any data request (for example, 99.999% available).

data compression

A technique or algorithm used to encode data such that the encoded result can be stored in less space than the original data. The original data can be recovered from the encoded result through a reverse technique or reverse algorithm. See also *compression*.

Data Facility Storage Management Subsystem (DFSMS)

An operating environment that helps automate and centralize the management of storage. To manage storage, DFSMS provides the storage administrator with control over data class, storage class, management class, storage group, and automatic class selection routine definitions.

data field

The optional third field of a count key data (CKD) record. The count field specifies the length of the data field. The data field contains data that the program writes.

data record

The basic unit of zSeries storage on a DS8000, also known as a count-key-data (CKD) record. Data records are stored on a track. The records are sequentially numbered starting with 0. The first record, R0, is typically called the track descriptor record and contains data that the operating system normally uses to manage the track. See also *count-key-data* and *fixed-block architecture*.

data set FlashCopy

For zSeries hosts, a feature of FlashCopy that indicates how many partial volume FlashCopy relationships are active on a volume.

data sharing

The ability of multiple host systems to concurrently utilize data that they store on one or more storage devices. The storage unit enables configured storage to be accessible to any, or all, attached host systems. To use this capability, the host program must be designed to support data that it is sharing.

DDM See *disk drive module*.

DDM group

See *disk pack*.

dedicated storage

Storage within a storage unit that is configured such that a single host system has exclusive access to the storage.

demote

To remove a logical data unit from cache memory. A storage server demotes a data unit to make room for other logical data units in the cache or because the logical data unit is not valid. The storage unit must destage logical data units with active write units before they can be demoted. See also *destage*.

destage

To move data from an online or higher priority to an offline or lower priority

device. The storage unit stages incoming data into cache and then destages it to disk.

device

For zSeries, a disk drive.

device adapter (DA)

A physical component of the DS8000 that provides communication between the clusters and the storage devices. The DS8000 has eight device adapters that it deploys in pairs, one from each cluster. Device adapter pairing enables the DS8000 to access any disk drive from either of two paths, providing fault tolerance and enhanced availability.

device address

For zSeries, the field of an ESCON device-level frame that selects a specific device on a control-unit image.

device ID

The unique two-digit hexadecimal number that identifies the logical device.

device interface card

A physical subunit of a storage cluster that provides the communication with the attached device drive modules.

device number

For zSeries, a four-hexadecimal-character identifier, for example 13A0, that the systems administrator associates with a device to facilitate communication between the program and the host operator. The device number is associated with a subchannel.

device sparing

A subsystem function that automatically copies data from a failing device drive module to a spare device drive module. The subsystem maintains data access during the process.

DFS See *distributed file service*.

DFSMS

See *Data Facility Storage Management Subsystem*.

direct access storage device (DASD)

1) A mass storage medium on which a computer stores data.

2) A disk device.

disk cage
> A container for disk drives. Each disk cage supports eight disk packs (64 disks).

disk drive
> Standard term for a disk-based nonvolatile storage medium. The DS8000 uses hard disk drives as the primary nonvolatile storage media to store host data.

disk drive module (DDM)
> A field replaceable unit that consists of a single disk drive and its associated packaging.

disk drive module group
> See *disk pack*.

disk pack
> A group of disk drive modules (DDMs) installed as a unit in a DDM bay.

disk group
> A collection of 4 disk drives that are connected to the same pair of IBM Serial Storage adapters and can be used to create a RAID array. A disk group can be formatted as count key data or fixed block, and as RAID or non-RAID, or it can be left unformatted. A disk group is a logical assemblage of disk drives. Contrast with *disk pack*.

distributed file service (DFS)
> A service that provides data access over IP networks.

DNS See *domain name system*.

domain
> 1) That part of a computer network in which the data processing resources are under common control.
>
> 2) In TCP/IP, the naming system used in hierarchical networks.
>
> 3) A Copy Services server group, in other words, the set of clusters the user designates to be managed by a particular Copy Services server.

domain name system (DNS)
> In TCP/IP, the server program that supplies name-to-address translation by mapping domain names to internet addresses. The address of a DNS server is the internet address of the server that hosts the DNS software for the network.

dotted decimal notation
> A convention used to identify IP

addresses. The notation consists of four 8-bit numbers written in base 10. For example, 9.113.76.250 is an IP address that contains the octets 9, 113, 76, and 250.

drawer
> A unit that contains multiple device drive modules and provides power, cooling, and related interconnection logic to make the device drive modules accessible to attached host systems.

drive 1) A peripheral device, especially one that has addressed storage media. See also *disk drive module*.
>
> 2) The mechanism used to seek, read, and write information on a storage medium.

DS8000
> See *IBM TotalStorage DS8000*.

DS8000 Batch Configuration tool
> A program that automatically configures a DS8000. The configuration is based on data that IBM service personnel enter into the program.

DS Storage Manager
> See *IBM TotalStorage DS Storage Manager*.

duplex
> 1) Regarding Copy Services, the state of a volume pair after Remote Mirror and Copy has completed the copy operation and the volume pair is synchronized.
>
> 2) In general, pertaining to a communication mode in which data can be sent and received at the same time.

dynamic sparing
> The ability of a storage server to move data from a failing disk drive module (DDM) to a spare DDM while maintaining storage functions.

E

E10 The predecessor of the F10 model of the Enterprise Storage Server. See also *F10*.

E20 The predecessor of the F20 model of the Enterprise Storage Server. See also *F20*.

EBCDIC
> See *extended binary-coded decimal interchange code*.

EC See *engineering change*.

ECKD See *extended count key data*.

eight pack
See *disk pack*.

electrostatic discharge (ESD)
An undesirable discharge of static electricity that can damage equipment and degrade electrical circuitry.

emergency power off (EPO)
A means of turning off power during an emergency, usually a switch.

EMIF See *ESCON multiple image facility*.

enclosure
A unit that houses the components of a storage subsystem, such as a control unit, disk drives, and power source.

end of file
A coded character recorded on a data medium to indicate the end of the medium. On a count-key-data direct access storage device, the subsystem indicates the end of a file by including a record with a data length of zero.

engineering change (EC)
An update to a machine, part, or program.

Enterprise Systems Architecture/390 (ESA/390)
An IBM architecture for mainframe computers and peripherals. Processor systems that follow the ESA/390 architecture include the ES/9000® family. See also *z/Architecture*.

Enterprise Systems Connection (ESCON)
1) A zSeries computer peripheral interface. The I/O interface uses zSeries logical protocols over a serial interface that configures attached units to a communication fabric.

2) A set of IBM products and services that provide a dynamically connected environment within an enterprise.

EPO See *emergency power off*.

ERDS See *error-recording data set*.

ERP See *error recovery procedure*.

error-recording data set (ERDS)
On zSeries hosts, a data set that records data-storage and data-retrieval errors. A

service information message (SIM) provides the error information for the ERDS.

error recovery procedure (ERP)
Procedures designed to help isolate and, where possible, to recover from errors in equipment. The procedures are often used in conjunction with programs that record information on machine malfunctions.

ESA/390
See *Enterprise Systems Architecture/390*.

ESCD See *ESCON director*.

ESCON
See *Enterprise System Connection*.

ESCON channel
A zSeries channel that supports ESCON protocols.

ESCON director (ESCD)
An I/O interface switch that allows the interconnection of multiple ESCON interfaces in a distributed-star topology.

ESCON host systems
zSeries hosts that attach to the DS8000 with an ESCON adapter. Such host systems run on operating systems that include MVS, VSE, TPF, or versions of VM.

ESCON multiple image facility (EMIF)
For zSeries, a function that enables LPARs to share an ESCON channel path by providing each LPAR with its own channel-subsystem image.

EsconNet
In the DS Storage Manager, the label on a pseudo host icon that represents a host connection that uses the ESCON protocol and that is not completely defined on the DS8000. See also *pseudo host* and *access-any mode*.

ESD See *electrostatic discharge*.

eserver
See *IBM e(logo)server*.

ESSNet
See *IBM TotalStorage Enterprise Storage Server Network*.

extended binary-coded decimal interchange code (EBCDIC)
An IBM-developed coding scheme used to represent various alphabetic, numeric, and

special symbols with a coded character set of 256 eight-bit codes.

extended count key data (ECKD)
An extension of the count key data (CKD) architecture.

extent A continuous space on a disk that is occupied by or reserved for a particular data set, data space, or file. The unit of increment is a track. See also *multiple allegiance* and *parallel access volumes*.

extent pool
A groups of extents. See also *extent*.

F

fabric In fibre-channel technology, a routing structure, such as a switch, receives addressed information and routes to the appropriate destination. A fabric can consist of more than one switch. When multiple fibre-channel switches are interconnected, they are said to be *cascaded*.

failback
Pertaining to a cluster recovery from failover following repair. See also *failover*.

failover
Pertaining to the process of transferring all control to a single cluster when the other cluster in the storage unit fails. See also *cluster* and *failback*.

fast write
A write operation at cache speed that does not require immediate transfer of data to a disk drive. The subsystem writes the data directly to cache, to nonvolatile storage, or to both. The data is then available for destaging. A fast-write operation reduces the time an application must wait for the I/O operation to complete.

FBA See *fixed-block architecture*.

FC See *feature code*. **Note**: *FC* is a common abbreviation for fibre channel in the industry, but the DS8000 customer documentation library reserves *FC* for feature code.

FC-AL See *Fibre Channel-Arbitrated Loop*.

FCP See *fibre-channel protocol*.

FCS See *fibre-channel standard*.

feature code (FC)
A code that identifies a particular orderable option and that is used by service personnel to process hardware and software orders. Individual optional features are each identified by a unique feature code.

fibre channel
A data-transmission architecture based on the ANSI Fibre Channel standard, which supports full-duplex communication. The DS8000 supports data transmission over fiber-optic cable through its fibre-channel adapters. See also *fibre-channel protocol* and *fibre-channel standard*.

Fibre Channel-Arbitrated Loop (FC-AL)
An implementation of the Fibre Channel standard that uses a ring topology for the communication fabric. Refer to American National Standards Institute (ANSI) X3T11/93-275. In this topology, two or more fibre-channel end points are interconnected through a looped interface.

fibre-channel connection (FICON)
A fibre-channel communications protocol designed for IBM mainframe computers and peripherals.

fibre-channel protocol (FCP)
A protocol used in fibre-channel communications with five layers that define how fibre-channel ports interact through their physical links to communicate with other ports.

Fibre-Channel standard (FCS)
An ANSI standard for a computer peripheral interface. The I/O interface defines a protocol for communication over a serial interface that configures attached units to a communication fabric. The protocol has two layers. The IP layer defines basic interconnection protocols. The upper layer supports one or more logical protocols (for example, FCP for SCSI command protocols and SBCON for zSeries command protocols). Refer to American National Standards Institute (ANSI) X3.230-199x. See also *fibre-channel protocol*.

fibre-channel topology
An interconnection topology supported on fibre-channel adapters. See also *point-to-point connection*, *switched fabric*, and *arbitrated loop*.

FICON

See *fibre-channel connection*.

FiconNet

In the DS Storage Manager, the label on a pseudo host icon that represents a host connection that uses the FICON protocol and that is not completely defined on the DS8000. See also *pseudo host* and *access-any mode*.

field replaceable unit (FRU)

An assembly that is replaced in its entirety when any one of its components fails. In some cases, a field replaceable unit might contain other field replaceable units. (GC)

FIFO See *first-in-first-out*.

File Transfer Protocol (FTP)

In TCP/IP, an application protocol used to transfer files to and from host computers. See also *Transmission Control Protocol/Internet Protocol*.

firewall

A protection against unauthorized connection to a computer or a data storage system. The protection is usually in the form of software on a gateway server that grants access to users who meet authorization criteria.

first-in-first-out (FIFO)

A queuing technique in which the next item to be retrieved is the item that has been in the queue for the longest time. (A)

fixed-block architecture (FBA)

An architecture for logical devices that specifies the format of and access mechanisms for the logical data units on the device. The logical data unit is a block. All blocks on the device are the same size (fixed size). The subsystem can access them independently.

fixed-block device

An architecture for logical devices that specifies the format of the logical data units on the device. The logical data unit is a block. All blocks on the device are the same size (fixed size); the subsystem can access them independently. This is the required format of the logical data units for host systems that attach with a SCSI or fibre-channel interface. See also *fibre channel* and *small computer systems interface*.

FlashCopy

An optional feature of the DS8000 that can make an instant copy of data, that is, a point-in-time copy of a volume.

FlashCopy relationship

A mapping of a FlashCopy source volume and a FlashCopy target volume that allows a point-in-time copy of the source volume to be copied to the target volume. FlashCopy relationships exist from the time that you initiate a FlashCopy operation until the storage unit copies all data from the source volume to the target volume or until you delete the FlashCopy relationship, if it is persistent.

FRU See *field replaceable unit*.

FTP See *File Transfer Protocol*.

full duplex

See *duplex*.

fuzzy copy

A function of the Global Copy feature wherein modifications to the primary logical volume are performed on the secondary logical volume at a later time. The original order of update is not strictly maintained. See also *Global Copy*.

G

GB See *gigabyte*.

GDPS See *Geographically Dispersed Parallel Sysplex*.

Geographically Dispersed Parallel Sysplex (GDPS)

A zSeries multisite application-availability solution.

gigabyte (GB)

A gigabyte of storage is 10^9 bytes. A gigabyte of memory is 2^{30} bytes.

Global Copy

An optional capability of the DS8000 remote mirror and copy feature that maintains a fuzzy copy of a logical volume on the same DS8000 or on another DS8000. In other words, all modifications that any attached host performs on the primary logical volume are also performed on the secondary logical volume at a later point in time. The original order of update is not strictly maintained. See also *Remote Mirror and Copy* and *Metro Mirror*.

Global Mirror

An optional capability of the DS8000 remote mirror and copy feature that provides a 2-site extended distance remote copy. Data that is written by the host to the storage unit at the local site is automatically maintained at the remote site. See also *Metro Mirror* and *Remote Mirror and Copy*.

group In DS8000 documentation, a nickname for two different kinds of groups, depending on the context. See *disk pack* or *Copy Services server group*.

H

HA See *host adapter*.

HACMP

See *High-Availability Cluster Multi-Processing*.

hard disk drive (HDD)

1) A storage medium within a storage server used to maintain information that the storage server requires.

2) A mass storage medium for computers that is typically available as a fixed disk (such as the disks used in system units of personal computers or in drives that are external to a personal computer) or a removable cartridge.

hardware service manager (HSM)

An option on an AS/400 or iSeries host that enables the user to display and work with system hardware resources and to debug input-output processors (IOP), input-output adapters (IOA), and devices.

HCD See *Hardware Configuration Data*.

HDA See *head and disk assembly*.

HDD See *hard disk drive*.

hdisk An AIX term for storage space.

head and disk assembly (HDA)

The portion of an HDD associated with the medium and the read/write head.

heartbeat

A status report sent at regular intervals from the DS8000. The service provider uses this report to monitor the health of the call home process. See also *call home*, *heartbeat call home record*, and *remote technical assistance information network*.

heartbeat call home record

Machine operating and service information sent to a service machine. These records might include such information as feature code information and product logical configuration information.

hierarchical storage management

1) A function in storage management software, such as Tivoli Storage Management or Data Facility Storage Management Subsystem/MVS (DFSMS/MVS), that automatically manages free space based on the policy that the storage administrator sets.

2) In AS/400 storage management, an automatic method to manage and distribute data between the different storage layers, such as disk units and tape library devices.

High-Availability Cluster Multi-Processing (HACMP)

Software that provides host clustering, so that a failure of one host is recovered by moving jobs to other hosts within the cluster.

high-speed link (HSL)

A hardware connectivity architecture that links system processors to system input/output buses and other system units.

home address

A nine-byte field at the beginning of a track that contains information that identifies the physical track and its association with a cylinder.

hop Interswitch connection. A hop count is the number of connections that a particular block of data traverses between source and destination. For example, data traveling from one hub over a wire to another hub traverses one hop.

host See *host system*.

host adapter

A physical subunit of a storage server that provides the ability to attach to one or more host I/O interfaces.

host name

The Internet address of a machine in the network. The host name can be entered in the host definition as the fully qualified domain name of the attached host system, such as `mycomputer.city.company.com`, or

as the subname of the fully qualified
domain name, for example, `mycomputer`.
See also *host system*.

host processor
A processor that controls all or part of a
user application network. In a network, the
processing unit in which the data
communication access method resides.
See also *host system*.

host system
A computer, either of the mainframe (for
example, zSeries) or of the open-systems
type, that is connected to theDS8000.
zSeries hosts are connected to the
DS8000 through ESCON interfaces.
Open-systems hosts are connected to the
DS8000 by SCSI or fibre-channel
interfaces.

hot plug
Pertaining to the ability to add or remove
a hardware facility or resource to a unit
while power is on.

HSL See *high-speed link*.

HSM See *hierarchical storage management* or
Hardware Service Manager.

I

i5/OS The IBM operating system that runs the
IBM i5/OS and e(logo)Server i5 server
families of servers.

IBM e(logo)server
The IBM brand name for a series of
server products that are optimized for
e-commerce. The products include the
iSeries, pSeries, xSeries, and zSeries.

IBM product engineering (PE)
The third-level of IBM service support.
Product engineering is composed of IBM
engineers who have experience in
supporting a product or who are
knowledgeable about the product.

IBM Serial Storage adapter
A physical adapter based on the IBM
Serial Storage architecture. IBM Serial
Storage adapters connect disk drive
modules to DS8000 clusters.

IBM TotalStorage
The brand name used to identify storage
products from IBM, including the IBM
TotalStorage DS8000. See also *IBM*
TotalStorage DS8000 and *IBM*
TotalStorage DS Storage Manager.

IBM TotalStorage DS8000
A member of the IBM TotalStorage
Resiliency Family of storage servers and
attached storage devices (disk drive
modules). The DS8000 delivers
high-performance, fault-tolerant storage
and management of enterprise data,
affording access through multiple
concurrent operating systems and
communication protocols. High
performance is provided by multiple
symmetrical multiprocessors, integrated
caching, RAID support for the disk drive
modules, and disk access through a
high-speed serial storage architecture
interface.

IBM TotalStorage DS CLI
The command-line interface (CLI) that is
specific to the DS8000.

IBM TotalStorage DS Storage Manager (DS
Storage Manager)
Software with a Web-browser interface for
configuring the DS8000.

IBM TotalStorage Enterprise Storage Server
Network (ESSNet)
A private network providing Web browser
access to the Enterprise Storage Server.
IBM installs the ESSNet software on an
IBM workstation called the IBM
TotalStorage ESS Master Console,
supplied with the first ESS delivery.

IBM TotalStorage Management Console (MC)
An IBM workstation that acts as the focal
point for configuration, Copy Services
management, and maintenance for the
DS8000 . It includes a Web browser that
provides links to the user interface,
including the DS Storage Manager and
the DS8000 Copy Services.

IBM TotalStorage Multipath Subsystem Device
Driver (SDD)
Software that is designed to support the
multipath configuration environments of
the DS8000. The SDD resides in a host
system with the native disk device driver.

IBM TotalStorage Resiliency Family
A set of hardware and software features
and products, as well as integrated
software and services that are available
on theIBM TotalStorage DS8000 and the

IBM TotalStorage Enterprise Storage Server, Models 750 and 800.

image See *storage image*.

IML See *initial microcode load*.

implicit allegiance
In Enterprise Systems Architecture/390, a relationship that a control unit creates between a device and a channel path when the device accepts a read or write operation. The control unit guarantees access to the channel program over the set of channel paths that it associates with the allegiance.

initial microcode load (IML)
The action of loading microcode for a computer into that computer's storage.

initial program load (IPL)
The action of loading software into a computer, typically an operating system that controls the computer.

initiator
A SCSI device that communicates with and controls one or more targets. Contrast with *target*.

i-node The internal structure in an AIX operating system that describes the individual files in the operating system. It contains the code, type, location, and owner of a file.

input/output (I/O)
Pertaining to (a) input, output, or both or (b) a device, process, or channel involved in data input, data output, or both.

input/output configuration data set
A configuration definition built by the I/O configuration program (IOCP) and stored on disk files associated with the processor controller.

interleave
To automatically create two striped partitions across the drives in a RAID-5 array, both of which use the count-key-data (CKD) record format.

Internet Protocol (IP)
In the Internet suite of protocols, a protocol without connections that routes data through a network or interconnecting networks and acts as an intermediary between the higher protocol layers and the physical network. The upper layer supports one or more logical protocols (for

example, a SCSI-command protocol and a zSeries command protocol). Refer to ANSI X3.230-199*x*. The IP acronym is the IP in TCP/IP. See also *Transmission Control Protocol/Internet Protocol*.

invalidate
To remove a logical data unit from cache memory because it cannot support continued access to the logical data unit on the device. This removal might be the result of a failure within the storage server or a storage device that is associated with the device.

I/O See *input/output*.

I/O adapter (IOA)
An input-output adapter on the PCI bus.

IOCDS
See *input/output configuration data set*.

IOCP See *I/O Configuration Program*.

I/O Configuration Program (IOCP)
A program that defines to a system all the available I/O devices and channel paths.

I/O device
An addressable read and write unit, such as a disk drive device, magnetic tape device, or printer.

I/O interface
An interface that enables a host to perform read and write operations with its associated peripheral devices.

I/O Priority Queueing
A facility in the Workload Manager of zSeries that enables the system administrator to set priorities for queueing I/Os from different system images. See also *multiple allegiance* and *parallel access volume*.

I/O processor (IOP)
Controls input-output adapters and other devices.

I/O sequential response time
The time an I/O request is queued in processor memory waiting for previous I/Os to the same volume to complete.

IOSQ See *I/O sequential response time*.

IP See *Internet Protocol*.

IPL See *initial program load*.

iSeries
An IBM e(logo)server product that emphasizes integration. It is the successor to the AS/400 family of servers.

J

Java Virtual Machine (JVM)
A software implementation of a central processing unit (CPU) that runs compiled Java code (applets and applications). (GC)

JVM See *Java Virtual Machine*.

K

KB See *kilobyte*.

key field
The second (optional) field of a count key data record. The key length is specified in the count field. The key length determines the field length. The program writes the data in the key field and uses the key field to identify or locate a given record. The subsystem does not use the key field.

kilobyte (KB)
1) For processor storage, real, and virtual storage, and channel volume, 2^{10} or 1024 bytes.

2) For disk storage capacity and communications volume, 1000 bytes.

Korn shell
Interactive command interpreter and a command programming language.

KPOH See *thousands of power-on hours*.

L

LAN See *local area network*.

last-in first-out (LIFO)
A queuing technique in which the next item to be retrieved is the item most recently placed in the queue. (A)

LBA See *logical block address*.

LCU See *logical control unit*.

least recently used (LRU)
1) The algorithm used to identify and make available the cache space that contains the least-recently used data.

2) A policy for a caching algorithm that chooses to remove from cache the item that has the longest elapsed time since its last access.

LED See *light-emitting diode*.

LMC See *licensed machine code*.

licensed machine code (LMC)
Microcode that IBM does not sell as part of a machine, but licenses to the customer. LMC is implemented in a part of storage that is not addressable by user programs. Some IBM products use it to implement functions as an alternate to hard-wired circuitry.

LIFO See *last-in first-out*.

light-emitting diode (LED)
A semiconductor chip that gives off visible or infrared light when activated.

link address
On an ESCON interface, the portion of a source or destination address in a frame that ESCON uses to route a frame through an ESCON director. ESCON associates the link address with a specific switch port that is on the ESCON director. Equivalently, it associates the link address with the channel subsystem or control unit link-level functions that are attached to the switch port.

link-level facility
The ESCON hardware and logical functions of a control unit or channel subsystem that allow communication over an ESCON write interface and an ESCON read interface.

local area network (LAN)
A computer network located on a user's premises within a limited geographic area.

local e-mail
An e-mail configuration option for storage servers that are connected to a host-system network that does not have a domain name system (DNS) server.

logical address
On an ESCON interface, the portion of a source or destination address in a frame used to select a specific channel-subsystem or control-unit image.

logical block address (LBA)
    The address assigned by the DS8000 to a sector of a disk.

logical control unit (LCU)
    See *control-unit image*.

logical data unit
    A unit of storage that is accessible on a given device.

logical device
    The facilities of a storage server (such as the DS8000) associated with the processing of I/O operations directed to a single host-accessible emulated I/O device. The associated storage is referred to as a logical volume. The logical device is mapped to one or more host-addressable units, such as a device on a zSeries I/O interface or a logical unit on a SCSI I/O interface, such that the host initiating I/O operations to the I/O-addressable unit interacts with the storage on the associated logical device.

logical partition (LPAR)
    For zSeries, a set of functions that create the programming environment in which more than one logical partition (LPAR) is established on a processor. An LPAR is conceptually similar to a virtual machine environment except that the LPAR is a function of the processor. Also, the LPAR does not depend on an operating system to create the virtual machine environment.

logical path
    1) The relationship between a channel image and a control-unit image that designates the physical path to be used for device-level communications between these images. The logical path is established as part of the channel and control-unit initialization procedures by the exchange of link-level frames.

    2) With the Remote Mirror and Copy feature, the relationship between a source logical subsystem (LSS) and a target LSS that is created over a physical path through the interconnection fabric that is used for Remote Mirror and Copy functions. An LSS is a primary control unit, which performs the functions of a channel image.

logical subsystem (LSS)
    A topological construct that consists of a group of up to 256 logical devices. A DS8000 can have up to 16 CKD-formatted logical subsystems (4096 CKD logical devices) and also up to 16 fixed-block logical subsystems (4096 fixed-block logical devices). The logical subsystem facilitates configuration of the DS8000 and might have other implications relative to the operation of certain functions. There is a one-to-one mapping between a CKD logical subsystem and a zSeries control-unit image.

    For zSeries hosts, a logical subsystem represents a logical control unit (LCU). Each control-unit image is associated with only one logical subsystem. See also *control-unit image*.

logical unit
    In open systems, a logical disk drive.

logical unit number (LUN)
    In the SCSI protocol, a unique number that is used on a SCSI bus to enable it to differentiate between separate devices, each of which is a logical unit.

logical volume
    The storage medium that is associated with a logical disk drive. A logical volume typically resides on one or more storage devices. The DS8000 administrator defines this unit of storage. The logical volume, when residing on a RAID-formatted array, is spread over the drives in the array.

logical volume manager (LVM)
    A set of system commands, library routines, and other tools that allow the user to establish and control logical volume storage. The LVM maps data between the logical view of storage space and the physical disk drive module.

longitudinal redundancy check (LRC)
    1) A method of error checking during data transfer that involves checking parity on a row of binary digits that are members of a set that forms a matrix. Longitudinal redundancy check is also called a longitudinal parity check.

    2) A mechanism that the DS8000 uses for locating errors. The LRC checks the data as it progresses from the host, through theDS8000 controller, into the device adapter, and to the array.

longwave laser adapter
A connector that is used between a host and the DS8000 to support longwave fibre-channel communication.

loop
The physical connection between a pair of device adapters in the DS8000. See also *device adapter*.

LPAR
See *logical partition*.

LRC
See *longitudinal redundancy check*.

LRU
See *least recently used*.

LSS
See *logical subsystem*.

LUN
See *logical unit number*.

LVM
See *logical volume manager*.

M

machine level control (MLC)
A database that contains the EC level and configuration of products in the field.

machine reported product data (MRPD)
Product data gathered by a machine and sent to a destination such as an IBM support server or RETAIN. These records might include such information as feature code information and product logical configuration information.

mainframe
A computer, usually in a computer center, with extensive capabilities and resources to which other computers may be connected so that they can share facilities. (T)

maintenance analysis procedure (MAP)
A hardware maintenance document that gives an IBM service representative a step-by-step procedure for tracing a symptom to the cause of a failure.

management console
See *IBM TotalStorage Management Console*.

Management Information Base (MIB)
1) A collection of objects that can be accessed by means of a network management protocol. (GC)

2) The MIB record conforms to the Open Systems Interconnection (OSI) standard defined by the International Organization for Standardization (ISO) for the exchange of information. See also *simple network management protocol*.

MAP
See *maintenance analysis procedure*.

master storage unit
The physical unit that controls the creation of consistency groups in a Global Mirror session. The master storage unit sends commands to subordinate storage units. A storage unit can be a master for only one Global Mirror session. Contrast with *subordinate storage unit*.

maximum consistency group drain time
The value in seconds that indicates the maximum time that writes from the local site are delayed to the remote site while the current consistency group is being formed at the remote site. When this time is exceeded, the current attempt to form a consistency group is ended and another attempt is started. If this time is exceeded five times, this maximum time is ignored on the next attempt to form a consistency group. The default value is the larger of four minutes or two times the consistency group interval time if this value is set to zero.

maximum coordination time
The value in milliseconds that indicates the maximum time that is allowed for host I/O to be delayed during the coordination of the primary volumes of an Global Mirror session. The default is 50 milliseconds if this value is set to zero.

MB
See *megabyte*.

MC
See *IBM TotalStorage Management Console*.

MCA
See *Micro Channel architecture*.

MDM
See *Multiple Device Manager*.

mean time between failures (MTBF)
1) A projection of the time that an individual unit remains functional. The time is based on averaging the performance, or projected performance, of a population of statistically independent units. The units operate under a set of conditions or assumptions.

2) For a stated period in the life of a functional unit, the mean value of the lengths of time between consecutive failures under stated conditions. (I) (A)

medium
For a storage unit, the disk surface on which data is stored.

megabyte (MB)
> 1) For processor storage, real and virtual storage, and channel volume, 2^{20} or 1 048 576 bytes.
>
> 2) For disk storage capacity and communications volume, 1 000 000 bytes.

Metro Mirror
> A function of a storage server that maintains a consistent copy of a logical volume on the same storage server or on another storage server. All modifications that any attached host performs on the primary logical volume are also performed on the secondary logical volume. See also *Remote Mirror and Copy* and *Global Copy*.

MES See *miscellaneous equipment specification*.

MIB See *management information base*.

Micro Channel architecture (MCA)
> The rules that define how subsystems and adapters use the Micro Channel bus in a computer. The architecture defines the services that each subsystem can or must provide.

Microsoft Internet Explorer (MSIE)
> Web browser software manufactured by Microsoft.

migration
> The replacement of a system or subsystem with a different type of system or subsystem, such as replacing a SCSI host adapter with a fibre-channel host adapter. In the context of data migration regarding the DS8000, the transfer of data from one storage unit to another, such as from a 3390 to the DS8000.

MIH See *missing-interrupt handler*.

mirrored pair
> Two units that contain the same data. The system refers to them as one entity.

mirroring
> In host systems, the process of writing the same data to two disk units within the same auxiliary storage pool at the same time.

miscellaneous equipment specification (MES)
> IBM field-installed change to a machine.

missing-interrupt handler (MIH)
> An MVS and MVS/XA facility that tracks

I/O interrupts. MIH informs the operator and creates a record whenever an expected interrupt fails to occur before a specified elapsed time is exceeded.

MLC See *machine level control*.

mobile solutions terminal (MoST)
> The mobile terminal used by service personnel.

mode conditioning patch cable
> A cable that converts a single-mode signal from a longwave adapter into a light signal that is appropriate for multimode fibre. Another mode conditioning patch cable is required at the terminating end of the multimode fibre to convert the signal back to a single-mode signal for a longwave adapter.

Model 100
> A 2105 Model 100, often simply referred to as a Mod 100, is an expansion enclosure for the Enterprise Storage Server. See also *2105*.

MoST See *mobile solutions terminal*.

MRPD See *machine reported product data*.

MSA See *multiport serial adapter*.

MSIE See *Microsoft Internet Explorer*.

MTBF See *mean time between failures*.

Multipath Subsystem Device Driver
> See *IBM TotalStorage DS8000 Multipath Subsystem Device Driver*.

multiple allegiance
> A DS8000 hardware function that is independent of software support. This function enables multiple system images to concurrently access the same logical volume on the DS8000 as long as the system images are accessing different extents. See also *extent* and *parallel access volumes*.

Multiple Device Manager (MDM)
> A component of the IBM TotalStorage Productivity Center that allows administrators to configure, manage, and monitor the performance of SAN storage devices from a single console.

multiple relationship FlashCopy
> An option of the DS8000 that creates backup copies from one source to multiple

targets by simultaneously establishing multiple FlashCopy relationships.

multiple virtual storage (MVS)
Implies MVS/390, MVS/XA, MVS/ESA, and the MVS element of the zSeries operating system.

multiplex
The action of transmitting simultaneously.

multiport serial adapter (MSA)
An adapter on the IBM TotalStorage Management Console that has multiple ports to which aDS8000 can be attached.

multiprocessor
A computer that includes two or more processors that have common access to a main storage. For the DS8000, the multiprocessors operate in parallel.

MVS See *multiple virtual storage*.

N

name server
A server that stores names of the participating DS8000 clusters.

Netfinity
IBM Intel-processor-based server; predecessor to the IBM xSeries server.

Netscape Navigator
Web browser software manufactured by Netscape.

network manager
A program or group of programs that is used to monitor, manage, and diagnose the problems of a network. (GC)

node The unit that is connected in a fibre-channel network. A DS8000 is a node in a fibre-channel network.

non-RAID
A disk drive set up independently of other disk drives and not set up as part of a disk pack to store data using the redundant array of disks (RAID) data-striping methodology.

nonremovable medium
A recording medium that cannot be added to or removed from a storage device.

nonvolatile storage (NVS)
Memory that stores active write data to avoid data loss in the event of a power loss.

NVS See *nonvolatile storage*.

O

octet In Internet Protocol addressing, one of the four parts of a 32-bit integer presented in dotted decimal notation. See also *dotted decimal notation*.

OEMI See *original equipment manufacturer's information*.

open system
A system whose characteristics comply with standards made available throughout the industry and that therefore can be connected to other systems complying with the same standards. Applied to the DS8000, such systems are those hosts that connect to the DS8000 through SCSI or FCP protocols. See also *small computer system interface* and *fibre-channel protocol*.

organizationally unique identifier (OUI)
An IEEE-standards number that identifies an organization with a 24-bit globally unique assigned number referenced by various standards. OUI is used in the family of 802 LAN standards, such as Ethernet and Token Ring.

original equipment manufacturer's information (OEMI)
A reference to an IBM guideline for a computer peripheral interface. The interface uses ESA/390 logical protocols over an I/O interface that configures attached units in a multidrop bus topology.

OS/390
The IBM operating system that includes and integrates functions that many IBM software products (including the MVS operating system) previously provided for the IBM S/390 family of enterprise servers.

OUI See *organizationally unique identifier*.

P

panel The formatted display of information that appears on a display screen.

parallel access volume (PAV)
An advanced function of the DS8000 that enables OS/390 and z/OS systems to issue concurrent I/O requests against a count key data logical volume by

associating multiple devices of a single control-unit image with a single logical device. Up to eight device addresses can be assigned to a PAV. The PAV function enables two or more concurrent write operations to the same logical volume, as long as the write operations are not to the same extents. See also *extent*, *I/O Priority Queueing*, and *multiple allegiance*.

parity A data checking scheme used in a computer system to ensure the integrity of the data. The RAID implementation uses parity to re-create data if a disk drive fails.

path group
In zSeries architecture, a set of channel paths that are defined to a control unit as being associated with a single logical partition (LPAR). The channel paths are in a group state and are online to the host. See also *logical partition*.

path group identifier
In zSeries architecture, the identifier that uniquely identifies a given logical partition (LPAR). The path group identifier is used in communication between the LPAR program and a device. The identifier associates the path group with one or more channel paths, thereby defining these paths to the control unit as being associated with the same LPAR. See also *logical partition*.

PAV See *parallel access volume*.

PCI See *peripheral component interconnect*.

PDU See *protocol data unit*.

PE See *IBM product engineering*.

peripheral component interconnect (PCI)
An architecture for a system bus and associated protocols that supports attachments of adapter cards to a system backplane.

persistent FlashCopy
A state where a FlashCopy relationship remains indefinitely until the user deletes it. The relationship between the source and target volumes is maintained after a background copy completes.

physical path
A single path through the I/O interconnection fabric that attaches two units. For Copy Services, this is the path from a host adapter on one DS8000

(through cabling and switches) to a host adapter on anotherDS8000.

pinned data
Data that is held in cache until either an error condition is corrected and it can be moved to disk storage or until the data is discarded by a host command. Pinned data conditions can only occur on an ESS Model 800 during fast-write or dual-copy functions.

point-in-time copy
A FlashCopy option that creates an instantaneous view of original source data at a specific moment in time.

point-to-point connection
A fibre-channel topology that enables the direct interconnection of ports. See also *arbitrated loop* and *switched fabric*.

port A physical connection on a host adapter to the cable that connects the DS8000 to hosts, switches, or another DS8000. The DS8000 uses SCSI and ESCON host adapters that have two ports per adapter, and fibre-channel host adapters that have one port. See also *ESCON*, *fibre channel*, *host adapter*, and *small computer system interface*.

POST See *power-on self test*.

power-on self test (POST)
A diagnostic test that servers or computers run when they are turned on.

predictable write
A write operation that can cache without knowledge of the existing format on the medium. All write operations on FBA DASD devices are predictable. On CKD DASD devices, a write operation is predictable if it does a format write operation for the first data record on the track.

primary control unit
The DS8000 to which a Remote Mirror and Copy primary device is physically attached.

processor complex
A partition of a storage server that is capable of performing all defined functions of the storage server. Multiple processor complexes provide redundancy.

product engineering
See *IBM product engineering*.

program
On a computer, a generic term for software that controls the operation of the computer. Typically, the program is a logical assemblage of software modules that perform multiple related tasks.

program-controlled interruption
An interruption that occurs when an I/O channel fetches a channel command word with the program-controlled interruption flag on.

program temporary fix (PTF)
A temporary solution to, or bypass of, a problem diagnosed by IBM as the result of a defect in a current unaltered release of a licensed program. (GC)

promote
To add a logical data unit to cache memory.

protected volume
In AS/400, a disk storage device that is protected from data loss by RAID techniques. An AS/400 host does not mirror a volume configured as a protected volume, while it does mirror all volumes configured as unprotected volumes. The DS8000, however, can be configured to indicate that an AS/400 volume is protected or unprotected and give it RAID protection in either case.

protocol data unit (PDU)
A unit of data specified in the protocol of a given layer and consisting of protocol control information for the layer and, possibly, user data for the layer.

pSeries
The product name of an IBM e(logo)server product that emphasizes performance. It is the successor to the RS/6000 family of servers.

pseudo host
A host connection that is not explicitly defined to the DS8000 and that has access to at least one volume that is configured on the DS8000. The FiconNet pseudo host icon represents the FICON protocol. The EsconNet pseudo host icon represents the ESCON protocol. The pseudo host icon labelled Anonymous represents hosts connected through the FCP protocol. *Anonymous host* is a commonly used synonym for *pseudo host*.

The DS8000 adds a pseudo host icon only when it is set to access-any mode. See also *access-any mode*.

PTF   See *program temporary fix*.

PV Links
Short for Physical Volume Links, an alternate pathing solution from Hewlett-Packard that provides for multiple paths to a volume, as well as static load balancing.

R

R0   See *track-descriptor record*.

rack   See *enclosure*.

RAID   See *redundant array of independent disks*. RAID is also commonly expanded to redundant array of *inexpensive* disks. See also *array*.

RAID 5
A type of RAID that optimizes cost-effective performance while emphasizing use of available capacity through data striping. RAID 5 provides fault tolerance for up to two failed disk drives by distributing parity across all the drives in the array plus one parity disk drive. The DS8000 automatically reserves spare disk drives when it assigns arrays to a device adapter pair (DA pair). See also *device adapter*, *RAID 10*, and *redundant array of independent disks*.

RAID 10
A type of RAID that optimizes high performance while maintaining fault tolerance for up to two failed disk drives by striping volume data across several disk drives and mirroring the first set of disk drives on an identical set. The DS8000 automatically reserves spare disk drives when it assigns arrays to a device adapter pair (DA pair). See also *device adapter*, *RAID 5*, and *redundant array of independent disks*.

random access
A mode of accessing data on a medium in a manner that requires the storage device to access nonconsecutive storage locations on the medium.

rank   One or more arrays that are combined to create a logically contiguous storage space.

redundant array of independent disks (RAID)
> A methodology of grouping disk drives for managing disk storage to insulate data from a failing disk drive.

refresh FlashCopy target volume
> An option (previously called *incremental FlashCopy*) of the DS8000 that creates a point-in-time data copy without copying an entire volume for each point-in-time copy.

Remote Mirror and Copy
> A feature of a storage server that constantly updates a secondary copy of a logical volume to match changes made to a primary logical volume. The primary and secondary volumes can be on the same storage server or on separate storage servers. See also *Global Mirror*, *Metro Mirror* and *Global Copy*.

remote technical assistance information network (RETAIN)
> The initial service tracking system for IBM service support, which captures heartbeat and call-home records. See also *support catcher* and *support catcher telephone number*.

REQ/ACK
> See *request for acknowledgment and acknowledgment*.

request for acknowledgment and acknowledgment (REQ/ACK)
> A cycle of communication between two data transport devices for the purpose of verifying the connection, which starts with a request for acknowledgment from one of the devices and ends with an acknowledgment from the second device. The REQ and ACK signals help to provide uniform timing to support synchronous data transfer between an initiator and a target. The objective of a synchronous data transfer method is to minimize the effect of device and cable delays.

reserved allegiance
> For zSeries, a relationship that is created in a control unit between a device and a channel path, or path group, when the device completes a Sense Reserve command. The allegiance causes the control unit to guarantee access (that is, busy status is not presented) to the device. Access is over the set of channel paths that are associated with the

allegiance; access is for one or more channel programs until the allegiance ends.

RETAIN
> See *remote technical assistance information network*.

S

S/390
IBM enterprise servers based on Enterprise Systems Architecture/390 (ESA/390). *S/390* is the currently accepted shortened form of the original name *System/390*.

S/390 storage
> Storage arrays and logical volumes that are defined as connected to S/390 servers. This term is synonymous with count-key-data storage.

SAID
See *system adapter identification number*.

SAM
See *sequential access method*.

SAN
See *storage area network*.

SBCON
> See *Single-Byte Command Code Sets Connection*.

screen
> The physical surface of a display device upon which information is shown to users.

SCSI
See *small computer system interface*.

SCSI device
> A disk drive connected to a host through an I/O interface using the SCSI protocol. A SCSI device is either an initiator or a target. See also *initiator* and *small computer system interface*.

SCSI-FCP
> Synonym for fibre-channel protocol, a protocol used to transport data between an open-systems host and a fibre-channel adapter on an DS8000. See also *fibre-channel protocol* and *small computer system interface*.

SCSI host systems
> Host systems that are attached to the DS8000 with a SCSI interface. Such host systems run on UNIX, i5/OS, Windows NT, Windows 2000, or Novell NetWare operating systems.

SCSI ID
> A unique identifier assigned to a SCSI

device that is used in protocols on the SCSI interface to identify or select the device. The number of data bits on the SCSI bus determines the number of available SCSI IDs. A wide interface has 16 bits, with 16 possible IDs.

SDD   See *IBM Subsystem Multipathing Device Driver*.

secondary control unit
The DS8000 to which a Remote Mirror and Copy secondary device is physically attached.

self-timed interface (STI)
An interface that has one or more conductors that transmit information serially between two interconnected units without requiring any clock signals to recover the data. The interface performs clock recovery independently on each serial data stream and uses information in the data stream to determine character boundaries and inter-conductor synchronization.

sequential access
A mode of accessing data on a medium in a manner that requires the storage device to access consecutive storage locations on the medium.

sequential access method (SAM)
An access method for storing, deleting, or retrieving data in a continuous sequence based on the logical order of the records in the file.

serial connection
A method of device interconnection for determining interrupt priority by connecting the interrupt sources serially.

server A host that provides certain services to other hosts that are referred to as clients.

A functional unit that provides services to one or more clients over a network. (GC)

service boundary
A category that identifies a group of components that are unavailable for use when one of the components of the group is being serviced. Service boundaries are provided on the DS8000, for example, in each host bay and in each cluster.

service clearance
The area that is required to open the service covers and to pull out components for servicing.

service information message (SIM)
A message sent by a storage server to service personnel through an zSeries operating system.

service personnel
A generalization referring to individuals or companies authorized to service the DS8000. The terms *service provider*, *service representative*, and *IBM service support representative (SSR)* refer to types of service personnel. See also *service support representative*.

service processor
A dedicated processing unit that is used to service a storage unit.

service support representative (SSR)
Individuals or a company authorized to service the DS8000. This term also refers to a service provider, a service representative, or an IBM service support representative (SSR). An IBM SSR installs the DS8000.

SES   SCSI Enclosure Services.

session
A collection of volumes within a logical subsystem that are managed together during the creation of consistent copies of data. All volumes in a session must transfer their data successfully to the remote site before the increment can be called complete.

SFP   Small form factor pluggables.

shared storage
Storage that is configured so that multiple hosts can concurrently access the storage. The storage has a uniform appearance to all hosts. The host programs that access the storage must have a common model for the information on a storage device. The programs must be designed to handle the effects of concurrent access.

shortwave laser adapter
A connector that is used between host and DS8000 to support shortwave fibre-channel communication.

SIM   See *service information message*.

Simple Network Management Protocol (SNMP)
In the Internet suite of protocols, a network management protocol that is used to monitor routers and attached networks. SNMP is an application layer protocol. Information on devices managed is defined and stored in the application's Management Information Base (MIB). (GC) See also *management information base.*

simplex volume
A volume that is not part of a FlashCopy, XRC, or PPRC volume pair.

Single-Byte Command Code Sets Connection (SBCON)
The ANSI standard for the ESCON I/O interface.

small computer system interface (SCSI)
A standard hardware interface that enables a variety of peripheral devices to communicate with one another. (GC)

smart relay host
A mail relay or mail gateway that has the capability to correct e-mail addressing problems.

SMIT See *System Management Interface Tool.*

SMP See *symmetrical multiprocessor.*

SNMP See *Simple Network Management Protocol.*

SNMP agent
A server process that resides on a network node and is responsible for communicating with managers regarding that node. The node is represented as a managed object, which has various fields or variables that are defined in the appropriate MIB.

SNMP manager
A managing system that runs a managing application or suite of applications. These applications depend on Management Information Base (MIB) objects for information that resides on the managed system. Managers generate requests for this MIB information, and an SNMP agent on the managed system responds to these requests. A request can either be the retrieval or modification of MIB information.

software transparency
Criteria applied to a processing environment that states that changes do not require modifications to the host software in order to continue to provide an existing function.

source device
One of the devices in a dual-copy or remote-copy volume pair. All channel commands to the logical volume are directed to the source device. The data on the source device is duplicated on the target device. See also *target device.*

spare A disk drive on the DS8000 that can replace a failed disk drive. A spare can be predesignated to allow automatic dynamic sparing. Any data preexisting on a disk drive that is invoked as a spare is destroyed by the dynamic sparing copy process.

spatial reuse
A feature of serial storage architecture that enables a device adapter loop to support many simultaneous read/write operations. See also *serial storage architecture.*

SSID See *subsystem identifier.*

SSR See *service support representative.*

stacked status
For zSeries, the condition when the control unit is in a holding status for the channel, and the last time the control unit attempted to present the status, the channel responded with the stack-status control.

stage operation
The operation of reading data from the physical disk drive into the cache.

staging
To move data from an offline or low-priority device back to an online or higher priority device, usually on demand of the system or on request of the user.

standard volume
A volume that emulates one of several zSeries volume types, including 3390-2, 3390-3, 3390-9, 3390-2 (3380-track mode), or 3390-3 (3380-track mode), by presenting the same number of cylinders and capacity to the host as provided by the native zSeries volume type of the same name.

STI See *self-timed interface.*

storage area network
A network that connects a company's heterogeneous storage resources.

storage capacity
The amount of data that a storage medium can hold; usually expressed in kilobytes, megabytes, or gigabytes.

storage complex
A configuration of one or more storage units that is managed by a management console.

storage device
A physical unit that provides a mechanism to store data on a given medium such that it can be subsequently retrieved. See also *disk drive module*.

storage extent
The minimum contiguous range of storage on a physical storage device, array, or rank that can be allocated to a local volume

storage image
A partitioning of a storage unit that provides emulation of a storage server with one or most storage devices that provides storage capability to a host computer. You can configure more than one storage image on a storage unit.

storage server
A physical unit that manages attached storage devices and provides an interface between them and a host computer by providing the function of one or more logical subsystems. The storage server can provide functions that the storage device does not provide. The storage server has one or more clusters.

storage unit
A physical unit that consists of a storage server that is integrated with one or more storage devices that provide storage capability to a host computer.

storage unit identifier
A unique identifier for a storage unit that consists of a manufacturer, a model number, a type number, a plant of manufacture, and a sequence number.

striping
A technique that distributes data in bit, byte, multibyte, record, or block increments across multiple disk drives.

subagent
An extension to an SNMP agent that permits a user to dynamically add, or in some cases replace, additional management variables in the local MIB, thereby providing a means of extending the range of information that network managers can access. See also *agent*.

subchannel
A logical function of a channel subsystem associated with the management of a single device.

subordinate storage unit
The physical unit that receives commands from the master storage unit and is specified when a Global Mirror session is started. The subordinate storage unit forms consistency groups and performs other Global Mirror processing. A subordinate storage unit can be controlled by only one master storage unit. Contrast with *master storage unit*.

subsystem identifier (SSID)
A number that uniquely identifies a logical subsystem within a computer installation.

support catcher
See *catcher*.

support catcher telephone number
The telephone number that connects the support catcher server to the DS8000 to receive a trace or dump package. See also *support catcher* and *remote technical assistance information network*.

switched fabric
A fibre-channel topology in which ports are interconnected through a switch. Fabric switches can also be interconnected to support numerous ports on a single network. See also *arbitrated loop* and *point-to-point connection*.

symmetrical multiprocessor (SMP)
An implementation of a multiprocessor computer consisting of several identical processors configured in a way that any subset of the set of processors is capable of continuing the operation of the computer. TheDS8000 contains four processors set up in SMP mode.

synchronous write
A write operation whose completion is indicated after the data has been stored on a storage device.

System/390
See *S/390*.

system adapter identification number (SAID)
The unique identification number that is automatically assigned to each DS8000 host adapter for use by Copy Services.

System Management Interface Tool (SMIT)
An interface tool of the AIX operating system for installing, maintaining, configuring, and diagnosing tasks.

System Modification Program
A program used to install software and software changes on MVS systems.

T

TAP See *Telocator Alphanumeric Protocol*.

target A SCSI device that acts as a subordinate to an initiator and consists of a set of one or more logical units, each with an assigned logical unit number (LUN). The logical units on the target are typically I/O devices. A SCSI target is analogous to a zSeries control unit. See also *small computer system interface*.

target device
One of the devices in a dual-copy or remote-copy volume pair that contains a duplicate of the data that is on the source device. Unlike the source device, the target device might only accept a limited subset of data. See also *source device.*

TB See *terabyte*.

TCP/IP
See *Transmission Control Protocol/Internet Protocol*.

Telocator Alphanumeric Protocol (TAP)
An industry standard protocol for the input of paging requests.

terabyte (TB)
1) Nominally, 1 000 000 000 000 bytes, which is accurate when speaking of bandwidth and disk storage capacity.

2) For DS8000 cache memory, processor storage, real and virtual storage, a terabyte refers to 2^{40} or 1 099 511 627 776 bytes.

terminal emulator
A function of the management console that allows it to emulate a terminal.

thousands of power-on hours (KPOH)
A unit of time used to measure the mean time between failures (MTBF).

time sharing option (TSO)
An operating system option that provides interactive time sharing from remote terminals.

TotalStorage
See *IBM TotalStorage*.

TPF See *transaction processing facility*.

track A unit of storage on a CKD device that can be formatted to contain a number of data records. See also *home address*, *track-descriptor record*, and *data record*.

track-descriptor record (R0)
A special record on a track that follows the home address. The control program uses it to maintain certain information about the track. The record has a count field with a key length of zero, a data length of 8, and a record number of 0. This record is sometimes referred to as R0.

transaction processing facility (TPF)
A high-availability, high-performance IBM operating system, designed to support real-time, transaction-driven applications. The specialized architecture of TPF is intended to optimize system efficiency, reliability, and responsiveness for data communication and database processing. TPF provides real-time inquiry and updates to a large, centralized database, where message length is relatively short in both directions, and response time is generally less than three seconds. Formerly known as the Airline Control Program/Transaction Processing Facility (ACP/TPF).

Transmission Control Protocol (TCP)
A communications protocol used in the Internet and in any network that follows the Internet Engineering Task Force (IETF) standards for internetwork protocol. TCP provides a reliable host-to-host protocol between hosts in packet-switched communications networks and in interconnected systems of such networks. It uses the Internet Protocol (IP) as the underlying protocol.

Transmission Control Protocol/Internet Protocol (TCP/IP)
1) A combination of data-transmission

protocols that provide end-to-end connections between applications over interconnected networks of different types.

2) A suite of transport and application protocols that run over the Internet Protocol. (GC) See also *Internet Protocol* and *Transmission Control Protocol*.

transparency
 See *software transparency*.

TSO See *time sharing option*.

turbo processor
 A faster multiprocessor that has six processors with common access to the main storage.

U

UFS UNIX filing system.

Ultra-SCSI
 An enhanced small computer system interface.

unconfigure
 To delete the configuration.

unit address
 For zSeries, the address associated with a device on a given control unit. On ESCON interfaces, the unit address is the same as the device address. On OEMI interfaces, the unit address specifies a control unit and device pair on the interface.

unprotected volume
 An AS/400 term that indicates that the AS/400 host recognizes the volume as an unprotected device, even though the storage resides on a RAID-formatted array and is, therefore, fault tolerant by definition. The data in an unprotected volume can be mirrored. Also referred to as an *unprotected device*.

upper-layer protocol
 The layer of the Internet Protocol (IP) that supports one or more logical protocols (for example, a SCSI-command protocol and an ESA/390 command protocol). Refer to ANSI X3.230-199*x.*

UTC See *Coordinated Universal Time*.

V

virtual machine facility
 A virtual data processing machine that appears to the user to be for the exclusive

use of that user, but whose functions are accomplished by sharing the resources of a shared data processing system. An alternate name for the VM/370 IBM operating system.

vital product data (VPD)
 Information that uniquely defines the system, hardware, software, and microcode elements of a processing system.

VM The root name of several IBM operating systems, such as VM/XA, VM/ESA, VM/CMS, and z/VM. See also *virtual machine facility*.

volume
 For zSeries, the information recorded on a single unit of recording medium. Indirectly, it can refer to the unit of recording medium itself. On a nonremovable-medium storage device, the term can also indirectly refer to the storage device associated with the volume. When multiple volumes are stored on a single storage medium transparently to the program, the volumes can be referred to as logical volumes.

volume group
 A collection of either physical or logical volumes.

volume label
 A unique identifier that a user assigns to a logical volume.

VPD See *vital product data*.

VSE/ESA
 An IBM operating system, the letters of which represent virtual storage extended/enterprise systems architecture.

W

weight distribution area
 The area that is required to distribute the weight of the storage unit.

worldwide node name (WWNN)
 A unique 64-bit identifier for a host that contains a fibre-channel port. See also *worldwide port name*.

worldwide port name (WWPN)
 A unique 64-bit identifier associated with a fibre-channel adapter port. It is assigned in an implementation- and

protocol-independent manner. See also
worldwide node name

write hit
A write operation in which the requested
data is in the cache.

write penalty
The performance impact of a classical
RAID-5 write operation.

WWNN
See *worldwide node name*.

WWPN
See *worldwide port name*.

X

xSeries
The product name of an IBM e(logo)server
product that emphasizes industry-standard
server scalability and self-managing server
technologies. It is the successor to the
Netfinity family of servers.

Z

z/Architecture
An IBM architecture for mainframe
computers and peripherals. The IBM
e(logo)server zSeries family of servers
uses the z/Architecture architecture. It is
the successor to the S/390 and 9672
family of servers. See also *iSeries*.

z/OS An operating system for the IBM
e(logo)server product line that supports
64-bit real storage.

z/OS Global Mirror
A function of a storage server that assists
a control program to maintain a consistent
copy of a logical volume on another
storage unit. All modifications of the
primary logical volume by any attached
host are presented in order to a single
host. The host then makes these
modifications on the secondary logical
volume. This function was formerly called
extended remote copy or XRC.

zSeries
An IBM e(logo)server family of servers
that emphasizes near-zero downtime.

IBM enterprise servers based on
z/Architecture.

zSeries storage
Storage arrays and logical volumes that
are defined in the DS8000 as connected
to zSeries servers.

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Introduction and Planning Guide

Publication No. GC35-0495-04

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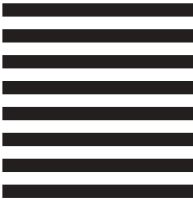
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GC35-0495-04

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IBM TotalStorage DS8000

Introduction and Planning Guide

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