IBM 3592 Tape Drives
and TS1120 Controller

Introduction and Planning Guide 3592 Models J1A, E05, E06, EU6, E07, E08, EH7, EH8, 55F, 60F, and J70, C06 Controllers

GA32-0555-10

Note

Before using this information and the product it supports, read the information in "Safety and environmental notices" on page xi and "Notices" on page 149.

Edition notice

This edition applies to the eleventh release of the *IBM 3592 Tape Drives and TS1120 Controller Introduction and Planning Guide* and to all subsequent releases and modifications until otherwise indicated in new editions.

Read this first

This is the eleventh edition of the *IBM 3592 Tape Drives and TS1120 Controller Introduction and Planning Guide* (November 2018).

What's new in this edition (November 2018)

Revision bars (|) appear next to information that was added or changed since the release of the last edition (GA32-0555-09). Changes include

- Added updates for the IBM Rack Mount Model 60F tape drive.
- Miscellaneous editorial changes.

Tenth Edition

Revision bars (|) appear next to information that was added or changed since the release of the last edition (GA32-0555-08). Changes include

- Added updates for the IBM Rack Mount Model 55F tape drive.
- Miscellaneous editorial changes.

Ninth Edition

Revision bars (|) appear next to information that was added or changed since the release of the last edition (GA32-0555-07). Changes include

- Added updates for the IBM Rack Mount EH7 and EH8 tape drives.
- Miscellaneous editorial changes.

Attention: Do not put the system into a dusty or contaminated environment that contains corrosive gases (for example, high sulfur) or metallic shavings (for example, zinc whiskers). Dusty environments can impact the air-cooling of assemblies and corrosive gasses can degrade components, causing a change to their characteristics, leading to a breakdown of the equipment.

Eighth Edition

The following information was added in the eighth edition.

- Added updates for the IBM TS1150 Model E08 tape drive, and the IBM 3592-C07 Controller.
- Miscellaneous editorial changes.

Seventh Edition

The following information was added in the seventh edition.

- TS1140 (3592 Model E07) Tape Drive read only capability of the following cartridges
  - IBM Tape Cartridge 3592 Standard Data (type JA)
  - IBM Tape Cartridge 3592 Economy (type JJ)
  - IBM Tape Cartridge 3592 Economy WORM (write-once, read-many) (type JR)
  - IBM Tape Cartridge 3592 Standard WORM cartridges (type JW)

  Refer to “Cartridge types and characteristics” on page 90 for information.
- Miscellaneous editorial changes.

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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

Observe the safety notices when using this product. These safety notices contain danger and caution notices. These notices are sometimes accompanied by symbols that represent the severity of the safety condition.

Most danger or caution notices contain a reference number (Dxxx or Cxxx). Use the reference number to check the translation in the *IBM Systems Safety Notices*, G229–9054 manual.

The sections that follow define each type of safety notice and give examples.

Danger notice

A danger notice calls attention to a situation that is potentially lethal or extremely hazardous to people. A lightning bolt symbol always accompanies a danger notice to represent a dangerous electrical condition. A sample danger notice follows:

DANGER: An electrical outlet that is not correctly wired could place hazardous voltage on metal parts of the system or the devices that attach to the system. It is the responsibility of the customer to ensure that the outlet is correctly wired and grounded to prevent an electrical shock. *(D004)*

Caution notice

A caution notice calls attention to a situation that is potentially hazardous to people because of some existing condition, or to a potentially dangerous situation that might develop because of some unsafe practice. A caution notice can be accompanied by one of several symbols:

If the symbol is...	It means...
	A generally hazardous condition not represented by other safety symbols.
	This product contains a Class II laser. Do not stare into the beam. (*C029*) Laser symbols are always accompanied by the classification of the laser as defined by the U. S. Department of Health and Human Services (for example, Class I, Class II, and so forth).
	A hazardous condition due to mechanical movement in or around the product.
	This part or unit is heavy but has a weight smaller than 18 kg (39.7 lb). Use care when lifting, removing, or installing this part or unit. (*C008*)

Sample caution notices follow:

Caution

The battery is a lithium ion battery. To avoid possible explosion, do not burn. Exchange only with the IBM-approved part. Recycle or discard the battery as instructed by local regulations. In the United States, IBM® has a process for the collection of this battery. For information, call 1-800-426-4333. Have the IBM part number for the battery unit available when you call. (*C007*)

Caution

The system contains circuit cards, assemblies, or both that contain lead solder. To avoid the release of lead (Pb) into the environment, do not burn. Discard the circuit card as instructed by local regulations. (*C014*)

Caution

When removing the Modular Refrigeration Unit (MRU), immediately remove any oil residue from the MRU support shelf, floor, and any other area to prevent injuries because of slips or falls. Do not use refrigerant lines or connectors to lift, move, or remove the MRU. Use handholds as instructed by service procedures. (*C016*)

Caution

This product may not be certified in your country for connection by any means whatsoever to interfaces of public telecommunications networks. Further certification may be required by law prior to making any such connection. Please contact IBM for information.

Environmental notices

The environmental notices that apply to this product are provided in the *Environmental Notices and User Guide*, Z125-5823-*xx* manual. A copy of this manual is located on the publications CD.

About this publication

This publication contains information about the IBM 3592 tape drives and TS1120 (3592 C06) Controller.

Accessibility

IBM strives to provide products with usable access for everyone, regardless of age or ability. This product uses standard Windows navigation keys. See Appendix B, “Accessibility,” on page 148 for more information.

Related information

Refer to the following publications and sources for information about the IBM 3592 tape drives and TS1120 (3592 C06) Controller. To ensure that you have the current publications, see IBM Support Portal.

For information, see *IBM 3592 E07/EH7, E08/EH8, 55F, and 60F Tape Drives documentation* at https://www.ibm.com/support/knowledgecenter/STPRH6/com.ibm.storage.drives.doc/jag_ichome.html.

IBM 3953 Tape System publications

- *IBM 3953 Library Manager Model L05 Operator Guide*, GA32-0558
- *IBM 3953 Tape System Introduction and Planning Guide*, GA32-0557

IBM 3592 tape drives and controller publications

- *IBM 3592 Tape Drives and TS1120 Controller Operator Guide*, GA32-0556
- *IBM 3592 SCSI Reference*, GA32-0562
- *IBM TS1120, TS1130, TS1140, TS1150, TS1155, and TS1160 Tape Drives Maintenance Information*
- IBM 3592 E07/EH7, E08/EH8, 55F, and 60F Tape Drives Knowledge Center, available at https://www.ibm.com/support/knowledgecenter/STPRH6/com.ibm.storage.drives.doc/jag_ichome.html.

IBM Encryption key management publications

- *IBM Tivoli® Key Lifecycle Manager Quick Start Guide*, GI11-8744
- *IBM Security Key Lifecycle Manager for z/OS® Planning and User's Guide*, SC14-7628
- IBM Security Key Lifecycle Manager Knowledge Center, available at https://www.ibm.com/support/knowledgecenter/en/SSWPVP

IBM 3590 Enterprise tape system publications

- *IBM Enterprise Tape System 3590 Introduction and Planning Guide*, GA32-0329
- *IBM Silo Compatible Tape Frame 3590 Introduction, Planning, and User's Guide*, GA32-0366
- *IBM Enterprise Tape System 3590 Operator Guide*, GA32-0330
- *IBM 3590 Tape Subsystem Hardware Reference Guide*, GA32-0331

IBM TS3400 tape library publication

- *IBM TS3400 Tape Library Planning and Operator Guide*, GC27-2107

IBM TS3500 Tape Library publications

Note: There are two versions of the *TS3500 Tape Library Introduction and Planning Guide*, as well as two versions of the *TS3500 Tape Library Operator Guide*. One version of each document is specific to the TS3500 tape library with the Advanced Library Management System (ALMS), and provides details about features and functions that are only available for libraries with ALMS installed and enabled. Refer to the title of each guide in order to determine which version you need.

- *IBM TS3500 Tape Library with ALMS Introduction and Planning Guide*, GA32-0593
- *IBM TS3500 Tape Library with ALMS Operator Guide*, GA32-0594
- *IBM TS3500 Tape Library Introduction and Planning Guide*, GA32-0559
- *IBM TS3500 Tape Library Operator Guide*, GA32-0560
- *IBM TS3500 Tape Library Maintenance Information* (provided with the TS3500 tape library)
- *IBM TS3500 Tape Library with ALMS Tape System Reporter User's Guide*, GA32-0589
- *IBM TS3500 Tape Library SCSI Reference*, GA32-0561
- IBM TS3500 Tape Library documentation is available in IBM Knowledge Center at: http://www-01.ibm.com/support/knowledgecenter/STCMML8/

IBM TS4500 tape library publications

Note: The *TS4500 Tape Library Introduction and Planning Guide*, and the *TS4500 Tape Library Operator Guide* are available. Refer to the title of each guide to determine which document you need.

- *IBM TS4500 Tape Library Introduction and Planning Guide*, SC27-5990
- *IBM TS3000 and TS4500 System Console Maintenance Information*, P/N 2727119
- IBM TS4500 tape library documentation is available in the IBM Knowledge Center at https://www.ibm.com/support/knowledgecenter/STQRQ9/com.ibm.storage.ts4500.doc/ts4500_ichome.html.
- The current TS4500 SCSI reference information is contained within the IBM Knowledge Center and can be viewed by selecting **Reference** > **SCSI Reference** or by using https://www.ibm.com/support/knowledgecenter/STQRQ9/com.ibm.storage.ts4500.doc/ts4500_ic_scsireference.html.

IBM Enterprise Automated tape library (3494) publications

- *IBM Automated Tape Library (3494) Introduction and Planning Guide*, GA32-0448
- *IBM Automated Tape Library (3494) Operator Guide*, GA32-0449

IBM System z publications

- *IBM z/OS DFSMS OAM Planning, Installation, and Storage Administration Guide for Tape Libraries,* SC35-0427
- *IBM z/VM® DFSMS/VM Removable Media Services,* SC24-6185

IBM Fibre Channel publications

- *IBM SAN Switch 2109 Model F16 Installation and Service Guide,* SY27-7623
- *IBM Fiber-Optic Channel Link Planning and Installation*, GA32-0367

IBM FICON and Fibre Channel publications

- *FICON Planning and Implementation Guide*, SG24-6497, IBM Redbooks® publication
- *IBM System z Connectivity Handbook*, SC24-5444, Redbooks publication
- *IBM Tape Solutions for Storage Area Networks and FICON*, SG24-5474, Redbooks publication
- *IBM System z Planning for Fiber Optic Links (ESCON, FICON, InfiniBand, Coupling Links, and Open System Adapters)*, GA23-0367

- *IBM System z Maintenance Information for Fiber Optic Links (ESCON, FICON, Coupling Links, and Open System Adapters)*, SY27-2597
- *IBM System z Fibre Channel Connection (FICON) I/O Interface Physical Layer*, SA24-7172

Related software publications

For information regarding software related to the IBM 3592 Tape System, refer to:

- *IBM Tape Device Drivers Installation and User's Guide*, GC27-2130
- *IBM Tape Device Drivers Programing Reference*, GA32-0566
- *IBM Tape Device Drivers Encryption Support*, GA32-0565
- *Basic Tape Library Support User's Guide and Reference*, SC26-7016
- *Environmental Record Editing and Printing (EREP) Program User's Guide and Reference*, GC35-0151
- *z/OS DFSMS: Introduction*, SC26-7397
- *z/OS DFSMS: Object Access Method Planning, Installation, and Storage Administration Guide for Tape Libraries*, SC35-0427
- *z/OS DFSMS Software Support for IBM TS1130, TS1140, TS1150, and TS1155 Tape Drives (3592)*, SC26-7514
- *z/VM General Information*, GC24-5991

Other publications

- *American National Standard Institute Small Computer System Interface* X3T9.2/86-109 X3.180, X3B5/91-173C, X3B5/91-305, X3.131-199X Revision 10H, and X3T9.9/91-11 Revision 1

IBM online access

IBM System z (zSeries) information

For additional information about IBM System z®, see:

- z/OS® V1R12.0 Information Center available at http://publib.boulder.ibm.com/infocenter/zos/v1r12/index.jsp
- z/OS Internet Library
- IBM System z Redbooks, including these titles:
  - *DFSMS V1.10 and EAV Technical Guide,* IBM Redbooks publication
  - *IBM zEnterprise® System Technical Guide,* Redbooks publication

IBM pSeries-RS/6000, AIX information

For additional information about the IBM eServer™ pSeries servers, including the RS/6000®, see the information center at:

- http://publib.boulder.ibm.com/infocenter/powersys/v3r1m5/index.jsp

For additional information about AIX®, see:

- http://publib16.boulder.ibm.com/pseries/en_US/infocenter/base/
- http://publib.boulder.ibm.com/infocenter/pseries/v5r3/index.jsp

IBM iSeries and AS/400 information

For additional information about iSeries and AS/400 systems, visit the information center at:

- http://publib.boulder.ibm.com/iseries/

IBM Storage media support

The following website provides access to current regional and country-specific IBM addresses and telephone numbers:

- IBM Storage media

IBM Tape systems 3592 support

For general information about the 3592 tape systems, including TS1120 and later tape drives, see:

- IBM Tape systems

For a list of compatible software, operating systems, and servers for TS1120 and later tape drives, see the website listed below. Select your tape drive, select Product details, then select Independent Software Vendor (ISV) matrix.

- IBM Tape drives

Device driver support

You can download device driver software and read documentation about various device drivers at:

- IBM Fix Central

Encryption management support

For the latest versions of Encryption Key Servers and supporting documentation, visit the web at:

- Tivoli Key Lifecycle Manager
- IBM Security Key Lifecycle Manager for z/OS

To search the IBM Tivoli Key Lifecycle Manager Knowledge Center, see https://www.ibm.com/support/knowledgecenter/SSB2KG.

To search the IBM Security Key Lifecycle Manager Knowledge Center, see https://www.ibm.com/support/knowledgecenter/en/SSWPVP.

IBM Network Integration and Deployment Services

The following website provides information about connectivity and the integration of cabling systems:

- IBM Integrated communications services

IBM Tape Storage publications

Refer to the following website for IBM hardware product documents in a PDF format for viewing and printing:

- IBM Tape Systems resources

Storage Area Network fabric

For information on high-performance switches and gateways, visit the web at:

- IBM Support Portal

I/O connectivity

For updated information regarding FICON® and Fibre Channel connectivity, visit the web at:

- IBM System z - I/O Connectivity

Redbooks

To access the IBM Redbooks, visit the web at:

- IBM Redbooks

Vendor support

This website provides compatibility information in PDF format for implementing software, servers, and operating systems with IBM tape drives and libraries:

- IBM Tape systems

Non-IBM support

Brocade information

For information on Brocade products and support, visit the web at:

- Brocade Mission-Critical Networks

Cisco information

For information on Cisco products and support, visit the web at:

- Cisco Systems, Inc.

HP information

The following publications and website relate to HP-UX systems:

- *HP-UX Reference for HP-UX 10.20, 11.00, and 11i*, Hewlett-Packard Company
- *System Administration Tasks, HP-UX Release 10.20, 11.00, and 11i*, Hewlett-Packard Company
- HP-UX 11i—HP UNIX

Linux information

The following website relates to Red Hat Linux systems:

- Red Hat

The following website relates to SUSE Linux systems:

- SUSE Linux Enterprise

Microsoft Windows information

The following website provides access to information about Microsoft Windows systems:

- Microsoft Corporation

SGI information

The following website provides access to information about SGI systems:

- SGI techpubs library

Oracle SUN information

The following website provides access to information about Oracle (SUN) systems:

- Oracle Documentation

Data storage values

This documentation displays data storage values using both decimal (base-10) and binary (base-2) units of measurement.

Decimal units such as KB, MB, GB, and TB have commonly been used to express data storage values, though these values are more accurately expressed using binary units such as KiB, MiB, GiB, and TiB. At the kilobyte level, the difference between decimal and binary units of measurement is relatively small (2.4%). This difference grows as data storage values increase, and when values reach terabyte levels the difference between decimal and binary units approaches 10%.

To reduce the possibility of confusion, this documentation represents data storage using both decimal and binary units. Data storage values are displayed using the following format:

```
#### decimal unit (binary unit)
```

By this example, the value 512 terabytes is displayed as:

```
512 TB (465.6 TiB)
```

Table 1 on page xviii compares the names, symbols, and values of the decimal and binary units. Table 2 on page xviii shows the increasing percentage of difference between decimal and binary units.

Table 1: Comparison of decimal and binary units and values

Decimal			Binary		
Name	**Symbol**	**Value (base-10)**	**Name**	**Symbol**	**Value (base-2)**
kilo	K	10^3	kibi	Ki	2^{10}
mega	M	10^6	mebi	Mi	2^{20}
giga	G	10^9	gibi	Gi	2^{30}
tera	T	10^{12}	tebi	Ti	2^{40}
peta	P	10^{15}	pebi	Pi	2^{50}
exa	E	10^{18}	exbi	Ei	2^{60}

Table 2: Percentage difference between decimal and binary units

Decimal Value	Binary Value	Percentage Difference
100 kilobytes (KB)	97.65 kibibytes (KiB)	2.35%
100 megabytes (MB)	95.36 mebibytes (MiB)	4.64%
100 gigabytes (GB)	93.13 gibibytes (GiB)	6.87%
100 terabytes (TB)	90.94 tebibytes (TiB)	9.06%
100 petabytes (PB)	88.81 pebibytes (PiB)	11.19%
100 exabytes (EB)	86.73 exbibytes (EiB)	13.27%

Send us your feedback

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- Exact publication title
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- Page numbers to which you are referring

Note: For suggestions on operating enhancements or improvements, please contact your IBM Sales team.

Chapter 1. Introduction

The IBM 3592 tape drives and IBM TS1120 (3592 C06) Controller provide higher levels of performance, functionality, reliability, and cartridge capacity, and a smaller size than the IBM Enterprise Tape System 3590 product offerings. These improvements are available to tape customers across a broad range of computing environments, including selected servers such as

- IBM System i®, System p, System x, and System z
- IBM AS/400 and RS/6000
- Oracle Sun
- Hewlett Packard (HP)

Also included are servers that run Microsoft Windows NT, Windows 2000, Windows Server 2003, and Linux.

For the current details on 3592 tape drives, go to the IBM Tape Drives website.

This document provides introductory and planning information for the IBM Rack Mount that uses tape drive Models EH7/EH8/55F/60F, IBM TS1150 Model E08, IBM TS1140 Model E07, IBM TS1130 Model E06/EU6, and IBM TS1120 Model E05 tape drives, and C06 Controller. The IBM Model J1A tape drive and the IBM 3592-J70 Controller are no longer available for ordering but are covered for existing product support.

Note: Not all 3592 tape drives or controllers are supported in the following tape systems.

- 3952 F05 Tape Frame (see “3952 Tape Frame installation” on page 22)
- 3953 F05 Tape Frame (see *IBM 3953 Tape System Introduction and Planning Guide*, GA32-0557)
- IBM TS3500 tape library (see *IBM TS3500 tape library Introduction and Planning Guide*, GA32-0559)
- IBM TS4500 tape library (see *IBM TS4500 tape library Introduction and Planning Guide*, SC27-5990 or the IBM Knowledge Center at http://www.ibm.com/support/knowledgecenter/STQRQ9/%0Acom.ibm.storage.ts4500.doc/ts4500_ichome.html)
- IBM TS3400 Tape Library (see *IBM TS3400 Tape Library Planning and Operator Guide*, GC27-2107)
- IBM 3494 Tape Library (see the *IBM 3494 Tape Library Introduction and Planning Guide*, GA32-0448)
- IBM Enterprise Tape Drive Frame 3590 Model A14 (see the *IBM Enterprise Tape System 3590 Introduction and Planning Guide*, GA32-0329)
- Stand-alone racks

The 3592 tape drives use a tape cartridge with a form factor similar to the 3590 tape cartridges, which allows them to be used in automated environments, such as the ones listed here and also in StorageTek Automated Cartridge System (ACS) solutions. See the *IBM Enterprise Silo Compatible Tape Frame 3592 Introduction, Planning, and User's Guide Model C20*, GA32-0463 or the *IBM Silo Compatible Tape Frame 3590 Introduction, Planning, and User's Guide*, GA32-0366.

3592 tape drives

The topics in this section provide general reference information for the 3592 tape drives.

With their higher performance, reliability, and cartridge capacity, and a smaller size as compared to the IBM Enterprise tape drive 3590 models (withdrawn), the 3592 tape drives reduces the number of tape drives and cartridges and the associated floor space. At the same time, greater overall storage capacity can be achieved.

Enhancements include

- Four different generations of media provide native cartridge capacities from 300 GB (279.39 GiB) on the JA Standard cartridge, up to 15 TB (13.64 TiB) on the JD Advanced Type D cartridge.
- WORM and Economy cartridge versions provide extra capabilities for the different media generations.
- See "Media" on page 27 for more details about capacities and capabilities of the different media types.
- AES 256-bit data encryption capability increases security with minimal performance impact.
- The different drive models provide a native data rate from 40 MB/s for the J1A tape drive up to 360 MB/s for the E08/EH8, and 55F tape drives, and up to 400 MB/s for the 60F tape drive.
- Scaling capability to optimize fast access, storage capacity, or a combination of both.
- Dual ported switched fabric Fibre Channel attachments.
- High reliability and availability design.
- Performance and access improvements.
- Smaller form factor that allows double the number of drives (compared to the 3590 tape drives) in a single 3494 frame or stand-alone rack.

More enhancements over the 3590 drives to improve availability, performance, and capacity include

- Redundant power supplies
- Larger 2.15 GB (2 GiB) internal buffer on the E08/EH8/55F/60F tape drive, 1.07 GB (1 GiB) internal buffer on the E07/EH7, E06, and EU6 tape drives, 536.9 MB (512 MiB) for the E05 tape drive, and 134.2 MB (128 MiB) for the J1A tape drive
- Dynamic digital speed matching
- Individual read and write data channel calibration
- Increased search speed
- Streaming Lossless Data Compression (SLDC) algorithm

Note: The actual throughput a customer might achieve is a function of many components, such as system processor, disk data rate, data block size, data compressibility, input/output (I/O) attachments, storage area network (SAN), and the system or application software used. Although the drives can handle a 400 MB/s (60F tape drive), 350 MB/s (E08/EH8. 55F tape drive), 250 MB/s (E07/EH7 tape drive), 160 MB/s (E06 and EU6 tape drives), 100 MB/s (E05 tape drive), and 40 MB/s (J1A tape drive) native data rate, other components might limit the actual effective data rate.

The 3592 tape drives come with dual ported, switched Fibre Channel attachments, 2 Gb/s (J1A tape drive), 4 Gb/s (E06/EU6, and E05 tape drives), 8 Gb/s (E07/E08/55F tape drives), 16 Gb/s (60F tape drive), for attachment to multiple servers or a single server with redundancy. The E06, EU6, and E07 tape drives can attach to the C06 and the C07 Controllers. The E06, EU6, E05, and J1A tape drives can attach to the C06 Controller and the J70 Controller. The J1A tape drive can also attach to the 3590 Model A60 controller. These tape drives use ESCON or FICON channels for attachment to System z servers.

The E06, E07/EH7, E08/EH8, 55F, and 60F tape drives come with an Ethernet port for use by an IBM Service Support Representative (SSR) for procedures such as updating microcode or viewing drive status. Though uncommon, some EU6 tape drives might have an Ethernet port. The Ethernet port on the E07/EH7, E08/EH8, 55F, and 60F tape drives can also be used by the customer for remote monitoring by attaching an Ethernet cable from the drive to the customer's network.

Note: This product might not be certified in your country for connection by any means whatsoever to interfaces of public telecommunications networks. Further certification might be required by law before any such connection is made. Contact IBM for information.

Figure 1 on page 3 illustrates the 3592 tape drive, up to Model E08. Figure 2 on page 3 shows the 60F/55F/EH8/EH7 tape drive.

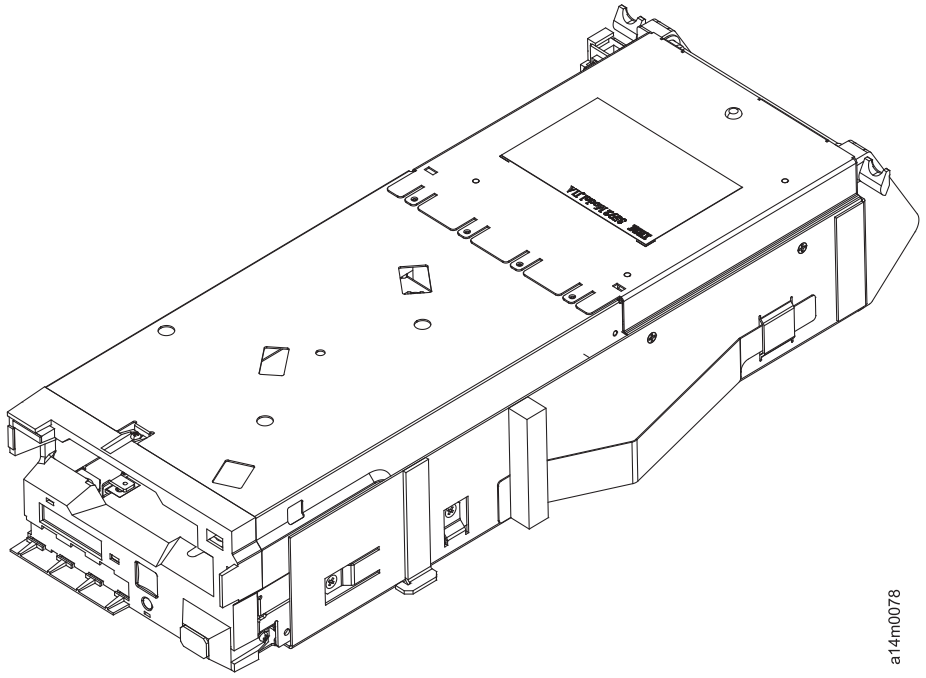

Figure 1: 3592 tape drive (E08, E07, E06/EU6, E05, and J1A models)

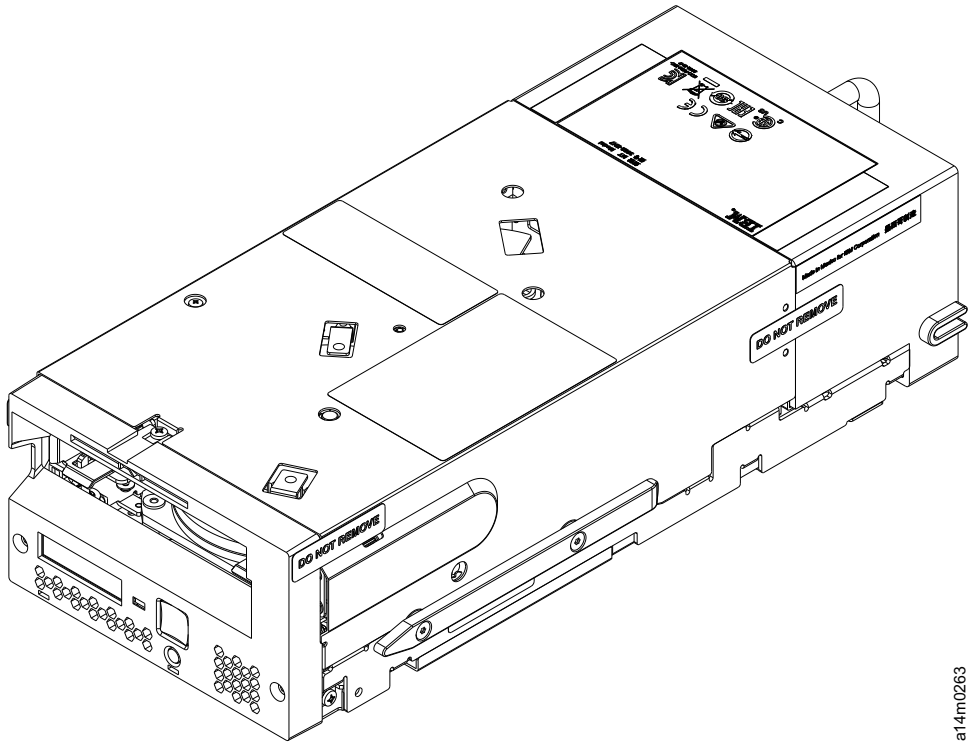

Figure 2: 3592 tape drive (60F/55F/EH8/EH7 models)

A note on terminology and model names

Throughout the remainder of this publication, the 60F, 55F, E08/EH8, E07/EH7, E06, EU6, E05, and J1A tape drives are all referred to collectively as the "3592 tape drive" unless a specific model is being

discussed. The IBM TS1160 60F, TS1155 55F, TS1150 E08/EH8, TS1140 E07/EH7, TS1130 E06/EU6, and TS1120 E05 tape drives are all referred to collectively as the "TS1120 and later tape drives."

The EU6 tape drive is an E05 tape drive canister that is upgraded to contain an E06 tape drive through the MES (Miscellaneous Equipment Specification) process. Therefore, it is the functional equivalent of the E06 tape drive. The EU6 tape drive model name is only used when information specific to the EU6 tape drive is discussed.

Drive attachments

This topic provides the maximum number of 3592 tape drive attachments in environments with and without a tape controller.

Table 3 on page 4 summarizes the maximum number of E08, E07, E06/EU6, E05, J1A tape drive attachments in environments without a tape controller.

Table 3: Maximum E08, E07, E06/EU6, E05, J1A tape drives in environments without a tape controller

Environment	**Number of 3592 drives**
2.0-meter rack (IBM Model 7014-T42)	Up to 16
1.6-meter rack (IBM Model 7014-S00)	Up to 12
1.8-meter rack (IBM Model 7014-T00)	Up to 12
3494 Model L22	Up to 4. See note 3.
3494 Model D22	Up to 12. See note 3.
TS3400 Tape Library	Up to 2. See note 3.
3584 Model L22/L23	See note 1.
3584 Model D22/D23	See note 2.

Notes:

1. The number varies, depending on the number of I/O slots, the number of storage slots, and the type of "Capacity On Demand" features installed. The absolute maximum number is 12.
2. The number varies, depending on the number of storage slots installed. The absolute maximum number is 12.
3. The E07 and E08 tape drives are not supported in 3494 or TS3400 tape libraries.

Table 4 on page 4 summarizes the maximum number of E08, E07, E06/EU6, E05, J1A tape drive attachments in environments with a tape controller.

Table 4: Maximum E08, E07, E06/EU6, E05, J1A tape drives in environments with a tape controller

Environment	**Number of drives**
2.0-meter rack (IBM Model 7014-T42)	Up to 12 **Note:** A total of 16 drives can be attached with multiple racks.
1.6-meter rack (IBM Model 7014-S00)	Up to 8
1.8-meter rack (IBM Model 7014-T00)	Up to 8
3494 Model D24	Up to 8. See note 3.
3494 Model D22	Up to 12 (with external controller attach for the C06 Controller). See note 3.

Table 4: Maximum E08, E07, E06/EU6, E05, J1A tape drives in environments with a tape controller (continued)	
Environment	**Number of drives**
3494 Model L22	Up to 4 (with adjacent frame support). See note 3.
TS3400 Tape Library	Up to 2 (with external controller attach for the C06 Controller). See note 3.
TS3500 tape library (3584) Model L22/L23	See note 1.
TS3500 tape library (3584) Model D22/D23	See note 2.

Notes:

1. The number varies, depending on the number of I/O slots, the number of storage slots, and the type of "Capacity On Demand" features installed. The absolute maximum number is 12.
2. The number varies, depending on the number of storage slots installed. The absolute maximum number is 12.
3. The E07 and E08 tape drives are not supported in 3494 or TS3400 tape libraries.

Table 5 on page 5 summarizes the maximum number of EH7, EH8, 55F, or 60F tape drive attachments in rack mount environments.

Table 5: Maximum EH7, EH8, 55F, or 60F tape drives in rack mount environments	
Environment	**Number of 3592 drives**
2.0-meter rack (IBM Model 7014-T42)	Up to 28
1.8-meter rack (IBM Model 7014-T00)	Up to 24
1.6-meter rack (IBM Model 7014-S00)	Up to 20

Characteristics

This topic describes the characteristics of the 3592 tape drives.

Note: For information on E07/EH7, E08/EH8, 55F, and 60F tape drive program support and physical characteristics, see the IBM Knowledge Center.

Table 6 on page 5 shows the 3592 tape drives and 3592 tape cartridge characteristics. For cartridge densities and capacities, see Table 36 on page 91.

Table 6: 3592 tape drive characteristics with 3592 tape cartridges							
Character-istics	**60x tape drive specs**	**55x tape drive specs**	**E08/EH8 tape drive specs**	**E07/EH7 tape drive specs**	**E06 tape drive specs**	**E05 tape drive specs**	**J1A tape drive specs**
Display panel	8-character alphanumeric LED display						
Media	Enterprise Tape Cartridge 3592						

Table 6: 3592 tape drive characteristics with 3592 tape cartridges (continued)

Character-istics	60x tape drive specs	55x tape drive specs	E08/EH8 tape drive specs	E07/EH7 tape drive specs	E06 tape drive specs	E05 tape drive specs	J1A tape drive specs
Host attach-ments	Fibre Channel attach	Fibre Channel attach	Fibre Channel attach	E07: Fibre Channel attach; ESCON or FICON with IBM TS1120 (3592 C06) Controller EH7: Fibre Channel attach	Fibre Channel attach; ESCON or FICON via C07 or J70 Controller		Fibre Channel attach; ESCON or FICON via 3590 A60 or C07 or J70 Controller
Device data rate (native)	400 MB/s	360 MB/s		250 MB/s	160 MB/s	100 MB/s	40 MB/s
Data transfer rate (maximum instantaneous)	1600 MB/s	800 MB/s		800 MB/s	400 MB/s		200 MB/s
Tape speed read/write maximum	5.94 m/s	5.81 m/s		4.17 m/s	8.55 m/s	6.21 m/s	4.74 m/s
Approx-imate usable tape length	1123 m Adv Type E 280 m (economy)	1032 m Adv Type D 241 m (economy)		842 m Adv Type C	570 m (standard), 785 m (Extended), 204 m (Economy)		
Load/ready	12 seconds	12 seconds		13 seconds			19 seconds
Search/ rewind speed (middle of tape)	12.4 m/s (488 in./s)					10 m/sec. (393 in./s)	8 m/sec. (315 in./s)
Maximum cartridge rewind time, Data cartridge **See Note[2].**	94 seconds	94 seconds		76 seconds	72 seconds	90 seconds	77 seconds

Table 6: 3592 tape drive characteristics with 3592 tape cartridges (continued)

Character-istics	60x tape drive specs	55x tape drive specs	E08/EH8 tape drive specs	E07/EH7 tape drive specs	E06 tape drive specs	E05 tape drive specs	J1A tape drive specs
Device data rate (3:1 comp-ression sustained)	900 MB/s	700 MB/s		650 MB/s	350 MB/s	280 MB/s	120 MB/s

Notes:

1. **See Table 36 on page 91 for read/write capabilities and capacities of tape cartridges.**
2. **It will take longer to rewind cartridges when in "Archive Mode".**

Operator controls

This topic provides an overview of the operator controls for the 3592 tape drives.

The 3592 tape drive is installed in a canister, which is a hot-swappable/quick disconnect field-replaceable unit (FRU). Installation and replacements are to be completed by qualified IBM Service Representatives only. The tape drive and canister do not have their own power supply, but are powered on when the canister is plugged into a drive enclosure or frame installation. When power is supplied to the unit, the drive runs several self-tests.

The 3592 tape drive is typically managed through an automated library manager or host, and its associated software. A display, buttons, and indicators are available on the front of individual drives when manual operation is required.

Drive front panel components

This topic describes the front panel components.

The front panel of the drive has an 8-character display panel, an **Unload** button, a **Reset** button, and an LED power indicator. See Table 7 on page 7 for a description of their functions.

Table 7: 3592 tape drive front panel component functions

Component	Functions
Display panel	An 8-character light-emitting diode (LED) display panel, which displays drive status codes and also a limited actions menu. Mount messages, attention messages, drive status messages, and FID (failure ID) messages can also be displayed.
Unload	**Unload** is used to manually unload a tape from the drive. If you press this button while a tape is loaded, the drive completes any operation in progress, rewinds, and unloads the tape cartridge.
Reset	**Reset** generates a drive reset. Current tape motion is terminated and stopped before the reset. The button is recessed to prevent accidental activation. Use a pencil or small screwdriver to press **Reset**.

Table 7: 3592 tape drive front panel component functions (continued)	
Component	**Functions**
LED power indicator	A green LED power indicator shows whether power is provided to the drive. As part of the power-on process, the LED automatically lights and the drive completes a series of power-on self-tests.

Drive compatibility

This topic describes tape cartridges and tape formats that are compatible with the 3592 tape drives.

The E06, EU6, and E07 tape drives can be used with the C06 and the C07 Controllers when they are *encryption-enabled*. The E07 tape drive is not supported by the J70 Controller or the 3590 A60 Controller. The 3494 and TS3400 tape libraries do not support the E07 and E08 tape drives. However, the TS3500 tape library does support the E07 tape drive. The IBM Model J1A tape drive can be used with the 3590 A60 Controller.

The EH7, EH8, 55F, and 60F tape drives can be used in the IBM TS4500 tape library and stand-alone racks.

The 3592 tape cartridge has external dimensions (form factor) that allow it to be used within existing storage cells of libraries that contain 3590 tapes. However, the 3592 tape drives must be installed in frames separate from any 3590 drives. The 3592 tape drive cartridges are not compatible with 3590 tape drives cartridges, and, likewise, 3590 tapes cannot be used in the 3592 drives. Other compatibility considerations include:

- Supported formats - seven formats with different recording densities that yield different capacities per cartridge type:
  - Enterprise Format 1 (EFMT1) used by the IBM Model J1A tape drive, and the E05 tape drive in both native and J1A tape drive emulation mode. This format records 512 tracks on 8 channels. The E06 tape drive, and E07/EH7 tape drive with code level D3I3_5CD or higher, reads data that is written in EFMT1 format but does not write in EFMT1.
  - Enterprise Format 2 (EFMT2), used by the E05 tape drive, and the E06 tape drive. This format records 896 tracks on 16 channels. The E07/EH7 tape drive with code level D3I3_5CD or higher, reads data that is written in EFMT2 format but does not write in EFMT2. When encrypted data is operating at this density, the recording format is Enterprise Encrypted Format 2 (EEFMT2).
  - Enterprise Format 3 (EFMT3), used by the E06 tape drive and the E07/EH7 tape drive. This format records 1152 tracks on 16 channels. When encrypted data is operating at this density, the recording format is Enterprise Encrypted Format 3 (EEFMT3).
  - Enterprise Format 4 (EFMT4), used by the E07/EH7 and E08/EH8, and 55F tape drive. This format records 664 tracks on JB and JX cartridges and 2176 tracks on JC, JK, and JY cartridges on 32 channels. When encrypted data is operating at this density, the recording format is Enterprise Encrypted Format 4 (EEFMT4).
  - Enterprise Format 5 (EFMT5-E08), used by the E08/EH8, and 55F/60F tape drive. This format records 4608 tracks on JC, JK, and JY cartridges and 5120 tracks on JD, JL, and JZ cartridges on 32 channels. When encrypted data is operating at this density, the recording format is EEFMT5.
  - Enterprise Format 5 (EFMT5-55F), used by the 55F/60F tape drive. This format records 4608 tracks on JC, JK, and JY cartridges and 7680 tracks on JD, JL, and JZ cartridges on 32 channels. When encrypted data is operating at this density, the recording format is EEFMT5.

    Note: JD, JL, and JZ media can be read and written to with increased capacity when the cartridges are formatted for the 55F drive.
  - Enterprise Format 6 (EFMT6), used by the 60F tape drive. This format records 8,704 tracks on JE, JV cartridges, 7680 tracks on JD, JZ cartridges, and 4608 tracks on JC, JY cartridges on 32 channels. When encrypted data is operating at this density, the recording format is EEFMT6.
- Supported cartridge types

- The 60F tape drive uses JE/JV native capacity of 20 TB, JM (economy) native capacity of 5 TB, JD/JZ native capacity of 10 TB EFMT5-E08 and 15 TB EFMT5-55F, JL (economy) native 2 TB EFMT5-E08 and 3 TB EFMT5-55F, JC/JY native capacity of 4 TB with EFMT4 format (read only) and 7TB with EFMT5-E08 format, JK native capacity of 500 GB for EFMT4 format (read only) and 900 GB for EFMT5-E08 format.
- The 55F tape drive uses: JD (read/write) native capacity of 15 TB, and JL (economy) native capacity of 3 TB, JZ (WORM) native capacity of 15 TB if the cartridges are formatted for 55F.
- The E08/EH8, and 55F tape drive uses: JD (read/write) native capacity of 10 TB, and JL (economy) native capacity of 2 TB, JZ (WORM) native capacity of 10 TB.
- The E07/EH7, E08/EH8, and 55F tape drives use the Advanced Data (type JC) and Advanced WORM (write-once, read-many) (type JY) cartridges. Both the type JC and JY cartridges have a maximum native capacity of 4000 GB (3725.29 GiB).
- The E07/EH7, E08/EH8, and 55F tape drives use the 3592 Advanced Economy (type JK) cartridge with a maximum native capacity of 500 GB (465.66 GiB) with EFMT4 format.
- The E07/EH7, E06, and E05 tape drives use 3592 Extended Data (type JB) and Extended WORM (type JX) with a maximum capacity of 1600 GB (1490.12 GiB) with EFMT4 format, 1000 GB (931.3 GiB) with EFMT3 format, and 700 GB (651.93 GiB) with EFMT2 format. The E07/EH7 tape drive with code level D3I3_5CD or higher, can read EFMT2 format but does not write in EFMT2.
- The E07/EH7, E06, E05, and JIA tape drives use 3592 Standard Data (type JA) and Standard WORM (type JW) cartridges with a maximum native capacity of 640 GB (596.04 GiB) with EFMT3 format, 500 GB (465.66 GiB) with EFMT2 format, and 300 GB (279.39 GiB) with EFMT1 format. The E07/EH7 tape drive with code level D3I3_5CD or higher, can read only cartridge types JA and JW.
- The E07/EH7, E06, E05, and JIA tape drives use 3592 Economy Data (type JJ) and Economy WORM (type JR) cartridges with a maximum native capacity of 128 GB (119.21 GiB) with EFMT3 format, 100 GB (93.13 GiB) with EFMT2 format, and 60 GB (55.88 GiB) with EFMT1 format. The E07/EH7 tape drive with code level D3I3_5CD or higher, can read only cartridge types JJ and JR.

For information on tape cartridges, see Table 36 on page 91.

- The J1A tape drive
  - Reads and writes EFMT1 format only.
- The E05 tape drive
  - Reads and writes EFMT1 and EFMT2 formats in native mode.
  - Reads and writes EFMT1 format in J1A tape drive emulation mode.

  See “Tape drive emulation mode support” on page 10 for information.
- The E06 tape drive
  - Reads and writes EFMT2 and EFMT3 formats.
  - Reads EFMT1 format.
  - Operates only in native mode.
- The E07/EH7 tape drive
  - Reads and writes EFMT3 and EFMT4 formats (EFMT3 can be written only with JB and JX media and EFMT4 format can be written only with JB, JX, JC, JY, and JK media).
  - Reads EFMT2 format and with code level D3I3_5CD or higher, EFMT1 format.
  - Operates only in native mode.
- The E08/EH8 tape drive
  - Reads and writes EFMT4 and EFMT5 formats.
- The 55F tape drive
  - Reads and writes EFMT4, EFMT5-E08, and EFMT5-55F formats.
- The 60F tape drive

  - Reads and writes EFMT5-E08, EFMT5-55F, and EFMT6 formats.
  - Reads EFMT4 format
- 3592 tape drives cannot read cartridges that are written by 3590 or 3490 tape drives. Cartridges that are written by the 3592 tape drive cannot be read by the 3590 or 3490 drives. Even though the cartridges are similar in size, they contain different media and media format, and are not interchangeable.
- 3592 drives that are manufactured before the general availability of WORM capability must have a microcode update to be able to read and write WORM cartridges. Drives without the updated microcode reject the WORM cartridges.
- 3592 tape drives need a code update to be able to recognize the current encrypted format written on a cartridge. Drives without the update the media is ejected by the library.
- Although multiple systems can be attached to a 3592 tape drive, the systems cannot use the drive simultaneously. The 3592 tape drive can be varied online to only one system at a time.
- 3592 tape drives are not supported for attachment to 3590 Model A50 or A00 controllers.
- The Fibre Channel switch (4 Gb or 2 Gb) or 2109 switch that is attached to 3590 or 3592 tape drives cannot be shared with open systems servers if attached to a controller.
- 3592 tape drives and different models of 3590 tape drives cannot be intermixed on the J70 Controller or 3590 Model A60 Controller. The C06 Controller does not support 3590 tape drives.

For information on the 3590 A60 Controller, refer to *IBM Enterprise Tape System 3590 Introduction and Planning Guide*, GA32-0329.

Tape drive emulation mode support

This topic provides reference information on the tape drive emulation mode.

The native E05 tape drive can reformat an EFMT1, EFMT3, or EFMT4 tape to EFMT2 and reformat an EFMT2 or EFMT3 tape to an EFMT1 when writing from beginning of tape (BOT). The IBM Model J1A tape drive (or the E05 tape drive emulating the J1A tape drive) can reformat an EFMT2 or EFMT3 tape to an EFMT1. The 3592 tape drive automatically reformats media when the tape is written while positioned at BOT, such as when writing the tape label, if the tape does not match the drive format. In such a case, the tape is reformatted to match the 3592 tape drive. The manual reformat process varies by operating system but usually includes running a program to issue the Mode Select command.

The E06 tape drive does not support emulation but can read tapes in EFMT1, EFMT2, and EFMT3 format, and write in EFMT2 and EFMT3 format. The E06 tape drive can reformat any EFMT1, EFMT2, EFMT3, and EFMT4 tape to EFMT3 format when writing from BOT.

The E07/EH7 tape drive does not support emulation but can read in EFMT1 with code level D3I3_5CD or higher, EFMT2, EFMT3, and EFMT4 format, and write in EFMT3 and EFMT4 format. The E07/EH7 tape drive can reformat any compatible EFMT2, EFMT3, or EFMT4 tape to EFMT3 or EFMT4 format when writing from BOT.

The E08/EH8 tape drive does not support emulation but can read and write in EFMT4 and EFMT5 format. The E08/EH8 tape drive can reformat any compatible EFMT4 tape to EFMT4 or EFMT5 format when writing from BOT.

The 55F tape drive does not support emulation but can read and write in EFMT4 and EFMT5 format. The 55F tape drive can reformat any compatible EFMT4 tape to EFMT4 or EFMT5 format when writing from BOT.

The 60F tape drive does not support emulation but can read and write in EFMT5 and EFMT6 format. The 60F tape drive can reformat any compatible EFMT5 tape to EFMT5 or EFMT6 format when writing from BOT. It can also read EFMT4 format.

Table 8: 3592 Drive Emulation

Drive Mode Setting	Formats read	Format used when writing and cartridge is at BOT	Format used when writing and cartridge is not at BOT	Model type reported to host in response to Inquiry command
J1A tape drive	EFMT1	EFMT1	EFMT1	J1A tape drive
Native E05 tape drive	EFMT1 and EFMT2	EFMT1 and EFMT2	EFMT1 and EFMT2	E05 tape drive
E05 emulating J1A tape drive	EFMT1	EFMT1	EFMT1	J1A tape drive
E06/EU6 tape drives	EFMT1, EFMT2, and EFMT3	EFMT2 and EFMT3	EFMT2 and EFMT3	E06 tape drive
E07/EH7 tape drives with code level D3I3_5CD or higher	EFMT1, EFMT2, EFMT3, and EFMT4	EFMT3 and EFMT4	EFMT3 and EFMT4	E07 tape drive
E08/EH8 tape drives with code level D314_460 or higher	EFMT4, and EFMT5	EFMT4 and EFMT5	EFMT4 and EFMT5	E08 tape drive
55F tape drive	EFMT4 and EFMT5	EFMT4 and EFMT5	EFMT4 and EFMT5	55F tape drive
60F tape drive	EFMT4, EFMT5, and EFMT6	EFMT5 and EFMT6	EFMT5 and EFMT6	60F tape drive
E06, EU6, E07/EH7, and E08/EH8[1] tape drives		Emulation is only available on some E05 tape drives and is not available on E06, EU6, E07/EH7, or E08/EH8 tape drives.		

[1] Not an actual emulation option, but is shown for reference only.

Two methods of setting the emulation mode for an E05 tape drive, Static Emulation and Dynamic Emulation are available

Static Emulation

The IBM TS1120 Model E05 tape drive now supports a new function called Static Emulation Mode. This function, available for both open systems and controller-attached E05 tape drives, allows E05 tape drives to be set in a mode to emulate the interface and format behaviors of the previous generation J1A tape drives. When Static Emulation mode is activated, the E05 tape drive reports that it is a J1A tape drive in inquiry data. It can write and read 3592 data and WORM cartridges only in the older J1A tape drive data format (EFMT1) rather than the E05 tape drive data format (EFMT2). In this mode, cartridges that are written by the E05 tape drives are fully interchanged compatible with older J1A tape drives with no format selection controls required. This mode can be useful for customers who might want to purchase the E05 tape drives but cannot upgrade software levels or other aspects of their system to support the new drives or data format.

Static Emulation mode, when activated on a drive, is a non-volatile feature and remains in effect until deactivated regardless of power cycles, reset cycles, or drive replacement. Emulation mode might be controlled in two ways:

- In TS3500 (or 3584) open system attached drives, the 3584 library now has support for customer capability to activate and deactivate this feature by using the web interface. This feature requires that both drives and libraries have the required minimum microcode levels or greater. Consult the *IBM*

TS3500 tape library Introduction and Planning Guide (GA32-0559), to determine the required microcode levels and control procedures.

- For all E05 tape drives in other system configurations, static emulation mode is activated and deactivated by the IBM Service Support Representative (SSR) by using the drive service panel. Activation can be completed during the installation and setup of the drives by the SSR if requested by the customer. Post-install activation or deactivation is fulfilled by ordering E05 tape drive Feature Code 0500. The SSR can verify and install the required microcode levels for the drive, run the requested activation or deactivation procedure, and update the customer publications as necessary.

Static Emulation mode is not designed to be used in drives that are attached to IBM Virtual Tape systems (VTS) or TS7700 Virtualization Engine. This mode uses a different, automatic means to ensure the E05 tape drives in a virtual subsystem process cartridge in the J1A tape drive compatible format. No activation or deactivation process is necessary to install E05 tape drives in VTS subsystems. Also, Static Emulation mode might not be activated or deactivated or otherwise controlled through the IBM device drivers and such control must not be attempted by using a host application.

Static Emulation mode is implemented in new drive microcode levels (D3I1_6E1 or higher) shipped standard on all E05 tape drives delivered after Jan 2006. E05 tape drives shipped before this date or operating with older levels of code must have the drive microcode updated to the current operating levels for this feature to be available. This microcode upgrade, if required, can be completed by the SSR with fulfillment of E05 tape drive Feature Code 0500 with feature activation.

Dynamic Emulation

When attached to VTS release 2.32.745.xx or later, TS7700 Virtualization Engine, or J70 or C06 Controller heterogeneous frames that contain J1A tape drives, E05 tape drives automatically operate in J1A tape drive emulation mode in these subsystems, even when set to operate as native E05 tape drives. This mode is set by the special ATAPE driver component resident in these subsystems and is automatic. In this mode, the E05 tape drives can read and write only in EFMT1 format at the J1A tape drive performance and capacity ratings. When removed from these subsystems, the drives automatically revert to native E05 tape drive operation and no action is necessary to restore normal mode.

Tape encryption overview

This topic provides an introduction to tape encryption by using the 3592 tape drives.

Data is one of the most highly valued resources in a competitive business environment. Protecting that data, controlling access to it, and verifying its authenticity while its availability is maintained are priorities in our security-conscious world. Data encryption is a tool that answers many of these needs.

The IBM TS1120 and later tape drives can encrypt data as it is written to any compatible IBM 3592 tape cartridge, including write-once, read-many (WORM) cartridges. This capability adds a strong measure of security to stored data without the processing overhead and performance degradation that is associated with encryption that is completed on the server or at the expense of a dedicated appliance.

Three major elements are available in the tape drive encryption solution.

The encryption-enabled tape drive

All E05, E06/EU6, E07/EH7, E08/EH8, 55F, and 60F tape drives are *encryption-capable*. All E05 tape drives with feature code 5592 or 9592 are *encryption-capable*. They are functionally capable of running hardware encryption, but this capability is not yet activated. To run hardware encryption, the tape drives must be *encryption-enabled*. In an IBM TS3500 or TS4500 tape library, E05 tape drives and later can be encryption-enabled through the IBM Tape Library Specialist web interface.

Note: When an E05 and later tape drive is attached to a tape controller, the tape drive must be encryption-enabled for system-managed encryption. **This statement applies even when encryption is not being used by the host.** The E05 and E06/EU6 tape drives can attach to a J70 Controller or C06 Controller. The E07 can attach to the C06 and C07 Controller.

Note: Not all E05 drives are encryption-capable. E05 tape drives with the Enc label and all EU6, E06, E07/EH7, E08/EH8, 55F, and 60F tape drives are encryption capable. No E06, E07/EH7, E08/EH8, 55F, and 60F tape drives and not all EU6 tape drives show the letters Enc or include an Enc label.

When EU5 and later tape drives are attached to a controller, this process consists of having an IBM System Services Representative (SSR) set up the drive as encryption-enabled. Only encryption-enabled EU5 and later tape drives can be used to read and write encrypted 3592 tape cartridges.

Encryption key management
Encryption involves the use of several kinds of keys, in successive layers. How these keys are generated, maintained, controlled, and transmitted depends upon the operating environment where the encrypting tape drive is installed. Some applications, such as Tivoli Storage Manager, can run key management. For environments without such applications or those where application-independent encryption is wanted, IBM offers an encryption key server (such as the Tivoli Key Lifecycle Manager, or the IBM Security Key Lifecycle Manager for z/OS). “Managing encryption” on page 13 describes key management in detail.

Encryption policy
The method that is used to implement encryption. It includes the rules that govern which volumes are encrypted and the mechanism for key selection. How and where these rules are set up depends on the operating environment. See “Managing encryption” on page 13 for information.

Note: In the tape storage environment, the encryption function on tape drives (desktop, stand-alone, and within libraries) is configured and managed by the customer and not the SSR. In some instances, an SSR is required to enable encryption at a hardware level when service access or service password controlled access is required. Customer setup support is by Field Technical Sales Specialist (FTSS), customer documentation, and software support for encryption software problems. Customer "how to" support is also provided with customers who have a support line contract.

Managing encryption

The encryption key server (EKS) and the three methods for managing encryption.

An *encryption key server* is a software program that assists IBM encryption-enabled tape drives in generating, protecting, storing, and maintaining encryption keys that are used to encrypt information that is written to, and decrypt information that is read from, tape media (tape and cartridge formats). IBM currently supports: encryption key servers: IBM Tivoli Key Lifecycle Manager, and IBM Security Key Lifecycle Manager for z/OS. Throughout the remainder of this publication, the encryption key servers are referred to collectively as the "encryption key server" (EKS) unless a specific software program is being described. The EKS operates on z/OS, i5/OS, AIX, Linux, HP-UX, Sun Solaris, and Windows, and is a shared resource that is deployed in several locations within an Enterprise. It is capable of serving numerous IBM encrypting tape drives, regardless of where those drives reside (for example, in tape library subsystems, which are connected to mainframe systems through various types of channel connections, or installed in other computing systems.)

The EKS uses a keystore to hold the certificates and keys (or pointers to the certificates and keys) required for all encryption tasks. Refer to the appropriate EKS documentation for detailed information about the EKS and the keystores it supports.

The EKS acts as a daemon process that is awaiting key generation or key retrieval requests sent to it through a TCP/IP communication path between the EKS and the tape library, tape controller, tape subsystem, device driver, or tape drive. When a TS1120 or later tape drive writes encrypted data, it first requests an encryption key. Upon receipt of the request, the EKS generates an Advanced Encryption Standard (AES) key and serves it to the tape drives in two protected forms:

- Encrypted or *wrapped*, with Rivest-Shamir-Adleman (RSA) key pairs. The tape drive writes this copy of the key to the cartridge memory and three extra places on the tape media in the cartridge for redundancy.
- Separately wrapped for secure transfer to the tape drive where it is unwrapped upon arrival and the key inside is used to encrypt the data that is written to tape.

When an encrypted tape cartridge is read by a TS1120 or later tape drive, the protected AES key on the tape is sent to the EKS where the wrapped AES key is unwrapped. The AES key is then wrapped with a different key for secure transfer back to the tape drive, where it is unwrapped and used to decrypt the data that is stored on the tape. The EKS also allows protected AES keys to be rewrapped, or rekeyed, with different RSA keys from the original ones used when the tape was written. Rekeying is useful when an unexpected need arises to export volumes to business partners whose public keys were not included; it

eliminates the need to rewrite the entire tape and enables a tape cartridge 's data key to be re-encrypted with a business partner's public key.

There are three methods of encryption management to choose from. These methods differ in where the encryption policy engine resides and where key management is completed for your encryption solution, and how the EKS is connected to the drive. Your operating environment determines which is the best for you. Key management and the encryption policy engine can be in any one of the following three environmental layers.

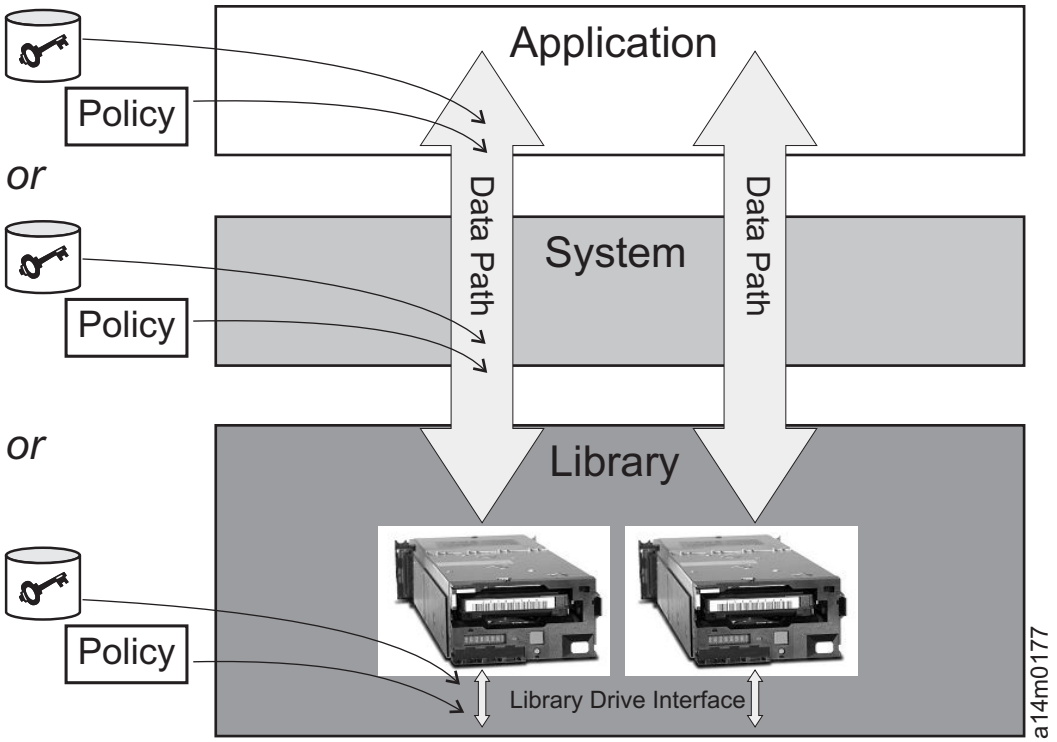

Figure 3: Three possible locations for encryption policy engine and key management.

Application Layer
Initiates data transfer for tape storage, for example TSM.

System Layer
Everything between the application and the tape drives, for example the operating system, z/OS DFSMS, device drivers, and FICON/ESCON controllers.

Library Layer
The enclosure for tape storage, such as the IBM TS3500 tape library. A modern tape library contains an internal interface to each tape drive within it.

Application-managed tape encryption
Application-managed tape encryption is described.

This method is best where operating environments run an application already capable of generating and managing encryption policies and keys, such as Tivoli Storage Manager. Policies specifying when encryption is to be used are defined through the application interface. The policies and keys pass through the data path between the application layer and the encrypting tape drives. Encryption is the result of interaction between the application and the encryption-enabled tape drive, and does not require any changes to the system and library layers. Because the application manages the encryption keys, data volumes that are written and encrypted with the application-managed encryption method can be read only by the same software application that wrote them.

An encryption key server is not required by, or used by, application-managed tape encryption.

Application-managed tape encryption on IBM TS1120 and later tape drives can use either of two encryption command sets:

- The IBM encryption command set developed for the encryption key server
- The T10 command set defined by the InterNational Committee for Information Technology Standards (INCITS)

Application-managed tape encryption with the TS1120 and TS1130 tape drives is supported in the following IBM libraries:

- IBM TS3400 tape library
- IBM TS3500 tape library
- IBM 3494 tape library

Application-managed tape encryption with the TS1140, TS1150, TS1155, and TS1160 tape drives is supported in the following IBM library:

- IBM TS4500 tape library

For information about setting up application-managed encryption, see your Tivoli Storage Manager documentation or go to http://publib.boulder.ibm.com/infocenter/tivihelp/v1r1/index.jsp .

System-managed tape encryption
System-managed tape encryption is described.

This method is best for encryption on TS1120 and later tape drives in Open Systems and System z operating environments where the applications that write or read from tape are not capable of completing the key management that is required for application-managed encryption.

Open Systems

Encryption policies that specify when to use encryption are set up in the IBM tape device driver. System-managed tape encryption and library-managed tape encryption interoperate with one another. In other words, a tape encrypted with system-managed encryption can be decrypted with library-managed encryption, and vice versa, provided they both have access to the same keys and certificates. Otherwise, this procedure might not be feasible.

For details on setting up system-managed encryption on tape drives in an AIX, Linux, Windows, or Solaris environment, see the *IBM Tape Device Drivers Installation and User 's Guide*, and the *Planning and Operator Guide* for your tape library.

System z

Encryption policies that specify when to use encryption are set up in z/OS DFSMS (Data Facility Storage Management Subsystem) or implicitly through each instance of IBM device driver. Extra software products such as IBM Integrated Cryptographic Service Facility (ICSF) and IBM Resource Access Control Facility (RACF®) might also be used. Key generation and management are completed by the encryption key server running on the host or externally on another host. Policy controls and keys pass through the data path between the system layer and the encrypting tape drives. Encryption is transparent to the applications.

For TS1120 and later tape drives connected to an IBM Virtualization Engine TS7700, encryption key labels are assigned on a per-storage pool basis with the TS7700 Management Interface. DFSMS storage constructs are used by z/OS to control the use of storage pools for logical volumes, resulting in an indirect form of encryption policy management. For information, see the white paper, *IBM Virtualization Engine TS7700 Series Encryption Overview,* available at the IBM White Papers website.

With system-managed encryption, System z hosts can rekey an encrypted tape on the TS1120 and later tape drives. Refer to the appropriate operating system documentation for the mechanism that is used to initiate a rekey operation.

For details on setting up system-managed encryption on TS1120 and later tape drives in a System z platform environment, see *z/OS DFSMS Software Support for IBM TS1130, TS1140, and TS1150 Tape Drives (3592)*, SC26-7514.

Encryption key paths
Encryption key paths are described.

In system-managed encryption on System z platforms, multiple key paths are supported by the tape controller.

In-band key flow

In-band key flow, which is shown in Figure 4 on page 16, occurs between the encryption key server and the tape drive through a FICON proxy (only available in z/OS) on the FICON/ESCON interface. The FICON proxy supports failover to the secondary key path on failure of first-specified encryption key server path addresses. Impact on controller service requirements is minimal.

The controller:

- Reports drive status in SMIT displays
- Passes encryption-related errors from the drive to the host
- Reports to the host "encryption failure unit checks"
- Must be reconfigured whenever new encryption drives are introduced for attachment or when an encryption-capable drive is enabled for encryption.

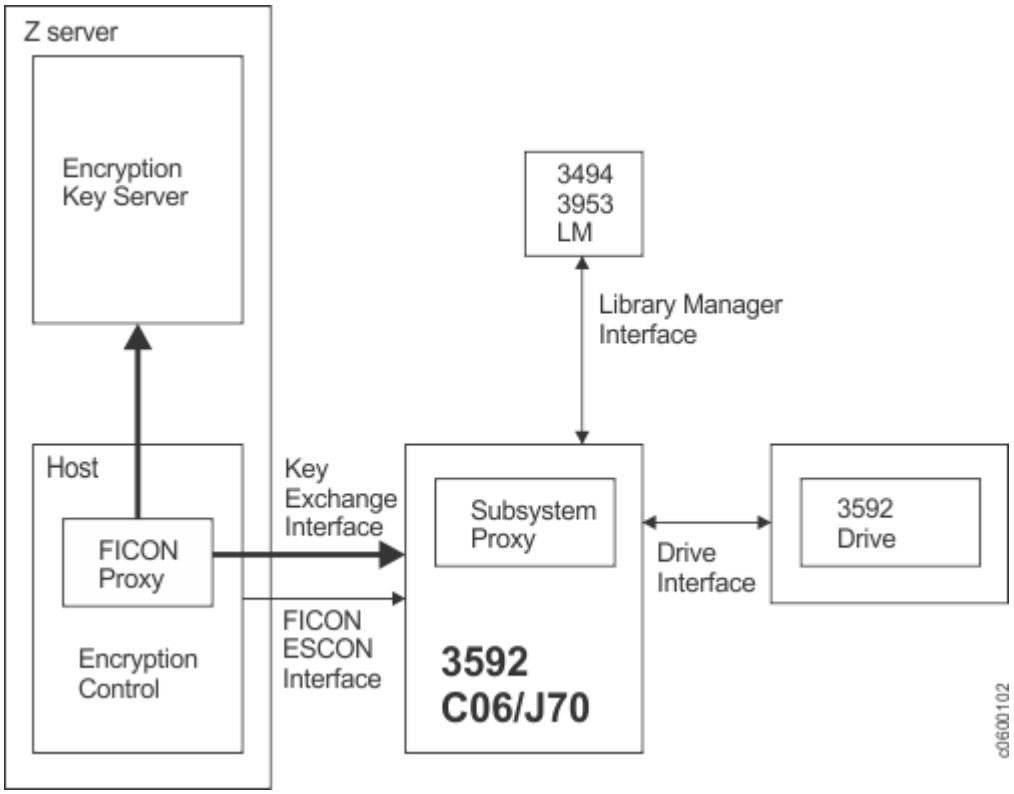

Figure 4: In-band encryption key flow

Out-of-band key flow

Out-of-band key flow, which is shown in Figure 5 on page 17, occurs between the encryption key server and the tape drive through a subsystem proxy, which is in the 3592 controller or TS7700 Virtualization Engine, on the encryption key server interface. Impact on service requirements can be greater than for in-band key flow because of the introduction of two routers on the encryption key server interface, to and from the controller.

The controller and TS7700:

- Supports failover to the secondary key path on failure of first-specified encryption key server path addresses
- Reports drive status in SMIT displays
- Passes encryption-related errors from the drive to the host
- Reports to the host "encryption failure unit checks"
- Must be reconfigured whenever new encryption drives are introduced for attachment or when an encryption-capable drive is enabled for encryption.

As many as two encryption key server IP/domain addresses (and as many as two ports) might be entered for each controller, and also two Domain name server IP addresses.

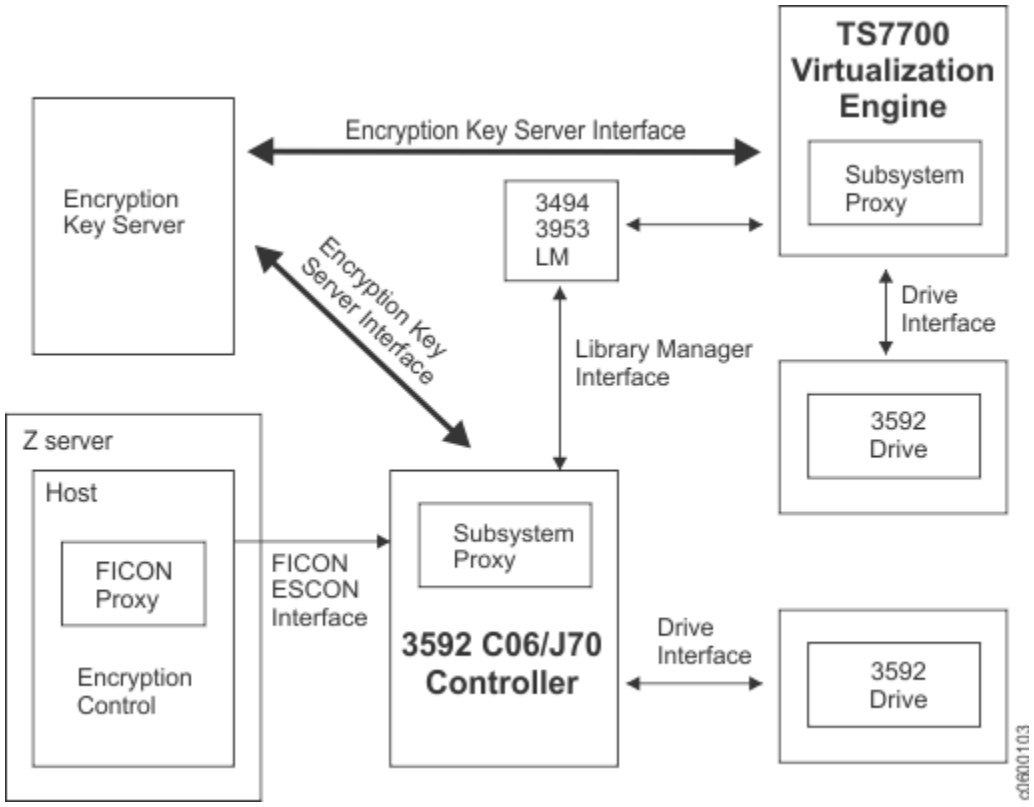

Figure 5: Out-of-band encryption key flow

Library-managed tape encryption
Library-managed tape encryption is described.

This method is best for tape drives in an open-attached IBM tape library. TS1120 and TS1130 tape drives can attach to a IBM TS3400, TS3500, or IBM 3494 tape library. TS1140 and TS1150 tape drives can attach only to a TS3500 or TS4500 tape library. For TS3500 and TS4500 tape library attachment, barcode encryption policies can be used to specify when to use encryption, and are set up through the IBM tape Library Specialist web interface. In such cases, policies are based on cartridge volume serial numbers.

Library-managed encryption also allows other options, such as encryption of all volumes in a library, independent of bar codes. Key generation and management are completed by the encryption key server. Policy control and keys pass through the library-to-drive interface, therefore encryption is transparent to the applications.

Library-managed encryption, when used with certain applications such as Symantec Netbackup™ or the EMC Legato NetWorker, includes support for an *internal label option*. When the internal label option is configured, the TS1120 and later tape drives automatically derive the encryption policy and key

information from the metadata that is written on the tape volume by the application. Refer to your *Tape Library Operator's Guide* for information.

Note: If you use library-managed encryption and IBM tape and changer drivers that are running on Open Systems platforms (AIX, HP-UX, Linux, Solaris, Windows), information for bulk rekey is available in the *IBM Tape Device Drivers Installation and User's Guide*, GC27-2130, available at the IBM Support Portal.

System-managed tape encryption and library-managed tape encryption interoperate with one another. In other words, a tape encrypted with system-managed encryption can be decrypted with library-managed encryption, and the other way around, provided they both have access to the same keys and certificates. Otherwise, this procedure cannot be feasible.

About encryption keys

The encryption keys that are used to encrypt data are described.

An encryption key is typically a random string of bits generated specifically to scramble and unscramble data. Encryption keys are created with algorithms designed to ensure that each key is unique and unpredictable. The longer the key constructed this way, the harder it is to break the encryption code. Both the IBM and T10 methods of encryption use 256-bit AES algorithm keys to encrypt data. 256-bit AES is the encryption standard that is recognized and recommended by the US government, which allows three different key lengths. 256-bit keys are the longest allowed by AES.

Two types of encryption algorithms can be used by the encryption key server: symmetric algorithms and asymmetric algorithms. Symmetric, or secret key encryption, uses a single key for both encryption and decryption. Symmetric key encryption is used for encrypting large amounts of data efficiently. 256-bit AES keys are symmetric keys. Asymmetric, or public/private encryption, uses a pair of keys. Data encrypted with one key are decrypted only with the other key in the public/private key pair. When an asymmetric key pair is generated, the public key is typically used to encrypt, and the private key is typically used to decrypt.

The encryption key server uses both symmetric and asymmetric keys; symmetric encryption for high-speed encryption of user or host data, and asymmetric encryption (which is necessarily slower) for protecting the symmetric key.

Encryption keys can be generated by the encryption key server, by applications such as Tivoli Storage Manager, or by a utility such as keytool. The responsibility for generating AES keys and the manner in which they are transferred to the tape drive depends on the tape drive type and the method of encryption management. However, it can be helpful to understand the difference between how the encryption key server uses encryption keys and how other applications use them.

How the encryption key server processes encryption keys

TS1120 and later tape drives

In system-managed and library-managed tape encryption, unencrypted data (clear text) is sent to the tape drive and converted to ciphertext with a symmetric 256-bit AES Data Key (DK) generated by the encryption key server. The ciphertext is then written to tape. The encryption key server uses a single, unique data key for each 3592 tape cartridge. This data key is also encrypted, or wrapped, by the encryption key server with the public key from an asymmetric Key Encrypting Key (KEK) pair. This process creates an Externally Encrypted Data Key (EEDK). The EEDK is written to the cartridge memory and to three more places on the tape media in the cartridge. The tape cartridge now holds both the encrypted data and the means to decrypt it for anyone that is holding the private part of the KEK pair. Figure 6 on page 19 illustrates this process.

The data key is also wrapped a second time, possibly with the public key of another party, to create an extra EEDK. Both EEDKs can be stored on the tape cartridge. In this way, the tape cartridge can be shipped to a business partner that is holding the corresponding private key that would allow the data key to be unwrapped and the tape that is decrypted by the business partner.

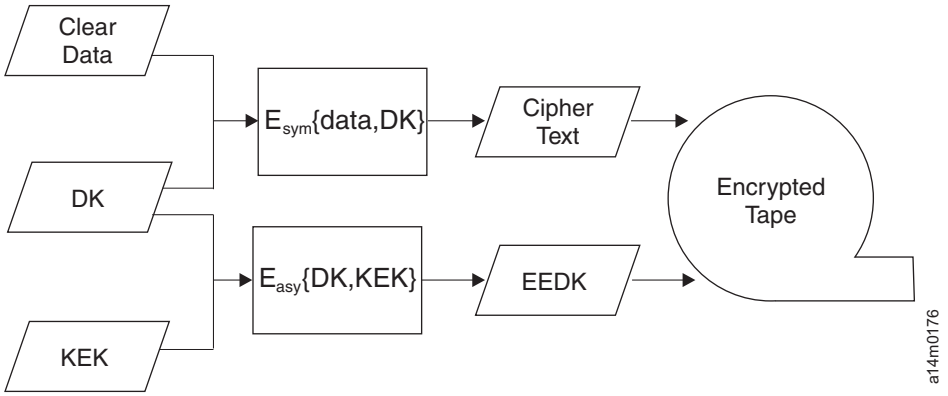

Figure 6: Encryption with both symmetric and asymmetric encryption keys

Encryption key processing by other applications (an encryption key server not used)

In application-managed tape encryption, unencrypted data (clear text) is sent to the tape drive and converted to ciphertext with a symmetric Data Key (DK) provided by the application, and is then written to tape. The data key is not stored anywhere on the tape cartridge. When the encrypted volume is written, the data key must be in a location available to the application, a server database, for example, in order for the volume to be read.

TS1120 and later tape drives can use applications such as Tivoli Storage Manager for application-managed encryption. Tivoli Storage Manager uses a single, unique data key for each tape cartridge.

Alternatively, the tape drives can be used by applications that use the T10 command set to complete encryption. The T10 command set uses symmetric 256-bit AES keys that are provided by the application. T10 can use multiple, unique data keys per tape cartridge, and even write encrypted data and clear data to the same tape cartridge. When the application encrypts a tape cartridge, it selects or generates a data key with a method determined by the application and sends it to the tape drive. The key is not wrapped with an asymmetric public key and it is not stored on the tape cartridge. When the encrypted data is written to tape, the data key must be in a location available to the application in order for the data to be read.

The process for application-managed tape encryption is shown in Figure 7 on page 19.

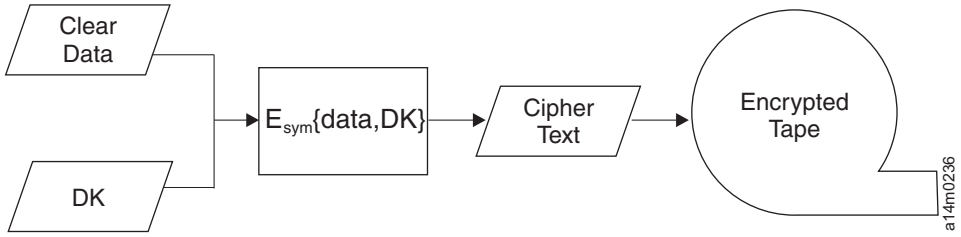

Figure 7: Encryption with only symmetric encryption keys

IBM TS1120 (3592 C06) Controller and the IBM 3592-J70 Controller

This topic provides information about the controllers.

The IBM TS1120 (3592 C06) Controller and its predecessor, the IBM 3592-J70 Controller, provide new levels of performance and attachment capabilities for System z customers. These controllers offer the following enhancements compared to the 3590 Model A60 controller:

- Up to four 4 Gb/s (TS1120 (3592 C06) Controller only) or 2 Gb/s (J70 Controller only) FICON attachments, twice the number that the 3590 Model A60 controller offers
- Up to eight ESCON attachments

- Support for an intermix of ESCON and FICON attachments
- Up to sixteen attached 3592 tape drives or twelve 3590 models B, E, and H tape drives (J70 Controller only) for some configurations (for information on 3590 tape drives, refer to *IBM Enterprise Tape System 3590 Introduction and Planning Guide*, GA32-0329.)
- Two 4 Gb/s or 2 Gb/s (J70 Controller only) Fibre Channel adapters for attaching 3592 tape drives
- Support for 3592 drive hot swap capabilities
- Support for capacity scaling/segmentation with the 3592 tape drive
- Support for WORM capabilities with the 3592 tape drives
- Support for high-speed CCW for increased performance of certain applications, such as Hierarchical Storage Management (HSM) audit
- Support for all IBM 3592 Tape Cartridge types including WORM cartridges
- Support for IBM TS3400 Tape Library (withdrawn) (TS1120 (3592 C06) Controller only)

Throughout the remainder of this publication, the TS1120 (3592 C06) Controller and the J70 Controller are referred to collectively as the 3592 controller unless a specific model is being discussed.

Fibre Channel switches for the C06 and J70 Controllers

This topic provides information about the Fibre Channel switches.

The 3592 controllers can attach to ESCON and FICON channels on selected System z servers or through a FICON/FICON switch with the appropriate levels of system software. The 3592 controllers can be directly attached to host systems that are within 10 k (6.2 mi) or attached with a FICON/FICON switch, with appropriate repeaters, within 100 k (62 mi). FICON attachment is available when the E05, E06, E07, and J1A tape drives or 3590 Model B, E, and H tape drives (J70 Controller only) are attached to the 3592 controllers.

A 3592-supported Fibre Channel switch is required to attach 3590 Model B, E, and H Fibre Channel tape drives or more than four 3592 tape drives to a 3592 controller.

For the most recent list of C06 Controller-supported Fibre Channel switches, please visit the IBM 3592 Frequently Asked Questions web page.

For the most recent list of J70 Controller-supported Fibre Channel switches, please visit the IBM Support Portal.

Controls and indicators

The 3592 Controllers require no operator interaction after setup by authorized IBM personnel. On the controller, there is a Power On button with a Power On indicator, power supply indicators, a Reset button, and a liquid crystal display (LCD). See Table 9 on page 20 for a description of their functions.

Table 9: Descriptions of the C06 and J70 controls and indicators

Control/Display	**Description**
Power On button	The Power On button turns the system power on and off to the 3592 controller.
Power On indicator	Blinking - Indicates that the system is in Standby mode and that the 3592 controller is connected to a power source. Solid - Indicates that the system is in On mode and that the 33592 controller is connected to a power source when the 'Power On' button has been pressed to turn system power on.

Table 9: Descriptions of the C06 and J70 controls and indicators (continued)	
Power supply indicators	There are two power supply indicators, one for each power supply, which are lit when that power supply drawer is operational.
Reset button	The Reset button is used by the IBM service representative to reset and initialize the 3592 controller.
Liquid crystal display (LCD)	This LCD displays the progress of the controller's self tests and diagnostic indicators. It is also used to display codes and diagnostic messages.

Compatibility

- You cannot intermix SCSI and Fibre Channel attached tape drives on a single 3592 tape controller.
- E05 and J1A tape drives can be attached to the same controller when E05 tape drives are emulating J1A tape drives.[1]
- 3592 tape drives cannot be attached to the same J70 Controller with 3590 tape drives. 3590 B, E, or H models cannot be intermixed on the same J70 Controller. 3590 tape drives are not supported by the IBM TS1120 (3592 C06) Controller.
- The 4 Gb/s or 2 Gb/s Fibre Channel Switch must be used exclusively by the IBM TS1120 (3592 C06) Controller.
- The 4 Gb/s or 2 Gb/s Fibre Channel Switch or 2109 Model F16 or S16 switch must be used exclusively by the J70 Controller.
- You cannot intermix 3592 and 3590 tape drives on a single Fibre Channel switch with either J70 or C06 Controller.
- 3590 tape drives are not supported by the C06 Controller.
- The 2109 switch (withdrawn) is not supported by the C06 Controller.
- External fabric is supported (see Chapter 2, “Standard Features,” on page 29).

Call Home

The IBM TS1120 (3592 C06) Controller and J70 Controller support the Call Home function. The Call Home function opens a service alert if a problem occurs with the controller. A service representative can then respond to fix the problem.

Feature codes FC 2710, FC 2711, or FC 2712 (these three feature codes are withdrawn from Marketing) provide base remote support for J70 Controller service alerts. In addition to error alerts, you can enhance Call Home functionality with features FC 2714, FC 2715, FC 2719, and FC 2732. Enhanced Call Home functionality sends wellness monitoring data through the IBM TS3000 System Console (TSSC). Your service representative can activate enhanced Call Home Functionality during the installation of the controller. Service menus provide means to deactivate the Remote Support. The 3953-F05 frame with FC 2721 provides the same service as 3592 FC 2732. One or the other is required.

The following 3592 tape controller environments support Call Home:

- C06 or J70 Controller in stand-alone frames/racks
- C06 or J70 Controller in StorageTek Automated Cartridge System (ACS) environments
- C06 or J70 Controller in the 3494 Tape Library
- C06 or J70 Controller in the 3953 F05 Tape Frame
- C06 Controller in the 3952 Tape Frame

[1] To take advantage of the performance improvements of the E05 tape drive, only native E05 tape drives must be attached to the IBM TS1120 (3592 C06) Controller or J70 Controller.

- The TS3400 Tape Library attached to a C06 Controller is also supported by Call Home through an ethernet connection to the TSSC.

3952 Tape Frame installation

The C06 Controller can be installed in the IBM 3952 Tape Frame Model F05 (3952 Tape Frame). There are two versions of the 3952 Tape Frame: the 3494 attachment frame and the silo attachment frame. A maximum of three C06 Controllers or two J70 Controllers can be installed in either version of the 3952 Tape Frame. See "3952 F05 Tape Frame specifications" on page 117.

Table 10: C06 Controllers in 3952 F05 frames

Frame	Attachments
3952 Model F05 (3494 attachment)	One to three C06 Controllers
3952 Model F05 (silo attachment)	One to three C06 Controllers

Connecting C06 Controllers in a 3952-F05 frame to tape drives in a D22 or D24 frame of a 3494 Tape Library

Every C06 Controller in a 3952-F05 frame is independent of the other tape controllers in the frame. This means that all C06 Controllers installed in a 3952-F05 frame to be attached to a 3494 do not have to attach to the same 3494 library. Each C06 Controller can be attached to a separate 3494 tape library, or some can be attached to the same 3494 tape library. Each 3494 D22 or D24 frame that is attaching to an outboard C06 Controller orders an attachment to an outbound controller. This provides the cabling needed for each C06 Controller to attach to a 3952-F05 or multiple 3952-F05 frames.

3953 Frame installation

The C06 and J70 Controllers can be installed in the 3953 F05 frame. There are two versions of this frame: the base frame and the expansion frame. One C07 or J70 Controller can be installed in the base frame; up to three C07 and J70 Controller can be installed and intermixed in the expansion frame. See the *IBM 3953 Tape System Introduction and Planning Guide*, GA32-0557, for a complete discussion of the 3592 controller in the 3953 F05 frame. See Table 11 on page 22 for a summary of the number of tape controllers that can be installed in the 3953 F05 frame.

Table 11: C06 Controller and J70 Controller in 3953 F05 frames

Frame	Attachments
3953 Model F05 (base)	One C06 or J70 Controller
3953 Model F05 (expansion)	Up to three C06 or J70 Controllers

TS3400 tape library installation

This product is no longer available for ordering and is not supported by the IBM TS1140 Model E07 tape drive.

One or two E05, E06, or EU6 tape drives can be installed in the IBM TS3400 Tape Library (3577 Model L5U). J1A tape drives are not supported in the TS3400 Tape Library. The TS3400 contains two magazines, each capable of holding nine tape cartridges. The lower magazine can be configured to use the first three

cartridge slots as an I/O station. The TS3400 Library can be rack mounted or used in a stand-alone (table top) environment. Rack mounted TS3400 libraries may be attached to a rack mounted TS1120 (3592 C06) Controller. See *IBM TS3400 Tape Library Planning and Operator Guide* for more information.

In a System z environment, 3592 drives in the TS3400 library report to the host as stand-alone drives with cartridge loaders rather than appear as a library to the host. The control unit supports the 3592 drives and simulated cartridge loaders in system mode and in automatic mode. Since support for the TS3400 is transparent to System z operating platforms, which mode is supported depends on the operating system support available today.

Table 12: E05 and E06/EU6 tape drives in TS3400 Tape Library

Frame	Attachments
TS3400 (3577 Model L5U)	Up to two E05, E06, or EU6 tape drives

TS3500 tape library installation

This topic describes the number of tape drives allowed in a Model D22, D23, L22, and L23 tape frame.

All model 3592 tape drives can be installed in the IBM TS3500 (3584) tape library Model L22/L23 and Model D22/D23 frames. Up to twelve 3592 tape drives can be installed in each TS3500 Model L22 and D22 frame. The 3592 tape drives can be intermixed within TS3500 libraries within the same frames. See the *IBM TS3500 tape library with ALMS Introduction and Planning Guide*, GA32-0593 for a complete discussion of the 3592 tape drive in the IBM TS3500 tape library. See Table 13 on page 23 for a summary of the number of 3592 tape drives that can be installed in the TS3500 tape library's Model L22/L23 and Model D22/D23 frames.

Table 13: 3592 tape drives in TS3500 tape library (3584) frames L22/L23 and D22/D23

Frame	Attachments
TS3500 Model L22/L23	Up to twelve 3592 tape drives
TS3500 Model D22/D23	Up to twelve 3592 tape drives

Note: Advanced Library Management System (ALMS) and enhanced node cards are required to support E07 and E08 tape drives in a 3584 library.

3494 frame installation

J1A, E05, E06, and EU6 tape drives can be installed in the IBM TotalStorage 3494 Tape Library's L22, D22, and D24 frames. The E07 and E08 tape drives are not supported by the 3494 library. Since the 3592 tape drive is smaller, the 3494 Model L22, D22, and D24 frames hold twice the number of tape drives compared to the corresponding frame with 3590 tape drives. The 3592 tape drives and 3590 model tape drives can be intermixed within libraries, but not within the same frames.

Existing 3494 frame models L10, L12, and L14 frames can be converted to the Model L22 (These frame conversions are withdrawn from Marketing as of December 29, 2006). Existing D10, D12, and D14 frame models can be converted to the D22 and D24 frames to accommodate the new 3592 drives. See the *IBM TotalStorage 3494 Tape Library Introduction and Planning Guide*, GA32-0448 for more information on frame conversions.

When using a TS1120 (3592 C06) Controller with a 3494 tape library, the C06 Controller resides in a 3952 Tape Frame that is detached from the library. The C06 Controller connection to the library is made through a 3494 D24 Frame or 3494 D22 Frame. The 3494 D24 Frame or 3494 D22 Frame contains the fibre channel switch(es) that the C06 Controller uses to communicate with up to twelve connected 3592

tape drives. Additional drives (up to 16 total per controller) can be connected in an adjacent 3494 D22 Frame or 3494 L22 Frame.

Table 14: L22, D14, D22, and D24 maximum frame capacities for drives and controllers

Frame	Attachments
3494 Model L22	Up to four J1A, E05, E06, or EU6 tape drives **Note:** 1. If a Model L22 frame is installed with the adjacent frame FC 4085, the maximum number of attached 3592 drives is four. 2. If a Model L22 frame is installed with the adjacent frame FC 4086, the maximum number of attached 3592 drives is four.
3494 Model D22	Up to twelve J1A, E05, E06, or EU6 tape drives **Note:** 1. If a Model D22 frame is installed with the adjacent frame FC 4085, the maximum number of attached 3592 drives is eight. 2. If a Model D22 frame is installed with the adjacent frame FC 4086, the maximum number of attached 3592 drives is four.
3494 Model D24	One J70 Controller or 3590 Model A60 controller, or TS1120 (3592 C06) Controller and up to eight J1A, E05, E06, or EU6 tape drives.
3494 Model D14	One J70 Controller or 3590 Model A60 controller and up to four model H1A, four E1A, or four B1A 3590 tape drives

3590 Model A14 Frame installation

The J70 Controller can be installed in the IBM TotalStorage Enterprise Tape Drive Frame 3590 Model A14. See Table 15 on page 24 for a summary of the number of drives and controllers that can be installed in the IBM TotalStorage Enterprise Tape Drive Frame 3590 Model A14. For more information regarding the IBM TotalStorage Enterprise Tape Drive 3590 and 3590 controllers, see the *IBM TotalStorage Enterprise Tape System 3590 Introduction and Planning Guide*, GA32-0329.

Table 15: 3590 Model A14 maximum frame capacity for drives and controllers

Frame	Attachments
3590 Model A14 (see [1])	One J70 Controller or 3590 Model A60 controller and up to eight SCSI drives or twelve Fibre Channel drives with multiframe FC 4084.
[1] This frame/controller combination is supported only for 3590 drive attachments.	

Rack installation (for E08, E07, E06/EU6, E05, and J1A tape drives)

This topic describes the requirements for installing 3592 E08, E07, E06/EU6, E05, and J1A tape drives in a rack.

The E07 and E08 tape drives require extra rack mount hardware. See FC 4684 for details.

The 3592 tape drives can be installed in a rack environment, and can be mixed with 3590 drives in the same rack, but not on the same shelves. In addition, J1A tape drives can be installed in racks with a TS1120 (3592 C06) Controller, J70 Controller, or a 3590 Model A60 controller, but E05, EU6, and E06 tape drives require a C06, or J70 Controller. E07 tape drives require a C06/C07 Controller. 3590 drives can be installed in racks with a J70 Controller or a 3590 A60 Controller. However, 3592 drives and 3590 drives cannot be attached to the same controller.

For information about rack installations for 3590 drives or controllers, see the *IBM Enterprise Tape System 3590 Introduction and Planning Guide*, GA32-0329.

To allocate the proper amount of rack space, determine the number of 3592 tape drives you plan to install. You can place up to two 3592 tape drives into one cradle. On each shelf in a rack, you can mount two cradles, for a maximum of four tape drives per shelf. One shelf, containing either one or two 3592 tape drive cradles requires 10U of rack space. For example, the installations of 1 - 4 drives requires the same total 10U of rack space. The fifth through eighth drive installations require an extra 10U of rack space. See Table 16 on page 25 for the maximum number of 3592 tape drives that can be installed in different rack environments.

Note: 1U is also often referred to as 1 RU or 1 EIA, and is an industry standard unit of measure for 19-inch server racks. 1U occupies "one unit" or one region of rack space, which is equal to 1.75 inches (44.45 mm).

Table 16: Maximum number of 3592 tape drives or 3590 drives installed in racks with or without a controller

Rack Size	Number of 3592 drives	Number of 3590 drives with controller
2.0 m (6.6 ft) rack (IBM Model 7014-T42)	• Up to 16 without controller • Up to 12 with controller	Up to 4
1.8 m (5.9 ft) (IBM Model 7014-T00)	• Up to 12 without controller • Up to 8 with controller	Up to 4
1.6 m (5.2 ft) (IBM Model 7014-S00)	• Up to 12 without controller • Up to 8 with controller	Up to 2
Note: For information on 3590 drives in racks without controllers, see the *IBM Enterprise Tape System 3590 Introduction and Planning Guide*, GA32-0329		

Rack installation (for EH7/EH8/55F/60F tape drives)

This topic describes the requirements for installing 3592 EH7, EH8, 55F, and 60F tape drives in a rack.

The EH7, EH8, 55F, and 60F tape drives require extra rack mount hardware. See FC 4804 for details.

The tape drives can be installed in a rack environment by using industry standard 19-inch racks. To allocate the proper amount of rack space, determine the number of 3592 tape drives you plan to install. With each Rack Mount kit, you can place up to two 3592 tape drives into one enclosure. On each shelf in a rack, you can mount an enclosure, for a maximum of two tape drives (side by side) per shelf. One shelf,

containing a 3592 tape drive enclosure requires 3U of rack space. Each additional shelf, with its enclosure that holds 1 or 2 tape drives, requires an extra 3U of rack space. Therefore, a standard 42U rack can hold a maximum of 14 enclosures or 28 tape drives.

Notes:

- 1U is also often referred to as 1 RU or 1 EIA, and is an industry standard unit of measure for 19-inch server racks. 1U occupies "one unit" or one region of rack space, which is equal to 1.75 inches (44.45 mm).
- Additional items must be considered for installation planning. A standard 42U rack can hold a maximum of 14 enclosures, but unless it is necessary, it is best to not install an enclosure in the top or bottom spaces in the rack. It can be difficult for an operator to load/unload cartridges in those positions, and it can also be difficult to read the 8-character message display on the front of the drive.
- With this Rack Mount kit design, drive canisters can be installed or removed from either the front or the rear of the rack.

Table 17: Maximum number of EH7, EH8, 55F, and 60F tape drives installed in a rack

Rack Size	Number of drives
2.0 m (6.6 ft) rack (IBM Model 7014-T42)	Up to 28
1.8 m (5.9 ft) (IBM Model 7014-T00)	Up to 24
1.6 m (5.2 ft) (IBM Model 7014-S00)	Up to 20

Hardware and software support

These topics provide information about supported hardware and software.

Support for the 3592 tape drives is provided in i5/OS, OS/400®, AIX, HP-UX, Linux, Sun, and Windows NT, 2000, or Windows Server 2003 operating system environments. Support for the z/OS, z/VM, z/TPF, and VSE/ESA operating system environments is available through the C06 and J70 Controllers.

For general tape drive information and details on operating systems, hardware support, supported software versions and release levels, visit the following website and select the tape drive of your choice IBM Tape systems.

The installation of a 3592 tape drive might require code updates for operating systems, supported open systems device drivers, or storage management software. Per the Solutions Assurance Product Review (SAPR) Guide, the account team or business partner should ensure that the customer checks the appropriate PSP buckets for System z environments or the equivalent support levels required for their particular software environment prior to the installation of the 3592 tape drive.

A Solutions Assurance call is required at a minimum for the installation of:

- The first new C06 or J70 Controller in an account, or
- The first new 3592 tape drive in an account

Device drivers

This topic describes how to obtain information about device drivers.

To access the 3592 firmware and device drivers, go to the IBM Tape Storage Systems website and:

1. Click the **Support & downloads** menu item.
2. Select **Download** > **Fixes, updates and drivers**.

Updated open systems device drivers can be obtained from the IBM Support Portal. Further information can be found in the *IBM Tape Device Drivers Installation and User's Guide*, GC35-0154, also available at this site.

Application software

This topic describes application software.

Tivoli Storage Manager and other industry-leading compatible software offerings provide storage and tape management software for the 3592 tape drives. Supporting software and applications must be obtained separately from IBM, IBM Business Partners, or independent software vendors (ISV). For a list of compatible software and additional information, refer to the 3592 ISV Matrix available at the following website Independent Software Vendor (ISV) matrix for 3592 and LTO.

Media

Data cartridges

This topic provides an overview of tape data cartridges used by the 3592 tape drives.

The IBM 3592 Tape Cartridge is an advanced magnetic tape that is optimized for the Enterprise tape environment. It is available in five sizes. See Table 36 on page 91 for information on cartridge types and native capacities for each tape drive model.

The 3592 Standard Data cartridge has a native capacity of 640 GB (596.04 GiB) when formatted for EFMT3, 500 GB (465.66 GiB) when formatted for EFMT2, and 300 GB (279.39 GiB) when formatted for EFMT1. The 3592 Advanced Data cartridge, used only by the E07 tape drive, has a native capacity of 4000 GB (3725.29 GiB) when formatted for EFMT4.

The 3592 Economy cartridge has a native capacity of 5 TB (4.55 TiB) in EFMT6 (60F format), 3 TB (2.73 TiB) in EFMT5 (55x format), 2 TB (1.82 TiB) in EFMT5 and EFMT4, 128 GB (119.21 GiB) in EFMT3, 100 GB (93.13 GiB) in EFMT2, and 60 GB (55.88 GiB) in EFMT1. The 3592 Advanced Economy cartridge, used only by the E07 tape drive, has a native capacity of 500 GB (465.66 GiB).

The 3592 Extended cartridge has a native capacity of 1600 GB (1490.12 GiB) in EFMT4, 1000 GB (931.32 GiB) in EFMT3 and 700 GB (651.93 GiB) in EFMT2. The 3592 Extended cartridge is not supported on the J1A tape drive or on a E05 tape drive that emulates a J1A tape drive (EFMT1). See Table 35 on page 89 for each tape drive and the formats that it can read and write.

The 3592 Advanced Type C cartridge has a native capacity of 7 TB (6.37 TiB) in EFMT5-E08, and 4 TB (3.64 TiB) in EFMT4. The 3592 Advanced Type C cartridge is not supported on the J1A, E05, E06, EU6, or 55F tape drives.

The 3592 Advanced Type D cartridge has a native capacity of 15 TB (13.64 TiB) in EFMT5-55F and 10 TB (9.09 TiB) in EFMT5-E08. The 3592 Advanced Type D cartridge is not supported on the J1A, E05, E06, EU6, or E07/EH7 tape drives.

The 3592 Advanced Type E cartridge has a native capacity of 20 TB (18.2 TiB) in EFMT6. The 3592 Advance Type E cartridge is supported only on the 60F tape drive.

The 3592 Tape Cartridge can be encrypted on the 60F, 55F, E08/EH8, E07/EH7, E06, and E05 tape drives. Capacities of data cartridges can be increased through data compression, with the actual compression and capacity depending upon the specific data. Write-once, read-many (WORM) cartridges are available in five sizes and can also be encrypted.

Cartridge memory is built into every data and cleaning cartridge to enhance the functions and reliability of the media. For information on 3592 data and cleaning cartridges, see Table 36 on page 91.

The 3592 tape cartridges are designed for automation, with a form factor similar to the 3590 tape cartridges. They can be used in the TS3500 or TS4500 tape library, the 3494 tape library, and the StorageTek Automated Cartridge System. However, 3592 tape cartridges cannot be used in 3590 tape drives and 3590 tape cartridges cannot be used in 3592 drives.

Cleaning cartridges

This topic describes the 3592 cleaning cartridge.

There is a cleaning cartridge designed specifically for the 3592 tape drive. As with the data cartridges, the 3592 cleaning cartridges are not interchangeable with 3590 cleaning cartridges, so you must have both types of cleaning cartridges if you have both types of drives in your environment. The cleaning cartridge also contains a Cartridge Memory (CM) device, which automatically keeps track of the number of times it has been used. Cleaning cartridges need to be replaced after 50 uses.

Chapter 2. Standard Features

The topics in this section provide feature code information for the 3592 tape drives.

This section provides feature code information to attach 3592 tape drives to IBM TS1120 (3592 C06) Controllers and J70 Controllers in various environments, including stand-alone rack environments. (See “Feature descriptions - Installations in racks (for E08, E07, E06/EU6, E05, and J1A tape drives)” on page 38 and “IBM 3592-J70 Controller and associated frame features” on page 56). Information is also provided on attaching IBM Model J1A tape drives to 3590 Model A60 Controllers.

More feature code information can be found in the introduction and planning guides for each of the following IBM tape systems that support 3592 tape drives, TS1120 (3592 C06) Controllers, and the J70 Controllers.

Note: Not all 3592 tape drives or controllers are supported in the following tape systems:

- IBM 3953 Tape Frame Model F05 (see the *IBM 3953 Tape Frame Model F05 and Library Manager Model L05 Introduction and Planning Guide*, GA32-0472)
- IBM TS3500 tape library (see the *IBM TS3500 Tape Library Introduction and Planning Guide*, GA32-0559)
- IBM TS4500 tape library (see the *IBM TS4500 Tape Library Introduction and Planning Guide*, SC27-5990)
- IBM 3494 Tape Library (see the *IBM 3494 Tape Library Introduction and Planning Guide*, GA32-0448)
- IBM Enterprise Tape Drive Frame 3590 Model A14 (see the *IBM Enterprise Tape System 3590 Introduction and Planning Guide*, GA32-0329)
- IBM 3592 Tape Frame Model C20 (see the *IBM 3592 Tape Frame Model C20 Introduction, Planning, and User's Guide*, GA32-0554)
- IBM Silo Compatible Tape Frame 3590 (see the *IBM Silo Compatible Tape Frame 3590 Introduction, Planning, and User's Guide*, GA32-0366)

3592 tape drive features

The topics in this section describe 3592 tape drive features for tape libraries, library frames, and racks.

The 3592 tape drive features are grouped according to TS3400 tape libraries, TS3500 library frames, 3494 library frames, and racks.

Feature descriptions - 3592 tape drives in TS3400 Tape Library

This product is no longer available for ordering and is not supported by the IBM TS1140 Model E07 tape drive or the IBM TS1150 Model E08 tape drive.

The following 3577 feature codes install a 3592 tape drive into a TS3400 Tape Library (3577 Model L5U). Refer to the *IBM TS3400 Tape Library Planning and Operator Guide*, GC27-2107 for feature code information required by the TS3400 Tape Library to support 3592 tape drives.

Table 18: 3577 Feature codes for 3592 tape drives in 3577 Model L5U

3577 Feature Code	Feature Description
FC 1663	3592 Tape Drive Removal
FC 4685	3592 Install Field/Merge
FC 9685	E05 tape drive Plant Ship with 3577
FC 9691	E06 tape drive Field Install in 3577

Feature definitions - 3592 tape drives in TS3400 Tape Library

This product is no longer available for ordering and is not supported by the IBM TS1140 Model E07 tape drive and the IBM TS1150 Model E08 tape drive.

3592 Tape Drive Removal - Field (FC 1663)

This feature provides removal of one tape drive from an installed tape library. In addition to the drive removal, Machine Level Control records are updated to indicate these features as no longer existing within the library. This feature is intended for those customers who need to remove drives from existing frames and later install them in other frames. For each FC 1663 one 3592 tape drive is removed from the library.

Maximum: Two.

Note: After the initial install, each FC 1663 removes one of FC 9865 or FC 4685 or FC 9691.

3592 tape drive install - field (FC 4685)

This feature field installs one 3592 tape drive canister into an installed 3577 Model L5U. This feature is also required to field merge a customer owned 3592 tape drive canister into a 3577 Frame coming from the plant.

Maximum: Two (FC 4685 plus FC 9685 plus FC 9691).

Note: The 3592 tape drive must be separately ordered. This feature only installs that tape drive. The reinstall (Field Merge) of a drive may require the removal of FC 1663.

Plant ship E05 tape drive in 3577 (FC 9685)

This feature notifies the plant to ship one E05 tape drive with a TS3400 Tape Library 3577 Model L5U.

Maximum: Two drives per frame (FC 4685 plus FC 9685 plus FC 9691).

E06 tape drive plant ship (FC 9691)

This feature notifies the plant to ship one E06 tape drive with a 3577 Model L5U.

This feature does not apply to EU6 tape drive.

Maximum: Two drives per frame (FC 4685 plus FC 9685 plus FC 9691).

Feature descriptions - 3592 tape drives in TS3500 library frames

The following features install a 3592 tape drive into a TS3500 (3584) L22/L23 or D22/D23 frame. Refer to the IBM TS3500 tape library Information Center, available at http://publib.boulder.ibm.com/infocenter/ts3500tl/v1r0/index.jsp, or the *IBM TS3500 tape library Introduction and Planning Guide*, GA32-0559 for feature code information required by the TS3500 tape system to support 3592 tape drives.

Table 19 on page 30 lists the 3584 feature codes for 3592 tape drives in 3584 library frames.

Table 19: 3584 feature codes for 3592 tape drives in 3584 frames

3584 Feature Code	Feature Description
FC 1663	3592 Tape Drive Removal
FC 1674	3592 Install Field/Merge
FC 1675	Field Install E07 tape drive in 3584
FC 9680	Plant Install E05 tape drive in 3584
FC 9683	Plant Install E06 tape drive in 3584
FC 9692	Plant Install E07 tape drive in 3584

Table 19: 3584 feature codes for 3592 tape drives in 3584 frames (continued)	
FC 9699	Plant Install E08 tape drive in 3584

Table 20 on page 31 lists the 3592 feature codes for tape drives in 3584 library frames.

Table 20: 3592 feature codes for tape drives in 3584 frames	
3592 Feature Code	**Feature Description**
FC 9677	Plant Install 3592 in a 3584 Frame
FC 9689	3592 Field Install in a 3584 Frame

Feature definitions - 3592 tape drives in TS3500 library frames

3592 tape drive removal (FC 1663)

This feature provides removal of one tape drive from an installed tape library. In addition to the drive removal, Machine Level Control records are updated to indicate these features as no longer existing within the library. This feature is intended for those customers who may have the need to remove drives from existing frames and later install them in other frames. One 3592 tape drive (FC 1674, FC 1675, FC 9680, FC 9683, or FC 9692) should be removed from the library for each FC 1663.

Maximum: 12.

Drive Field Install (FC 1674)

This feature field installs one 3592 tape drive canister into an installed 3584 Model D22, D23, L22, or L23. This feature is also required to field merge a customer owned 3592 tape drive canister into a 3584 frame coming from the plant. Installation of a 3592 tape drive canister requires that a 3592 Fibre Drive Mounting Kit feature (FC 1513 or FC 1515) be installed to contain the canister. The 3592 tape drive must be ordered separately. This feature only installs that tape drive. Field install only.

Maximum: 12 per frame of FC 1674 plus FC 9680 plus FC 9683.

Prerequisites: The quantity of FC 1513 or FC 1515 must be equal to or greater than the quantity of tape drives installed (FC 1674 plus FC 9680 plus FC 9683).

Field install E07 tape drive in 3584 (FC 1675)

This feature allows the field installation of a E07 tape drive into an installed 3584 Model D22, D23, L22, or L23. This feature is also required to field merge a customer owned 3592 tape drive canister into a 3584 frame coming from the plant. Installation of a 3592 tape drive canister requires that a 3592 Fibre Drive Mounting Kit feature (FC 1515) be installed to contain the canister. The 3592 tape drive must be ordered separately. This feature only installs that tape drive. Field install only.

Maximum: 12 per frame. The sum of FC 1674, FC 1675, FC 9680, FC 9683, or FC 9692 is a maximum of twelve.

Prerequisites: The quantity of FC 1513 plus FC 1515 must be equal to or greater than the quantity of tape drives installed (FC 1674, FC 1675, FC 9680, FC 9683, or FC 9692).

Plant install E05 tape drive in 3584 (FC 9680)

This feature tells the plant to install one E05 tape drive into a 3584 Model D23 or L23 coming from the plant. Installation of a E05 tape drive canister requires that a 3592 Fibre Drive Mounting Kit feature (FC 1513) be installed to contain the canister.

Maximum: 12 per frame, of FC 9680 plus FC 1674 plus FC 9683.

Prerequisites: The quantity of FC 1513 plus FC 1515 must be equal to or greater than the quantity of FC 9680 plus FC 1674 plus FC 9683.

Note: An additional LC/LC Patch Panel Cable (FC 1461) is required to attach the second port of the 3592 tape drive.

Plant install E06 tape drive in 3584 (FC 9683)

This feature tells the plant to install one E06 tape drive into a 3584 Model D23 or Model L23 coming from the plant. Installation of a E06 tape drive canister requires that a 3592 Fibre Drive Mounting Kit (FC 1515) be installed to contain the canister. Plant installation only.

Maximum: 12. The sum of FC 9680 plus FC 1674 plus FC 9683 is a maximum of twelve.

Prerequisites: The quantity of FC 1515 must be equal to or greater than the quantity of FC 9683.

Note: An additional LC/LC Patch Panel Cable (FC 1461) is required to attach the second port of the 3592 tape drive.

Plant Install E07 tape drive in 3584 (FC 9692)

This feature tells the plant to install one E07 tape drive into a 3584 Model D23 or Model L23. Installation of a E07 tape drive canister requires that a 3592 Fibre Drive Mounting Kit (FC 1515) be installed to contain the canister. Plant install only.

Maximum: 12 per frame. The sum of FC 1674, FC 1675, FC 9680, FC 9683, or FC 9692 is a maximum of twelve.

Prerequisites: The quantity of FC 1515 must be equal to or greater than the quantity of FC 9692.

Note: An additional LC/LC Patch Panel Cable (FC 1461) is required to attach the second port of the 3592 tape drive.

Plant Install 3592 in a 3584 Frame (FC 9677)

This feature notifies the plant to factory install a new 3592 tape drive into a new 3584 tape library Frame. This code must appear on the tape drive order and also the Plant Install E05 tape drive in a 3584 (FC 9680) or Plant Install E06 tape drive in a 3584 Drive (FC 9683) or Plant Install E07 tape drive in a 3584 (FC 9687) must appear on the 3584 frame order. Plant install only.

Maximum of one of the following: FC 9673, FC 9673, FC 9675, FC 9677, FC 9685, FC 9686, FC 9687, FC 9688, FC 9689, or FC 4674.

3592 Field Install in a 3584 Frame (FC 9689)

This feature notifies the plant to ship one 3592 tape drive which will be field installed in a 3584 tape library Frame. This code must appear on the tape drive order and also the Field Merge 3592 tape drive (FC 1674), or for a E07 tape drive, FC 1675 must appear on the 3584 tape library Frame order. Field install only.

Maximum of one of the following: FC 9673, FC 9675, FC 9677, FC 9685, FC 9686, FC 9687, FC 9688, FC 9689, or FC 4674.

Feature descriptions - 3592 tape drives in 3494 tape library

This product is no longer available for ordering and is not supported by the IBM TS1140 Model E07 tape drive or the IBM TS1150 Model E08 tape drive.

The following 3494 features install a E05 or E06 tape drive into a 3494 Tape Library. See the *IBM 3494 Tape Library Introduction and Planning Guide*, GA32-0448 for feature code information required by the IBM 3494 Tape Library to support 3592 tape drives.

Table 21: 3494 Feature codes for 3592 tape drives in 3494

3494 Feature Code	Feature Description
FC 4673	Replace J1A tape drive with an E05 tape drive

Table 21: 3494 Feature codes for 3592 tape drives in 3494 (continued)	
3494 Feature Code	**Feature Description**
FC 4674	Field merge J1A tape drive
FC 4675	Field install E05 tape drive
FC 4676	Field install E06 tape drive
FC 4677	Field install EU6 tape drive
FC 4678	Replace J1A or E05 tape drive with an E06 or EU6 tape drive
FC 4772	Remove 3592 Tape Drive from 3494 Frame
FC 9674	Field merge J1A tape drive
FC 9676	Plant install E05 tape drive
FC 9678	Field merge E05 tape drive
FC 9683	Plant install E06 tape drive
FC 9684	Field merge E06 tape drive
FC 9694	Field merge EU6 tape drive

Feature definition - 3592 tape drives in 3494 library frames

This product is no longer available for ordering and is not supported by the IBM TS1140 Model E07 tape drive and the IBM TS1150 Model E08 tape drive.

Replace J1A tape drive with E05 tape drive (FC 4673)

This feature is required to provide the mounting changes to replace a J1A tape drive with a E05 tape drive in a currently installed Model D22 Frame.

Maximum: 12. The sum of FC 4673, FC 4674, FC 4675, FC 4676, FC 4677, FC 4678, FC 9673, FC 9674, FC 9676, FC 9678, FC 9683, FC 9684, or FC 9694 is a maximum of twelve.

Field install IBM Model J1A tape drive (FC 4674)

This feature code allows field installation of a IBM Model J1A tape drive in a 3494 Model D22. This feature code is for currently installed 3494 frames only. See FC 9673 or FC 9674 for new 3494 orders.

Maximum: 12. The sum of FC 4673, FC 4674, FC 4675, FC 4676, FC 4677, FC 4678, FC 9673, FC 9674, FC 9676, FC 9678, FC 9683, FC 9684, or FC 9694 is a maximum of twelve.

Corequisite: A cradle feature (FC 4800 or FC 4803) with an available canister slot must be installed. Field Installation: MES only.

Field install E05 tape drive (FC 4675)

This feature allows the field installation of a E05 tape drive in a 3494 Model D22. This feature is for currently installed 3494 Frames only. See FC 9676 or FC 9678 for new 3494 orders.

Maximum: 12. The sum of FC 4673, FC 4674, FC 4675, FC 4676, FC 4677, FC 4678, FC 9673, FC 9674, FC 9676, FC 9678, FC 9683, FC 9684, or FC 9694 is a maximum of twelve.

Corequisites: A cradle feature (FC 4800 or FC 4803) with an available canister slot must be installed.

Field install E06 tape drive (FC 4676)

This feature allows the field installation of a E06 tape drive in a 3494 Model D22. This feature is for currently installed 3494 frames only. See FC 9683 or FC 9684 for new 3494 orders.

Maximum: 12. The sum of FC 4673, FC 4674, FC 4675, FC 4676, FC 4677, FC 4678, FC 9673, FC 9674, FC 9676, FC 9678, FC 9683, FC 9684, or FC 9694 is a maximum of twelve.

Corequisites: A cradle feature (FC 4800 or FC 4803) with an available canister slot must be installed.

Field install EU6 tape drive (FC 4677)

This feature allows the field installation of a EU6 tape drive in a 3494 Model D22. This feature is for currently installed 3494 frames only.

Maximum: 12. The sum of FC 4673, FC 4674, FC 4675, FC 4676, FC 4677, FC 4678, FC 9673, FC 9674, FC 9676, FC 9678, FC 9683, FC 9684, or FC 9694 is a maximum of twelve.

Corequisites: A cradle feature (FC 4800 or FC 4803) with an available canister slot must be installed.

Replace J1A or E05 tape drive with E06 or EU6 tape drive (FC 4678)

This feature is required to provide the mounting changes to replace a J1A or E05 tape drive with a E06 or EU6 tape drive in a currently installed Model D22 Frame.

Maximum: 12. The sum of FC 4673, FC 4674, FC 4675, FC 4676, FC 4677, FC 4678, FC 9673, FC 9674, FC 9676, FC 9678, FC 9683, FC 9684, or FC 9694 is a maximum of twelve.

Prerequisites: This feature is mutually exclusive with FC 9010.

Remove 3592 Tape Drive from 3494 frame (FC 4772)

This feature provides the instructions to remove a IBM Model J1A tape drive from a currently installed Model D22 frame.

Maximum: 12.

Corequisite: One of FC 4673, FC 4674, FC 4675, FC 4676, FC 4677, FC 4678, FC 9673, FC 9674, FC 9676, FC 9678, FC 9683, FC 9684, or FC 9694 must be removed when this feature is added. Field Installation: MES only.

Field merge IBM Model J1A tape drive in 3494 (FC 9674)

This feature allows the field merge of a customer owned IBM Model J1A tape drive into a new 3494 Model D22 coming from the factory. This feature notifies the factory to leave a mounting slot available for a field merge of a tape drive unit prior to completion of the installation at the customer site.

Maximum: 12. The sum of FC 4673, FC 4674, FC 4675, FC 4676, FC 4677, FC 4678, FC 9673, FC 9674, FC 9676, FC 9678, FC 9683, FC 9684, or FC 9694 is a maximum of twelve.

Corequisite: A cradle feature (FC 4800 or FC 4803) with an available canister slot must be installed.

Plant install E05 tape drive (FC 9676)

This feature tells the factory to install one E05 tape drive into a new 3494 Model D22 coming from the plant.

Maximum: 12. The sum of FC 4673, FC 4674, FC 4675, FC 4676, FC 4677, FC 4678, FC 9673, FC 9674, FC 9676, FC 9678, FC 9683, FC 9684, or FC 9694 is a maximum of twelve.

Corequisites: A cradle feature (FC 4800 or FC 4803) with an available canister slot must be installed.

Field merge E05 tape drive (FC 9678)

This feature allows the field merge of a customer owned E05 tape drive into a new 3494 Model D22 coming from the factory. This feature notifies the factory to leave a mounting slot available for a field merge of a tape drive unit prior to completion of the installation at the customer site.

Maximum: 12. The sum of FC 4673, FC 4674, FC 4675, FC 4676, FC 4677, FC 4678, FC 9673, FC 9674, FC 9676, FC 9678, FC 9683, FC 9684, or FC 9694 is a maximum of twelve.

Corequisites: A cradle feature (FC 4800 or FC 4803) with an available canister slot must be installed.

Plant install E06 tape drive (FC 9683)

This feature tells the factory to install one E06 tape drive into a new 3494 Model D22 coming from the plant.

Maximum: 12. The sum of FC 4673, FC 4674, FC 4675, FC 4676, FC 4677, FC 4678, FC 9673, FC 9674, FC 9676, FC 9678, FC 9683, FC 9684, or FC 9694 is a maximum of twelve.

Field merge E06 tape drive (FC 9684)

This feature allows the field merge of a customer-owned E06 tape drive into a new 3494 Model D22 coming from the factory. This feature notifies the factory to leave a mounting slot available for a field merge of a tape drive unit prior to completion of the installation at the customer site.

Maximum: 12. The sum of FC 4673, FC 4674, FC 4675, FC 4676, FC 4677, FC 4678, FC 9673, FC 9674, FC 9676, FC 9678, FC 9683, FC 9684, or FC 9694 is a maximum of twelve.

Corequisites: A cradle feature (FC 4800 or FC 4803) with an available canister slot must be installed.

Field merge EU6 tape drive (FC 9694)

This feature allows the field merge of a customer-owned EU6 tape drive into a new 3494 Model D22 coming from the factory. This feature notifies the factory to leave a mounting slot available for a field merge of a tape drive unit prior to completion of the installation at the customer site.

Maximum: 12. The sum of FC 4673, FC 4674, FC 4675, FC 4676, FC 4677, FC 4678, FC 9673, FC 9674, FC 9676, FC 9678, FC 9683, FC 9684, or FC 9694 must be a maximum of twelve.

Corequisites: A cradle feature (FC 4800 or FC 4803) with an available canister slot must be installed.

Feature descriptions - 3592 tape drives in 3592 tape frame model C20

This product is no longer available for ordering and is not supported by the IBM TS1140 Model E07 tape drive or the IBM TS1150 Model E08 tape drive.

The following 3592 Model C20 features install a 3592 tape drive into a Tape Frame Model C20. See the *IBM Enterprise Tape Frame Model C20 Introduction, Planning, and User's Guide*, GA32-0463 for feature code information required to support 3592 tape drives.

Table 22: 3592 C20 Feature codes for 3592 tape drives in Tape Frame Model C20

3592 C20 Feature Code	**Feature Description**
FC 4830	Install Model C20 Drive Shelf Pair
FC 4831	Field install J1A tape drive in C20 frame
FC 4832	Remove 3592 tape drive from C20 frame
FC 4833	Field install E05 tape drive in C20 frame
FC 4835	Replace J1A tape drive with E05 tape drive
FC 4836	Field install E06 tape drive in C20 frame
FC 4837	Field install EU6 tape drive in C20 frame
FC 4840	Air Box Drive Cover
FC 4841	Replace J1A or E05 tape drive with E06 or EU6 tape drive
FC 9679	Plant install E05 tape drive in C20
FC 9693	Plant install E06 tape drive in C20

Feature definitions - 3592 Tape Drives in Tape Frame Model C20

Install model C20 enclosure pair (FC 4830)

This feature installs the redundant power supplies and hardware on a horizontal enclosure for mounting of up to two 3592 Tape Drives. Up to two J1A tape drive canisters (FC 4831 or FC 9675) or two E05 tape drive canisters (FC 4833 or FC 4835 or FC 9679) or two E06/EU6 tape drive canisters (FC 4836 or FC 4837 or FC 4841 or FC 9693) can be installed in each C20 Enclosure Pair, if the Air Box Drive Cover (FC 4840) is not installed.

Maximum: ten.

Field install IBM Model J1A tape drive in Model C20 (FC 4831)

This feature provides the hardware and instructions for field installation of one IBM Model J1A tape drive canister in a C20 Drive Shelf Pair in the 3592 Model C20. Two tape drive canisters can be installed in each C20 Drive Shelf Pair feature (FC 4830).

Maximum: 20 if the Air Box Drive Cover (FC 4840) is not installed, or a maximum of 10 if feature FC 4840 is installed.

Prerequisite: An available C20 Drive Shelf Pair feature (FC 4830) according to the following:

- The number of drives installed (FC 4831 or FC 9675 or FC 4833 or FC 4835 or FC 9679 or FC 4836 or FC 4837 or FC 4841 or FC 9693) can be no greater than twice the number of C20 Drive Shelf Pair features (FC 4830) if the Air Box Drive Cover (FC 4840) is not installed.
- The number of drives installed (FC 4831 or FC 9675 or FC 4833 or FC 4835 or FC 9679 or FC 4836 or FC 4837 or FC 4841 or FC 9693) can be no greater than the number of C20 Drive Shelf Pair features (FC 4830), if the Air Box Drive Cover (FC 4840) is installed.

Remove 3592 Tape Drive from Model C20 frame (FC 4832)

Remove a 3592 Tape Drive from a Model C20 Frame This feature removes a J1A or E05 tape drive canister that is installed in a C20 Drive Shelf Pair in a 3592 Model C20. This feature does not remove a C20 Drive Shelf Pair, associated power supplies, or other associated hardware.

Maximum: 20.

Corerequisite: One FC 4831 or FC 4833 or FC 4835 or FC 9675 or FC 9679 or FC 4836 or FC 4837 or FC 4841 or FC 9693 must be removed with this feature.

Field install E05 tape drive in model C20 frame (FC 4833)

This feature provides the hardware and instructions for field installation of one E05 tape drive canister in a C20 Drive Shelf Pair in the 3592 Model C20. Two tape drive canisters can be installed in each C20 Drive Shelf Pair FC 4830.

Maximum: 20 if the Air Box Drive Cover (FC 4840) is not installed, or a maximum of 10 if feature FC 4840 is installed.

Prerequisite: An available C20 Drive Shelf Pair feature (FC 4830) according to the following:

- The number of drives installed (FC 4831 or FC 9675 or FC 4833 or FC 4835 or FC 9679 or FC 4836 or FC 4837 or FC 4841 or FC 9693) can be no greater than twice the number of C20 Drive Shelf Pair features (FC 4830) if the Air Box Drive Cover (FC 4840) is not installed.
- The number of drives installed (FC 4831 or FC 9675 or FC 4833 or FC 4835 or FC 9679 or FC 4836 or FC 4837 or FC 4841 or FC 9693) can be no greater than the number of C20 Drive Shelf Pair features (FC 4830), if the Air Box Drive Cover (FC 4840) is installed.

Replace IBM Model J1A tape drive with Model E05 (FC 4835)

This feature is required to provide the mounting changes to replace a J1A tape drive with a Model E05 Tape Drive in a currently installed Model C20 frame.

Maximum: 20. The sum of features FC 4831, FC 4833, FC 4835, FC 9675, FC 9679, FC 4836, FC 4837, FC 4841 or FC 9693 is a maximum of 20.

Field install E06 tape drive in model C20 frame (FC 4836)

This feature provides the hardware and instructions for field merge or field installation of one E06 tape drive canister in a C20 Drive Shelf Pair in the 3592 Model C20. Two tape drive canisters can be installed in each C20 Drive Shelf Pair FC 4830.

Maximum: 20 if the Air Box Drive Cover (FC 4840) is not installed, or a maximum of 10 if feature FC 4840 is installed.

Prerequisite: An available C20 Drive Shelf Pair feature (FC 4830) according to the following:

- The number of drives installed (FC 4831 or FC 9675 or FC 4833 or FC 4835 or FC 9679 or FC 4836 or FC 4837 or FC 4841 or FC 9693) can be no greater than twice the number of C20 Drive Shelf Pair features (FC 4830) if the Air Box Drive Cover (FC 4840) is not installed.
- The number of drives installed (FC 4831 or FC 9675 or FC 4833 or FC 4835 or FC 9679 or FC 4836 or FC 4837 or FC 4841 or FC 9693) can be no greater than the number of C20 Drive Shelf Pair features (FC 4830), if the Air Box Drive Cover (FC 4840) is installed.

Field install EU6 tape drive in model C20 frame (FC 4837)

This feature provides the hardware and instructions for field merge or field installation of one EU6 tape drive canister in a C20 Drive Shelf Pair in the 3592 Model C20. Two tape drive canisters can be installed in each C20 Drive Shelf Pair FC 4830.

Maximum: 20 if the Air Box Drive Cover (FC 4840) is not installed, or a maximum of 10 if feature FC 4840 is installed.

Prerequisite: An available C20 Drive Shelf Pair feature (FC 4830) according to the following:

- The number of drives installed (FC 4831 or FC 9675 or FC 4833 or FC 4835 or FC 9679 or FC 4836 or FC 4837 or FC 4841 or FC 9693) can be no greater than twice the number of C20 Drive Shelf Pair features (FC 4830) if the Air Box Drive Cover (FC 4840) is not installed.
- The number of drives installed (FC 4831 or FC 9675 or FC 4833 or FC 4835 or FC 9679 or FC 4836 or FC 4837 or FC 4841 or FC 9693) can be no greater than the number of C20 Drive Shelf Pair features (FC 4830), if the Air Box Drive Cover (FC 4840) is installed.

Air Box Drive Cover (FC 4840)

This feature provides an Air Box Cover for a StorageTek 9310 PowderHorn Tape Library. If the StorageTek LSM has the four-drive or ten-drive wall panel, then the Air Box Drive Cover feature (FC 4840) must be installed and a maximum of ten or fewer tape drives can be installed.

Maximum: One.

Replace J1A or E05 tape drive with E06 or EU6 tape drive (FC 4841)

This feature is required to provide the mounting changes to replace a J1A tape drive or E05 tape drive with a E06 or EU6 tape drive in a currently installed Model C20 frame.

Maximum: 20. The sum of FC 4831, FC 4833, FC 4835, FC 9675, FC 9679, FC 4836, FC 4837, FC 4841 or FC 9693 is a maximum of 20.

Plant install E05 tape drive in tape frame model C20 (FC 9679)

This feature notifies the plant to factory install a E05 tape drive into a 3592 Model C20 Frame coming from the plant. This feature must appear on the E05 tape drive order and also on the Model C20 order.

Maximum: 20. If FC 4840 is not installed, the sum of FC 4831, FC 9675, FC 4833, FC 4835, FC 9679, FC 4836, FC 4837, FC 4841, or FC 9693 is a maximum of 20. If FC 4840 is installed, the sum of FC 4831, FC 9675, FC 4833, FC 4835, FC 9679, FC 4836, FC 4837, FC 4841, or FC 9693 is a maximum of ten.

Plant install E06 tape drive in tape frame model C20 (FC 9693)

This feature notifies the plant to factory install a E06 tape drive into a 3592 Model C20 Frame coming from the plant. This feature must appear on the E06 tape drive order and also on the Model C20 order.

Maximum: 20. If FC 4840 is not installed, the sum of FC 4831, FC 9675, FC 4833, FC 4835, FC 9679, FC 4836, FC 4837, FC 4841, or FC 9693 is a maximum of 20. If FC 4840 is installed, the sum of FC 4831, FC 9675, FC 4833, FC 4835, FC 9679, FC 4836, FC 4837, FC 4841, or FC 9693 is a maximum of ten.

Feature descriptions - Installations in racks (for E08, E07, E06/EU6, E05, and J1A tape drives)

Feature codes that use the term *Field merge* instruct the plant to leave a mounting slot available in the frame. This action allows for the merging of a tape drive at the customer site. Feature codes that use the term *Field install* indicate that a mounting slot is to be made available in an existing frame at the customer site. Table 23 on page 38 lists the feature codes that apply for rack installations.

Table 23: Feature codes for 3592 tape drives in rack installations

Feature Code	Description
4674	Field Install 3592 Tape Drive in Rack
4684	E07/E08 tape drive Additional Rack Mount Hardware
4772	Remove 3592 Tape Drive from Rack
4802	Install Left Drive-Pair Cradle in Rack
4812	Install Right Drive-Pair Cradle in Rack

Feature definitions - 3592 tape drive installations in racks

Install the 3592 Tape Drive in a Rack (FC 4674)

This feature provides the hardware and instructions to install the 3592 tape drive canister in a rack. Two tape drive canisters can be installed in each cradle feature (FC 4802 or FC 4812). A cradle with an available canister slot must already be installed in the rack to accept the drive canister. Plant or field install.

Corequisite: A cradle feature (FC 4802 or FC 4812) with an available canister slot. Maximum: one. The maximum of FC 9673 plus FC 9675 plus FC 9677 plus FC 9685 plus FC 9686 plus FC 9687 plus FC 9688 plus FC 9689 plus FC 4674 is one.

In any given rack, the following aggregate maximums apply:

- For 2 m (6.6 ft.) racks without a controller: 16
- For 1.6 m (5.25 ft.) and 1.8 m (5.9 ft.) racks without a controller or 2 m (6.6 ft.) racks with a controller: 12
- For 1.6 m (5.25 ft.) and 1.8 m (5.9 ft.) racks with a controller: 8

E07/E08 tape drive additional rack mount hardware (FC 4684)

This feature provides hardware that enables installation of a E07/E08 tape drive in an existing rack. Plant or field installation.

Maximum number of features: one. Prerequisite: FC 4674 for E07 tape drive.

Remove 3592 Tape Drive from a Rack (FC 4772)

This feature removes a 3592 tape drive canister that is installed in a cradle in a rack. Any cradle features associated with this removed tape drive are also removed from the tape drive, but the physical cradle or shelf may remain installed in that rack. Maximum: One per ordered feature code. Corerequisite: One

feature FC 4674 must be removed with this feature. Maximum: The total of drives installed in a rack (FC 4674). Field removal only.

Install Left Drive-Pair Cradle in Rack (FC 4802)

This feature adds a left-side drive cradle for accepting up to two 3592 tape drive canisters in a rack. The feature also provides a shelf capable of supporting a left-and right-side drive cradle, as well as rack panels for covering either cradle. It includes two redundant power supplies, drive identification logic for up to two 3592 tape drives, and a pluggable large display and control panel for the drives.

Prerequisite: FC 4674. Maximum: one. For any given rack, the following maximum FC 4802 cradle installations apply:

- For 2 m (6.6 ft.) racks without controllers: Four (4)
- For 1.6 m (5.25 ft.) and 1.8 m (5.9 ft.) racks without controllers: Three (3)
- Maximum cradle pair capacity is decreased by one if a controller is installed in the rack

Install Right Drive-Pair Cradle in Rack (FC 4812)

This feature adds one right-side drive cradle, on the same shelf as a tape drive with the cradle FC 4802, for accepting up to two 3592 tape drive canisters in a rack. It includes two redundant power supplies and drive identification logic for up to two 3592 tape drives. One feature FC 4802 must be currently installed for each feature FC 4812. Plant or field installation.

Prerequisite: FC 4674. Maximum: one. For any given rack the following maximum FC 4812 cradle installations apply:

- For 2 m (6.6 ft.) racks without controllers: Four (4)
- For 1.6 m (5.25 ft.) and 1.8 m (5.9 ft.) racks without controllers: Three (3)
- Maximum cradle pair capacity is decreased by one if a controller is installed in the rack

Feature descriptions - Installations in racks (for EH7/EH8/55F/60F tape drives)

The following feature codes install EH7, EH8, 55F, or 60F tape drives into a rack. Table 24 on page 39 lists the feature codes that apply for EH7, EH8, 55F, or 60F rack installations.

Table 24: Feature codes for EH7, EH8, 55F, or 60F tape drives in rack installations

Feature Code	Description
4804	Rack Mount Kit
4805	Rack Drive Accessories
4806	Drive Filler Panel
9806	Install First Drive in Rack Mount Kit
9807	Install Second Drive in Rack Mount Kit

Feature definitions - 3592 EH7, EH8, 55F, and 60F tape drive installations in racks

Rack Mount Kit (FC 4804)

This feature provides a Rack Mount Kit to accept up to two 3592 EH7, EH8, or 55F Tape Drives. It includes the enclosure hardware and also provides two redundant power supplies and two C13-C14 power cords.

Corequisite: If only 9806 and no 9807 are resident for 4804 Rack Mount kit, a 4806 Drive filler panel is required.

Prerequisite: FC 9806. Maximum: one. Plant or field installation.

In any specified rack, the following aggregate maximums apply:

- For 2 m (6.6 ft.) racks: 14

- For 1.8 m (5.9 ft.) racks: 12
- For 1.6 m (5.25 ft.) racks: 10

Rack Drive Accessories (FC 4805)

This feature provides documentation and miscellaneous items. It includes the Rack Mount Kit installation instructions, drive maintenance manuals, one JC Data cartridge, one cleaning and one CE Diagnostic cartridge, and an Ethernet cable for service.

Prerequisite: FC 9806 or 9807. Maximum: one. Plant or field installation. *eConfig* limits this feature to one per customer rack.

Drive Filler Panel (FC 4806)

This feature provides a blank filler panel. Required when only one drive resides in a FC 4804 Rack Mount kit enclosure.

Prerequisite: FC 4804. Maximum: two. Plant or field installation.

Install first drive in a Rack Mount Kit (FC 9806)

This feature adds an EH7, EH8, 55F, or 60F tape drive to the left-side of an FC 4804 Rack Mount Kit enclosure. Tape drives are not installed into the Rack Mount Kit; they are shipped separately.

Prerequisite: Must have FC 4804. Maximum: one. Plant or field installation.

Install second drive in a Rack Mount Kit (FC 9807)

This feature adds an EH7, EH8, 55F, or 60F tape drive to the right-side of an FC 4804 Rack Mount Kit enclosure. Tape drives are not installed into the Rack Mount Kit; they are shipped separately.

Prerequisite: Mutually exclusive with FC 4804. Maximum: one. Plant or field installation.

Feature descriptions - 3592 tape drive standard features

The following 3592 tape drive features are common throughout rack and frame installations.

Table 25: Common feature codes for 3592 tape drives

Feature Code	Feature Description
FC 0500	Tape drive microcode update
FC 5592	Encryption-capable E05 tape drive/Field
FC 5596	Encryption configuration 3592 Tape Drive/Field
FC 5913	13 m LC/SC Fibre Channel Cable 50um shortwave multimode
FC 5922	22 m LC/SC Fibre Channel Cable 50um shortwave multimode
FC 5961	61 m LC/SC Fibre Channel Cable 50um shortwave multimode
FC 6013	13 m LC/LC Fibre Channel Cable 50um shortwave multimode
FC 6025	25 m LC/LC Fibre Channel Cable 50um shortwave multimode
FC 6061	61 m LC/LC Fibre Channel Cable 50um shortwave multimode
FC 8802[1]	3592 Cleaning Cartridge (withdrawn)
FC 8820[1]	Twenty 3592 Data Cartridges (withdrawn)
FC 9000	Attached to System z
FC 9210	Attached to HP-UX System
FC 9211	Attached to Solaris System

Table 25: Common feature codes for 3592 tape drives (continued)	
Feature Code	**Feature Description**
FC 9212	Attached to Windows System
FC 9213[2]	Attached to Other Non-IBM System
FC 9215	Attached to Linux System
FC 9400	Attached to i5/OS or AS/400
FC 9590[1]	No data cartridges (withdrawn)
FC 9596	Encryption configuration 3592 / Plant
FC 9600	Attached to AIX System

[1] These features are no longer marketed by IBM beginning in January 2005. To order 3592 media, see "3599 media supplies" on page 100.
[2] Other non-IBM systems vendors might support attachment of the J1A tape drive. Check with the non-IBM system vendor for specifics on hardware and software support requirements. Any device drivers needed to support attachment to these systems must be provided by the non-IBM vendor.

Feature definitions - 3592 tape drive standard features

Drive Microcode Update (FC 0500)

This feature provides an update to the 3592 tape drive microcode on an installed tape drive. Newer microcode levels might be required when attaching the 3592 tape drive in selected Fibre Channel or SAN environments.

For additional information on minimum required microcode levels, access the IBM Tape Storage Systems website and:

1. Click the **Support & downloads** menu item.
2. Select **Download** > **Fixes, updates and drivers**.

Maximum: none. Field installation only.

Encryption-capable E05 tape drive - field (FC 5592)

This feature replaces an IBM TS1120 Model E05 tape drive shipped prior to September 8, 2006 with an encryption-capable IBM TS1120 Model E05 tape drive.

Encryption configuration - field (FC 5596)

This feature provides configuration and reconfiguration support for encryption-capable tape drives in Open Systems environments.

For encryption configuration support of tape drives attached to a control unit in System z environments, order FC 9595 or FC 5595 on the 3592 control unit.

For open system attached tape drives in TS3500 tape libraries, the capability is provided through the library interface for the customer to perform encryption configuration, FC 9900. When the customer performs this activity, it is not necessary to install FC 5596.

FC 5596 cannot be ordered when the tape drives will be attached to a VTS or TS7700 Virtualization Engine.

Prerequisites: One of FC 5592 or FC 9592 for E05 tape drives only. Mutually exclusive with FC 9596. Maximum: 99. Field installation only.

LC/SC Fibre Channel Cables (FC 5913 - 5961)

These features supply one 50.0/125 micrometer fiber-optic cable with an LC duplex connector on one end for attachment to the 3592 tape drive, and an SC duplex connector on the other end for attachment to switches or hosts with SC duplex fibre channel connectors. This feature is for field or plant installation.

- 13 meter (43 ft.) LC/SC Fibre Cable **(FC 5913)**
- 22 meter (72 ft.) LC/SC Fibre Cable **(FC 5922)**
- 61 meter (200 ft.) LC/SC Fibre Cable **(FC 5961)**

Maximum: Two installed per tape drive. The sum of FC 5913 plus FC 5922 plus FC 5961 plus FC 6013 plus FC 6025 plus FC 6061 = maximum of five per order.

LC/LC Fibre Channel Cables (FC 6013 - 6061)

These features supply one 50.0/125 micrometer short wavelength multimode fiber-optic cable with LC duplex cable connectors at both ends. These cables are for attaching 3592 tape drives that have an LC duplex connector to switches or hosts with LC duplex fibre channel connectors. This feature is for field or plant installation.

- 13 meter (43 ft.) LC/LC Fibre Channel Cable **(FC 6013)**
- 25 meter (82 ft.) LC/LC Fibre Channel Cable **(FC 6025)**
- 61 meter (200 ft.) LC/LC Fibre Channel Cable **(FC 6061)**

Maximum: Two installed per tape drive. The sum of FC 5913 plus FC 5922 plus FC 5961 plus FC 6013 plus FC 6025 plus FC 6061 = maximum of five per order.

3592 Cleaning Cartridge (FC 8802)

FC 8802 is no longer marketed by IBM beginning in January 2005. See “3599 media supplies” on page 100 to order 3592 media.

This feature provides a 3592 cleaning cartridge for J1A tape drives. Prerequisite: FC 4674. Maximum: Five. Plant or field installation.

3592 Data Cartridges (20–Pack) (FC 8820)

FC 8820 is no longer marketed by IBM beginning in January 2005. See “3599 media supplies” on page 100 to order 3592 media.

This feature supplies a package containing twenty of the 300 GB (279.39 GiB) IBM TotalStorage Enterprise Tape Data Cartridge 3592, with a new order of a 3592 tape drive. Prerequisite: FC 4674. Maximum: Five. Plant installation only.

Attached to System z (FC 9000)

This attachment feature code identifies the system type as System z and determines the distribution method for microcode updates.

Attached to HP-UX System (FC 9210)

A device driver is available with FC 9200, Open Systems Device Driver, for HP-UX attachment.

Attached to Solaris System (FC 9211)

A device driver is available with FC 9200, Open Systems Device Driver, for Solaris attachment.

Attached to Windows System (FC 9212)

A device driver is available with FC 9200, Open Systems Device Driver, for attachment to Windows systems.

Attached to Other Non-IBM System (FC 9213)

Several non-IBM systems vendors support attachment of the 3592 tape drive. The customer should check with the non-IBM system vendor for specifics on hardware and software support requirements. Device drivers supporting attachment to these systems must be provided by the non-IBM vendor.

Attached to Linux System (FC 9215)

A device driver is available with FC 9200, Open Systems Device Driver, for attachment to Linux systems.

Attached to i5/OS or AS/400 (FC 9400)

A device driver is available with FC 9200, Open systems Device Driver, for i5/OS or OS/400 systems.

No Data Cartridge (FC 9590)

FC 9590 is no longer marketed by IBM beginning in January 2005. See “3599 media supplies” on page 100 to order 3592 media.

This feature notifies the plant that no data cartridges are to be shipped with this tape drive from the factory. Either feature FC 8820, or FC 9590 must be ordered with each drive. Prerequisite: FC 4674.

Encryption Configuration - Plant (FC 9596)

This feature provides configuration support for encryption-capable tape drives in Open Systems environments.

This feature does not apply to EU6 tape drive.

For encryption configuration support of tape drives attached to a control unit in System z environments, order FC 9595 or FC 5595 on the 3592 control unit.

For open system attached tape drives in TS3500 tape libraries, the capability is provided through the library interface for the customer to perform encryption configuration, FC 9900. When the customer performs this activity, it is not necessary to install FC 9596.

FC 9596 cannot be ordered when the tape drives are attached to a VTS or TS7700 Virtualization Engine.

Prerequisites: One of FC 5592 or FC 9592 for E05 tape drive only. Mutually exclusive with FC 5596. Maximum: one. Plant installation only.

Attached to AIX System (FC 9600)

A device driver is available with FC 9200, Open systems Device Driver, for AIX systems.

Feature descriptions - 3592 tape drives in 3494 library frames

This product is no longer available for ordering and is not supported by the IBM TS1140 Model E07 tape drive and the IBM TS1150 Model E08 tape drive.

The following 3592 tape drive features install a 3592 tape drive into the IBM 3494 tape library's Model L22, D22, and D24 frames. Earlier frame models can also be converted to D22 and D24 models. See the *IBM 3494 Tape Library Introduction and Planning Guide*, GA32-0448 for feature code information that is required by the IBM 3494 tape library to support 3592 tape drives.

Feature codes that use the term *Field merge* instruct the plant to leave a mounting slot available in the frame. This action allows for the merging of a tape drive at the customer site. Feature codes that use the term *Field install* indicate that a mounting slot is to be made available in an existing frame at the customer site. See Table 26 on page 44 for the features that apply to the 3494 L22, D22, and D24 frames. Except where noted, all features apply to all three frames.

Some features are ordered only against the drive, others are ordered against only the frame, and others are ordered against both the frame and the drive.

Table 26: Feature codes for 3592 tape drives in 3494 L22, D22, and D24 library frame installations		
Category	**Feature Code**	**Description**
Cradle Installation	4800[1]	Install Cradle Pair
	4801[1]	Remove Cradle Pair
	4803[1]	Field Re-Install Cradle Pair
Adjacent Drive Attachment	4065[3]	Adjacent Frame 3592 Tape Drives With SC Attachment
	4075[3]	Adjacent Frame 3592 Tape Drives With LC Attachment
	4085[3]	Adjacent Frame Fibre Channel 3592
	4086[3]	Adjacent Frame 3592 Tape Drives L22/D22 to D22
Drive Installation	4673[1]	Replace J1A tape drive with E05 tape drive
	4674	Field Install J1A tape drive
	4675[1]	Field Install E05 tape drive
	4676	Field Install E06 tape drive
	4677	Field Install EU6 tape drive
	4678	Replace J1A or E05 tape drive with the E06 or EU6 tape drive
	4772[2]	Remove 3592 tape drive
	9676[6]	Factory Install E05 tape drive
	9678[6]	Field Merge E05 tape drive
	9683	Factory Install E06 tape drive
	9684	Field Merge E06 tape drive
	9694	Field Merge E06 tape drive
LM Microcode Updates	0520	Drive Microcode Update
Tape Cartridges	8802[5]	3592 Cleaning Cartridge
	8820[5]	Twenty 3592 Data Cartridges
	9540[5]	No Data Cartridges
Operating Systems Attachments	9104[3]	iSeries OS/400 attach
	9106[3]	pSeries AIX attach
	9109	zSeries ESCON/FICON attach
	9200[4]	Open Systems Device Drivers
	9210[3]	HP-UX attach
	9211[3]	Sun Solaris attach
	9212[3]	Microsoft Windows attach
	9213	Other Non-IBM attachment
	9215	Open Linux system attach
	9216	zSeries Linux attach

Table 26: Feature codes for 3592 tape drives in 3494 L22, D22, and D24 library frame installations (continued)		
Category	**Feature Code**	**Description**
Languages[4]	2924	English
	2928	French
	2930	Japanese (Service Panel only)
	2931	Spanish
	2932	Italian (Withdrawal from marketing announced May 9, 2006)
	2935	French Canadian - keyboard only (Withdrawal from marketing announced May 9, 2006)
Note: [1]These features are ordered against the 3494 frame. [2]These features are ordered against both the 3494 frame and the J1A tape drive. [3]Applies only to the L22 and D22 frames. [4]Applies to the L22 frames only. [5] These features are no longer marketed by IBM beginning in January 2005. To order 3592 media, see "3599 media supplies" on page 100. [6]These features are ordered against both the 3494 frame and the E05 tape drive		

IBM TS1120 (3592 C06) Controller and associated frame features

For features listed in numerical order, refer to Table 27 on page 45 and refer to "IBM TS1120 (3592 C06) Controller and associated frame feature descriptions" on page 47.

For features listed according to supported Fibre Channel environments, refer to the following sections:

- "Features for the Fibre Channel Switches" on page 54
- "Features for External Fabric Support (FC 3492, FC 9492)" on page 55

Feature codes using the term *Field merge* instruct the plant to leave a mounting slot available in the frame for merging a device at the customer site. Feature codes using the term *Field install* indicate that an existing rack or frame at the customer site requires a mounting slot.

Table 27: Feature codes for C06 Controllers and associated features		
Feature Code	**Machine Type/Model**	**Description**
0520	C06 Controller, J70 Controller, 3494 Models Lxx	Functional Enhancement Field
2714	C06 Controller	Console Expansion
2715	C06 Controller	Console Attachment
2719	C06 Controller	IBM TS3000 System Console Upgrade
2720	C06 Controller	IBM TS3000 System Console (withdrawn)
2732	C06 Controller	TS3000 System Console
2733	C06 Controller	TS3000 Internal Modem
3062	C06 Controller	Drive-to-Switch Cables / Rack
3440	C06 Controller	Dual ESCON Attachment for the C06 Controller

Table 27: Feature codes for C06 Controllers and associated features (continued)		
Feature Code	**Machine Type/Model**	**Description**
3441	C06 Controller	FICON Short Wavelength Attachment
3442	C06 Controller	FICON Long Wavelength Attachment
3443	C06 Controller	FICON 10 km Long Wavelength Attachment
3478	C06 Controller	Two Dual Ported Fibre Drive Adapters
3488	C06 Controller	4 Gb Fibre Channel Switch
3492	C06 Controller, 3952 Frame F05	External Fabric Support (Field)
3493	C06 Controller, 3952 Frame F05	Direct Connect Drives (Field)
3494	C06 Controller	Fibre Channel Switch Rack Mount Kit
3495	C06 Controller	Redundant Fibre Channel Attach
4641	C06 Controller	Install Controller in Rack
4887	C06 Controller	Reinstall 2 Gb Fibre Channel Switch
4897	C06 Controller	Reinstall 4 Gb Fibre Channel Switch
5247	C06 Controller	Enhanced Router
5248	C06 Controller	Network 16-Port Switch for IPv4/IPv6
5593	C06 Controller	Router for EKM attach
5595	C06 Controller	Control Unit Encryption configuration / Field
9000	C06 Controller	Attach to System z
9014	C06 Controller	Attach TS3400 to Controller
9478	C06 Controller	3592 Drive Attach to C06 Controller
9492	C06 Controller, 3952 F05 Frame	External Fabric Support (Plant)
9493	C06 Controller, 3952 F05 Frame	Direct Connect Drives (Plant)
9595	C06 Controller	Control Unit Encryption configuration / Plant
9885	C06 Controller	Field Merge C06 Controller into 3952 F05
9886	C06 Controller	Plant Install C06 Controller into 3952 F05 for Silo
9887	C06 Controller	Field Merge C06 Controller into 3953 F05
9888	C06 Controller	Plant Install C06 Controller into 3953 F05
9889	C06 Controller	Plant Install C06 Controller in 3952 F05 for 3494
9906	C06 Controller	IPv6 Configuration

IBM TS1120 (3592 C06) Controller and associated frame feature descriptions

Functional Enhancement Field (FC 0520)

This feature provides an update to the microcode of an installed TS1120 (3592 C06) Controller and the attached tape drives to provide the latest level of functional microcode firmware support. Newer microcode levels may be required when adding new functions. In order to take advantage of the 700 GB (651.93 GiB) Enterprise Tape Cartridge 3592 Extended, you must update controller microcode installed before December 8, 2006.

Note: C06 Controller 1.21.7.x microcode is required for E07 tape drive support.

3592 Tape Drive-to-Switch Cables (FC 3062)

This feature provides a single Fibre Channel cable between a 3592 Tape Drive and a 2 Gb or 4 Gb Switch in a rack, for connection to a TS1120 (3592 C06) Controller installed in that rack. One of these features should be specified for each 3592 Tape Drive to be attached to the C06 Controller in the rack.

Maximum: twelve (with single switch feature FC 3488, FC 3487, FC 4887, or FC 4897) or Twenty-four (with two switches feature FC 3487, FC 3488, or FC 4887 or FC 4897), when installed in a rack

Dual ESCON Host Adapter (FC 3440)

See Table 53 on page 137 for the allowable combinations of FICON/ESCON attachments using features FC 3440, FC 3441, FC 3442, and FC 3443 described below.

This feature provides an ESCON adapter for attachment of 3592 Tape Drives through the TS1120 (3592 C06) Controller to two ESCON host system channels. Each port on the ESCON adapter can support up to 64 logical channels and, using ESCON Directors, can be up to 43 kilometers from the host system.

Maximum: four. Minimum: one of Feature FC 3440, FC 3441, FC 3442, or FC 3443 is required on each C06 Controller. Permitted combinations of Feature FC 3440, FC 3441, FC 3442, and FC 3443 are shown in Table 53 on page 137.

For information on ESCON cable features, see “Dual ESCON attachment for 3592 controller cable features” on page 82.

FICON Short Wave Attachment (FC 3441)

See Table 53 on page 137 for the allowable combinations of FICON/ESCON attachments using features FC 3440, FC 3441, FC 3442, and FC 3443 described below.

This feature provides one short-wavelength FICON adapter, with an LC Duplex connector, for the attachment of 3592 Tape Drives through the TS1120 (3592 C06) Controller to a FICON host system long wave channel utilizing a 50-micron multimode fibre cable. The total cable length cannot exceed 150 meters (492 feet). Each FICON attachment can support up to 128 logical channels. A feature conversion is available to convert FC 3441 to FC 3442 or FC 3443.

Maximum: Four. Minimum: One of FC 3440, FC 3441, FC 3442, or FC 3443 is required on each TS1120 (3592 C06) Controller. Plant or field installation.

FICON Long Wave Attachment (FC 3442)

See Table 53 on page 137 for the allowable combinations of FICON/ESCON attachments using features FC 3440, FC 3441, FC 3442, and FC 3443 described below.

This feature provides one long-wavelength FICON adapter, with an LC Duplex connector, for the attachment of 3592 Tape Drives through the TS1120 (3592 C06) Controller to a FICON host system long wave channel utilizing a 9-micron single-mode fibre cable. The total cable length cannot exceed 4 KM. Each FICON attachment can support up to 128 logical channels. A feature conversion is available to convert FC 3442 to FC 3441 or FC 3443.

Maximum: Four. Minimum: one of FC 3440, FC 3441, FC 3442, or FC 3443 is required on each C06 Controller. Plant or field installation.

FICON Long Wave 10km Attachment (FC 3443)

See Table 53 on page 137 for the allowable combinations of FICON/ESCON attachments using features FC 3440, FC 3441, FC 3442, and FC 3443 described below.

This feature provides one long-wavelength FICON adapter, with an LC Duplex connector, for the attachment of 3592 Tape Drives through the TS1120 (3592 C06) Controller to a FICON host system long wave channel utilizing a 9-micron single-mode fibre cable. The total cable length cannot exceed 10 KM. Each FICON attachment can support up to 128 logical channels. A feature conversion is available to convert FC 3443 to FC 3441 or FC 3442.

Maximum: Four. Minimum: one FC 3440, FC 3441, FC 3442, or FC 3443 is required on each C06 Controller. Plant or field installation.

Two Dual Ported Fibre Channel Drive Adapters (FC 3478)

This feature installs two short-wavelength 4 Gb Dual Ported Fibre Channel adapters with LC connectors in a IBM TS1120 (3592 C06) Controller for attaching up to sixteen 3592 Tape Drives when attached through a 2 Gb or 4 Gb Fibre Channel Switch. Total cable length from the adapters to the switch cannot exceed 150 meters. Factory installed. Minimum: one. Maximum: one.

4 Gb Fibre Channel Switch (FC 3488)

This feature provides a 4 Gb Fibre Channel Switch with 20 LC Shortwave ports for attachment of up to sixteen 3592 Tape Drives to a IBM TS1120 (3592 C06) Controller. Hardware errors detected on the switch are managed by the IBM TS1120 (3592 C06) Controller. The 4 Gb Fibre Channel Switch has dual power connection for attachment to separate power supplies. Factory or field installed.

Maximum: two. Prerequisites: FC 3478. This feature is mutually exclusive of FC 3492, FC 3493, FC 4887, FC 9492, and FC 9493. Intermix of 2 Gb and 4 Gb Fibre Channel Switches is not supported within the IBM TS1120 (3592 C06) Controller.

External Fabric Support - Field (FC 3492)

This feature indicates that 3592 Tape Drives will be connected to C06 Controller through an external customer-supplied Fibre Channel Switch. Field installed.

Maximum: one. Prerequisites: FC 3478. This feature is mutually exclusive with FC 3488, FC 3493, FC 4887, FC 4897, FC 9492, and FC 9493.

The customer is responsible for providing the cables from the C06 Controller installed in a 3952 or 3953 Model F05 frame to a customer-supplied fibre channel switch. Cables from the switch or controller to the 3592 Tape Drives can be ordered with the 3592 Tape Drives or supplied by the customer.

Direct Connect Drives - Field (FC 3493)

This feature indicates that 3592 Tape Drives will be directly connected to the IBM TS1120 (3592 C06) Controller. Direct connect drives require either this feature or FC 9493 (External Fabric Support - Plant) specified on the IBM TS1120 (3592 C06) Controller with one to four FC 3062 for rack-installed 3592 Tape Drives.

The cables are provided to direct connect the 3592 Tape Drives in a rack to the IBM TS1120 (3592 C06) Controller by specifying FC 3062 when the external fabric feature FC 3493 or FC 9493 is specified.

Field installed. Maximum: one. Prerequisites: FC 3478. This feature is mutually exclusive of FC 3488, FC 3492, FC 4887, FC 4897, FC 9492, and FC 9493.

Fibre Channel Switch Rack Mount Kit (FC 3494)

This feature provides the required hardware to support attachment of 3592 Tape Drives through a 2 Gb or 4 Gb Fibre Channel Switch (FC 3488, FC 4887, or FC 4897) for connection to a IBM TS1120 (3592 C06) Controller in a rack. It includes the mounting hardware and instructions for installing the 2 Gb or 4 Gb Fibre Channel Switch in the rack, including associated ethernet cabling between the C06 Controller and the switch. Fibre Channel cables from the 3592 Tape Drives to the switch in the rack with the C06 Controller are included by specifying FC 3062 (one or two for each tape drive). For multi-rack attachment

of 3592 Tape Drives in other racks to the switch, order the cables with the drives. Factory or field installed. Maximum: one. Prerequisites: FC 4641 plus FC 3488, 4887, or FC 4897.

Redundant FC Rack Attach (FC 3495)

This feature provides the mounting hardware and instructions for installing a second 2 Gb or 4 Gb Fibre Channel Switch in the rack. Factory or field installed. Maximum: one. Prerequisites: FC 3494 and a second FC 3488, FC 4887 or FC 4897.

Install Controller in Rack (FC 4641)

This optional feature provides the rack mounting hardware to install a IBM TS1120 (3592 C06) Controller in a rack. Factory or field installed. Maximum: one. This feature is mutually exclusive with FC 9885, FC 9886, FC 9887, and FC 9888.

Reinstall 2 Gb Fibre Channel Switch (FC 4887)

This feature is the same as FC 3487, but allows the customer to provide a 2 Gb Fibre Channel Switch (FC 3487) that was removed from a J70 Controller or a 3953 Model F05 and reinstall it for attachment to a IBM TS1120 (3592 C06) Controller.

Field install only. Maximum: Two. Minimum: None. Prerequisites: FC3478 on the IBM TS1120 (3592 C06) Controller. This feature is mutually exclusive of FC 3488, FC 3492, FC 3493, FC 4897, FC 9492, and FC 9493.

Reinstall 4 Gb Fibre Channel Switch (FC 4897)

This feature is the same as FC 3488 but allows the customer to provide a 4 Gb Fibre Channel Switch feature FC 3488 that was removed from a 3592 Controller or a 3952 F05 Frame or 3953 F05 Frame and reinstall it for attachment to this IBM TS1120 (3592 C06) Controller. Factory or field installed. Maximum: two. Prerequisites: FC 3478. This feature is mutually exclusive of FC 3492, FC 3493, FC 4887, FC 9492, and FC 9493.

Enhanced Router (FC 5247)

This feature provides one 8-port router with enhanced capabilities. This feature does not support IPv6. Order a second feature for out of band encryption connection to the Encryption Key Manager.

Maximum: two. Prerequisites: FC 4641 and FC 9014. This feature is mutually exclusive of FC 5248 and FC 5593.

Network 16-Port Switch (FC 5248)

This feature provides a 16-port switch for use in attaching to a customer network. This features also supports IPv4/IPv6 environments and provides a single Ethernet cable. This feature only provides one path to an Out-of-Band Encryption Key Manager server.

Note: The C06 Controller has limited support for IPv6. IPv6 traffic is restricted to the customer's connection only. When attached to a TS3400, the C06 Controller supports IPv4 / IPv6 traffic for receiving SNMP traps from the attached TS3400 libraries. When attached to a TS3400 or configured for a rack mounted controller, IPv4 / IPv6 support is provided for a single path to enable Out-of-Band Encryption key exchanges. The C06 Controller blocks all other IPv4 / IPv6 inbound and outbound traffic from the customer network.

Maximum: one.

Prerequisites: FC 4641. Mutually exclusive of FC 5593 and FC 5247.

Router for EKM attach (FC 5593)

This feature provides two routers for redundant paths between the Encryption Key Manager and the tape controller through the customer network. Ethernet cables from the routers to the tape controller are also provided.

This feature is only supported with encryption capable IBM TS1120 Model E05 tape drive, IBM TS1130 Model E06/EU6 tape drive, IBM TS1140 Model E07 tape drive, and IBM TS1150 Model E08 tape drives. Not valid with IBM Model J1A tape drives or IBM TotalStorage 3590 Tape Drives.

Maximum: seven. Prerequisites: FC 4641, FC 5247. Plant or field installed. Mutually exclusive of FC 5247 and FC 5248.

Control unit encryption configuration / field (FC 5595)

Provides encryption configuration and reconfiguration support of the control unit attached tape drives. The first time FC 5595 is ordered, it will ship the minimum level control unit microcode required. The minimum level Library Manager microcode will also be supplied if the control unit is not in a customer rack solution (FC 4641). For inband encryption, no other control unit features are required. For out-of-band encryption, FC 5593 is required on the C06 or J70 Controller, the Tape Frame (3952 Model F05 or 3953 Model F05), the Library Manager Frame (3494 Model Lxx or the 3590 C10 frame) to provide a path through the router to the EKM.

Maximum: 99. Field installation only. Mutually exclusive of FC 9595.

This feature is only supported with encryption capable E05 tape drives. It is not valid with J1A or 3590 tape drives.

Attached to zSeries (FC 9000)

No power cords need be specified for the tape controller. It comes with a short cord that plugs into the 3952 Tape Frame, 3953 F05 Frame, or rack, and takes advantage of the external power cord of the box in which it is installed.

Attach TS3400 to Controller (FC 9014)

This feature indicates a C06 Controller will be attached to tape drives in a TS3400 Tape Library. It ships the Ethernet cable to attach the TS3400 to either FC 5247 or FC 5248. Install one FC 9014 on the 3592 Tape Controller for each TS3400 Tape Library to be attached. See *IBM TS3400 Tape Library Planning and Operator Guide* for more information.

Maximum: seven. Prerequisites: FC 4641, FC 5247, or FC 5248. Plant or field installed.

3592 Tape Drive Attached to C06 Controller (FC 9478)

This feature is required on all TS1120 (3592 C06) Controllers that will have a 3592 Tape Drive attached. Minimum: one. Maximum: one. Factory or field installed.

External Fabric Support - Plant (FC 9492)

This feature on the controller indicates that 3592 tape drives will be connected to the IBM TS1120 (3592 C06) Controller through an external customer-supplied Fibre Channel switch.

Maximum: one. Prerequisites: FC 3478. This feature is mutually exclusive of FC 3488, FC 3492, FC 3493, FC 4887, FC 4897, and FC 9493.

The customer is responsible for providing the cables from the IBM TS1120 (3592 C06) Controller installed in a 3952 or 3953 Model F05 frame to a customer-supplied Fibre Channel switch. Cables from the switch or controller to the 3592 tape drives can be ordered with the 3592 tape drives or supplied by the customer.

For the most recent list of C06 Controller-supported Fibre Channel switches, please visit the IBM 3592 Frequently Asked Questions web page.

Direct Connect Drives - Plant (FC 9493)

This feature on the controller indicates that 3592 Tape Drives will be directly connected to a IBM TS1120 (3592 C06) Controller. Direct connect drives require either this feature or FC 3493 (Direct Connect Drives -- Field) specified on the IBM TS1120 (3592 C06) Controller with one to four FC 3062.

Field installed. Maximum: one. Prerequisites: FC 3478. This feature is mutually exclusive of FC 3488, FC 3492, FC 3493, FC 4887, FC 4897, and FC 9492.

Control unit encryption configuration / plant (FC 9595)

Provides encryption configuration and reconfiguration support of the control unit attached tape drives. This feature will ship the minimum level control unit microcode required. The minimum level Library Manager microcode will also be supplied if the control unit is not in a customer rack solution (FC 4641). For inband encryption, no other control unit features are required. For out-of-band encryption, FC 5593 is required on the C06 or J70 Controller, the tape frame (3952 Model F05 or 3953 Model F05), the Library Manager frame (3494 Model Lxx or the 3590 C10 frame) to provide a path through the router to the EKM.

Maximum: one. Plant installation only. Mutually exclusive of FC 5595.

This feature is only supported with encryption capable E05, E06, or E07 tape drives. It is not valid with J1A or 3590 tape drives. The E07 tape drives are only supported with the C06 Controller while in the encryption enabled mode.

Field Merge C06 Controller into 3952 F05 (FC 9885)

This feature specifies the attachment of a new IBM TS1120 (3592 C06) Controller to an installed 3952 F05 Frame.

Maximum: one. This feature is mutually exclusive of FC 4641, FC 9886, FC 9887, and FC 9888.

Corequisites: One field install/field merge C06 Controller Feature (FC 5878, FC 5880) must be ordered on the 3952 F05 Frame.

Plant Install C06 Controller in 3952 F05 for Silo (FC 9886)

This feature specifies the factory attachment of a new IBM TS1120 (3592 C06) Controller to a new 3952 F05 Frame.

Maximum: one. This feature is mutually exclusive of FC 4641, FC 9885, FC 9887, and FC 9888.

Corequisites: One plant install IBM TS1120 (3592 C06) Controller FC 5879 must be ordered on the 3952 F05 Frame.

Field Merge C06 Controller in 3953 F05 (FC 9887)

This feature specifies that a IBM TS1120 (3592 C06) Controller will be field merged, or field installed, into a 3953 F05 Frame.

Maximum: one.

Corequisites: One Field Install/Field Merge IBM TS1120 (3592 C06) Controller Feature (FC 5878, FC 5880) must be ordered on the 3953 F05 Frame.

Plant Install C06 Controller in 3953 F05 (FC 9888)

This feature specifies the factory attachment of a new IBM TS1120 (3592 C06) Controller to a 3953 F05 Frame.

Maximum: one.

Corequisites: One Plant Install IBM TS1120 (3592 C06) Controller (FC 5879) must be ordered on the 3953 F05 Frame.

Plant Install C06 Controller in 3953 F05 for 3494 (FC 9889)

This feature provides for the factory installation of a new C06 Controller in a new 3952 Model F05 Frame from the plant. This feature must appear on the C06 Controller and FC 5879 and FC 7316 must appear on the 3952 Model F05 order.

Maximum: one. This Feature is mutually exclusive with FC 4641, FC 9885, FC 9887, and FC 9888.

Prequisites: One plant install C06 Controller Feature (FC 5879) must be ordered on the 3952 Model F05. One Enterprise Tape Library Attachment feature (FC 7316) must be ordered on the 3952 Model F05.

IPv6 Configuration (FC 9906)

Service/Call Home features

Table 28: C06 Controller feature codes for Service/Call Home features		
Category	**Feature Code**	**Description**
Service/Call Home	2714	Console Expansion
	2715	Console Attachment
	2719	TS3000 System Console Upgrade
	2720	TS3000 System Console (withdrawn)
	2721	TS3000 System Console
	2732	TS3000 System Console
	2733	TS3000 Internal Modem

IBM TS3000 System Console features

The following features FC 2714, FC 2715, and FC 2732 provide connection to an IBM TS3000 System Console to enable enhanced remote support to improve availability and enable early detection of problems and unusual conditions. The TS3000 System Console enables remote monitoring of each attached unit to expedite microcode updates, reduce service times, and enhance local service. The TS3000 System Console may be shared among the following units:

- 3494 Model L10, L12, L14, L22, AX0, B10, B18, B20, and HA1
- VTC in a 3494 Model CX1
- TS7700 Virtualization Engine
- C06 Controller
- J70 Controller
- 3590 Model A60

To connect a 3592 controller to a TS3000 System Console, one of the following features must be selected on the 3592 controller based on the number of units attached to that master console facility in the installation.

Console Expansion (FC 2714)

This feature provides an attachment cable for connection of a TS3000 System Console (TSSC) and an Ethernet switch for expanding the number of units that can be attached to the TSSC, or Master Console for Service. Up to 14 additional connections are provided by this feature for connection of FC 2715 or another FC 2714. FC 2714 can attach to any existing FC 2721, FC 2722, or FC 2732.

A minimum of one FC 2714, FC 2715, or FC 2732 is required. A maximum of one other Console Expansion (FC 2714) can be connected to the Ethernet switch provided by this feature FC 2714. A maximum of two of feature FC 2714 may be included in a single TS3000 System Console facility (providing a total maximum of 43 unit connections). Plant or field installable.

Console Attachment (FC 2715)

This feature provides a cable to attach a unit to the Ethernet switch provided by the TS3000 System Console, or Master Console For Service, or Console Expansion (FC 2714). A maximum of 40 of feature FC 2715 may be included in a single TS3000 System Console facility. FC 2715 can attach to any existing FC 2721, FC 2722, or FC 2732.

Minimum: one of FC 2714, FC 2715, or FC 2732 is required. Maximum: one of FC 2714, FC 2715, or FC 2732. Plant or field installable.

TS3000 System Console Upgrade (FC 2719)

This feature provides a memory upgrade to 2.1 GB (2 GiB) total RAM and a second ethernet card for the Service Console to allow redundant connections into the service network. This feature only applies to consoles shipped with FC 2718, FC 2720 and 3953-F05 FC 2721.

TS3000 System Console (FC 2720) (withdrawn)

This feature provides the enhanced TS3000 System Console, an Ethernet switch, and a cable and connectors for connection of one of the above units to an IBM supplied modem to enable remote enhanced service. This feature should be specified on the first unit in an installation connected to a TS3000 System Console facility. The Ethernet switch provides 14 additional connections for cables supplied with feature FC 2714 or FC 2715.

A minimum of one FC 2714, FC 2715, or FC 2720 is required. A maximum of one FC 2714 may be connected to FC 2720. FC 2720 Plant or field installable. The 3953-F05 FC 2721 may be used in place of FC 2720 (FC 2714 or FC 2715 still required on controller).

TS3000 System Console (FC 2721)

This feature provides the rack mountable TS3000 System Console, an Ethernet switch for the Master Console and a cable and connector for connection of one subsystem.

TS3000 System Console (FC 2732)

This feature provides a rack mount version of TS3000 System Console for installation. FC 2732 provides a 1U server, keyboard, display, mouse, and Ethernet switch. Includes console upgrade previously provided as FC 2719 (Memory upgrade to 2 GB total RAM and a second Ethernet card for the Service Console to allow redundant connections into the service network).

Minimum: one of FC 2714, FC 2715, or FC 2732 is required. Maximum: one of FC 2714, FC 2715, or FC 2732. Plant or field installable.

Corequisite: FC 2733 (Refer to the “Limitations” on page 53 section).

TS3000 Internal Modem (FC 2733)

This feature provides an internal modem installed in the TSSC server (FC 2732).

Maximum: one. Plant or field installable.

Corequisite: FC 2732 is required. Refer to the “Limitations” on page 53 section for a list of countries where the modem is qualified for use.

Limitations

FC 2733, Internal modem, is qualified for use in the following countries:

Argentina, Australia, Bahrain, Bolivia, Brazil, Canada, Chile, China CCC, China NALTE, Colombia, Costa Rica, Croatia, Ecuador, Egypt, Guatemala, Guyana, Honduras, Hong Kong, India, Indonesia, Israel, Japan, Jordan, Kazakhstan, Korea, Kuwait, Kyrgyzstan, Lebanon, Macau, Malaysia, Mexico, Morocco, New Zealand, Nicaragua, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Russia, Saudi Arabia, Singapore, South Africa, Sri Lanka, Suriname, Taiwan, Thailand, Turkey, UAE, Ukraine, United States, Uruguay, Vietnam, Venezuela, Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom. Overseas regions of the European Union, Portugal: Azores, Madeira, Spain: Canarias, France: Guyane, Guadeloupe, Martinique, Réunion. United States: includes U.S. Territories: Guam, Northern Mariana Islands, Puerto Rico, U.S. Virgin Islands.

Fibre Channel environments and their feature codes

This section specifies feature for each of the following two fibre channel environments:

- “Features for the Fibre Channel Switches” on page 54

- "Features for External Fabric Support (FC 3492, FC 9492)" on page 55

For more details on the adapter and attachment features indicated below, see Table 27 on page 45.

Features for the Fibre Channel Switches

When a 2 Gb or 4 Gb Fibre Channel Switch is used, all mounting hardware, twenty GBICs, dual power, and cooling fans are installed. The following requirements apply in the specified environments:

C06 Controller requirements

The following requirements apply when installing a C06 Controller with a 2 Gb or 4 Gb Fibre Channel Switch.

- **4 Gb Fibre Channel Switch (FC 3488)** or **Reinstall 4 Gb Fibre Channel Switch (FC 4897)** or **Reinstall 2 Gb Fibre Channel Switch (FC 4887)** must be specified on the C06 Controller. Two FC 3488s, FC 4887s, or two FC 4897s can be installed for redundancy. Intermixing of 2 Gb and 4 Gb switches is not allowed on the TS1120 (3592 C06) Controller.

and

- **Dual Ported Fibre Adapters (FC 3478)** must be specified for each installed TS1120 (3592 C06) Controller.
- **3592 Drive Attach to Controller (FC 9478)** must be specified on the C06 Controller if attaching 3592 drives.

Rack requirements

The following features are required when installing the C06 Controller in a rack environment with a 2 Gb or 4 Gb Fibre Channel Switch:

- **Install Controller in a Rack (FC 4641)** must be specified.
- **Fibre Channel Switch Rack Mount Kit (FC 3494)** provides the hardware for installing the 2 Gb or 4 Gb Fibre Channel Switch in the rack and cables from the C06 Controller to the switch. Up to sixteen 3592 tape drives can be attached to a single C06 Controller with this feature.
- **Redundant FC Attach (FC 3495)** provides the mounting hardware and instructions for installing a second 2 Gb or 4 Gb Fibre Channel Switch in the rack. Any two of the following features must be installed for FC 3495: FC 3488, FC 4887, or FC 4897.
- **3592 Tape Drive-to-Switch Cables (FC 3062)** (see "3592 Tape Drive-to-Switch Cables (FC 3062)" on page 47) must be specified on the IBM TS1120 (3592 C06) Controller for each 3592 tape drive attached to the controller with the 2 Gb or 4 Gb Fibre Channel Switch in the rack.

3592 tape drives in a stand-alone rack

The following feature is required when installing 3592 drives in a stand-alone rack with a 2 Gb or 4 Gb Fibre Channel Switch:

- **LC/LC Fibre Channel Cables (FC 6013, FC 6025, or FC 6061)** must be specified on each tape drive not in the rack with the controller to provide one short-wavelength cable to attach those tape drives to the 2 Gb or 4 Gb Fibre Channel Switch.

Enterprise Tape Library 3494 features

The following features pertain when installing a TS1120 (3592 C06) Controller in a 3952 Tape Frame with Outboard C06 Controller (FC 5266) and a 2 Gb (FC 4887) or 4 Gb Fibre Channel Switch (FC 4888):

- **FC Switch Mount Kit (FC 3486)** must be specified on the 3494 Model D22 or D24 frame that attaches to the C06 Controller.
- **Redundant FC Attach (FC 3490)** may be added for redundancy. Two of FC 4887, FC 3488, or FC 4897 must be installed for FC 3490.
- **Adjacent Frame Fibre Channel 3592 (FC 4085)** must be specified on the associated 3494 Model L22 or D22 frame that contains the other 3592 tape drives that will be attached to the C06 Controller. When

FC 4085 is ordered against a 3494 Model L22 or D22 frame, the correct number of 3592 Drive-to-Switch cables for the 3494 Model L22 or D22 frame is provided, based on the number of 3592 tape drives ordered against the 3494 Model D22 or L22 frame.

- One **3592 Drive-to-Switch Cable (FC 3061)** must be specified on the 3494 D24 Frame for each 3592 tape drive attached to the 2 Gb or 4 Gb switches.

3953 F05 Tape Frame features

The following features pertain when installing a C06 Controller in a 3953 F05 Tape Frame:

- **2 Gb Fibre Channel Switch (FC 3487)** This feature provides a 2 Gb Fibre Channel Switch with 20 LC Shortwave ports for attachment of up to 16 E05 tape drive and J1A tape drives to a TS1120 (3592 C06) Controller.
- **4 Gb Fibre Channel Switch (FC 3488)** This feature provides a 4 Gb Fibre Channel Switch with 20 LC Shortwave ports for attachment to 3592 Tape Drives in the 3584 Tape Library. The 4 Gb Fibre Channel Switch has dual power connection for optional attachment to separate power supplies. For each TS1120 (3592 C06) Controller there is a maximum of two. For each VTS this feature must be ordered in pairs.
- **Fibre Channel Switch Mount Kit (FC 4888)** provides the mounting hardware for the 2 Gb or 4 Gb Fibre Channel Switch in a 3953 F05 Tape Frame that contains one or more TS1120 (3592 C06) Controllers. This feature includes the required mounting hardware, bifurcated power cables, and instructions for installing up to two Fibre Channel Switches in the frame. One FC 4888 must be ordered for each TS1120 (3592 C06) Controller for which FC 3487, FC 3488, FC 4889, or FC 4897 will be ordered.
- **Customer-Supplied 2 Gb Fibre Channel Switch (FC 4889)** allows a 2 Gb Fibre Channel Switch provided by the customer to attach to the 3592 tape drives in a 3584 Tape Library. Two fibre channel switches are recommended for each controller for redundancy, but only one is required. However, if only one switch is installed per controller, it must be installed in the lower of the two positions. This feature can be ordered in any quantity from one to six for each frame. One FC 4888, Fibre Channel Switch Mount Kit, must be ordered for each TS1120 (3592 C06) Controller for which FC 4889 will be ordered.
- **Customer-Supplied 4 Gb Fibre Channel Switch (FC 4897)** allows a 4 Gb Fibre Channel Switch provided by the customer to attach to the 3592 tape drives in a 3584 Tape Library. Two fibre channel switches are recommended for each controller for redundancy, but only one is required. However, if only one switch is installed per controller, it must be installed in the lower of the two positions. This feature can be ordered in any quantity from one to six for each frame. One FC 4888, Fibre Channel Switch Mount Kit, must be ordered for each TS1120 (3592 C06) Controller for which FC 4897 will be ordered.

Features for External Fabric Support (FC 3492, FC 9492)

When connecting 3592 tape drives to a TS1120 (3592 C06) Controller using external fabric (FC 3492 - field installed, FC 9492 - Plant installed), the following requirements apply in the specified environments:

3592 Controller zoning requirements

When using a supported, customer-supplied Fibre Channel director (see “Fibre Channel switches for the C06 and J70 Controllers” on page 20), connectivity is through 2 Gb or 4 Gb multimode ports. Supported directors can be connected to single or dual ports on the 3592 tape drives. Each director must be zoned to ensure the only devices in the zone are the controller and 3592 tape drives. Up to two zones can be configured per controller in order to provide failover in the event of a controller adapter, director, blade or port failure. This requires each controller adapter (FC 3478) to be connected to a separate zone and each 3592 tape drive port connected to those separate zones. The cables from the controller to the director and from the director to the tape drives can be ordered against the 3592 tape drives.

IBM TS1120 (3592 C06) Controller requirements

The following requirements apply when connecting IBM Model J1A and E05 tape drives to a C06 Controller using external fabric:

- **Two Dual Ported LC Fibre Drive Adapters (FC 3478)** must be specified for each installed C06 Controller.

- **Drive Attached to Controller (FC 9478)** must be specified on the C06 Controller.
- Either **External Fabric Support Field (FC 3492)** or **External Fabric Support Plant (FC 9492)** must be specified on the C06 Controller.

Enterprise Tape Library 3494 features

The following requirements apply when connecting 3592 tape drives to a C06 Controller using external fabric in a 3494 environment:

- Either **External Fabric Support Field (FC 3492)** or **External Fabric Support Plant (FC 9492)** must be specified on the D24, and D22 or L22 adjacent frames.

Features for Direct Connect Support (FC 3493, FC 9493)

For limited configurations, four 3592 drives can be attached to a controller using direct connect support (FC 3493 - field installed, FC 9493 - plant installed). One FC 3061 must be ordered for each 3592 drive in a rack. Cables from the controller to the 3592 drives can be ordered with the 3592 drive or supplied by the customer. To attach additional drives, any of the Fibre Channel options can be ordered (see "Fibre Channel switches for the C06 and J70 Controllers" on page 20). Additional drives may be added later via any of the other switch options.

IBM 3592-J70 Controller and associated frame features

This product is no longer available for ordering and is not supported by the IBM TS1140 Model E07 tape drive or the IBM TS1150 Model E08 tape drive.

For features listed in numerical order, refer to Table 29 on page 56 and refer to "J70 Controller and associated frame feature descriptions" on page 59.

For features listed according to supported Fibre Channel environments, refer to the following sections:

- "Features for the Fibre Channel Switches" on page 70
- "Features for external fabric support" on page 73
- "Features for the IBM Storage Area Network Switch Model F16" on page 73
- "Features for the IBM SAN switch Model S16" on page 75

Feature codes using the term *Field merge* instruct the plant to leave a mounting slot available in the frame for merging a device at the customer site. Feature codes using the term *Field install* indicate that an existing rack or frame at the customer site requires a mounting slot.

Table 29: Feature codes for J70 control units and associated features

Feature Code	Machine Type/Model	Description
0520	J70 Controller, 3494 Models Lxx	Functional Enhancement Field
3059	J70 Controller	3592 Tape Drive-to-Switch Cables
3413	J70 Controller	Dual ESCON Host Adapter
3434	J70 Controller	2 Gb/s FICON Long Wave Attachment
3435	J70 Controller	2 Gb/s FICON Short Wave Attachment
3413 to 3434	J70 Controller	Convert Dual ESCON Host Adapter to 2 Gb LW FICON Adapter
3413 to 3435	J70 Controller	Convert Dual ESCON Host Adapter to SW FICON Adapter

Table 29: Feature codes for J70 control units and associated features (continued)

Feature Code	Machine Type/Model	Description
3434 to 3435	J70 Controller	Convert 2 Gb LW FICON Host Adapter to 2 Gb SW FICON Adapter
3435 to 3434	J70 Controller	Convert 2 Gb SW FICON Adapter to 2 Gb LW FICON Adapter
3464	3590 Model A14, 3494 Models D14, D24	Fibre Drive Attach Controller
3465	J70 Controller (for rack installation)	SC Fibre Switch Controller in Rack
3474	3590 Model A14, 3494 Models D14, D24	LC Fibre Drive Attached Controller
3475	J70 Controller (for rack installation)	LC Fibre Switch Controller in Rack
3476	J70 Controller	Two LC Fibre Drive Adapters
3477	J70 Controller	Dual Ported SCSI Drive Adapters
3478	J70 Controller	Two Dual Ported Fibre Channel Drive Adapters
3483	J70 Controller	Drive Attach to SC Switch
3484	J70 Controller	Drive Attach to LC Switch
3485	J70 Controller (for rack installation)	2 Gb Fibre Channel Drive Attach Rack
3486	3590 Model A14, 3494 Model D14/D24	Fibre Channel Switch Mount Kit
3487	J70 Controller	2 Gb Fibre Channel Switch (Withdrawal from marketing announced May 9, 2006)
3488	3494 Model D22, J70 Controller, 3953 Model F05	4 Gb Fibre Channel Switch
3489	J70 Controller (for rack installation)	Redundant 2 Gb Attach Rack
3490	3590 Model A14, 3494 Model D14/D24	Redundant Fibre Channel Attach
3491	J70 Controller, 3494 Models D22/D24/L22	External Fabric Support Field
4060	3590 Model A14	Multiframe SCSI A14
4065	J70 Controller (for rack installation) 3494 Models D22/L22	Multiframe SCSI Rack AttachAdjacent Frame 3592 Tape Drives with SC Attachment
4075	3494 Models L22, D22	Adjacent Frame 3592 Tape Drives with LC Attachment
4084	3590 Model A14, 3494 Model D12/L12 Frame	Multiframe 2 Gb 3590
4085	3494 Model D22/L22	Adjacent Frame 2 Gb 3592
4641	J70 Controller (for rack installation)	Install J70 Control Unit in Rack
4772	3494 Models D22, D24, L22	Remove E05/J1A tape drive
4800	3494 Models D22, D24, L22	Install Cradle Pair
4801	3494 Models D22, D24, L22	Remove Cradle Pair
4803	3494 Models D22, D24, L22	Reinstall Cradle Pair

Table 29: Feature codes for J70 control units and associated features (continued)		
Feature Code	**Machine Type/Model**	**Description**
4855	3494 Models D14, D24	Field Install J70 Controller in 3494
4860	3590 Model A14, 3494 D14/D24	Replace Controller with a J70 Controller
4865	3494 Model D14/D24	Remove J70 Controller from a 3494 Model D14/D24 Frame
4868	3590 Model A14	Field Install J70 Controller in a 3590 Model A14 Frame
4887	J70 Controller	Reinstall 2 Gb Fibre Channel Switch
4889	J70 Controller, 3953 F05	Reinstall 2 Gb Fibre Channel Switch in 3953 F05 frame
4890	J70 Controller, 3953 F05	Reinstall 2109 F16 Fibre Channel Switch in 3953 F05 frame
4897	J70 Controller	Reinstall 4 Gb Fibre Channel Switch
5593	J70 Controller	Router for EKM attach
5595	J70 Controller	Control Unit Encryption configuration / Field
9000	J70 Controller	Attach to System z
9059	J70 Controller	J70 Controller to 3590 Attachment
9060	J70 Controller	Multiframe SCSI A14
9476	J70 Controller	J1A tape drive Attached to Controller
9477	J70 Controller	3592 Drive Attached to J70 Controller
9491	J70 Controller, 3494 Model D22/D24/L22	External Fabric Support/Plant (Withdrawal from marketing announced May 9, 2006)
9595	J70 Controller	Control Unit Encryption configuration / Plant
9673	3494 Models D22, D24, L22	Factory Install J1A tape drive
9676	3494 Models D22, D24, L22	Factory Install E05 Drive
9865	J70 Controller, 3494 Model D14, D24	Field Merge J70 Controller in a 3494 Model D14/D24 Frame
9866	J70 Controller, 3494 Model D14, D24	Plant Install J70 Controller in a 3494 Model D14/D24 Frame
9867	J70 Controller, 3590 Model A14	Plant Install J70 Controller in a 3590 Model A14 Frame
9868	J70 Controller, 3590 Model A14	Field Merge J70 Controller in a 3590 Model A14 Frame
9875	J70 Controller	Field Merge J70 Controller in a 3953 Model F05 Frame
9876	J70 Controller	Plant Install J70 Controller in a 3953 Model F05 Frame (Withdrawal from marketing announced May 9, 2006)
9877	J70 Controller	Field Install J70 Controller in 3952 F05

Table 29: Feature codes for J70 control units and associated features (continued)		
Feature Code	**Machine Type/Model**	**Description**
Note: For more information on 3590 Model A14 features, refer to the *IBM Enterprise Tape System 3590 Introduction and Planning Guide*, GA32-0329. For more information on 3494 Model frame features, refer to the *IBM 3494 Tape Library Introduction and Planning Guide*, GA32-0448. For more information on 3953 Model F05 features, refer to the *IBM 3953 Tape Frame Model F05 and Library Manager Model L05 Introduction and Planning Guide*, GA32-0472.		

J70 Controller and associated frame feature descriptions

Functional Enhancement Field (FC 0520)

This feature provides a microcode upgrade to the J70 Controller to support:

- The Enterprise Tape Cartridge 3592 Extended. You must update controller microcode installed before December 8, 2006.
- The non-disruptive addition of 3592 drives to an installed and operating J70 Controller. This feature must be added to any J70 Controller that was shipped prior to October 29, 2004.

This feature, when ordered for both the J70 Controller and the 3494 Lxx frame, provides:

- Application performance and enhancements, including support of WORM capability of the 3592 drives. It is required to utilize WORM and Economy Cartridge capability in any 3592 drives attached to the J70 Controller. This feature must be added to any J70 Controller that was shipped prior to May 21, 2004. If the 3592 controller and 3592 drives are installed in a 3494 library, this feature must also be ordered against the LXX frame to utilize WORM and Economy Cartridges capability. This feature adds support for attachment to the 3953 L05 Library Manager to J70 Controllers shipped before May 27, 2005. Refer to the *IBM Automated Tape Library (3494) Introduction and Planning Guide*, GA32-0448, for additional information on 3494 FC 0520.

3592 Tape Drive-to-Switch Cables (FC 3059)

This feature provides the necessary hardware and a single Fibre Channel cable between a 3592 Tape Drive and a 2 Gb or 4 Gb Fibre Channel Switch or the F16 or S16 model 2109 switch in a rack or frame for connection to a J70 Controller installed in that rack. The number of this feature specified should equal the number of 3592 Tape Drives in the rack or frame attached to the J70 Controller in that rack.

Dual ESCON Host Adapter (FC 3413)

See Table 53 on page 137 for the allowable combinations of FICON/ESCON attachments using features FC 3413, FC 3434, and FC 3435 described below.

This feature installs a dual-ported ESCON adapter for the attachment of 3590 and 3592 tape drives through the J70 Controller. The adapter provides an MT-RJ conformant connector. Each port on the adapter can support up to 64 logical channels and, using ESCON Directors, can be up to 43 kilometers from the host system. Feature conversions are available to convert FC 3413 to FC 3434 or FC 3435. Maximum: Four. Plant or field installation.

For information on ESCON cable features, see “Dual ESCON attachment for 3592 controller cable features” on page 82.

2 Gb FICON Long Wave Attachment (FC 3434)

See Table 53 on page 137 for the allowable combinations of FICON/ESCON attachments using features FC 3413, FC 3434, and FC 3435 described below.

This feature provides one long–wavelength 2 Gb FICON adapter, with LC Duplex Connectors for the attachment of 3590 or 3592 tape drives through the J70 Controller to a FICON host system long–wave channel utilizing a 9–micron single mode fibre cable. Each 2 Gb FICON attachment can support up to 128

logical channels. A feature conversion is available to convert FC 3434 to FC 3435. Maximum: Four. Plant or field installation.

For information on appropriate FICON cable features, see "FICON long-wavelength attachment cable features" on page 84.

2 Gb FICON Short Wave Attachment (FC 3435)

See Table 53 on page 137 for the allowable combinations of FICON/ESCON attachments using features FC 3413, FC 3434, and FC 3435 described below.

This feature provides one short–wavelength FICON adapter, with an LC Duplex connector, for the attachment of the 3590 or 3592 tape drives through the J70 Controller to a FICON host system short–wavelength channel utilizing a 50–micron fibre cable. The total cable length cannot exceed 300 meters. Each 2 Gb FICON attachment can support up to 128 logical channels. A feature conversion is available to convert FC 3435 to FC 3434. Maximum: Four. Plant or field installation.

For information on appropriate FICON cable features, see "FICON short-wavelength attachment cable features" on page 85.

Convert Dual ESCON Host Adapter to 2 Gb LW FICON Adapter (3413 to 3434)

This feature provides for the removal of the ESCON adapter, FC 3413, from the J70 Controller and the replacement with FC 3434, the 2 Gb LW FICON adapter. The ESCON adapter is returned. A FICON cable specify feature should be included with the feature conversion to ship the desired cable option (FC 9700, FC 9752, or FC 9753). Maximum: Four. Field installation only.

For information on appropriate FICON cable features, see "FICON long-wavelength attachment cable features" on page 84.

Convert Dual ESCON Host Adapter to SW FICON Adapter (3413 to 3435)

This feature provides for the removal of the ESCON adapter, FC 3413, from the J70 Controller and the replacement with FC 3435, the 2 Gb SW FICON adapter. The ESCON adapter is returned. A FICON cable specify feature should be included with the feature conversion to ship the desired cable option (FC 9700, FC 9752, or FC 9753). Maximum: Four. Field installation only.

For information on appropriate FICON cable features, see "FICON short-wavelength attachment cable features" on page 85.

Convert 2 Gb LW FICON Host Adapter to 2 Gb SW FICON Adapter (3434 to 3435)

This feature provides for the removal of the 2 Gb LW FICON adapter, FC 3434, from the J70 Controller and the replacement with FC 3435, the 2 Gb SW FICON adapter. The 2 Gb LW FICON adapter is returned. A FICON cable specify feature should be included with the feature conversion to ship the desired cable option (FC 9700, FC 9762, or FC 9763). Maximum: Four. Field installation only.

For information on appropriate FICON cable features, see "FICON short-wavelength attachment cable features" on page 85.

Convert 2 Gb SW FICON Adapter to 2 Gb LW FICON Adapter (3435 to 3434)

This feature provides for the removal of the 2 Gb SW FICON adapter, FC 3435, from the J70 Controller and the replacement with FC 3434, the 2 Gb LW FICON adapter. The 2 Gb SW FICON adapter is returned. A FICON cable specify feature should be included with the feature conversion to ship the desired cable option (FC 9700, FC 9752, or FC 9753). Maximum: Four. Field installation only.

For information on appropriate FICON cable features, see "FICON long-wavelength attachment cable features" on page 84.

SC Fibre Switch Controller in Rack (FC 3465)

Note: The IBM 2109 Model S16 SAN Fibre Channel switch is no longer marketed by IBM.

This feature provides the required mounting hardware and instructions for installing the IBM 2109 Model S16 SAN Fibre Channel switch in the rack, the fibre-switch to controller fibre channel cabling, as well as

the associated ethernet router and ethernet cabling between the controller, router, and fibre switch. The 2109 Model S16 SAN Fibre Channel limits the number of 3592 tape drives which can be attached to the J70 Controller to twelve.

Corequisites:

- IBM 2109 SAN Fibre Channel switch Model S16 must be installed in the rack
- When Model S16 is installed, additional S16 features FC 2010 (Shortwave GBIC) will be required for each 3592 drive in excess of two
- FC 6103 (Power Supply, Additional) which provides an additional redundant power supply enabling dual-power source configurations to minimize power outages should also be present with the 2109 Model S16
- J70 Controller used in the frame and must have feature FC 3483
- Two LC/SC controller-to-switch cables

This feature is mutually exclusive of FC 3475 and FC 3485.

LC Fibre Switch Controller in Rack (FC 3475)

Note: The IBM 2109 Model F16 SAN Fibre Channel switch will no longer be marketed by IBM beginning January 2005.

This feature provides the required mounting hardware and instructions for installing the 2109 Model F16 SAN Fibre Channel switch in the rack, the fibre-switch to controller fibre channel cabling, as well as the associated ethernet router and ethernet cabling between the controller, router, and fibre switch. The 2109 Model F16 SAN Fibre Channel limits the number of 3592 tape drives which can be attached to the J70 Controller to twelve.

Corequisites:

- IBM 2109 SAN Fibre Channel switch Model F16 must be installed in the rack
- When Model F16 is installed, additional F16 features FC 2210 (Shortwave GBIC) will be required for each 3592 drive in excess of six
- FC 6103 (Power Supply, Additional), which provides an additional redundant power supply enabling dual-power source configurations to minimize power outages due to a failed power supply, should also be present with the 2109 Model F16
- J70 Controller used in the frame and must have feature FC 3484
- Two LC/LC controller-to-switch cables

This feature is mutually exclusive of FC 3465 and FC 3485.

Two LC Fibre Drive Adapters (FC 3476)

This feature installs two short-wavelength 2 Gb Fibre Channel adapters with LC connectors in a J70 Controller for attaching up to twelve 3592 Tape Drives when attached through a 2109 SAN Fibre Channel Switch, or sixteen 3592 Tape Drives when attached through a 2 Gb/4 Gb Fibre Channel Switch, or twelve 3590 Tape Drives with Fibre Channel Attachment through a 2109 SAN Fibre Channel Switch or the 2 Gb/4 Gb Fibre Channel Switch. Total cable length from the adapters to the switch cannot exceed 500 meters.

Dual Ported SCSI Drive Adapters (FC 3477)

This feature installs two dual ported ultra SCSI adapters in a J70 Controller for attaching parallel SCSI 3590 drives via the Fast20 protocol. Total cable length from the adapters to the switch cannot exceed 25 meters. Adapter to drive connectivity is provided via daisy chained SCSI bus. Any cards currently placed in the slots for these cards must be removed. A fibre switch feature cannot be installed in the frame. Only 3590 SCSI drives are supported with this adapter. Maximum: One. Plant or field installation.

Two Dual Ported LC Fibre Channel Drive Adapters (FC 3478)

This feature installs two short-wavelength 4 Gb Dual Ported Fibre Channel adapters with LC connectors in a J70 Controller for attaching up to 12 3592 Tape Drives, or 12 3590 Tape Drives with Fibre Channel

Attachment (FC 3510 or FC 9510), through a 2109 SAN Fibre Channel or the 2 Gb/4 Gb Fibre Channel Switch. Total cable length from the adapters to the switch cannot exceed 500 meters. Maximum: One. Mutually exclusive of FC 3477 (Dual-Ported SCSI Drive Adapters) or FC 3476 (Two LC Fibre Channel Drive Adapters). Plant or field installation.

Drive Attach to SC Switch (FC 3483)

In a J70 Controller, this ships controller microcode support for 3590 or 3592 drive attachment through a 2109 Model S16 switch, but does not ship FCP adapters. A fibre switch feature must be installed in the frame, along with fibre drives. This feature is mutually exclusive of FC 3484 and FC 3486. Maximum: One. Plant or field installation.

Drive Attach to LC Switch (FC 3484)

This feature enables attachment of 3592 drives or 3590 H model or E model Tape Drives with Fibre Channel Attachment (features FC 3510 or FC 9510) through a 2109 Model F16. This feature is mutually exclusive with FC 3483 and FC 3486. Maximum: One. Plant or field installation. Corequisites: All attaching 3590 Tape Drives must have either feature FC 3510 or FC 9510.

Fibre Channel Switch Rack Mount Kit (FC 3485)

This feature is ordered against the J70 Controller for stand-alone rack installations.

This feature provides the required hardware to support attachment of 3592 Tape Drives, or 3590 Tape Drives with Fibre Channel Attachment (FC 3510 or FC 9510), through a 2 Gb Fibre Channel Switch (FC 3487 or FC 4887) or a 4 Gb Fibre Channel Switch (FC 3488 or FC 4897) for connection to a J70 Controller in a rack. It includes the mounting hardware and instructions for installing the 2 Gb or 4 Gb Fibre Channel Switch in the rack, including associated Ethernet cabling between the J70 Controller and the switch.

Fibre Channel cables from the 3592 Tape Drives to the switch in the rack with the J70 Controller are included by specifying feature #3059 (one for each tape drive). Fibre Channel cables from the 3590 Fibre Channel Tape Drives to the switch in the rack with the J70 Controller are included by specifying feature #9059 (one for each tape drive). For the multi-rack attachment of 3592 or 3590 Tape Drives in other racks to the switch, the cables should be ordered with the drives.

The switch will operate in 1 Gb mode only if the drives in the environment are 3590 Tape Drives. Plant or field install. Maximum: One. Minimum: None. Prerequisites: FC 4641 plus FC 3487, FC 4887, FC 3488, or FC 4897 must be installed on the J70 Controller.

This feature is mutually exclusive of FC 3465 and FC 3475.

Fibre Channel Switch Mount Kit (FC 3486)

This feature is ordered against either the 3590 Model A14 or the 3494 Model D14 or D24.

This feature provides the mounting hardware for the 2 Gb or 4 Gb Fibre Channel Switch on the 3590 Model A14 Frame or the 3494 Model D14 or D24 that contains a J70 Controller that supports attachment of 3590 Tape Drives with Fibre Channel Attachment (FC 3510 or FC 9510) or 3592 tape drives. It includes the required mounting hardware and instructions for installing a 2 Gb or 4 Gb Fibre Channel Switch in the 3590 Model A14 or the 3494 Model D14 or D24, including associated Ethernet router and cabling between the J70 Controller and the switch in the 3590 Model A14 or the 3494 Model D14 or D24. Up to twelve 3590 Tape Drives in three Model A14 Frames can be attached to the J70 Controller. Up to 10 3590 Tape Drives in the two 3494 adjacent frames can be attached to the J70 Controller. Up to 16 3592 tape drives in a 3494 Model D24/D22/L22 combination can be attached to the J70 Controller.

Plant or field install. Maximum: One. Minimum: None. Prerequisites: FC 3487 or FC 4887 or FC 3488 or FC 4897 must be installed on the J70 Controller. FC 3486 is mutually exclusive of 3494 frame features FC 3464, FC 3474, FC 4060, FC 4064, FC 4065, FC 4074, FC 4075, FC 4084, and FC 4085, and with J70 Controller features FC 3483 and FC 3484.

2 Gb Fibre Channel Switch (FC 3487) (Withdrawal from marketing announced May 9, 2006)

This feature is ordered against the J70 Controller.

This feature provides a 2 Gb Fibre Channel Switch with 20 LC Shortwave ports for attachment of up to 16 3592 Tape Drives or 12 3590 Tape Drives to a J70 Controller. Hardware errors detected on the switch are managed by the J70 Controller. The 2 Gb Fibre Channel Switch has dual power connection for attachment to separate power supplies and fully populated with twenty GBICs. Intermix of 3590 and 3592 Tape Drives is not allowed. Intermix of 2 Gb Fibre Channel Switch FC 3487 and the 4 Gb Fibre channel Switch FC 3488 is not allowed.

Plant or field install. Maximum: Two. Minimum: None. The Fibre Channel Switch types attached to the J70 Controller must be the same 2 Gb or 4 Gb and cannot be intermixed. Prerequisites: FC 3476 or FC 3478 must be installed on the J70 Controller, and this feature is mutually exclusive of FC 3483, FC 3484, FC 3488, FC 3491, and FC 9491.

4 Gb Fibre Channel Switch (FC 3488)

This feature is ordered against the J70 Controller.

This feature provides a 4 Gb Fibre Channel Switch with 20 LC Shortwave ports for attachment of up to 16 3592 Tape Drives or 12 3590 Tape Drives to a J70 Controller. Hardware errors detected on the switch are managed by the J70 Controller. The 4 Gb Fibre Channel Switch has dual power connection for attachment to separate power supplies and fully populated with twenty GBICs. Intermix of 3590 and 3592 Tape Drives is not allowed. Intermix of 2 Gb Fibre Channel Switch FC 3487 and the 4 Gb Fibre channel Switch FC 3488 is not allowed.

Plant or field install. Maximum: Two. Minimum: None. Prerequisites: FC 3476 or FC 3478 must be installed on the J70 Controller, and this feature is mutually exclusive of FC 3483, FC 3484, FC 3487, FC 3491, and FC 9491.

Redundant FC Rack Attach (FC 3489)

This feature is ordered against the J70 Controller for stand-alone rack installations.

This feature provides the mounting hardware and instructions for installing a second 2 Gb or 4 Gb Fibre Channel Switch in the rack.

Plant or field install. Maximum: One. Minimum: None.Prerequisites: FC 3485 on the J70 Controller. A second FC 3487 or FC 4887 or FC 3488 or FC 4897 on the J70 Controller is required.

Redundant Fibre Channel Attach (FC 3490)

This feature is ordered against either the 3590 Model A14 or the 3494 Model D14 or D24.

This feature provides the mounting hardware and instructions for installing a second 2 Gb or 4 Gb Fibre Channel Switch in the 3590 Model A14 Frame or 3494 Model D14 or D24.

Plant or field install. Maximum: One. Minimum: None. Prerequisites: FC 3486 must be installed.

External Fabric Support Field (FC 3491)

This feature is ordered against the J70 Controller **and** either the 3494 Model D22, D24, or L22.

This feature on the controller and on the 3494 frame indicates that E05 or J1A tape drive will be connected to the J70 Controller through an external customer-supplied Fibre Channel switch or directly to the controller. One or two 3592 tape drives can be directly attached to the J70 Controller. FC 3059 should be ordered for each drive. (This feature is not supported on a frame with a 3590 Model A60 Controller.)

For the most recent list of 3592-supported Fibre Channel switches, please visit the IBM Support Portal.

The customer is responsible for providing the cables from the J70 Controller to a customer-supplied Fibre Channel switch. (Cables from the switch or controller to the 3592 tape drives can be ordered with the 3592 tape drives or supplied by the customer.)

Field install only. Maximum: One. Minimum: None. Prerequisites: FC 3476 or FC 3478 must be specified on the J70 Controller. This feature is mutually exclusive of FC 3483, FC 3484, FC 3487, FC 3488, FC 4887, FC 4897, FC 9491 on the J70 Controller, and is mutually exclusive of FC 3486, FC 4065, FC 4075, FC 4085, and FC 9491 on the frame(s).

Multiframe SCSI Rack Attach (FC 4065)

This feature includes cables to connect the J70 Controller to tape drives in the second rack, and necessary drive-to-drive interconnection cables in that rack. Because of SCSI cable length restrictions, the two racks must be installed adjacent to each other. This feature is mutually exclusive with FC 3465, FC 3475, FC 3483, FC 3484, and FC 3485.

Multiframe 2 Gb 3590 (FC 4084)

This feature is ordered against either the 3590 Model A14 or the 3494 Models D12 or L12.

This feature provides the hardware and installation instructions to support attachment of 3590 Tape Drives with Fibre Channel Attachment (FC 3510 or FC 9510) in a 3590 Model A14 Frame or a 3494 Model D12 or L12 Frame to a J70 Controller in a different Model A14 Frame or adjacent 3494 Model D14 Frame. This feature allows for a Fibre Channel cable from each tape drive to the 2 Gb or 4 Gb Fibre Channel Switch in the Model A14 Frame or 3494 Model D14 Frame with the J70 Controller to be included based on the number of drives installed in this frame. The distance between the Model A14 Frames in this multiframe fibre configuration must be no more than 7 meters (23 feet). If another controller is installed in this Model A14 Frame, that controller will be non-functional. Maximum: Two. Minimum: None. Plant or field installation. One FC 3487 or FC 4887, or FC 3488 or FC 4897 must be ordered on the J70 Controller in the adjacent frame for each of these features ordered. Order one FC 4084 if the 3494 Model D14 has FC 3486 only, two if the Model D14 has FC 3486 and FC 3490. This feature is mutually exclusive of frame features FC 3464, FC 3474, FC 4060, FC 4062, FC 4064, FC 4074, and FC 9062.

Adjacent Frame Fibre Channel 3592 (FC 4085)

This feature is ordered against either the 3494 Model D22 or L22.

This feature provides the hardware and installation instructions to support attachment of 3592 Tape Drives in a 3494 Model D22 or L22 Frame to a J70 Controller with the 2 Gb or 4 Gb Fibre Channel Switch in an adjacent Model D24 Frame. Up to 16 3592 Tape Drives can be attached to the J70 Controller, up to eight in the Model D24 Frame and up to four in the Model L22 or eight in the Model D22 Frame. When FC 4085 is ordered against a 3494 Model L22 or D22 frame, the correct number of 3592 Drive-to-Switch cables for the 3494 Model L22 or D22 frame is provided, based on the number of 3592 tape drives ordered against the 3494 Model D22 or L22 frame. Maximum: Two. Minimum: None. Plant or field installation. One FC 3487 or FC 4887 or 3488 or 4897 must be ordered on the J70 Controller in the adjacent frame for each of these features ordered. Order one FC 4085 if the 3494 Model D24 has FC 3486 only, two if the Model D24 has FC 3486 and FC 3490. This feature is mutually exclusive of FC 3491, FC 4065, FC 4075, and FC 9491.

Install J70 Control Unit in Rack (FC 4641)

This feature provides the rack mounting hardware to install a J70 Controller in a rack. Field installation only.

Replace Controller with an IBM 3592-J70 Controller (FC 4860)

This feature is required to provide the mounting changes to replace a 3590 Model A60 controller with a J70 Controller in a currently installed 3494 Model D14/D24 or 3590 Model A14 frame. Maximum: One. Field installation only.

Remove J70 Controller from a 3494 Model D14/D24 Frame (FC 4865)

This feature allows the field removal of a J70 Controller from an installed 3494 Model D14/D24 frame. This feature is for currently installed units only. All tape drives in the 3494 Model D14/D24 frame and their associated features must also be removed. Maximum: One. Field removal only.

Field Install J70 Controller in a 3590 Model A14 Frame (FC 4868)

This feature is required to provide the mounting hardware to add a J70 Controller to a currently installed 3590 Model A14 frame. This feature is not available if FC 9012 is installed. Maximum: One. Field installation only.

Reinstall 2 Gb Fibre Channel Switch (FC 4887)

This feature is ordered against the J70 Controller.

This feature is the same as FC 3487, but allows the customer to provide a 2 Gb Fibre Channel Switch (FC 3487) that was removed from a J70 Controller or a 3953 Model F05 and reinstall it for attachment to a J70 Controller.

Field install only. Maximum: Two. Minimum: None. Prerequisites: FC 3476 or FC 3478 on the J70 Controller. This feature is mutually exclusive of FC 3483, FC 3484, FC 3491, and FC 9491.

Reinstall 4 Gb Fibre Channel Switch (FC 4897)

This feature is ordered against the J70 Controller.

This feature is the same as feature #3488 but allows the customer to provide a 4 Gb Fibre Channel Switch feature (#3488) that was removed from a J70 Controller or a 3953 Model F05 and reinstall it for attachment to this J70 Controller.

Field install only. Maximum: Two. Minimum: None. Prerequisites: FC 3476 or FC 3478 on the J70 Controller. This feature is mutually exclusive of FC 3483, FC 3484, FC 3491, and FC 9491.

Router for EKM attach (FC 5593)

This feature provides two routers for redundant paths between the Encryption Key Manager and the tape controller through the customer network. Ethernet cables from the routers to the tape controller are also provided.

This feature is only supported with encryption capable IBM TS1120 Model E05 tape drive, IBM TS1130 Model E06/EU6 tape drive, IBM TS1140 Model E07 tape drive, and IBM TS1150 Model E08 tape drives. Not valid with IBM Model J1A tape drives or IBM TotalStorage 3590 Tape Drives.

Maximum: seven. Prerequisites: FC 4641, FC 5247. Plant or field installed. Mutually exclusive of FC 5247 and FC 5248.

Control unit encryption configuration / field (FC 5595)

Provides encryption configuration and reconfiguration support of the control unit attached tape drives. The first time FC 5595 is ordered, it will ship the minimum level control unit microcode required. The minimum level Library Manager microcode will also be supplied if the control unit is not in a customer rack solution (FC 4641). For inband encryption, no other control unit features are required. For out-of-band encryption, FC 5593 is required on the C06 or J70 Controller, the Tape Frame (3952 Model F05 or 3953 Model F05), the Library Manager Frame (3494 Model Lxx or the 3590 C10 frame) to provide a path through the router to the EKM.

Maximum: 99. Field installation only. Mutually exclusive of FC 9595.

This feature is only supported with encryption capable E05 tape drives. It is not valid with J1A or 3590 tape drives.

Attached to zSeries (FC 9000)

No power cords need be specified for the tape controller. It comes with a short cord that plugs into the 3952 Tape Frame, 3953 F05 Frame, or rack, and takes advantage of the external power cord of the box in which it is installed.

J70 Controller to 3590 Attachment (FC 9059)

This feature provides the necessary hardware and a single cable to connect a 3590 tape drive in a 3494 Model D14 frame, 3590 Model A14 frame, or stand-alone rack to a J70 Controller installed in that frame or rack. One of these features should be specified for each 3590 tape drive attached to the J70 Controller in that frame or rack. Maximum: Four. Plant or field installation.

Multiframe SCSI A14 (FC 9060)

This feature is required on the J70 Controller to support SCSI multiframe attachment of up to eight 3590 tape drives in two different 3590 Model A14 frames. This feature must be on both the J70 Controller and the 3590 Model A14 frame containing the J70 Controller. Maximum: One. Plant or field installation.

3592 Drive Attached to Controller (FC 9476)

This feature provides controller support for J1A tape drives for all environments. This feature is mandatory for any A60 or J70 Controller attaching 3592 drives. Maximum: One. Plant or field installation.

3592 Tape Drive attached to J70 Controller (FC 9477)

This feature is required on all J70 Controllers that will have a J1A or E05 tape drive attached to the J70 Controller. Maximum: one. This feature is mutually exclusive of Feature FC 9476.

External Fabric Support/Plant (FC 9491) (Withdrawal from marketing announced May 9, 2006)

This feature is ordered against the J70 Controller **and** either the 3494 Model D22, D24, or L22.

This feature on the controller and on the 3494 frame indicates that 3592 tape drives will be connected to the J70 Controller through an external customer-supplied Fibre Channel switch or directly to the controller. One or two 3592 tape drives can be directly attached to the J70 Controller. FC 3059 should be ordered for each drive. (This feature is not supported on a frame with a 3590 Model A60 Controller.)

For the most recent list of J70-supported Fibre Channel switches, please visit the IBM Support Portal.

The customer is responsible for providing the cables from the J70 Controller to a customer-supplied Fibre Channel switch. (Cables from the switch or controller to the J1A tape drives can be ordered with the 3592 tape drives or supplied by the customer.)

Plant install only. Maximum: One. Minimum: None. Prerequisites: FC 3476 or FC 3478 must be specified on the J70 Controller. This feature is mutually exclusive of FC 3483, FC 3484, FC 3487, FC 3488, FC 3491, FC 4887, and FC 4897 on the J70 Controller, and is mutually exclusive of FC 3486, FC 3491, FC 4065, FC 4075, and FC 4085 on the frame(s).

Control unit encryption configuration / plant (FC 9595)

Provides encryption configuration and reconfiguration support of the control unit attached tape drives. This feature will ship the minimum level control unit microcode required. The minimum level Library Manager microcode will also be supplied if the control unit is not in a customer rack solution (FC 4641). For inband encryption, no other control unit features are required. For out-of-band encryption, FC 5593 is required on the C06 or J70 Controller, the tape frame (3952 Model F05 or 3953 Model F05), the Library Manager frame (3494 Model Lxx or the 3590 C10 frame) to provide a path through the router to the EKM.

Maximum: one. Plant installation only. Mutually exclusive of FC 5595.

This feature is only supported with encryption capable E05, E06, or E07 tape drives. It is not valid with J1A or 3590 tape drives. The E07 tape drives are only supported with the C06 Controller while in the encryption enabled mode.

Field Merge J70 Controller in a 3494 Model D14/D24 Frame (FC 9865)

This feature allows the field merge of a J70 Controller in a 3494 Model D14 or D24 frame. This feature notifies the factory to leave a mounting slot available for a field merge of a J70 tape control unit prior to completion of installation. FC 9865 must also be ordered on both the J70 Controller and the frame. Maximum: One. This applies to the sum of features FC 4660, FC 4665, FC 4855, FC 4860, FC 5266, FC 9665, FC 9666, FC 9865, and FC 9866. Plant installation only.

Plant Install IBM 3592-J70 Controller in a 3494 Model D14/D24 Frame (FC 9866)

This feature factory installs a J70 Controller in a new 3494 Model D14 or D24 frame from the plant. FC 9866 must be ordered on both the J70 Controller and the frame. Maximum: One. This applies to the sum of features FC 4660, FC 4665, FC 4855, FC 4860, FC 5266, FC 9665, FC 9666, FC 9865, and FC 9866. Plant installation only.

Plant Install IBM 3592-J70 Controller in a 3590 Model A14 Frame (FC 9867)

This specify feature factory installs a new J70 Controller into a new 3590 Model A14 frame from the plant. This feature must appear on both the J70 Controller and Model A14 orders. Maximum: One. Plant installation only

Field Merge IBM 3592-J70 Controller in a 3590 Model A14 Frame (FC 9868)

This specify feature notifies the plant that a J70 Controller will be field merged into a 3590 Model A14 frame coming from the plant, as part of the final customer installation. Maximum: One. Plant installation only.

Field Merge IBM 3592-J70 Controller in a 3953 Model F05 Frame (FC 9875)

This specify feature notifies the plant that a J70 Controller will be field merged into a new 3953 Model F05 frame coming from the plant, as part of the final customer installation. This feature requires that FC 5875, Field Merge J70 Controller in a 3953 Model F05 Frame, be ordered against the 3953 F05 frame. In a 3584 tape library, it is recommended that up to four drives be set as control paths for each logical library. See the *IBM 3953 Tape Frame Model F05 and Library Manager Model L05 Introduction and Planning Guide*, GA32-0472, for any additional requirements. Maximum: One. Plant installation only.

Plant Install IBM 3592-J70 Controller in a 3953 Model F05 Frame (FC 9876) (Withdrawal from marketing announced May 9, 2006)

This specify feature factory installs a new J70 Controller into a new 3953 Model F05 frame from the plant. This feature requires that FC 5876, Plant Install J70 Controller in a 3953 Model F05 Frame, be ordered against the 3953 F05 frame. In a 3584 tape library, it is recommended that up to four drives be set as control paths for each logical library. See the *IBM 3953 Tape Frame Model F05 and Library Manager Model L05 Introduction and Planning Guide*, GA32-0472, for any additional requirements. Maximum: One. Plant installation only.

Field Install J70 Controller in 3952 F05 (FC 9877)

The feature notifies the plant that a J70 Controller will be field merged or field installed into a 3952 Model F05 Frame. One Field Merge J70 Controller feature (FC 5875) or one Field Install J70 Controller feature (FC 5877) must also be ordered on the 3952 Model F05.

Maximum: one. Prerequisites: FC 3476 (Two LC Fibre Channel Drive Adapters), or feature FC 3478 (Two Dual-Ported LC Fibre Channel Drive Adapters), and feature FC 5245 (Dual Path Attachment), and one IBM TotalStorage Master Console or TS3000 System Console feature (FC 2713, FC 2714, FC 2715, or FC 2720)

Mutually exclusive of FC 4641, FC 9861, FC 9862, FC 9865, FC 9866, FC 9867, FC 9868, FC 9875, FC 9876.

Field Merge IBM 3592-J70 Controller in a 3952 Model F05 Frame (FC 9895)

This specify feature notifies the plant that a J70 Controller will be field merged into a new 3952 Model F05 frame coming from the plant, as part of the final customer installation. This feature requires that FC 5877, Field Install J70 Controller in a 3952 Model F05 Frame, be ordered against the 3952 F05 frame. In a 3584 tape library, it is recommended that up to four drives be set as control paths for each logical library. See the *IBM 3953 Tape Frame Model F05 and Library Manager Model L05 Introduction and Planning Guide*, GA32-0472, for any additional requirements. Maximum: One. Plant installation only.

Plant Install IBM 3592-J70 Controller in a 3952 Model F05 Frame (FC 9896)

This specify feature factory installs a new J70 Controller into a new 3952 Model F05 frame from the plant. In a 3584 tape library, it is recommended that up to four drives be set as control paths for each logical library. See the *IBM 3953 Tape Frame Model F05 and Library Manager Model L05 Introduction and Planning Guide*, GA32-0472, for any additional requirements. Maximum: One. Plant installation only.

Service/Call Home features

Note: FC 2710, FC 2711, and FC 2712 for the J70 Controller are no longer marketed by IBM beginning in January 2005.

Table 30: Feature codes for Service/Call Home Features

Category	Feature Code	Description
Service/Call Home	2710	Remote Support Facility
	2711	Remote Support Switch
	2712	Remote Support Attachment
	2713	Master Console for Service (Withdrawal from marketing announced May 9, 2006)
	2714	Console Expansion
	2715	Console Attachment
	2719	TS3000 System Console Upgrade
	2720	TS3000 System Console (withdrawn)
	2722	TS3000 System Console

Remote Support features

The following features are to provide rapid diagnostic and remote support capability. The same modem and switch may be shared between the following units:

- 3494 Model AX0, B10, B16, B18, B20, L10, L12, L14, L22, and HA1
- VTC in a 3494 Model CX1
- C06 Controller
- IBM 3592-J70 Controller
- 3590 Model A60, A50, or A00
- 3490 Model F1A (or FC 0) Control Unit (FC 3000 or 3500)

One of the following three features should be selected based on the number of units in the installation.

Remote Support Facility (FC 2710)

Note: FC 2710 is no longer marketed by IBM beginning in January 2005.

This feature supplies a cable and connectors for attachment to an IBM supplied modem which enables remote diagnostic support. This feature should only be specified on the first unit in an installation. Each J70 Controller must specify only one of features FC 2710, FC 2711, or FC 2712. Plant or field installation.

Remote Support Switch (FC 2711)

Note: FC 2711 is no longer marketed by IBM beginning in January 2005.

This feature provides a switch, cables, and connectors for the attachment of units through the switch to a modem. It should be ordered on the second unit in an installation. One switch should be specified for every set of fourteen units in an installation site. Each J70 Controller must specify one of features FC 2710, FC 2711, or FC 2712.

Remote Support Attachment (FC 2712)

Note: FC 2712 is no longer marketed by IBM beginning in January 2005.

This feature provides an additional cable and connector to attach to the Remote Support Switch (FC 2711). It should be ordered on the third through fourteenth unit attached to the Remote Support Switch in an installation site. Each J70 Controller must specify one of features FC 2710, FC 2711, or FC 2712. Plant or field installation.

IBM master console features

The following features FC 2713, FC 2714, FC 2715, FC 2719, FC 2720, and FC 2722 provide connection to an IBM Master Console to enable enhanced remote support to improve availability and enable early detection of problems and unusual conditions. The 3953-F05 FC 2721 may be used in place of FC 2722. The master console enables remote monitoring of each attached unit to expedite microcode updates, reduce service times, and enhance local service. The same master console may be shared among the following units:

- 3494 Model L10, L12, L14, L22, AX0, B10, B18, B20, and HA1
- VTC in a 3494 Model CX1
- TS7700 Virtualization Engine
- C06 Controller
- J70 Controller
- 3590 Model A60
- TS3500 tape library

To connect a J70 Controller to an IBM Master Console, one of the following three features must be selected on the J70 Controller based on the number of units attached to that master console facility in the installation.

Master Console for Service (FC 2713) (Withdrawal from marketing announced May 9, 2006)

This feature provides the IBM TotalStorage Master Console, an Ethernet switch and a cable and connectors for connecting one of the above units to an IBM supplied modem to enable remote enhanced service. This feature should be specified on the first unit in an installation connected to a master console facility. The Ethernet switch provides 14 additional connections for cables supplied with feature FC2714 or FC2715. This is an optional feature on the J70 Controller. Maximum: One of FC2713, FC2714, or FC2715. A maximum of one of feature FC2714 may be connected to the Master Console For Service feature FC2713. Plant or field installable.

One of FC 2713, FC 2714, or FC 2715 is required. Plant or field installable.

Console Expansion (FC 2714)

This feature provides an attachment cable for connection of a TS3000 System Console (TSSC) and an Ethernet switch for expanding the number of units that can be attached to the TSSC, or Master Console for Service. Up to 14 additional connections are provided by this feature for connection of FC 2715 or another FC 2714. FC 2714 can attach to any existing FC 2721, FC 2722, or FC 2732.

A minimum of one FC 2714, FC 2715, or FC 2732 is required. A maximum of one other Console Expansion (FC 2714) can be connected to the Ethernet switch provided by this feature FC 2714. A maximum of two of feature FC 2714 may be included in a single TS3000 System Console facility (providing a total maximum of 43 unit connections). Plant or field installable.

Console Attachment (FC 2715)

This feature provides a cable to attach a unit to the Ethernet switch provided by the TS3000 System Console, or Master Console For Service, or Console Expansion (FC 2714). A maximum of 40 of feature FC 2715 may be included in a single TS3000 System Console facility. FC 2715 can attach to any existing FC 2721, FC 2722, or FC 2732.

Minimum: one of FC 2714, FC 2715, or FC 2732 is required. Maximum: one of FC 2714, FC 2715, or FC 2732. Plant or field installable.

TS3000 System Console Upgrade (FC 2719)

This feature provides a memory upgrade to 2.1 GB (2 GiB) total RAM and a second ethernet card for the Service Console to allow redundant connections into the service network. This feature only applies to consoles shipped with FC 2718, FC 2720 and 3953-F05 FC 2721.

TS3000 System Console (FC 2720) (withdrawn)

This feature provides the enhanced TS3000 System Console, an Ethernet switch, and a cable and connectors for connection of one of the above units to an IBM supplied modem to enable remote enhanced service. This feature should be specified on the first unit in an installation connected to a TS3000 System Console facility. The Ethernet switch provides 14 additional connections for cables supplied with feature FC 2714 or FC 2715.

A minimum of one FC 2714, FC 2715, or FC 2720 is required. A maximum of one FC 2714 may be connected to FC 2720. FC 2720 Plant or field installable. The 3953-F05 FC 2721 may be used in place of FC 2720 (FC 2714 or FC 2715 still required on controller).

TS3000 System Console (FC 2722)

This feature provides the enhanced TS3000 System Console, an Ethernet switch, and a cable and connectors for connection of one of the above units to an IBM supplied modem to enable remote enhanced service. This feature should be specified on the first unit in an installation connected to a TS3000 System Console facility. The Ethernet switch provides 14 additional connections for cables supplied with feature FC 2714 or FC 2715.

A minimum of one FC 2714, FC 2715, or FC 2722 is required. A maximum of one FC 2714 may be connected to FC 2722. FC 2722 Plant or field installable. The 3953-F05 FC 2721 may be used in place of FC 2722 (FC 2714 or FC 2715 still required on controller).

Fibre Channel environments and their feature codes

This section specifies feature for each of the following four fibre channel environments:

- “Features for the Fibre Channel Switches” on page 70
- “Features for external fabric support” on page 73
- “Features for the IBM Storage Area Network Switch Model F16” on page 73
- “Features for the IBM SAN switch Model S16” on page 75

Note that you cannot mix attachment of 3592 and 3590 drives or different models of 3590 drives on the same controller.

For more details on the adapter and attachment features indicated below, see Table 29 on page 56.

Features for the Fibre Channel Switches

When a 2 Gb or 4 Gb Fibre Channel Switch is used, all mounting hardware, twenty GBICs, dual power, and cooling fans are installed. The following requirements apply in the specified environments:

IBM 3592-J70 Controller requirements

The following requirements apply when installing a J70 Controller with a 2 Gb or 4 Gb Fibre Channel Switch.

- **2 Gb Fibre Channel Switch (FC 3487)** or **Reinstall 2 Gb Fibre Channel Switch (FC 4887)** must be specified on the J70 Controller. Two FC 3487s or two FC 4887s can be installed for redundancy.

or

- **4 Gb Fibre Channel Switch (FC 3488)** or **Reinstall 4 Gb Fibre Channel Switch (FC 4897)** must be specified on the J70 Controller. Two FC 3488s or two FC 4897s can be installed for redundancy.

and

- **Two LC Fibre Drive Adapters (FC 3476)** or **Two Dual Ported LC Fibre Drive Adapters (FC 3478)** must be specified for each installed J70 Controller.
- **E05/J1A tape drive Attached to Controller (FC 9477)** must be specified on the J70 Controller if attaching 3592 drives.

Rack requirements

The following features are required when installing the J70 Controller in a rack environment with a 2 Gb or 4 Gb Fibre Channel Switch:

- **Install Controller in a Rack (FC 4641)** must be specified.
- **Fibre Channel Switch Rack Mount Kit (FC 3485)** provides the hardware for installing the 2 Gb or 4 Gb Fibre Channel Switch in the rack and cables from the J70 Controller to the switch. Up to sixteen 3592 tape drives can be attached to a single J70 Controller with this feature. Up to twelve 3590 tape drives (in up to three racks) can be attached to a single J70 Controller with this feature.
- **Redundant FC Rack Attach (FC 3489)** provides the mounting hardware and instructions for installing a second 2 Gb or 4 Gb Fibre Channel Switch in the rack. Any two of the following four features must be installed for FC 3489: FC 3487, FC 4887, FC 3488, FC 4897. Intermixing of 2 Gb or 4 Gb switches is not allowed on the J70 Controller.
- **3592 Tape Drive-to-Switch Cables (FC 3059)** (see "3592 Tape Drive-to-Switch Cables (FC 3059)" on page 59) must be specified on the J70 Controller for each 3592 tape drive attached to the J70 Controller with the 2 Gb or 4 Gb Fibre Channel Switch in the rack.
- One feature **3590 Tape Drive Attached (FC9059)** must be specified on the J70 Controller for each 3590 tape drive attached to the J70 Controller in the rack that contains the J70 Controller.

3592 tape drives in a stand-alone rack

The following feature is required when installing 3592 drives in a stand-alone rack with a 2 Gb or 4 Gb Fibre Channel Switch:

- **LC/LC Fibre Channel Cables (FC 6013, FC 6025, or FC 6061)** must be specified on each tape drive not in the rack with the controller to provide one short-wavelength cable to attach those tape drives to the 2 Gb or 4 Gb Fibre Channel Switch.

3590 tape drives in a stand-alone rack

The following features are required when installing 3590 drives in a stand-alone rack with a 2 Gb Fibre Channel Switch:

- **Fibre Channel Attachment (FC 3510 or FC 9510)** must be specified on each 3590 tape drive.
- **LC/SC Fibre Channel Cables (FC 5913, FC 5922, or FC 5961)** must be specified on each 3590 tape drive not in the rack with the J70 Controller to provide one short-wavelength cable to attach those tape drives to the 2 Gb Fibre Channel Switch.

3590 Model A14 frame features (attaching 3590 tape drives only)

The following features pertain when installing a J70 Controller and attaching 3590 drives in a 3590 Model A14 frame with a 2 Gb or 4 Gb Fibre Channel Switch:

- **FC Switch Mount Kit (FC 3486)** must be specified on the frame that contains the J70 Controller.
- **Redundant FC Attach (FC 3490)** may be added for redundancy. Two FC 3487s, FC 4887s, 3488s, or 4897s must be installed for FC 3490. Intermixing of 2 Gb or 4 Gb switches is not allowed on the J70 Controller.
- **Plant Install Hxx Fibre Drive (FC 9670)** must be specified on the Model A14—one feature for each 3590 Model H11 Tape Drive with FC 9510 (Fibre Channel Attachment) installed in that Model A14 coming from the plant.
- **Plant Install Fibre Drive (FC 9511)** must be specified on the Model A14, instead of feature FC 9663 (Plant Install Drive)—one feature for each 3590 Model E11 Tape Drive with feature FC 9510 (Fibre Channel Attachment) installed in that Model A14 coming from the plant.

- **Adjacent Frame Fibre Channel 3590 (FC 4084)** must be ordered for multiframe fibre attachment. See the *IBM TotalStorage Enterprise Tape System 3590 Introduction and Planning Guide*, GA32-0329.
- One feature **3590 Tape Drive Attached (FC 9059)** must be specified on the J70 Controller for each tape drive attached to the J70 Controller in the Model A14 frame that contains the J70 Controller.
- The maximum distance between Model A14 frames is seven meters.

Enterprise Tape Library 3494 features

The following features pertain when installing a J70 Controller in a 3494 library frame with a 2 Gb or 4 Gb Fibre Channel Switch:

- **FC Switch Mount Kit (FC 3486)** must be specified on the 3494 Model D24 or D14 frame that contains the J70 Controller.
- **Redundant FC Attach (FC 3490)** may be added for redundancy. Two FC 3487s, FC 4887s, 3488s, or 4897s must be installed for FC 3490. Intermixing of 2 Gb or 4 Gb switches is not allowed on the J70 Controller.
- **Adjacent Frame Fibre Channel 3592 (FC 4085)** must be specified on the associated 3494 Model L22 or D22 frame that contains the other 3592 tape drives that will be attached to the J70 Controller. When FC 4085 is ordered against a 3494 Model L22 or D22 frame, the correct number of 3592 Drive-to-Switch cables for the 3494 Model L22 or D22 frame is provided, based on the number of 3592 tape drives ordered against the 3494 Model D22 or L22 frame.
- **Adjacent Frame Fibre Channel 3590 (FC 4084)** must be specified on the associated 3494 Model L12 or D12 frame that contains the other 3590 Fibre Channel tape drives that will be attached to the J70 Controller.
- One **3592 Drive-to-Switch Cables (FC 3059)** must be specified on the J70 Controller for each 3592 tape drive attached to the J70 Controller in the Model D24 frame.
- **Factory Install H1A Fibre Drive (FC 9670)** must be specified on the Model D14—one feature for each 3590 Model H1A Tape Drive with feature FC 9510 (Fibre Channel Attachment) installed in that Model D14 coming from the plant.
- **Factory Install Fibre Drive (FC 9511)** must be specified on the Model D14, instead of feature FC 9663 (Factory Install E1A)—one feature for each 3590 Model E1A Tape Drive with feature FC 9510 (Fibre Channel Attachment) installed in that Model D14 coming from the plant.
- One **3590 Tape Drive Attached (FC 9059)** must be specified on the J70 Controller for each 3590 tape drive attached to the J70 Controller in the Model D14 frame.
- One **Install Fibre Channel Drive (FC 3511)** must be specified on a 3494 Model D12 or L12 frame for each installed tape drive.

3953 F05 Tape Frame features

The following features pertain when installing a J70 Controller in a 3953 F05 Tape Frame:

- **2 Gb Fibre Channel Switch (FC 3487)** provides a 2 Gb Fibre Channel Switch with 20 LC Shortwave ports for attachment to J1A tape drives in a 3584 Tape Library. Two fibre channel switches are recommended for each controller for redundancy, but only one is required. However, if only one switch is installed per controller, it must be installed in the lower of the two positions. This feature can be ordered in any quantity from one to six for each frame. One FC 4888, Fibre Channel Switch Mount Kit, must be ordered for each J70 Controller for which FC 3487 will be ordered.
- **4 Gb Fibre Channel Switch (FC 3488)** This feature provides a 4 Gb Fibre Channel Switch with 20 LC Shortwave ports for attachment to 3592 Tape Drives in the 3584 Tape Library. The 4 Gb Fibre Channel Switch has dual power connection for optional attachment to separate power supplies. For each J70 Controller there is a maximum of two. For each VTS this feature must be ordered in pairs.
- **Fibre Channel Switch Mount Kit (FC 4888)** provides the mounting hardware for the 2 Gb or 4 Gb Fibre Channel Switch in a 3953 F05 Tape Frame that contains one or more J70 Controllers. This feature includes the required mounting hardware, bifurcated power cables, and instructions for installing up to two Fibre Channel Switches in the frame. One FC 4888 must be ordered for each J70 Controller for which FC 3487, FC 3488, FC 4889, or FC 4890 will be ordered.

- **Customer-Supplied 2 Gb Fibre Channel Switch (FC 4889)** allows a 2 Gb Fibre Channel Switch provided by the customer to attach to the 3592 tape drives in a 3584 Tape Library. Two fibre channel switches are recommended for each controller for redundancy, but only one is required. However, if only one switch is installed per controller, it must be installed in the lower of the two positions. This feature can be ordered in any quantity from one to six for each frame. One FC 4888, Fibre Channel Switch Mount Kit, must be ordered for each J70 Controller for which FC 4889 will be ordered.

Features for external fabric support
This section describes the requirements for external fabric support in specified environments.

When connecting 3592 tape drives to a J70 Controller using external fabric, the following requirements apply in the specified environments:

3592 Controller zoning requirements

When using a supported, customer-supplied Fibre Channel director (see "Fibre Channel switches for the C06 and J70 Controllers" on page 20), connectivity is through 2 Gb or 4 Gb multimode ports. Supported directors can be connected to single or dual ports on the 3592 tape drives. Each director must be zoned to ensure the only devices in the zone are the controller and 3592 tape drives. Up to two zones can be configured per controller in order to provide failover in the event of a controller adapter, director, blade or port failure. This requires each controller adapter (FC 3478) to be connected to a separate zone and each 3592 tape drive port connected to those separate zones. The cables from the controller to the director and from the director to the tape drives can be ordered against the 3592 tape drives.

Limited configurations

For limited configurations, four 3592 drives can be attached to a controller using direct connect support. One FC 3061 must be ordered for each 3592 drive. To attach additional drives, any of the Fibre Channel options can be ordered (see "Fibre Channel switches for the C06 and J70 Controllers" on page 20). Additional drives may be added later via any of the other switch options.

IBM 3592-J70 Controller requirements

The following requirements apply when connecting J1A and E05 tape drives to a J70 Controller using external fabric:

- **Two LC Fibre Drive Adapters (FC 3476)** or **Two Dual Ported LC Fibre Drive Adapters (FC 3478)** must be specified for each installed J70 Controller.
- **J1A/E05 tape drive Attached to Controller (FC 9477)** must be specified on the J70 Controller.
- Either **External Fabric Support Field (FC 3491)** or **External Fabric Support Plant (FC 9491)** must be specified on the J70 Controller.

Enterprise Tape Library 3494 features

The following requirements apply when connecting J1A tape drives to a J70 Controller using external fabric in a 3494 environment:

- Either **External Fabric Support Field (FC 3491)** or **External Fabric Support Plant (FC 9491)** must be specified on the D24, and D22 or L22 adjacent frames.

Features for the IBM Storage Area Network Switch Model F16
This section describes the requirements for using the 2109 storage area network (SAN) Fibre switch Model F16.

Note: The IBM 2109 SAN Fibre switch Model F16 is longer marketed by IBM.

When a Model F16 SAN switch is used, the following requirements and features apply:

IBM 3592-J70 Controller requirements

The following requirements apply when installing an IBM 3592-J70 Controller with a Model F16 SAN switch.

- **J1A tape drive Attached to Controller (FC 9476)** must be specified on the J70 Controller if attaching 3592 drives.
- **Two LC Fibre Channel Drive Adapters (FC 3476)** and **Fibre Drive Attached LC Switch (FC 3484)** are required on the J70 Controller when attaching 3592 or 3590 tape drives with a 2109 Model F16 switch.

2109 SAN Fibre switch Model F16 requirements

One 2109 Model F16 is required for each J70 Controller attaching 3592 tape drives. Each 2109 Model F16 switch comes standard with eight shortwave Gigabit Interface Convertors (GBICs), enough to connect to the two J70 Controller Fibre Channel Attachments and up to six 3592 or 3590 tape drives. Additional features that may be ordered include:

- **Additional Shortwave Transceiver (FC 2210)**, which provides one additional GBIC. It must be ordered when more than six 3592 or 3590 tape drives will be attached to the J70 Controller. The quantity of this feature should equal at least the number of tape drives attached to the J70 Controller beyond six. (For example, to attach ten 3592 Fibre Channel tape drives to a J70 Controller, a minimum of four feature FC 2210 must be ordered.)
- **Power Supply, Additional (FC 6203)**, which provides an additional redundant power supply enabling dual-power source configurations to minimize power outages.
- **Non-Rack Install (FC9205)** should **not** be specified.

Rack requirements
This topic describes the requirements for installing the J70 Controller in a rack environment with a 2109 Model F16 switch.

The following features are required when installing the J70 Controller in a rack environment with a 2109 Model F16 switch:

- **Install Controller in a Rack (FC 4641)** must be specified.
- **LC Fibre Drive Attached Rack (FC 3475)** provides mounting hardware for the 2109 Model F16 in the rack and cables from the J70 Controller to the 2109.
- One feature **3592 Tape Drive-to-Switch Cables (FC 3059)** must be specified on the J70 Controller for each 3592 tape drive attached to the J70 Controller in the rack that contains the J70 Controller.
- One feature **3590 Tape Drive Attached (FC 9059)** must be specified on the J70 Controller for each 3590 tape drive attached to the J70 Controller in the rack that contains the J70 Controller.

3592 tape drives in a stand-alone rack

The following feature is required when installing 3592 drives in a stand-alone rack attaching to a 2109 Model F16 switch:

- **LC/LC Fibre Channel Cables (FC 1013, FC 1025, or FC 1061)** must be specified on each tape drive not in the same rack as the J70 Controller to provide one shortwave cable to attach tape drives to the 2109 Model F16 switch.

3590 tape drives in a stand-alone rack

The following features are required when installing 3590 drives in a stand-alone rack with a 2109 Model F16 switch:

- **Fibre Channel Attachment (FC 3510 or FC 9510)** must be specified on each 3590 tape drive.
- **LC/SC Fibre Channel Cables (FC 5913, FC 5922, or FC 5961)** must be specified on each 3590 tape drive not in the same rack as the J70 Controller to provide one shortwave cable to attach tape drives to the 2109 Model F16 switch.

3590 Model A14 frame features (attaching 3590 tape drives only)
This topic describes the requirements for attaching 3590 drives with a Model F16 switch in a 3590 Model A14 frame.

The following features pertain when installing a J70 Controller and attaching 3590 drives in a 3590 Model A14 frame with a Model F16 switch:

- **LC Fibre Drive Attached Controller (FC 3474)** must be specified on the frame that contains the J70 Controller.
- **LC Multiframe Fibre Drives (FC 4074)** must be specified on the other Model A14 frames that contain Fibre Channel tape drives that will be attached to the J70 Controller.
- **Plant Install Hxx Fibre Drive (FC 9670)** must be specified on the Model A14—one feature for each 3590 Model H11 Tape Drive with FC 9510 (Fibre Channel Attachment) installed in that Model A14 coming from the plant.
- **Plant Install Fibre Drive (FC 9511)** must be specified on the Model A14, instead of feature FC 9663 (Plant Install Drive)—one feature for each 3590 Model E11 Tape Drive with feature FC 9510 (Fibre Channel Attachment) installed in that Model A14 coming from the plant.
- One feature **3590 Tape Drive Attached (FC 9059)** must be specified on the J70 Controller for each tape drive attached to the J70 Controller in the Model A14 frame that contains the J70 Controller.
- The maximum distance between Model A14 frames is seven meters.

3953 F05 Tape Frame features

The following features pertain when installing a J70 Controller in a 3953 F05 tape frame with a Model F16 switch:

- **Customer-Supplied 2 Gb Fibre Channel 2109 F16 Switch (FC 4890)**. One FC 4890 must be specified for each J70 Controller in the frame.
- **Fibre Channel Switch Mount Kit (FC 4888)** must be specified on the frame that contains the J70 Controller. One FC 4888 must be specified for each pair of FC 4890 ordered.

Enterprise Tape Library 3494 features

The following features pertain when installing a J70 Controller in a 3494 library frame with a Model F16 switch:

- **LC Fibre Drive Attached Controller (FC 3474)** must be specified on the 3494 Model D24 or D14 frame that contains the J70 Controller.
- **Adjacent Frame 3592 Tape Drives with LC Attachment (FC 4075)** must be specified on the associated 3494 Model L22 or D22 frame that contains the other 3592 tape drives that will be attached to the J70 Controller.
- One **3592 Drive-to-Switch Cables (FC 3059)** must be specified on the J70 Controller for each 3592 tape drive attached to the J70 Controller in the Model D24 frame.
- **LC Adjacent Frame Fibre Drives (FC 4074)** must be specified on the associated 3494 Model L12 or D12 frame that contains the other 3590 Fibre Channel tape drives that will be attached to the J70 Controller.
- One **3590 Tape Drive Attached (FC 9059)** must be specified on the J70 Controller for each 3590 tape drive attached to the J70 Controller in the Model D14 frame.
- One **Install Fibre Channel Drive (FC 3511)** must be specified on a 3494 Model D12 or L12 frame for each installed tape drive.

Features for the IBM SAN switch Model S16

Note:

1. The IBM 2109 SAN Fibre switch Model S16 is no longer marketed by IBM.
2. The IBM 2109 SAN Fibre switch Model S16 is not supported in the 3953 F05 tape frame.

When a Model S16 SAN switch is used, the following requirements and features apply:

IBM 3592-J70 Controller requirements

The following requirements apply when installing a J70 Controller with a Model S16 SAN switch.

- **3592 Drive Attached to Controller (FC 9476)** must be specified on the J70 Controller if attaching 3592 drives.

- **Two LC Fibre Channel Drive Adapters (FC 3476)** and **Fibre Drive Attached SC Switch (FC 3483)** are required on the J70 Controller when attaching 3592 or 3590 tape drives with a 2109 Model S16 switch.

2109 SAN Fibre switch Model S16 requirements

One 2109 Model S16 is required for each J70 Controller attaching 3592 Tape Drives. Each 2109 Model S16 Switch comes standard with four shortwave Gigabit Interface Convertors (GBICs), enough to connect to the two J70 Controller Fibre Channel Attachments and two 3592 or 3590 Tape Drives. Additional features that may be ordered include:

- **Additional Shortwave Transceiver (FC 2210)** provides one additional GBIC. It must be ordered for 3592 or 3590 tape drives beyond two that will be attached to the J70 Controller. The quantity of this feature should equal at least the number of 3592 or 3590 tape drives beyond two, attached to the J70 Controller. (For example, to attach six 3592 Fibre Channel tape drives to a J70 Controller, a minimum of four FC 2210 must be ordered.)
- **Power Supply, Additional (FC 6203)**, which provides an additional redundant power supply enabling dual-power source configurations to minimize power outages.
- **Non-Rack Install (FC9205)** should **not** be specified.

Rack requirements

The following features are required when mounting a J70 Controller in a rack environment with a 2109 Model S16 switch:

- **Install Controller in a Rack (FC 4641)** must be specified.
- **Fibre Drive Attached Rack (FC 3465)** provides mounting hardware for the 2109 Model S16 in the rack and cables from the J70 Controller to the 2109.
- One **3592 Drive-to-Switch Cables (FC 3059)** must be specified on the J70 Controller for each 3592 tape drive attached to the J70 Controller in the rack that contains the J70 Controller.
- One **3590 Tape Drive Attached (FC 9059)** must be specified on the J70 Controller for each 3590 tape drive attached to the J70 Controller in the rack that contains the J70 Controller.

3592 tape drives in a stand-alone rack

The following feature is required when installing 3592 drives in a stand-alone rack with a 2109 Model S16 switch:

- **LC/SC Fibre Channel Cables (FC 5913, FC 5922, or FC 5961)** must be specified on each 3592 tape drive not in the rack with the J70 Controller to provide one short-wavelength cable to attach those tape drives to the 2109 Model S16 switch.

3590 tape drives in a stand-alone rack

The following features are required when installing 3590 drives in a stand-alone rack with a 2109 Model S16 switch:

- **Fibre Channel Attachment (FC 3510 or FC 9510)** must be specified on each 3590 tape drive.
- **SC/SC Fibre Channel Cables (FC 5813, FC 5825, or FC 5861)** must be specified on each 3590 tape drive not in the rack with the J70 Controller to provide one short-wavelength cable to attach those tape drives to the 2109 Model S16 switch.

3590 Model A14 frame features (attaching 3590 tape drives only)

The following features pertain when installing a J70 Controller and attaching 3590 drives in a 3590 Model A14 frame with a Model S16 switch:

- **Fibre Drive Attached Controller (FC 3464)** must be specified on the frame that contains the J70 Controller.
- **Multiframe Fibre Drives (FC 4064)** must be specified on the other Model A14 frames that contain Fibre Channel tape drives that will be attached to the J70 Controller.

- One feature **3590 Tape Drive Attached (FC 9059)** must be specified on the J70 Controller for each tape drive attached to the J70 Controller in the Model A14 frame that contains the J70 Controller.
- The maximum distance between Model A14 frames is seven meters.

Enterprise Tape Library 3494 features

The following features pertain when installing a J70 Controller in a 3494 library frame with a Model S16 switch:

- **Fibre Drive Attached Controller (FC 3464)** must be specified on the 3494 Model D24 or D14 frame that contains the J70 Controller.
- **Adjacent Frame 3592 Tape Drives with SC Attachment (FC 4065)** must be specified on the associated 3494 Model L22 or D22 frame that contains the other 3592 tape drives that will be attached to the J70 Controller.
- One **3592 Drive-to-Switch Cables (FC 3059)** must be specified on the J70 Controller for each 3592 tape drive attached to the J70 Controller in the Model D24 frame.
- **LC Adjacent Frame Fibre Drives (FC 4064)** must be specified on the associated 3494 Model L12 or D12 frame that contains the other 3590 Fibre Channel tape drives that will be attached to the J70 Controller.
- One **3590 Tape Drive Attached (FC 9059)** must be specified on the J70 Controller for each 3590 tape drive attached to the J70 Controller in the Model D14 frame.
- One **Install Fibre Channel Drive (FC 3511)** must be specified on a 3494 Model D12 or L12 frame for each installed tape drive.

J70 Controller and 3590 SCSI tape drive attachment

The IBM 3592-J70 Controller can attach to selected 3590 model tape drives through SCSI attachment. The following sections describe the requirements in different environments that support SCSI drive attachment.

Enterprise Tape Library 3494 attachment

In a 3494 library, up to four 3590 Model B1A, E1A, or H1A tape drives and one J70 Controller can be attached in a 3494 D14 frame. One **FC 9059 (3590 Drive Attached)** should be specified on the J70 Controller for each 3590 tape drive in the 3494 Model D14 that is attached to the J70 Controller in that frame, up to a maximum of four.

A J70 Controller in a 3494 Model D14 frame with Adjacent Frame Support can attach to drives in an adjacent 3494 Model L12 or L14 frame, thereby attaching up to a total of six 3590 tape drives. Or, a J70 Controller in a 3494 Model D14 frame can attach to drives in an adjacent 3494 Model D12 frame, thereby attaching up to a total of ten tape drives.

3590 Model A14 attachment

Up to four Model H11 tape drives, up to four Model E11 tape drives, or up to four Model B11 tape drives can be placed with one J70 Controller in a 3590 Model A14 frame for non-library attachment to a System z server. One **FC 9059** should be specified on the J70 Controller for each 3590 tape drive in the 3590 Model A14 frame that is attached to the J70 Controller in that frame.

To support SCSI attachment of 3590 tape drives in two different Model A14 frames, **Multiframe SCSI A14 (FC 4060)** must be specified on the frame that contains the J70 Controller, and **Multiframe SCSI Drives - Field Install (FC 4062)** or **Multiframe SCSI Drives - Plant Install (FC 9062)** must be specified on the other Model A14 frame. **Multi-frame SCSI A14 (FC 9060)** must also be specified on the J70 Controller.

Up to eight 3590 tape drives may be attached in a multiframe SCSI configuration and all hardware and required cables between the J70 Controller and the drives in the other Model A14 frame are included in these features. Because of SCSI cable length restrictions, the two Model A14 frames must be installed adjacent to each other.

Rack attachment

The J70 Controller can be installed in a standard 19-inch rack such as the IBM 7014 Model T00 or T42, with up to four 3590 tape drives. For rack installation, **Install the J70 Controller in a Rack (FC 4641)** must also be ordered on the J70 Controller. The SCSI cables from each 3590 tape drive to the J70 Controller in that rack are included when **3590 Drive Attached (FC 9059)** is specified on the J70 Controller (the quantity of **FC 9059** must equal the number of tape drives in the rack with the J70 Controller).

To support SCSI attachment of 3590 tape drives in two different racks, **FC 4065 (Multiframe SCSI Rack Attachment)** must be specified on the J70 Controller. This feature includes cables to connect the J70 Controller to tape drives in the second rack, and necessary drive-to-drive interconnection cables in that rack. Up to eight 3590 tape drives in the two racks may be attached to the J70 Controller. Because of SCSI cable length restrictions, the two racks must be installed adjacent to each other.

J70 Controller dual path attachment

The **Dual Path Attachment (FC 5245)** provides the necessary cables and hardware to allow a J70 Controller in a 3494 Model D14 or D24 frame to connect the control path to a second internal LAN attachment on the 3494, the **Dual Path Concentrator (FC 5246)**. The J70 Controller must be attached via the **Attachment Concentrator (FC 5232)** on the 3494 L12, L14, or L22 frame.

3952 F05 Frame and associated features

The topics in this section describe the feature codes for the 3952 F05 Frame and associated features.

For features listed in numerical order, refer to the table below and to “IBM TS1120 (3592 C06) Controller and associated frame features” on page 45.

For features listed according to supported Fibre Channel environments, refer to the following sections:

- “Features for the Fibre Channel Switches” on page 54
- “Features for External Fabric Support (FC 3492, FC 9492)” on page 55
- “Features for the IBM Storage Area Network Switch Model F16” on page 73
- “Features for the IBM SAN switch Model S16” on page 75

Feature codes using the term *Field merge* instruct the plant to leave a mounting slot available in the frame for merging a device at the customer site. Feature codes using the term *Field install* indicate that an existing rack or frame at the customer site requires a mounting slot.

Table 31: Feature codes for 3952 F05 Frame and associated features

Feature Code	Machine Type/Model	Description
3492	3952 F05 Frame	External Fabric Support - Field
3493	3952 F05 Frame	Direct Connect Drives - Field
3516	3952 F05 Frame	Fibre Channel Switch Mount Kit
3517	3952 F05 Frame	Redundant Fibre Channel Attach
4870	3952 F05 Frame	Replace controller with IBM TS1120 (3592 C06) Controller
5593	3952 F05 Frame	Router for EKM attach
5594	3952 F05 Frame	Attach additional CU to Router
5595	3952 F05 Frame	Control Unit Encryption Key Manager configuration / Field

Table 31: Feature codes for 3952 F05 Frame and associated features (continued)		
Feature Code	**Machine Type/Model**	**Description**
5875	3952 F05 Frame	Field Merge J70 Controller
5877	3952 F05 Frame	Field install J70 Controller
5878	3952 F05 Frame	Field merge IBM TS1120 (3592 C06) Controller
5879	3952 F05 Frame	Plant Install IBM TS1120 (3592 C06) Controller
5880	3952 F05 Frame	Field Install IBM TS1120 (3592 C06) Controller in a 3952 F05 Frame
7315	3952 F05 Frame	TS7640 Silo Compatible Controller Attachment
7316	3952 F05 Frame	Enterprise Tape Library Attachment (3494 Outbound Controller Frame)
9492	3952 F05 Frame	External Fabric Support - Plant
9493	3952 F05 Frame	Direct Connect Drives - Plant
9959	3952 F05 Frame	Unterminated Power Cord
9966	3952 F05 Frame	China Unterminated Power Cord

3952 F05 and associated feature descriptions

External Fabric Support - Field (FC 3492)

This feature on the 3952 F05 Frame indicates that 3592 Tape Drives will be directly connected to a IBM TS1120 (3592 C06) Controller.

Maximum: one. Prerequisites: FC 7315 or 7316 on the 3952 F05 Frame. This feature is mutually exclusive of FC 3493, FC 9492, and FC 9493.

The customer is responsible for providing the cables from the IBM TS1120 (3592 C06) Controller installed in a 3952 or 3953 Model F05 frame to a customer-supplied fibre channel switch. (Cables from the switch or controller to the 3592 Tape Drives can be ordered with the 3592 Tape Drives or supplied by the customer.)

Direct Connect Drives - Field (FC 3493)

This feature on the 3952 F05 Frame indicates that 3592 Tape Drives will be directly connected to a controller.

The customer is responsible for providing the cables from the IBM TS1120 (3592 C06) Controller installed in a 3952 or 3953 Model F05 frame to the 3592 Tape Drives. (Cables from the controller to the 3592 Tape Drives can be ordered with the 3592 Tape Drives or supplied by the customer.)

Field installed. Maximum: one. Prerequisites: Must specify FC 7315 or FC 7316 on the 3952 F05 Frame. Must specify FC 3493 or FC 9493 on the C06 Controller. This feature is mutually exclusive of FC 9492, FC 9493, and FC 3492.

Fibre Channel Switch Mount Kit (FC 3516)

One of these features is required for each IBM TS1120 (3592 C06) Controller that supports attachment of 3592 Tape Drives with a 2 Gb or 4 Gb Fibre Channel Switch in a 3952 Model F05 Silo Compatible Frame. This feature includes the required mounting hardware and instructions for installing a 2 Gb or 4 Gb Fibre Channel Switch in the Model F05, including the associated Ethernet switch and cabling between the IBM

TS1120 (3592 C06) Controller and the switch. Up to sixteen 3592 Tape Drives in 3592 Model C20 Frames can be attached to each IBM TS1120 (3592 C06) Controller.

Fibre Channel Cables from the 3592 Tape Drives to the 2 Gb or 4 Gb Fibre Channel Switch should be ordered with FC 6013, FC 6025, or FC 6061 with each tape drive in the 3592 Model C20 Silo Compatible Frame.

A maximum of two switches, C06 Controller FC 3488, FC 4887, or FC 4897, can be mounted in one F05 Frame FC 3516 when the Redundant Fibre Channel Attach feature FC 3517 is also specified. Intermixing of 2 Gb or 4 Gb switches is not supported on the IBM TS1120 (3592 C06) Controller.

Maximum: three.

Prerequisites:

- FC 7315 is required.
- FC 3488 or FC 4887 or FC 4897 is required on the IBM TS1120 (3592 C06) Controller.
- One of the following: FC 4831, FC 4833, FC 4835, FC 9675, or FC 9679 must be installed on each 3592 Model C20 Frame for each attaching 3592 Tape Drive.

Redundant Fibre Channel Attach (FC 3517)

This feature provides the mounting hardware and instructions for installing a second 2 Gb or 4 Gb Fibre Channel Switch in the 3952 F05 Frame. Factory or field installed.

Maximum: three.

Prerequisites:

- One FC 3516 must be installed on the 3952 F05 Frame for each FC 3517.
- One FC 3517 is required on this frame for each IBM TS1120 (3592 C06) Controller that supports a second 2 Gb or 4 Gb Fibre Channel Switch.
- A second FC 3488, FC 4887, or FC 4897 is required on the IBM TS1120 (3592 C06) Controller.
- One of the following: FC 3431, FC 9675, FC 4833, FC 4835, or FC 9679 must be installed on each 3592 Model C20 Frame for each attaching 3592 Tape Drive.

Fibre Channel Cables from the 3592 Tape Drives to the 2 Gb or 4 Gb Fibre Channel Switch should be ordered with FC 6013, FC 6025, or FC 6061 with each tape drive in the 3592 Model C20 Silo Compatible Frame. A second cable is required on each tape drive to attach to the redundant switch.

Replace Controller with C06 Controller (FC 4870)

This feature is required to provide the mounting changes to replace a J70 Controller with a IBM TS1120 (3592 C06) Controller in a currently installed 3952 or 3953 Model F05 Frame.

Maximum: One for a base frame, three if an expansion or silo attached frame, or 3494 attached frame. The sum of FC 4870 plus FC 5877 plus FC 5878 plus FC 5879 plus FC 5880 cannot exceed three.

Router for EKM attach (FC 5593)

This feature provides two routers for redundant paths between the Encryption Key Manager and the tape controller through the customer network. Ethernet cables from the routers to the tape controller are also provided.

This feature is only supported with encryption capable IBM TS1120 Model E05 tape drive, IBM TS1130 Model E06/EU6 tape drive, IBM TS1140 Model E07 tape drive, and IBM TS1150 Model E08 tape drives. Not valid with IBM Model J1A tape drives or IBM TotalStorage 3590 Tape Drives.

Maximum: seven. Prerequisites: FC 4641, FC 5247. Plant or field installed. Mutually exclusive of FC 5247 and FC 5248.

Attach Additional CU to Router FC 5594

The feature provides Ethernet cables to connect the second or third tape controller in the frame to the routers supplied by FC 5593.

Maximum: two. Plant or field installed. Prerequisite: FC 5593.

Field Merge J70 Controller (FC 5875)

This feature provides mounting hardware and notifies the plant that a customer-supplied J70 Controller will be installed into a 3952 F05 Frame coming from the plant, as part of the final customer installation.

Maximum: Two FC 5875 or FC 5877.

Field Install IBM 3592-J70 Controller in F05 (FC 5877)

This feature code provides mounting hardware to field install a customer-supplied J70 Controller.

Maximum: Two FC 5875 or FC 5877.

Field Merge TS1120 (3592 C06) Controller (FC 5878)

This feature code provides mounting hardware for a customer-supplied IBM TS1120 (3592 C06) Controller that will be installed in a 3952 F05 Frame coming from the plant, as part of the final customer installation. This feature must appear on the 3952 F05 Frame and FC 9885 must appear on the TS1120 (3592 C06) Controller order.

Maximum: three if ordered with the SILO Attachment FC 7315 or with 3494 Attachment FC 7316. The sum of FC 4870 plus FC 5875 plus FC 5877 plus FC 5878 plus FC 5879 plus FC 5880 cannot exceed three.

Plant Install TS1120 (3592 C06) Controller (FC 5879)

This feature code provides the mounting hardware to factory install a TS1120 (C06) Controller into a new 3952 F05 Frame. This feature must appear on the 3952 F05 Frame and FC 9885 must appear on the TS1120 (C06) Controller order.

Maximum: three if ordered with the SILO Attachment FC 7315 or with 3494 Attachment FC 7316. The sum of FC 4870 plus FC 5875 plus 5877 plus FC 5878 plus FC 5879 plus FC 5880 cannot exceed three.

Field Install TS1120 (3592 C06) Controller in a 3952 Model F05 Frame (FC 5880)

This feature is required to provide the mounting hardware to add a IBM TS1120 (3592 C06) Controller to a currently installed 3952 F05 Frame. This feature must appear on the 3952 F05 Frame and FC 9885 must appear on the TS1120 (3592 C06) Controller order.

Maximum: three. The sum of FC 4870 FC 5875 plus FC 5877 plus FC 5878 plus FC 5879 plus FC 5880 cannot exceed three.

TS7640 Silo Compatible Controller Attachment (FC 7315)

This feature identifies this 3952 Tape Frame the TS7640 Silo Compatible Controller Attachment Frame.

FC 1903 is required with FC 7315.

Maximum: one. This Feature is mutually exclusive of FC 7310, FC 7311, and FC 7316.

Enterprise Tape Library Attachment (3494 Outbound Controller Frame FC 7316)

This feature identifies this 3952 Tape Frame as the 3494 Outbound Controller Frame. Factory installed only. Maximum: one. This Feature is mutually exclusive with FC 7310, FC 7311, and FC 7315.

External Fabric Support - Plant (FC 9492)

This feature on the 3952 F05 Frame indicates that 3592 Tape Drives will be connected to a IBM TS1120 (3592 C06) Controller through an external customer-supplied Fibre Channel.

Maximum: one. Prerequisites: FC 7315 or 7316 on the 3952 F05 Frame. This feature is mutually exclusive of FC 3493, and FC 9493.

The customer is responsible for providing the cables from the IBM TS1120 (3592 C06) Controller installed in a 3952 or 3953 Model F05 frame to a customer-supplied fibre channel switch. (Cables from

the switch or controller to the 3592 Tape Drives can be ordered with the 3592 Tape Drives or supplied by the customer.)

Direct Connect Drives - Plant (FC 9493)

This feature on the 3952 F05 Frame indicates that 3592 Tape Drives will be directly connected to a IBM TS1120 (3592 C06) Controller. FC 3493 (Direct Connect Drives / Field) or FC 9493 (Direct Connect Drives / Plant) must be specified on the IBM TS1120 (3592 C06) Controller.

The customer is responsible for providing the cables from the IBM TS1120 (3592 C06) Controller installed in a 3952 or 3953 Model F05 frame to a customer-supplied fibre channel switch. (Cables from the switch or controller to the 3592 Tape Drives can be ordered with the 3592 Tape Drives or supplied by the customer.)

Field installed. Maximum: one. Prerequisites: FC 7315 or FC 7316 on the 3952 F05 Frame. This feature is mutually exclusive of FC 3492, FC 3493, and FC 9492.

Unterminated Power Cord (FC 9959)

This feature provides an unterminated non-watertight 4.3 meter (14 foot), 200-208, 240 Vac, 24 Amp power cord with IRAM and BSMI agency certifications. This is the recommended power cord for Argentina and Taiwan.

Maximum: one. Plant or field installed.

China Unterminated Power Cord (FC 9966)

This feature provides an unterminated non-watertight 4.3 meter (14 foot), 200-208, 240 Vac, 24 Amp power cord with CCC agency certification. This is the recommended power cord for China.

Maximum: one. Plant or field installed.

Controller cable features

The topics in this section describe the controller cable features.

A variety of cables are required for device and host system attachment, depending upon the individual customer configuration. Cables are often included within a feature code for a common installation, and may be included or separately ordered on the device or the frame.

Since customer environments may significantly differ from standard installations, additional or substitute cables may be needed. See “Fiber Transport Services” on page 135 for information about fibre cabling services provided by IBM.

The sections below provide cable types and descriptions for a variety of cables for controller connections that can be ordered by feature codes. For Fibre Channel cables specific to the 3592 drives, see “3592 tape drive features” on page 29.

Host system attachment cables

Dual ESCON attachment for 3592 controller cable features

The tape controllers attach with ESCON cables to ESCON channels of System z servers. If host attachment cables are required they can be specified with two of the following cables:

Table 32: Dual ESCON attachment cables

Feature Code	Feature Description
FC 9700	No Factory ESCON/FICON cables
FC 9770	62.5 Micron MT-RJ to ESCON Riser-Rated 31 meter ESCON Cable
FC 9771	62.5 Micron MT-RJ to ESCON Plenum-Rated 31 meter ESCON Cable

Table 32: Dual ESCON attachment cables (continued)	
FC 9775	62.5 Micron MT-RJ to ESCON 2 meter ESCON Jumper Cable
FC 9789	62.5 Micron MT-RJ to MT-RJ Plenum-Rated 31 meter ESCON Cable
FC 9790	62.5 Micron MT-RJ to MT-RJ Riser-Rated 31 meter ESCON Cable

ESCON cable feature definitions

No Factory FICON/ESCON Cables (FC 9700)

This feature should be specified if you do not want the factory to ship any ESCON or FICON cables with the new shipment of a tape controller. This feature should be specified if none of the following features is desired: FC 9752, FC 9753, FC 9762, FC 9763, FC 9771, FC 9775, FC 9789, FC 9793, or FC 9794. Maximum: One. Minimum: None. Plant installation only.

62.5-Micron MT-RJ to ESCON Riser-Rated ESCON Cable, 31m (FC 9770)

This feature ships a 31-meter (100-Foot) 62.5-micron riser-rated ESCON fibre cable with an MT-RJ connector on one end for connecting to the tape controller, and an ESCON adapter on the other end, for connecting to a host system or ESCON director. This feature should be specified when attaching a J70 Controller to fibre components with ESCON connectors, such as the 4-ported ESCON channel feature for zSeries or most ESCON directors. Indoor/outdoor riser-rated cables can be installed between buildings as well as in a building's riser system. Riser rated cables can eliminate the need for a splice or transition point where a campus fiber enters a building and must continue on to additional termination points within the building's riser system. Maximum: Eight. Plant or field installed.

Corequisite:

- Only available on the J70 Controller when ordered with FC 3413. Two of FC 9770, FC 9771, FC 9775, FC 9789, or FC 9790 can be ordered with each FC 3413.

62.5-Micron MT-RJ to ESCON Plenum-Rated ESCON Cable, 31m (FC 9771)

This feature ships a 31-meter (100-Foot) 62.5-micron plenum-rated ESCON fibre cable with an MT-RJ connector on one end for connecting to the controller, and an ESCON adapter on the other end, for connecting to a host system or ESCON director. This feature should be specified when attaching a controller to fibre components with ESCON connectors, such as the 4-ported ESCON channel feature for zSeries, or most ESCON directors. This cable should be ordered when a plenum cable is required to reduce the hazard of fire spreading between rooms. A plenum is a compartment or chamber to which one or more air ducts are connected and which forms part of a building's air distribution system. Maximum: Eight. Plant or field installed.

Corequisite:

- Only available on the TS1120 (3592 C06) Controller when ordered with FC 3440. Two of FC 9771, FC 9775, or FC 9789 can be ordered with each FC 3440.
- Only available on the J70 Controller when ordered with FC 3413. Two of FC 9770, FC 9771, FC 9775, FC 9789, or FC 9790 can be ordered with each FC 3413.

62.5-Micron MT-RJ to ESCON Jumper Cable, 2m (FC 9775)

This feature ships a 2-meter (6-Foot) 62.5-micron ESCON fibre jumper cable with an MT-RJ connector on one end for connecting to the tape controller, and an ESCON adapter on the other end for connecting to a pre-existing ESCON cable with an ESCON connector. Maximum: Eight. Plant or field installed.

Corequisite:

- Only available on the TS1120 (3592 C06) Controller when ordered with FC 3440. Two of FC 9771, FC 9775, or FC 9789 can be ordered with each FC 3440.
- Only available on the J70 Controller when ordered with FC 3413. Two of FC 9770, FC 9771, FC 9775, FC 9789, or FC 9790 can be ordered with each FC 3413.

62.5-Micron MT-RJ to MT-RJ Plenum-Rated ESCON Cable, 31m (FC 9789)

This feature ships a 31-meter (100-Foot) 62.5-micron plenum-rated ESCON fibre cable with an MT-RJ connector on both ends for connecting the tape controller to a host system or ESCON director. This feature should be specified when attaching a tape controller to fibre components with ESCON connectors, such as the 16-ported ESCON channel feature for zSeries.

This cable should be ordered when a plenum cable is required, to reduce the hazard of fire spreading between rooms. A plenum is a compartment or chamber to which one or more air ducts are connected and which forms part of a building's air distribution system. Maximum: Eight. Plant or field installed.

Corequisites:

- Only available on the TS1120 (3592 C06) Controller when ordered with FC 3440. Two of FC 9771, FC 9775, or FC 9789 can be ordered with each FC 3440.
- Only available on the J70 Controller when ordered with FC 3413. Two of FC 9770, FC 9771, FC 9775, FC 9789, or FC 9790 can be ordered with each FC 3413.

62.5-Micron MT-RJ to MT-RJ Riser-Rated ESCON Cable, 31m (FC 9790)

This feature ships a 31-meter (100-Foot) 62.5-micron riser-rated ESCON fibre cable with MT-RJ connectors on both ends for connecting the J70 Controller to a host system or ESCON director. This feature should be specified when attaching a J70 Controller to fibre components with ESCON connectors, such as the 16-ported ESCON channel feature for zSeries.

Indoor/outdoor riser-rated cables can be installed between buildings as well as in a building's riser system. Riser rated cables can eliminate the need for a splice or transition point where a campus fiber enters a building and must continue on to additional termination points within the building's riser system. Maximum: Eight. Plant or field installed.

Corequisites:

- Only available on the J70 Controller when ordered with FC 3413. Two of FC 9770, FC 9771, FC 9775, FC 9789, or FC 9790 can be ordered with each FC 3413.

FICON long-wavelength attachment cable features

The FICON long-wavelength adapter shipped with FC 3434 (2 Gb FICON Long-Wavelength Attachment), FC 3442 (FICON Long-Wavelength Attachment), and FC 3443 (FICON Long-Wavelength 10 km Attachment) has an LC Duplex connector, and can connect to FICON long-wavelength channels of System z servers utilizing a 9-micron single-mode fibre cable. If host attachment cables or jumper cables are required they can be specified with one of the following feature numbers:

Table 33: 2 Gb FICON long-wavelength attachment cables

Feature Code	Description
FC 9700	No Factory FICON cables
FC 9752	9-micron LC/LC Fibre Cable, 31m
FC 9753	9-micron LC/SC Fibre Jumper Cable, 2m
FC 9763	50-micron LC/SC Fibre Jumper Cable, 2m
FC 9793	9-micron LC/SC Fibre Cable, 31m

Feature definitions

No Factory FICON/ESCON Cables (FC 9700)

This feature should be specified if you do not want the factory to ship any ESCON or FICON cables with the new shipment of a TS1120 (3592 C06) Controller or J70 Controller. This feature should be specified if none of the following features are desired: FC 9752, FC 9753, FC 9762, FC 9763, FC 9770, FC 9771, FC 9775, FC 9789, or FC 9790. Maximum: One. Minimum: None. Plant installation only.

9-Micron LC/LC Fibre Cable, 31m (FC 9752)

This feature ships a 31-meter (100-Foot) 9-micron single-mode fibre cable with an LC Duplex connector on both ends for FICON Long-Wavelength connection of the tape controller to a host system. This feature should be specified when attaching a tape controller to fibre components with LC Duplex connectors, such as the FICON channel feature for zSeries (FICON Express LW 1.75 Feature FC 2319) or supported Fibre Channel Directors with LC Duplex attachments.

Corequisites:

- Only available on the TS1120 (3592 C06) Controllers when ordered with FC 3442 or FC 3443 . Only one of the FC 9752, FC 9753, or FC 9793 can be ordered with each FC 3442 or FC 3443.
- Only available on the J70 Controller when ordered with FC 3434 . Only one FC 9752, FC 9753, or FC 9793 can be ordered with FC 3434.

9-Micron LC/SC Fibre Jumper Cable, 2m (FC 9753)

This feature ships a 2-meter (6-Foot) 9-micron single-mode fibre cable with an LC Duplex connector on one end for FICON Long-Wavelength connection to the tape controller, and an SC Duplex connector on the other end for connection to a director or host system requiring an SC Duplex connection. This feature should be specified when attaching a tape controller in an environment with a single-mode SC Duplex cable already in place. Maximum: four. Plant or field installation.

Corequisites:

- Only available on the TS1120 (3592 C06) Controllers when ordered with FC 3442 or FC 3443. Only one of FC 9752, FC 9753, or FC 9793 can be ordered with each FC 3442 or FC 3443.
- Only available on the J70 Controller when ordered with FC 3434. Only one FC 9752, FC 9753, or FC 9793 can be ordered with each FC 3434.

9-Micron LC/SC 31 Meter Fibre Cable (FC 9793)

This feature ships a 31-meter (100-Foot) 9-micron single-mode fibre cable with an LC Duplex connector on one end for FICON Long-Wavelength connection to the tape controller, and an SC Duplex connector on the other end for connection to a host system. This feature should be specified when attaching tape controller to fibre components with SC Duplex connectors, such as the FICON longwave channel features on G5 or G6 servers (#2314) or zSeries servers (#2315), or supported Fibre Channel Directors with SC Duplex attachments.

Maximum: four. Plant or field installation.

Corequisites:

- Only available on the TS1120 (3592 C06) Controller when ordered with FC 3442 or FC 3443 . Only one of FC 9752, FC 9753, or FC 9793 can be ordered with each FC 3442 or FC 3443.
- Only available on the J70 Controller when ordered with FC 3434 . Two of FC 9752, FC 9753, or FC 9793 can be ordered with each FC 3434.

FICON short-wavelength attachment cable features

The FICON short-wavelength adapters shipped with FC 3435 (2 Gb FICON Short-Wavelength Attachment) and FC 3441 (FICON Short-Wavelength Attachment) have an LC Duplex connector, and can connect to FICON short-wavelength channels of System z servers utilizing a 50-micron multimode fibre cable. If host attachment cables or jumper cables are required they can be specified with one of the following feature numbers:

Table 34: 2 Gb FICON short-wavelength attachment cables

Feature Code	Description
9700	No Factory FICON Cables
9762	50-micron LC/LC Fibre Cable, 31m

Table 34: 2 Gb FICON short-wavelength attachment cables (continued)	
9763	50-micron LC/SC Fibre Jumper Cable, 2m
9794	50-micron LC/SC Fibre Cable, 31m

Feature descriptions

No Factory FICON/ESCON Cables (FC 9700)

This feature should be specified if you do not want the factory to ship any ESCON or FICON cables with the new shipment of a tape controller. This feature should be specified if none of the following features are desired: FC 9752, FC 9753, FC 9762, FC 9763, FC 9770, FC 9771, FC 9775, FC 9789, or FC 9790. Maximum: One. Minimum: None. Plant installation only.

50-Micron LC/LC Fibre Cable, 31m (FC 9762)

This feature ships a 31-meter (100-Foot) 50-micron multimode fibre cable with LC Duplex connectors on both ends for FICON Short-Wavelength connection of the tape controller to a host system. This feature should be specified when attaching a tape controller to fibre components with LC Duplex connectors, such as the FICON channel feature for zSeries (FICON Express SW 1.75 feature FC 2320) or supported Fibre Channel Directors with LC Duplex attachments. Maximum: four. Plant or field installation.

Corequisites:

- Only available on the TS1120 (3592 C06) Controllers when ordered with FC 3441. Only one of FC 9762, FC 9763, or FC 9794 can be ordered with each FC 3441.
- Only available on the J70 Controller when ordered with FC 3435. Only one of FC 9762, FC 9763, or FC 9794 can be ordered with each FC 3435.

50-Micron LC/SC Fibre Jumper Cable, 2m (FC 9763)

This feature ships a 2-meter (6-Foot) 50-micron multimode fibre cable with an LC Duplex connector on one end, for FICON Short-Wavelength connection to the tape controller, and an SC Duplex connector on the other end, for connection to a director or host system requiring an SC Duplex connection. This feature should be specified when attaching a tape controller in an environment with a single-mode SC Duplex cable already in place. Maximum: four. Plant or field installation.

Corequisites:

- Only available on the TS1120 (3592 C06) Controllers when ordered with FC 3441. Only one FC 9762, FC 9763, or FC 9794 can be ordered with each FC 3441.
- Only available on the J70 Controller when ordered with FC 3435. Only one FC 9762, FC 9763, or FC 9794 can be ordered with each FC 3435.

50-Micron LC/SC 31 Meter Fibre Cable (FC 9794)

This feature ships a 31-meter (100-Foot) 50-micron multimode fibre cable with an LC Duplex connector on one end, for FICON Short-Wavelength connection to the tape controller and an SC Duplex connector on the other end, for connection to a host system. This feature should be specified when attaching a tape controller to fibre components with SC Duplex connectors, such as the FICON shortwave channel features on G5 or G6 servers (FC 2316) or zSeries servers (FC 2318), or supported Fibre Channel Directors with SC Duplex attachments. Maximum: four. Plant or field installation.

Corequisites:

- Only available on the TS1120 (3592 C06) Controllers when ordered with FC 3441. Only one of FC 9762, FC 9763, or FC 9794 can be ordered with each FC 3441.
- Only available on the J70 Controller when ordered with FC 3435. Only one of FC 9762, FC 9763, or FC 9794 can be ordered with each FC 3435.

2109 switch attachment cable features

Fibre cables are required to connect tape drives to the J70 Controller via the 2109 SAN switch. The 2109 SAN switch Model F16 requires 50-micron fiber cables with an LC Duplex connector and the cables to the 2109 SAN switch Model S16 require 50-micron fiber cables with an SC Duplex connector. These cables can be customer supplied or ordered with features on the 3494 frames or tape drives where required.

SCSI drive cables

3590 Model A14 or 3494 Model D14 installation

The appropriate SCSI cables required for attaching 3590 tape drives to a J70 Controller in a 3590 Model A14 frame or in a 3494 Model D14 frame are included when FC 9059 (3590 Drive Attached) is specified on the J70 Controller (the quantity of FC 9059 must equal the number of tape drives attached to the J70 Controller in that frame). SCSI cables for attachment of 3590 tape drives in a Model A14 frame to a J70 Controller in a different Model A14 are included when FC 4062 or FC 9062 (Multiframe SCSI Drives) is specified on that frame. FC 9060 (Multiframe SCSI A14) must also be specified on the J70 Controller.

Rack installation

The SCSI cables from each 3590 tape drive to the J70 Controller in that rack are included when FC 9059 (3590 Drive Attached) is specified on the J70 Controller (the quantity of FC 9059 must equal the number of tape drives in the rack with the J70 Controller). SCSI cables for attachment of 3590 tape drives in a rack to a J70 Controller in a different rack are included when FC 4065 (Multiframe SCSI Rack Attachment) is specified on the J70 Controller.

Fibre Channel drive cables

For Fibre Channel cables specific to the 3592 drives, see “3592 tape drive features” on page 29.

3494 frame installation

Fibre Channel cables for attachment of 3592 or 3590 tape drives in a 3494 Tape Library to a J70 Controller are included when FC 3464, FC 3474, FC 4064, FC 4065, FC 4074, or FC 4075 is specified on those frames. The number of cables in the frame containing the J70 Controller are specified by the quantity of FC 3059 or FC 9059 on the J70 Controller.

Adjacent D12 Frames

For the adjacent D12 frame attaching to a D14 with a **2109 S16** switch, the interframe cables are ordered with FC 4064 (against the D12 frame) in quantity one (1), where the actual number of cables shipped is determined by the quantity of feature FC 3511 (against the D12 frame). FC 3511 is used to order the cables from the drives in the D12 to the patch panel in the D12. FC 3511 also ships the patch panel with the first order.

In the case of the adjacent D12 frame attaching to a D14 frame with **Adjacent/Multi–Frame 2 Gb (FC 4084)** or a **2109 F16** switch, the interframe cables are ordered with FC 4074 (against the D12) in quantity one (1), where the actual number of cables determined by quantity of FC 3511 quantity against the D12 frame.

Adjacent D22 Frames

For adjacent D22 frame attaching a D24 frame with **Adjacent/Multi–Frame 2 Gb (FC 4085)** or a **2109 S16** switch, the interframe cables are ordered with FC 4064 against the D22 frame in the quantity desired. You should order a quantity of FC 4065 equal to the sum of features FC 4674 and FC 9673 against the D22 frame, i.e., the number of drives in the D22 frame. The D22 does not use a patch panel.

For adjacent D22 frame attaching a D24 frame with an **2 Gb Fibre Channel Switch** or a **2109 F16** switch, the interframe cables are ordered with FC 4075 (against the D22 frame) in the quantity desired.

3590 Model A14 installation

Fibre Channel cables for attachment of 3590 tape drives in a 3590 Model A14 frame to a J70 Controller are included when FC 3464, FC 3474, FC 4064, or FC 4074 is specified on those frames. The number of cables in the frame containing the J70 Controller is specified by the quantity of FC 9059 on the J70 Controller.

Rack installation

The appropriate length Fibre Channel cables for attachment of 3592 tape drives in a rack to the tape controller in another rack must be ordered with each 3592 tape drive using FC 6013, FC 6025, and FC 6061 (LC/LC Fibre Channel Cables) when FC 3484 is ordered on the J70 Controller, or FC 5913, FC 5922, and FC 5961 (LC/SC Fibre Channel Cables) when FC 3483 is ordered on the J70 Controller. For Fibre Channel cables specific to the 3592 drives, see “3592 tape drive features” on page 29.

Cables from 3592 tape drives to the J70 Controller that are in the rack with the J70 Controller are specified by the quantity of FC 3059 on the J70 Controller and FC3062 on the TS1120 (3592 C06) Controller.

The appropriate length Fibre Channel cables for attachment of 3590 tape drives in a rack to the J70 Controller in another rack must be ordered with each 3590 tape drive using feature FC 5913, FC 5922, and FC 5961 (LC/SC Fibre Channel Cables) when FC 3484 is ordered on the J70 Controller, or FC 5813, FC 5825, and FC 5861 (SC/SC Fibre Channel Cables) when feature FC 3483 is ordered on the J70 Controller. Cables from 3590 tape drives to the J70 Controller that are in the rack with the J70 Controller are specified by the quantity of FC9059 on the J70 Controller.

Chapter 3. Media

The 3592 tape drive uses an advanced bidirectional serpentine recording technique that writes multiple data tracks at a time. Improved Error Correction Code (ECC) and servo tracks with embedded longitudinal position written on the tape help ensure data integrity and reliability. The servo tracks enable the 3592 tape drive to accurately position the read/write head with regard to the media while the tape is in motion. Resident diagnostic tests monitor operations to detect potential problems and aid in fast resolution.

Both the format and the physical characteristics of the 3592 cartridges differ from 3590 cartridges. Therefore, they cannot be used interchangeably. Only 3592 tape cartridges are used in 3592 tape drives, and only 3590 tapes are used in 3590 drives. This characteristic is true for the cleaning cartridges, as well. If you have both 3590 and 3592 tape drives in your environment, you must have both types of cleaning tapes.

IBM 3592 tape cartridge

This topic provides general information on the IBM 3592 tape cartridge.

The 3592 tape drive has a bidirectional read/write head capable of operating at up to four different recording densities, depending on the tape drive model. See Table 36 on page 91 for recording densities, read/write capability, and capacities.

Table 35: General information about tape cartridges

Text on product and type of media[1]	Case Color	Label door and write-protect switch color	Part number
Data - JA	Black	Dark blue	18P7534
Extended Data - JB	Black	Dark green	23R9830
Advanced Data Type C - JC	Black	Dark purple	46X7452
Advanced Data Type D - JD	Black	Burnt orange	2727263
Advanced Data Type E - JE	Black	Brick red	02CE960
Economy - JJ	Black	Light blue	24R0316
Advanced Type C Economy - JK	Black	Light purple	46X7453
Advanced Type D Economy - JL	Black	Apricot	2727264
Advanced Type E Economy - JM	Black	Cherry red	02CE961
Economy WORM - JR	Platinum (silvery gray)	Light blue	24R0317
WORM - JW	Platinum (silvery gray)	Dark blue	18P7538
Extended WORM - JX	Platinum (silvery gray)	Dark green	23R9831
Advanced Type C WORM - JY	Platinum (silvery gray)	Dark purple	46X7454

Table 35: General information about tape cartridges (continued)

Text on product and type of media[1]	Case Color	Label door and write-protect switch color	Part number
Advanced Type D WORM - JZ	Platinum (silvery gray)	Burnt orange	2727265
Advanced Type E WORM - JV	Platinum (silvery gray)	Brick Red	No PN - aftermarket sales only
Cleaning Cl*xxx*JA[2]	Black	Gray	18P7535

Notes:

1. This designation displays as the last 2 characters on standard bar code labels. In addition, for cleaning cartridges, the first 3 characters of the volume serial number (VOLSER) are CLN
2. Where *xxx* equals three numerals.

Capacities of data cartridges can be increased through data compression, with the actual compression and capacity depending upon the specific data. Write-once, read-many (WORM) cartridges are also available in all capacities. All 3592 cartridge types can be encrypted when used with a compatible 3592 tape drive.

Cartridge types and characteristics

Information about the tape cartridges that are used in the 3592 tape drives.

Cartridges are distinguished by the text on the label, and by the color of the tape cartridge case and the color of the cartridge label. See 2 in Figure 8 on page 93, write-protect switch 4, and door, 1 in Figure 10 on page 94. The characteristics of the different data cartridge types and the cleaning cartridge that are used by operators with the 3592 drive are summarised in Table 36 on page 91. The main external components of the IBM 3592 tape cartridge are shown in Figure 8 on page 93.

The capacity of the 3592 tape cartridge depends on the format that is used when written from the beginning of tape (BOT). Each tape drive model has different formatting capabilities. The TS1140 Model E07/EH7 tape drive with code D3I3_5CD or later installed can read the JA, JJ, JR, JW, and similar cartridges. Drives with earlier code levels cannot read these cartridges.

The 3592 55x drive introduces two new logical formats to improve the capacity and data rate of media that support these formats. The two new formats are

- J5A or Jaguar 5 Archive logical format - unencrypted
- J5A-E or Jaguar 5 Archive logical format - encrypted

Notes:

- Non-supported media is rejected on load.
- Reformatted media is loaded (provided a prerequisite drive code level is loaded), but can be rewritten only in a supported format.
- The 3592 55x supports writing the new J5A logical formats. This format is the default write format for writes from BOT unless overridden. Append operations in supported formats default to the format of the media.
- PGA releases are provided for 3592 Ex8 previous generation drives to support the recognition and reformatting of tapes in the J5A logical format back to the J5 (10 TB) format (both encrypted or non-encrypted). Existing field microcode levels on these devices does not load cartridges in the J5A logical format and therefore must be upgraded to support media reformat interchanges.

All 3592 tape drives support cartridge reuse. The 3592 tape cartridges can be reformatted to any tape format supported by the tape drive when it writes from BOT. When reformatting, all existing data on the cartridge is erased.

All compatible 3592 tape cartridge types can be used with the encryption function of the E05, E06, E07/EH7, E08/EH8, 55F, and 60F tape drives. Encrypted cartridges use a unique format, Enterprise Encrypted Format 2 (EEFMT2), Enterprise Encrypted Format 3 (EEFMT3), Enterprise Encrypted Format 4 (EEFMT4), Enterprise Encrypted Format 5 (EEFMT5), or Enterprise Encrypted Format 6 (EEFMT6).

Table 36: 3592 capacities by density, cartridges, and products

Format (Density Name)	**Cartridge**	**Supported by**						
		3592 J1A	**3592 E05**	**3592 E06**	**3592 E07**	**3592 E08**	**3592 55F**	**3592 60F**
J1A (3592A1)		**WR**	**WR**	**RO**				
	JJ/JR	60 GB	100 GB	128 GB	-	-	-	-
	JA/JW	300 GB	500 GB	640 GB	-	-	-	-
E05 (3592A2)			**WR**	**WR**	**RO**			
	JB/JX	-	700 GB	700 GB	700 GB	-	-	-
E06 (3592A3)				**WR**	**WR**			
	JB/JX	-	-	1 TB	1 TB	-	-	-
E07 (3592A4)					**WR**	**WR**	**RO**	**RO**
	JB/JX	-	-	-	1.6 TB	-	-	-
	JK	-	-	-	500 GB	500 GB	500 GB	500 GB
	JC/JY	-	-	-	4 TB	4 TB	4 TB	4 TB
E08 (3592A5)						**WR**	**WR**	**WR**
	JK	-	-	-	-	900 GB	900 GB	900 GB
	JC/JY	-	-	-	-	7 TB	7 TB	7 TB
	JL	-	-	-	-	2 TB	2 TB	2 TB
	JD/JZ	-	-	-	-	10 TB	10 TB	10 TB
55F (3592B5)							**WR**	**WR**
	JL	-	-	-	-	-	3 TB	3 TB
	JD/JZ	-	-	-	-	-	15 TB	15 TB
60F (3592A6)								**WR**
	JM	-	-	-	-	-	-	5 TB
	JE/JV	-	-	-	-	-	-	20 TB

Table 36: 3592 capacities by density, cartridges, and products (continued)

Format (Density Name)	Cartridge	Supported by	
Notes: • Values are in GB and TB (10^9) no compression. • The terms 'Extended' and 'Advanced' are used in the cartridge descriptions below to denote increased capacity. • Devices with updated firmware might support reformatting media written with unsupported formats to a supported format based on media type. • In addition to these cartridges, a "CE" cartridge is available for use by Service Representatives only. The VOLSER label for this cartridge begins with "CE" followed by a space and three numerals, and ending with "JA" or "JK" .			
JJ	Economy Cartridge	JR	Economy WORM Cartridge
JA	Standard Cartridge	JW	Standard WORM Cartridge
JB	Extended Cartridge	JX	Extended WORM Cartridge
JK	Advanced Type C Economy Cartridge	JY	Advanced Type C WORM Cartridge
JC	Advanced Type C Cartridge	JZ	Advanced Type D WORM Cartridge
JL	Advanced Type D Economy Cartridge	JV	Advanced Type E WORM Cartridge
JD	Advanced Type D Cartridge	-	Not supported
JM	Advanced Type E Economy Cartridge	WR	Write and Read
JE	Advanced Type E Cartridge	RO	Read Only

Cartridge external components

This topic describes cartridge external components.

The main external components, common to all types of 3592 tape cartridges are shown in Figure 8 on page 93 and Figure 9 on page 94.

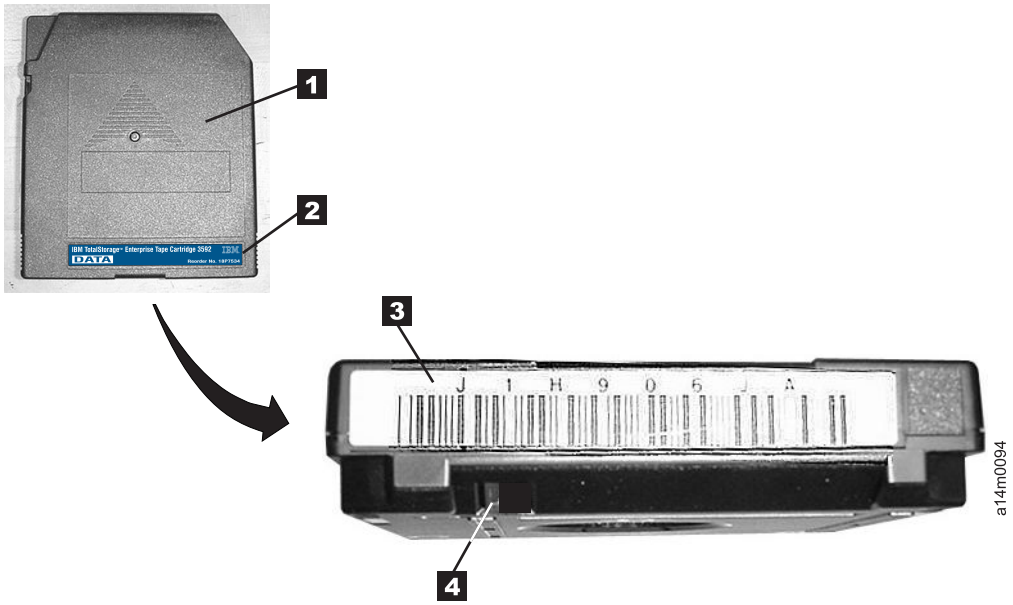

Figure 8: 3592 tape cartridge

1	Cartridge case	3	Cartridge bar code label
2	IBM product label	4	Write-protect selector

In tape libraries, the library vision system identifies the types of cartridges during an inventory operation. The vision system reads a volume serial number (VOLSER) 3, which appears on the label on the edge of the cartridge. The VOLSER contains from one to six characters, which are left-justified on the label. If fewer than six characters are used, spaces are added. The media type is indicated by seventh and eighth characters. The different cartridge type codes are shown in the "Type" column of Table 36 on page 91.

If you are attaching VOLSER labels to cartridges that do not have pre-attached labels, place the label entirely within the label recessed area on the cartridge. See 3 in Figure 8 on page 93 as an example of proper placement. The label must be flat to within 0.5 mm (0.02 in.) over the length of the label and have no folds, missing pieces, tears, or any extraneous markings. Failure to follow these placement requirements will result in degraded readability.

Each data cartridge includes a write-protect selector 4 which can be set to prevent data from being over-written or erased from the tape by the tape drive. To write-enable a cartridge, slide the selector to the left (see 1 in Figure 9 on page 94), which exposes a square hole, to permit data to be written to and erased from the cartridge. To write-protect a cartridge, slide the selector to the right 2, which covers the hole, preventing data to be written to or erased from the cartridge.

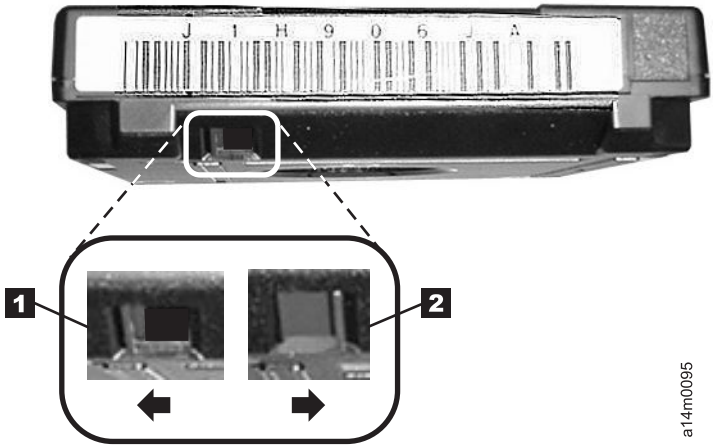

Figure 9: Write-protect selector

1 Write-enabled

2 Write-protected

When you insert a cartridge into the drive, a threading mechanism pulls the tape leader pin and the attached tape out of the cartridge, across the drive head, and onto a non-removeable take-up reel. The cartridge door (1 in Figure 10 on page 94) protects the tape from contamination when the cartridge is out of the drive. The only time you should manually retract this door is to check for proper tape pin position .

Figure 10: Data cartridge door

Cartridge memory

This topic describes the cartridge memory (CM) of the 3592 tape cartridge.

Each 3592 data cartridge contains a passive, contactless, silicon storage device called CM. This CM holds information about the cartridge and the media in the cartridge, and holds statistics about the media in the cartridge. The cartridge and media information is stored in a protected, read-only area of the CM. This information is read by the CM reader in the drive, by using a contactless, radio-frequency interface, when the cartridge is loaded into the drive. The media performance statistics are stored in an unprotected, read/write area of the CM. These statistics are updated by the CM reader just before the cartridge is unloaded. The media performance statistics are maintained by the Statistical Analysis and Reporting System (SARS) portion of the drive microcode. Each cleaning cartridge also contains a CM, which tracks the number of cleaning uses.

Write-once, read-many

These topics describe the write-once, read-many (WORM) tape cartridge and microcode controls.

Some records retention and data security applications require the WORM function of tape data storage. The 3592 tape drives, when used with WORM media, could serve as a replacement to the IBM 3995 Optical Library where long-term records retention is required.

WORM function is accomplished on the 3592 by a combination of a special WORM tape cartridge and microcode controls in the drive. All 3592 drives with the appropriate microcode version installed can read and write WORM cartridges.

Write-once, read-many tape cartridge characteristics

This topic describes the write-once, read-many (WORM) tape cartridge.

The following lists characteristics of WORM cartridges:

- WORM format pervades the entirety of every WORM cartridge. The WORM tape media is formatted to give every block on a WORM cartridge write-once, read-many protection. Additionally, the cartridge memory (CM) has a WORM indicator byte in the cartridge type field. Both of these conditions must be true for the drive to work with a WORM cartridge. If one condition is true and the other is false, an `ATTN DRV - Invalid Cartridge` message posts.
- Each WORM cartridge is identified by using a WorldWide Unique Cartridge Identifier (WWCID), which is permanent and locked, providing another level of security for data that must be maintained. This permanent locked information is stored in both the cartridge CM and on the tape itself, and can also be associated with the unique bar code volume serial (VOLSER). WORM cartridges can be audited by using the WWCID and the write mount count.
- WORM cartridges are labeled with a 'JR,' 'JV,' 'JW,' 'JX' , 'JY' , or 'JZ' and they are color-coded to distinguish them from rewritable cartridges. The color-coding is distinguishable by people with any of the three major varieties of color blindness.
- The WORM cartridge is tamper-proof (see “Write-once, read-many microcode controls” on page 95).
- WORM cartridges can be read (or appended) only on WORM enabled 3592 drives. Non-WORM enabled drives are not able to take any action with a WORM cartridge other than to unload it.
- A WORM cartridge cannot be made non-WORM.
- A non-WORM cartridge cannot be made WORM.
- Written user data cannot be modified or erased. Deletion of the data requires destruction of the media and its usability, such as heat, crushing, physical shredding, or magnetic fields sufficient to delete all formatting that is required to read or write the cartridge.

Write-once, read-many microcode controls

This topic describes the write-once, read-many (WORM) microcode controls.

When the drive senses that a cartridge is a WORM cartridge, the microcode prohibits the changing or altering of user data already written on the tape. The microcode tracks the last appendable point on the tape with an overwrite-protection pointer stored in the cartridge memory (CM). Statistical Analysis and Reporting System (SARS) data can be written and updated on WORM tapes because the SARS data is not in the user area of the tape.

Note: When a WORM cartridge is loaded and positioned at a non-appendable point on a drive attached to a controller, the controller gives good status to a write type command if the data being written is the same as what is already recorded on the media at the same location. However, the tape is not written. The tape position is after the block with the apparent overwrite and all data following is still valid on tape. When positioned at a non-appendable point on a WORM cartridge, the microcode reports overwrite errors only if attempts are made to write conflicting data. The scenario for the apparent overwrite is as follows: The host issues a write type command to the controller and the tape is at a non-appendable point. The controller attempts to write the WORM cartridge but the drive gives an overwrite error. The controller then reads the block and compares it to the block received from the host. If the block is the same, the controller gives good status to the host and leaves the tape positioned after the overwritten block. If the block varies in data or size, the controller repositions the tape in front of the read block and reports the overwrite error to the host. This process is not optimal for performance considerations.

Capacity scaling and segmentation

This section describes how the 3592 tape drive uses capacity scaling and segmentation to place data in a designated section of tape to speed access and manage efficient capacity.

The 3592 tape drives support capacity-scaling for tape cartridges of media types JA, JB, JC, JD, and JE over a broad range of capacities. The effect of capacity scaling is to contain data in a specified fraction of the tape, yielding faster locate and read times. The 3592 tape drive supports a logical division of the tape into longitudinal segments. The JA, JB, JC, and JD data cartridges can be formatted with space that is assigned to two segments. For a 300 GB, JA data cartridge in a J1A tape drive, an example of segmentation might be -

- A 60 GB segment for fast access
- A 200 GB segment that is assigned to extra capacity

Note: This capacity scaling and segmentation is only supported for the JA, JB, JC, JD, and JE data cartridges.

Alternatively, you can purchase economy tapes (the JJ, JK, JL, or JM media type) to achieve this faster performance.

Performance scaling limits the data that is written to the first 20% of the cartridge. When the performance segmentation option is used, the overall capacity of the cartridge is limited to 86.6% of the total capacity. The fast access segment occupies the first 20% of the cartridge, followed by the slower access segment. For example, with the E06 tape drive operating in EFMT3 format, the 3592 Extended Data Tape Cartridge (type JB) can be scaled to 200 GB (186.26 GiB). And using performance segmentation, the 1000 GB (931.32 GiB) Extended Data cartridge can be segmented into a 200 GB (186.26 GiB) fast access segment, and 666 GB (620.26 GiB) slower access segment. Segmentation is only available within a specified range of capacity-scaling settings.

Capacity scaling is not supported for economy (JJ, JK, JL, or JM) or write-once, read-many (WORM) tapes (JV, JW, JX, JY, JR, and JZ). For information about implementing segmentation and capacity scaling, refer to the readme files that pertain to your device driver on the IBM Fix Central website.

Customers that use z/OS can use the capacity-scaling capability of the 3592 drive. A data class parameter determines whether a tape is to be scaled. OPEN processing scales a tape when the associated data class requests it and the tape is being written from load point (DISP=NEW, file sequence 1). On a subsequent reading of a performance scaled tape, the data is entirely contained in the first 20% of the tape, yielding fast locate and read times.

DFSMShsm and DFSMSdfp OAM can use this new feature, and also other applications that use standard Open/Close/EOV processing. Refer to *z/OS DFSMS Software Support for IBM TS1130 and TS1140 Tape Drives (3592)*, SC26-7514, for information about software support for the 3592 drive.

For technical information about WORM, capacity scaling, and segmentation, see also the *IBM Enterprise Tape System 3592 SCSI Reference*.

Cartridges pre-scaled for 60 GB (55.88 GiB) or 100 GB (93.13 GiB) capacity are also available for order with the 3599 Tape Media method. These pre-scaled cartridges can be ordered (and labeled) for a specific VOLSER range. Capacity scaling can then be used by an application that permits media pools to be defined by VOLSER range.

Note: Virtual tape subsystems (TS7700 Virtualization Engine) do not support capacity scaling or segmentation.

For information on which independent software vendors support capacity-scaling by command or with the pre-scaled cartridges and the 3592 tape drives, refer to the Independent Software Vendor (ISV) matrix for 3592 and LTO.

Cleaning cartridges

To help prevent errors that are caused by debris, it is important to clean the tape path, and to manually clean the outsides of all data cartridges when first installing them in the library. Cleaning of the tape path

in each drive is normally an automated procedure, and rarely requires manual intervention. This action works automatically only if the appropriate cleaning cartridges (IBM part 18P7535) are installed in the library, and they still have remaining uses available. A 3592 cleaning cartridge is shipped with the first drive in each installation, and extra cleaning cartridges are available through IBM. The cleaning cartridge contains a Cartridge Memory (CM) device, which automatically tracks the number of times it is used. Cleaning cartridges need to be replaced after 50 uses. The 3592 cleaning cartridges are not interchangeable with 3590 cleaning cartridges, so you must have both types of cleaning cartridges if you have both types of drives in your environment.

Attention: Insert only clean and undamaged cleaning cartridges into a tape system. Do not use a grease pencil on the label.

The physical characteristics of the 3592 cleaning cartridge can be used to distinguish it from 3592 data cartridges. The product label on the top of the cartridge is white, with the word "cleaning" printed on it. In place of the write-protect switch, a non-moveable light gray block is seen (see 1 in Figure 11 on page 97). If you order cleaning cartridges with pre-attached labels, the first 3 characters of the volume serial number (VOLSER) 2 are CLN. The cartridge door (see 1 in Figure 12 on page 97) is also light gray.

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Figure 11: Cleaning cartridge - identifying characteristics

1 Light gray non-moveable block

2 Cleaning cartridge sample label

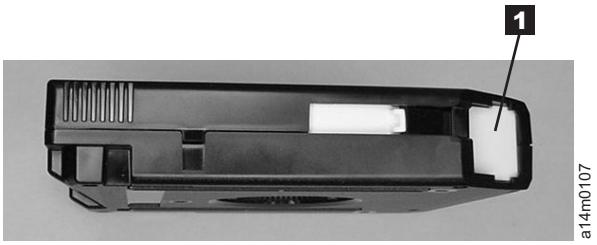


Figure 12: Cleaning cartridge door

Cartridge care and handling

This section describes the care and handling of the IBM 3592 Tape Cartridge.

Handling the cartridges

Attention: Do not insert a damaged tape cartridge into your tape drive. A damaged cartridge can interfere with the reliability of a drive and may void the warranties of the drive and the cartridge. Before inserting a tape cartridge, inspect the cartridge case, cartridge door, and write-protect switch for breaks.

Incorrect handling or an incorrect environment can damage the IBM 3592 Tape Cartridges and the magnetic tape. To avoid damage to your tape cartridges and to ensure the continued high reliability of your TS1120 and later tape drives use the following guidelines:

Provide training

- Post procedures that describe proper media handling in places where people gather.
- Ensure that anyone who handles tape has been properly trained in handling and shipping procedures. This includes operators, users, programmers, archival services, and shipping personnel.
- Ensure that any service or contract personnel who perform archiving are properly trained in media-handling procedures.
- Include media-handling procedures as part of any services contract.
- Define and make personnel aware of data recovery procedures.

Ensure proper packaging

- When you ship a cartridge, ship it in its original or better packaging.
- Use only shipping containers that securely hold the cartridges in place during transportation. This can be in a well-packaged cardboard box or other container. One such container can be procured from Perm-A-Store at the Turtle Case by Perm-A-Store website.
- If you ship the cartridge in a cardboard box or a box of a sturdy material, ensure the following:
  - Place the cartridge in polyethylene plastic wrap or bags to protect it from dust, moisture, and other contaminants.
  - Pack the cartridge snugly; do not allow it to move around.
  - Double-box the cartridge (place it inside a box, then place that box inside the shipping box) and add padding between the two boxes.
- Never ship a cartridge in a commercial shipping envelope. Always place it in a box or package.

Provide proper acclimation and environmental conditions

- Before you use a cartridge, let it acclimate to the normal operating environment for a minimum of 24 hours. If you see condensation on the cartridge, wait an additional hour.
- Ensure that all surfaces of a cartridge are dry before inserting it.
- Do not expose the cartridge to moisture or direct sunlight.
- Do not expose recorded or blank cartridges to stray magnetic fields of greater than 350 oersteds (for example, terminals, motors, video equipment, X-ray equipment, or fields that exist near high-current cables or power supplies). Such exposure can cause the loss of recorded data or make the blank cartridge unusable.
- Maintain the conditions that are described in “Environmental specifications for tape cartridges” on page 99.

Perform a thorough inspection

After purchasing a cartridge and before using it, perform the following steps:

- Inspect the cartridge's packaging to determine potential rough handling.
- When inspecting a cartridge, open only the cartridge door. Do not open any other part of the cartridge case. The upper and lower parts of the case are held together with screws; separating them destroys the usefulness of the cartridge.
- Inspect the cartridge for damage before using or storing it.
- Check that the leader pin is properly seated.
- If you suspect that the cartridge has been mishandled but it appears usable, copy any data onto a good cartridge immediately for possible data recovery. Discard the mishandled cartridge.

Handle the cartridge carefully

- Do not drop the cartridge. If the cartridge drops, slide the cartridge door back and ensure that the leader pin is properly seated.

- Do not handle tape that is outside the cartridge. Handling the tape can damage the tape's surface or edges, which may interfere with read or write reliability. Pulling on tape that is outside the cartridge can damage the tape and the brake mechanism in the cartridge.
- Do not stack more than six cartridges. Although 3590 tapes can be stacked with 3592 tapes, be cautious about mixing the different types of cartridges, since they are not interchangeable, and can be used only with their respective drives.
- Do not degauss a cartridge that you intend to reuse. Degaussing makes the tape unusable.

Environmental specifications for tape cartridges

Before you use a tape cartridge, acclimate it to the operating environment for 24 hours or the time necessary to prevent condensation in the drive (the time varies, depending on the environmental extremes to which the cartridge was exposed).

The best storage container for the cartridges (until they are opened) is the original shipping container. The plastic wrapping prevents dirt from accumulating on the cartridges and partially protects them from humidity changes.

Table 37 on page 99 lists the environmental conditions for operating and storing IBM Enterprise tape cartridges.

Table 37: Environment for storage and shipping the IBM 3592 tape cartridge.

Environmental specifications			
Environmental factor	**Allowable storage**	**Recommended storage**	**Shipping**
Temperature	16 to 32°C (61 to 90°F)	16 to 25°C (61 to 77°F)	-23 to 49°C (-9 to 120°F)
Relative humidity (noncondensing)	20 to 80%	20 to 50%	5 to 80%
Maximum wet bulb temperature (does not apply to 3592 JE tape cartridges)	26°C (79°F)	26°C (79°F)	26°C (79°F)
Maximum dew point temperature (applies only to 3592 JE tape cartridges)	22°C (72°F)	22°C (72°F)	22°C (72°F)
Magnetic field	Stray magnetic field at any point on tape not to exceed 50 oersteds (4000 ampere/meter).		

Cartridge quality and library maintenance

The IBM tape cartridge provides high performance and reliability with IBM magnetic tape cartridge drives when the cartridge is properly handled and stored. Repeated handling or inadvertent mishandling can damage the physical parts of the cartridge and make it unusable.

The magnetic tape inside the cartridge is made of highly durable materials. However, the tape wears after repeated cycles in the tape system. Eventually, such wear can cause an increase in tape errors.

Track the error data available by monitoring both the cartridge and cartridge library performance. By monitoring error data, you can identify and replace cartridges that are no longer acceptable for continued use.

Proper maintenance of your cartridge library helps to keep IBM magnetic tape cartridge systems operating in a reliable and efficient manner.

Media supplies

The topics in this section describe planning considerations for media supplies.

This section provides information on different ways of ordering media supplies, including feature codes and part numbers for ordering media supplies for 3592 tape drives. Selected media supplies can be ordered using feature codes when purchasing a 3592 drive. This is the "pack-in" method of ordering, and the media will be shipped with the hardware order. Not all media types are available with this method. The 3599 Tape Media method is available for ordering all types of data and cleaning cartridges. This method is typically used for ordering larger quantities, and for ordering initialized and/or pre-labeled cartridges. Media supplies can also be ordered using part numbers, through IBM-authorized distributors.

Feature Code descriptions ("pack-in")

This topic describes media feature codes.

Note: FC 8802, FC 8820, FC 9590 are no longer marketed by IBM as of January 2005. See “3599 media supplies” on page 100 to order 3592 media.

Feature Code definitions

The topics in this section describe the feature codes.

Cleaner Cartridge (FC 8802)

This topic describes the Cleaner Cartridge (FC 8802).

Note: FC 8802 will no longer be marketed by IBM beginning in January 2005.

This feature provides a 3592 cleaning cartridge for 3592 tape drives. Maximum: five. Plant or field installation.

Twenty 3592 Data Cartridges (FC 8820)

This topic describes Feature Code 8820.

Note: FC 8820 will no longer be marketed by IBM beginning in January 2005.

This feature provides twenty 300 GB Data cartridges for 3592 tape drives. Maximum: five. Plant installation only.

3599 media supplies

This topic describes 3599 media supplies.

Customers can order media by using the 3599 Tape Media method. You can order unlabeled, pre-labeled, initialized, and bulk-packaged tape data cartridges in a wide variety of combinations and cleaning cartridges for the 3592 tape drive. Orders can be placed by calling IBM Americas at 1-800-IBM-CALL (1-800-426-2255). The following cartridge types are available.

- Standard Data cartridges (JA)
  - 300 GB (279.39 GiB) EFMT1 format
  - 500 GB (465.66 GiB) EFMT2 format
  - 640 GB (596.04 GiB) EFMT3 format
- Extended Data cartridges (JB)
  - 700 GB (651.93 GiB) EFMT2 format
  - 1000 GB (931.32 GiB) EFMT3 format
  - 1600 GB (1490.12 GiB) EFMT4 format
- Advanced Type C Data cartridges (JC)
  - 4000 GB (3725.29 GiB) EFMT4 format
  - 7 TB (6.37 TiB) EFMT5 format

- Advanced Type D Data cartridges (JD)
  - 10 TB (9.09 TiB) EFMT5 format
  - 15 TB (13.64 TiB) EFMT5 formatted for 55x drives
- Advanced Type E Data cartridges (JE)
  - 20 TB (18.2 TiB) EFMT6 format
- Economy Data cartridges (JJ)
  - 60 GB (55.88 GiB) EFMT1 format
  - 100 GB (93.13 GiB) EFMT2 format
  - 128 GB (119.21 GiB) EFMT3 format
  - Read only for EFMT4 format
- Advanced Type C Economy Data cartridges (JK)
  - 500 GB (465.66 GiB) EFMT4 format
  - 900 GB (838.18 GiB) EFMT5 format
- Advanced Type D Economy Data cartridges (JL)
  - 2 TB (1.82 TiB) EFMT5 format
  - 3 TB (2.73 TiB) EFMT5 formatted for 55x drives
- Advanced Type E Economy Data cartridges (JM)
  - 5 TB (4.55 TiB) EFMT6 format
- Economy WORM (write-once, read-many) cartridges (JR)
  - 60 GB (55.88 GiB) EFMT1 format
  - 100 GB (93.13 GiB) EFMT2 format
  - 128 GB (119.21 GiB) EFMT3 format
- Standard WORM cartridges (JW)
  - 300 GB (279.39 GiB) EFMT1 format
  - 500 GB (465.66 GiB) EFMT2 format
  - 640 GB (596.04 GiB) EFMT3 format
- Extended WORM cartridges (JX)
  - 700 GB (651.93 GiB) EFMT2 format
  - 1000 GB (931.32 GiB) EFMT3 format
  - 1600 GB (1490.12 GiB) EFMT4 format
- Advanced Type C WORM cartridges (JY)
  - 4000 GB (3725.29 GiB) EFMT4 format
  - 7 TB (6.37 TiB) EFMT5 format
- Advanced Type D WORM cartridges (JZ)
  - 10 TB (9.09 TiB) EFMT5 format
  - 15 TB (13.64 TiB) EFMT5 formatted for 55x drives
- Advanced Type E WORM cartridges (JV)
  - 20 TB (18.2 TiB) EFMT6 format

With the 3599 Tape Media method of ordering, model numbers are used to identify the cartridge types, and feature code combinations are used to specify the quantities, labeling, and initialization options. Table 38 on page 102 shows a few examples of ordering options for each cartridge type. Additional feature codes are required to completely specify all wanted characteristics of the cartridges.

3599 media feature descriptions

This topic describes the 3599 media features.

Table 38: Descriptions of 3599 tape media features

3599 Model	Media ID/ Feature Code	Feature Code for Labeling, Initialization, and Quantity		Format	Individual Cartridge Capacity[2, 5]	Description
		Regular	RFID[1]			
011	JA/9030	1020	1021	9082	640 GB (596.05 GiB)	20-pack 3592 Data cartridges, labeled and initialized
				9081	500 GB (465.66 GiB)	
				9080	300 GB (279.39 GiB)	
012	JA/9030	2020	2021	N/A[3]	500 GB (465.66 GiB)	20-pack 3592 Data cartridges, labeled, not initialized
					300 GB (279.39 GiB)	
013	JA/9030	3020	N/A	N/A	500 GB (465.66 GiB)	20-pack 3592 Data cartridges, not labeled and not initialized
					300 GB (279.39 GiB)	
014	JB/9032	4020	4021	9084	1600 GB (1490.12 GiB)	20-pack 3592 Extended Data cartridges, labeled and initialized
				9082	1000 GB (931.32 GiB)	
				9081	700 GB (651.93 GiB)	
015	JB/9032	5020	5021	N/A	700 GB (651.93 GiB)	20-pack 3592 Extended Data cartridges, labeled, not initialized
016	JB/9032	6020	N/A	N/A	700 GB (651.93 GiB)	20-pack 3592 Extended Data cartridges, not labeled and not initialized
420	JC/9035	4211	4221	9084	4 TB (3.64 TiB)	20-pack 3592 Advanced Data cartridges, labeled and initialized

Table 38: Descriptions of 3599 tape media features (continued)

3599 Model	Media ID/ Feature Code	Feature Code for Labeling, Initialization, and Quantity		Format	Individual Cartridge Capacity[2, 5]	Description
		Regular	RFID[1]			
520	JC/9035	5221	5231	N/A	4 TB (3.64 TiB)	20-pack 3592 Advanced Data cartridges, labeled, not initialized
620	JC/9035	6200	N/A	N/A	4 TB (3.64 TiB)	20-pack 3592 Advanced Data cartridges, not labeled and not initialized
425	JD/9036	4251	4261	9085	10 TB (9.1TiB)	20-pack 3592 Advanced Data cartridges, labeled and initialized
525	JD/9036	5251	5261	N/A	10 TB (9.1TiB)	20-pack 3592 Advanced Data cartridges, labeled, not initialized
625	JD/9036	6250	N/A	N/A	10 TB (9.1TiB)	20-pack 3592 Advanced Data cartridges, not labeled and not initialized
426	JE/9037	4262	N/A	N/A	20 TB (18.2 TiB)	20-pack 3592 Advanced Data cartridges, labeled and initialized
526	JE/9037	5262	N/A	N/A	20 TB (18.2 TiB)	20-pack 3592 Advanced Data cartridges, labeled, not initialized
626	JE/9037	6262	N/A	N/A	20 TB (18.2 TiB)	20-pack 3592 Advanced Data cartridges, not labeled and not initialized
E11	JJ/9050	1120	1121	9082	128 GB (119.21 GiB)	20-pack 3592 Economy cartridges, labeled and initialized
				9081	100 GB (93.13 GiB)	
				9080	60 GB (58.88 GiB)	
E12	JJ/9050	1220	1221	N/A	60 GB (58.88 GiB)	20-pack 3592 Economy cartridges, labeled, not initialized
E13	JJ/9050	1320	N/A	N/A	60 GB (58.88 GiB)	20-pack 3592 Economy cartridges, not labeled and not initialized
430	JK/9052	4300	4310	9084	500 GB (465.66 GiB)	20-pack 3592 Advanced Economy cartridges, labeled and initialized

Table 38: Descriptions of 3599 tape media features (continued)

3599 Model	Media ID/ Feature Code	Feature Code for Labeling, Initialization, and Quantity		Format	Individual Cartridge Capacity[2, 5]	Description
		Regular	RFID[1]			
530	JK/9052	5300	5310	N/A	500 GB (465.66 GiB)	20-pack 3592 Advanced Economy cartridges, labeled, not initialized
630	JK/9052	6300	N/A	N/A	500 GB (465.66 GiB)	20-pack 3592 Advanced Economy cartridges, not labeled and not initialized
435	JL/9054	4351	4361	9085	2 TB (1.8 TiB)	20-pack 3592 Advanced Economy cartridges, labeled and initialized
535	JL/9054	5351	5361	N/A	2 TB (1.8 TiB)	20-pack 3592 Advanced Economy cartridges, labeled, not initialized
635	JL/9054	6350	N/A	N/A	2 TB (1.8 TiB)	20-pack 3592 Advanced Economy cartridges, not labeled and not initialized
436	JM/9055	4362	N/A	N/A	5 TB (4.55 TiB)	20-pack 3592 Advanced Economy cartridges, labeled and initialized
536	JM/9055	5362	N/A	N/A	5 TB (4.55 TiB)	20-pack 3592 Advanced Economy cartridges, labeled, not initialized
636	JM/9055	6362	N/A	N/A	5 TB (4.55 TiB)	20-pack 3592 Advanced Economy cartridges, not labeled and not initialized
021[4]	JW/9040	2120	2121	9082	640 GB (596.05 GiB)	20-pack 3592 WORM cartridges, labeled and initialized
				9081	500 GB (465.66 GiB)	
				9080	300 GB (279.39 GiB)	
022[4]	JW/9040	2220	2221	N/A	500 GB (465.66 GiB)	20-pack 3592 WORM cartridges, labeled, not initialized
					300 GB (279.39 GiB)	

Table 38: Descriptions of 3599 tape media features (continued)

3599 Model	Media ID/ Feature Code	Feature Code for Labeling, Initialization, and Quantity		Format	Individual Cartridge Capacity[2, 5]	Description
		Regular	RFID[1]			
023[4]	JW/9040	2320	N/A	N/A	500 GB (465.66 GiB)	20-pack 3592 WORM cartridges, not labeled and not initialized
					300 GB (279.39 GiB)	
024[4]	JX/9044	2420	2421	9082	1000 GB (931.32 GiB)	20-pack 3592 Extended WORM cartridges, labeled and initialized
				9081	700 GB (651.93 GiB)	
025[4]	JX/9044	2520	2521	N/A	700 GB (651.93 GiB)	20-pack 3592 Extended WORM cartridges, labeled, not initialized
026[4]	JX/9044	2620	N/A	N/A	700 GB (651.93 GiB)	20-pack 3592 Extended WORM cartridges, not labeled and not initialized
440	JY/9046	4400	4410	9084	4 TB (3.64 TiB)	20-pack 3592 Advanced WORM cartridges, labeled and initialized
540	JY/9046	5400	5410	N/A	4 TB (3.64 TiB)	20-pack 3592 Advanced WORM cartridges, labeled, not initialized
640	JY/9046	6400	N/A	N/A	4 TB (3.64 TiB)	20-pack 3592 Advanced WORM cartridges, not labeled and not initialized
445	JZ/9049	4455	4465	9085	10 TB (9.1 TiB)	20-pack 3592 WORM cartridges, labeled and initialized
545	JZ/9049	5451	5461	N/A	10 TB (9.1 TiB)	20-pack 3592 WORM cartridges, labeled, not initialized
645	JZ/9049	6450	N/A	N/A	10 TB (9.1 TiB)	20-pack 3592 WORM cartridges, not labeled and not initialized

Table 38: Descriptions of 3599 tape media features (continued)

3599 Model	Media ID/ Feature Code	Feature Code for Labeling, Initialization, and Quantity		Format	Individual Cartridge Capacity[2, 5]	Description
		Regular	RFID[1]			
E21[4]	JR/9042	3120	3121	9082	128 GB (119.21 GiB)	20-pack 3592 Economy WORM cartridges, labeled and initialized
				9081	100 GB (93.13 GiB)	
				9080	60 GB (58.88 GiB)	
E22[4]	JR/9042	3220	3221	N/A	100 GB (93.13 GiB)	20-pack 3592 Economy WORM cartridges, labeled, not initialized
					60 GB (58.88 GiB)	
E23[4]	JR/9042	3320	N/A	N/A	100 GB (93.13 GiB)	20-pack 3592 Economy WORM cartridges, not labeled and not initialized
					60 GB (58.88 GiB)	
017	JA	7005	N/A	N/A	cleaning, 50 uses	5-pack 3592 Cleaning Cartridges, with media identification labels
017	JA	7006	N/A	N/A	cleaning, 50 uses	5-pack 3592 Cleaning Cartridges without media identification labels

Notes:

1. Radio frequency identification labels
2. For more details about individual cartridge capacities, see “Cartridge types and characteristics” on page 90.
3. N/A = Not applicable
4. This product is no longer available for order by this method. Refer to “Ordering media supplies by part number” on page 106 to order this media type.
5. For cartridges that are not initialized, the actual cartridge capacity is dependent on the format used to write the cartridge.

Ordering media supplies by part number

This topic describes ordering media supplies by part number.

Table 39 on page 107 and Table 40 on page 108 list the data cartridges and media supplies that you can order for the 3592 tape drives.

You can use one of the following methods to order the cartridges and media supplies shown in Table 39 on page 107 and Table 40 on page 108 by part number:

- Order online or through an IBM-authorized distributor (for the closest distributor or to order online, see the IBM Storage Media website)
- If you do not have Internet access, order from any authorized IBM business partner or your IBM sales representative.

- Call 1-888-IBM-MEDIA

Table 39: 3592 media supplies for the 3592 tape drive

Supply Item[1]	Capacity[2]	Part Number
IBM Tape Cartridge 3592 Data (JA)	E06 format: 640 GB (596.04 GiB) E05 format: 500 GB (465.66 GiB) J1A format: 300 GB (279.39 GiB)	18P7534
IBM Tape Cartridge 3592 Extended Data (JB)	E07 format: 1600 GB (1490.12 GiB) E06 format: 1000 GB (931.32 GiB) E05 format: 700 GB (651.93 GiB)	23R9830
IBM Tape Cartridge 3592 Advanced Type C Data (JC)	E08 format: 7 TB (6519.26 GiB) E07 format: 4000 GB (3725.29 GiB)	46X7452
IBM Tape Cartridge 3592 Advanced Type D Read/Write (JD)	55F format: 15 TB (13969.8 GiB) E08 format: 10 TB (9313.23 GiB)	2727263
IBM Tape Cartridge 3592 Advanced Type E Read/Write (JE)	60F format: 20 TB (18.2 TiB)	02CE960
IBM Tape Cartridge 3592 Economy (JJ)	E06 format: 128 GB (119.21 GiB) E05 format: 100 GB (93.13 GiB) J1A format: 60 GB (58.88 GiB)	24R0316
IBM Tape Cartridge 3592 Advanced Type C Economy (JK)	E08 format: 900 GB (838.19 GiB) E07 format: 500 GB (465.66 GiB)	46X7453
IBM Tape Cartridge 3592 Advanced Type D Economy (JL)	55F format: 3 TB (2.73 TiB) E08 format: 2 TB (1.82 TiB)	2727264
IBM Tape Cartridge 3592 Advanced Type E Economy (JM)	60F format: 5 TB (4.55 TiB)	02CE961
IBM Tape Cartridge 3592 Economy WORM (write-once, read-many) (JR)	E06 format: 128 GB (119.21 GiB) E05 format: 100 GB (93.13 GiB) J1A format: 60 GB (58.88 GiB)	24R0317
IBM Tape Cartridge 3592 WORM (JW)	E06 format: 640 GB (596.04 GiB) E05 format: 500 GB (465.66 GiB) J1A format: 300 GB (279.39 GiB)	18P7538
IBM Tape Cartridge 3592 Extended WORM (JX)	E07 format: 1600 GB (1490.12 GiB) E06 format: 1000 GB (931.32 GiB) E05 format: 700 GB (651.93 GiB)	23R9831

Table 39: 3592 media supplies for the 3592 tape drive (continued)

Supply Item[1]	Capacity[2]	Part Number
IBM Tape Cartridge 3592 Advanced WORM (JY)	E08 format: 7 TB (6.37 TiB) E07 format: 4000 GB (3725.29 GiB)	46X7454
IBM Tape Cartridge 3592 Advanced Type D WORM (JZ)	55F format: 15 TB (13.64 TiB) E08 format: 10 TB (9.09 TiB)	2727265
IBM Tape Cartridge 3592 Cleaning	Cleaning, 50 uses	18P7535

Notes:

1. Be sure to order bar code labels for all cleaning and data cartridges. Order volume serial (VOLSER) labels separately.
2. Cartridge capacities vary depending on tape drive and format.

We recommend that you keep a lint-free cloth for wiping the outside of cartridges, and the item listed in Table 40 on page 108, to maintain your cartridges.

Table 40: Supplies for 3592 cartridge maintenance

Description	Part number
Leader Pin Reattachment Kit. This kit is for 3592 cartridges only. It contains the necessary tools to reattach the leader pin to the tape. It includes the rewind tool, which can be used to add tension to a tape if the leader pin is displaced.	18P8887

Repair supplies

The topics in this section describe repair supplies.

Ordering bar code labels

This topic describes ordering bar code labels.

Bar code labels with VOLSERS are required for cartridges used within a library. You can order these labels separately from the IBM Data Cartridges and Cleaning Cartridges.

Attention: The IBM TS3400, TS3500, and TS4500 tape libraries and the IBM 3494 tape library are designed to work with bar code labels that meet the specifications and requirements set forth in the Barcode Label Specification for use with 3592 Tape Media. The label providers listed in Table 41 on page 109 have demonstrated the ability to produce finished bar code labels that meet the foregoing specifications and requirements. This information is provided for the convenience of IBM tape library users only, and is not an endorsement or recommendation of such providers. IBM is not responsible for the quality of bar code labels procured from sources other than IBM. This information is applicable to bar code labels actually printed by the listed companies. IBM has not reviewed the quality of any labels produced by software or services offered by such companies which allow end users to print labels on their own printing equipment.

You can order bar code labels directly from the authorized label suppliers in Table 41 on page 109.

Table 41: Authorized suppliers of custom bar code labels

In the Americas	**In Europe and Asia**
EDP/Tri-Optic 6800 West 117th Avenue Broomfield, CO 80020 US Telephone: 888-438-8362 or 303-464-3547 Fax: 888-438-8363 or 303-666-2166 http://www.tri-optic.com	
Netc, L.L.C.[1] 100 Corporate Drive Trumbull, CT 06611 US Telephone: 203-372-6382 Fax: 203-372-0676 http://www.netclabels.com	Netc Europe[1] Telephone.: +49-2151-970-900 Fax: +49-2151-970-908 Email: Vertrieb@netclabels.de http://www.netclabels.de
	Netc Asia Pacific Pty. Ltd.[1] 7 Cordwood Drive Cooroy QLD 4563 Australia Telephone: +61 (0)7 5442 6263 Fax: +61 (0)7 5442 6522 http://www.netclabels.com.au

[1]Netc is the only authorized supplier of radio frequency identification (RFID) labels. Orders for RFID labels must be placed through the U.S. office. Orders are shipped worldwide.

Chapter 4. Site planning

This section describes various characteristics and specifications necessary for your site planning.

Environmental specifications

This topic describes planning environmental specifications for 3592 drives.

The environments shown in Table 42 on page 110 apply to the components of the tape subsystem, and not to tape cartridges. Measurements should be taken at the front of the drive. The maximum allowed operational altitude of 2134 m (7000 ft.) applies to the 3592 tape drives and controllers.

Table 42: Equipment environment specifications for the 3592 tape library.

Product operation (equipment is powered on)									**Product power off[1]**		
Dry-bulb temperature			Humidity range, non-condensing			Maximum wet-bulb temperature[5]	Maximum dew point temperature[6]	Maximum elevation	Dry-bulb temperature	Relative humidity	Maximum wet-bulb temperature
Allowable[2]	Recommended[3]	Maximum rate of change	Allowable	Recommended	Maximum rate of change						
16 to 32°C (60 to 90°F)	16 to 25°C (60 to 77°F)	5°C/hour (9°F/hour)	20% to 80% RH	20% to 50% RH	5% RH/hour[4] with no condensation	26°C (79°F)	22°C (72°F)	3050 m (10,000 feet)	5 to 45°C (40 to 113°F)	8% to 80% RH	26°C (79°F)

Notes:

1. Product equipment is removed from the original shipping container and installed but not in use - for example, during repair, maintenance, or upgrade.
2. Derate maximum dry-bulb temperature 1°C/300 m above 900 m (1.8°F/1,000 feet above 3,000 feet).
3. Derate maximum recommended dry-bulb temperature 1°C/300 m above 1,800 m (1.8°F/1,000 feet above 6,000 feet).
4. For 3592 media, changes of up to 40% RH in 5 minutes are allowed as long as the 20% to 80% absolute limits are not exceeded.
5. Applies to LTO drive generations 1 through 8 and to legacy 3592 drives (TS1155 and prior generations).
6. Applies to TS1160 drives.

Table 43: J70 Controller environmental specifications	
Operating Temperature	16° to 32° C (60.8° to 89.6° F)
Relative Humidity	20% to 80% non-condensing (limited by media)

Table 43: J70 Controller environmental specifications (continued)	
Wet Bulb Temperature	23° C (73.4° F)

Cooling requirements

This topic describes the cooling requirements for 3592 drives.

There are no additional external cooling requirements for the 3592 tape drives or controllers if ambient environment is within limits described in Table 42 on page 110 and Table 43 on page 110. Do not obstruct air inlets or exhaust of cooling fans.

Acoustic specifications

This topic describes the acoustic specifications for 3592 drives.

Table 44 on page 111 shows the acoustic specifications for the 3592 tape drives and controllers.

Table 44: Acoustic specifications

Model	L_{WAd}		$<L_{pA}>_m$	
	Operating (bels)	**Idling (bels)**	**Operating (dB)**	**Idling (dB)**
3592 tape drive	6.3	6.2	49	48
3592 C06 Controller and J70 Controller	6.4	6.4	49.8	49.8

Notes:

- For definitions of levels, refer to *IBM General Information Manual: Installation Manual-Physical Planning*
- L_{WAd} - is the declared upper limit sound power level.
- $<L_{pA}>_m$ - is the mean value of the A-weighted sound pressure at the one-meter position.

Cabling information

This topic describes planning considerations for cabling.

For host system cable attachment planning information, see Chapter 6, “Device attachment planning,” on page 134 and “Controller cable features” on page 82 for various cable feature definitions and requirements.

To locate IBM resources to assist you in determining cabling needs, see “3592 tape drive features” on page 29.

3592 power characteristics

This topic describes power characteristics.

A rack or frame, with connections to an ac source, supplies ac power to the 3592 dc power supply.

The 3592 devices accept a variety of supply voltages and frequencies. The voltage and frequency range is from 100 - 240 V ac (nominal) and 50 - 60 Hz (nominal) respectively. The device adjusts itself automatically for proper operation with any combination of these voltages and frequencies.

This equipment design is connectable to an impedance-terminated neutral power system.

Power specifications

This topic describes power specifications.

Table 45 on page 112 shows the power specifications for the 3592 tape drives and the controllers.

Table 45: Input voltages

Model	50 Hz±0.5 Hz	60 Hz±0.5 Hz	Operating Current Nominal at 200 V ac	Inrush Current	Typical Power Consumed
3592 tape drive[1]	100 - 240 V ac	100 - 240 V ac	0.3 amps	50 amps	65 w[2] 45 w[3]
J70 Controller	100 - 240 V ac	100 - 240 V ac	3.0 amps	200 amps	600 w
C06 Controller	100 - 240 V ac	100 - 240 V ac	3.0 amps	200 amps	1190 w

Notes:

1. For single drive and single power supply.
2. Operating maximum continuous - not peak. For J1A, E05, E06/EU6 tape drives.
3. Operating maximum continuous - not peak. For E07/EH7 and E08/EH8 tape drives.

Power cords

This topic describes power cords.

The power cords on the 3592 tape drives have a bifurcated (y-shaped) plug which connects the tape drives' two redundant power supplies to one power receptacle in the rack, library, or frame.

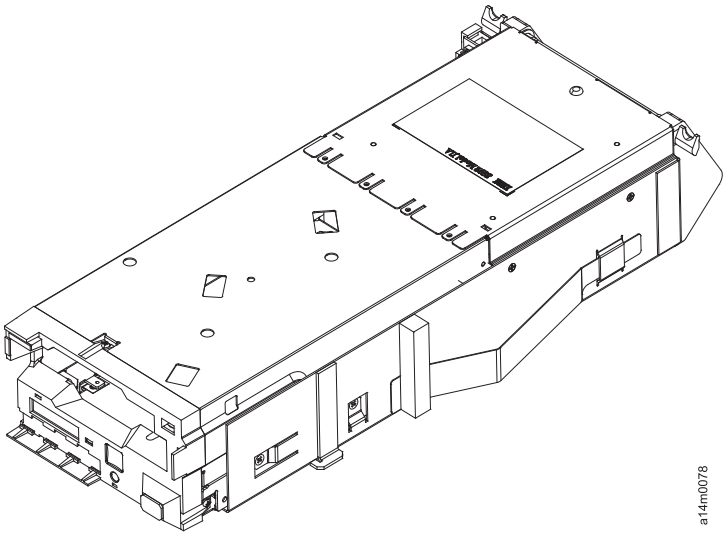
The 3592 controller connects to one or two power receptacles. It is recommended to use two power cords and separate power supplies to power the C06 Controller whether in a rack, library, or frame. The 3592 controller power supplies operate from 100 to 127 V ac or 200 to 240 V ac, at 50 or 60 Hz.

3592 tape drive specifications

Note: 3592 tape drives are hot-swappable. Power is automatically disconnected from a drive when it is pulled from its cradle in a rack or frame.

English measurements are shown in parentheses.

Table 46: 3592 tape drive specifications (E08, E07, E06/EU6, E05, and J1A tape drives)



SPECIFICATIONS

Dimensions

Front Side Height
mm 154.2 466.6 94.5
(in.) (6.071) (18.37) (3.72)

Service Clearances

Refer to the rack installation for clearances.

Weight

kg 5.7
(lb.) (12 lbs. 9 oz.)

Heat Output

.043 kw
(.147 kBTU /Hour)

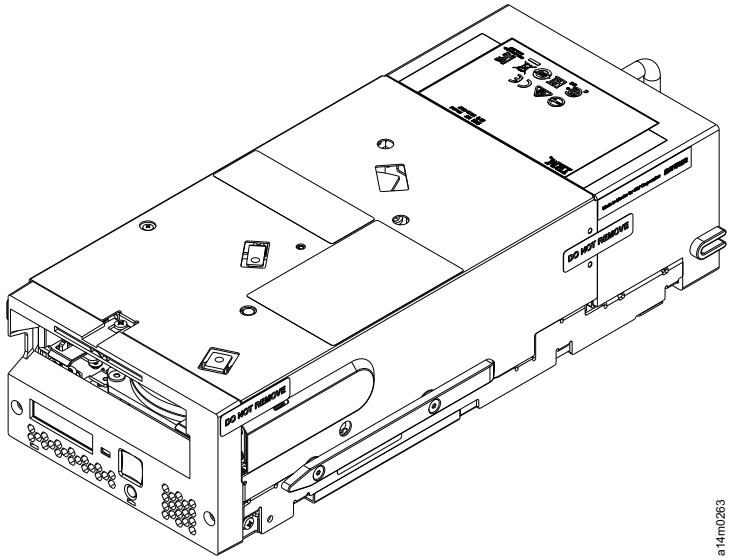
Exhaust capacity

0.34 m^3/min
(12 CFM)

Power Requirements

See Table 45 on page 112

Table 47: 3592 tape drive specifications (EH7 , EH8, 55F, and 60F tape drives)



a14m0263

SPECIFICATIONS

Dimensions

Front Side Height
mm 156 374 86
(in.) (6.1) (14.7) (3.4)

Service Clearances

Refer to the rack installation for clearances.

Weight

kg 3.97
(lb.) (8.75)

Heat Output

.0.050 kw
(0.171 kBTU /Hour)

Exhaust capacity

0.21 m^3/min
(7.5 CFM)

Power Requirements

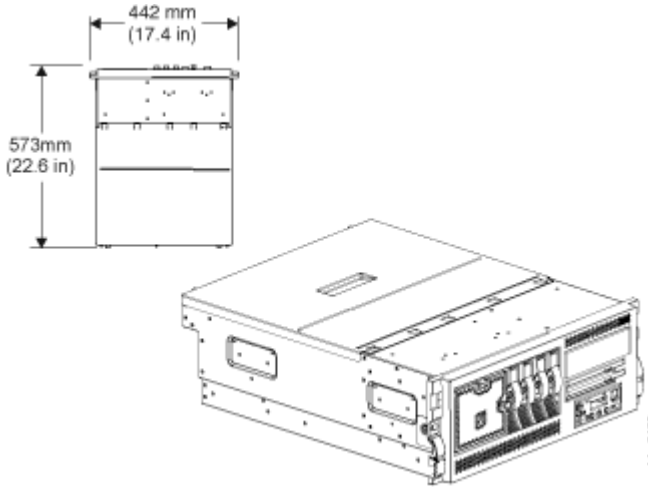
See Table 45 on page 112

IBM TS1120 (3592 C06) Controller specifications

DANGER: To prevent a possible electrical shock when adding or removing any devices to or from the system, ensure that the power cords for those devices are unplugged before the signal cables are connected or disconnected. If possible, disconnect all power cords from the existing system before you add or remove a device. *(RSFTD203)*

English measurements are shown in parentheses.

Table 48: TS1120 (3592 C06) Controller Specifications



TS1120 (3592 C06) Controller

SPECIFICATIONS

Dimensions:

Width: 442 mm (17.4 in.)
Depth: 573 mm (22.6 in.)
Height: 172 mm (6.8 in.)

Service Clearances:

Refer to the frame or rack installation for clearances.

Weight: 28.1 kg (62 lb.) without mounting hardware. 39 kg (86 lb.) with mounting hardware.

Heat Output:

0.63 kw (2046 BTU/hr)

Exhaust Capacity:

1.4 m³/min (50 CFM)

Power Requirements:

1190 Watts
Phases 1

Note: An appropriate internal line cord is attached at the factory that plugs into the rack, library, or frame and takes advantage of its external power cord.

IBM TS1120 (3592 C06) Controller connections

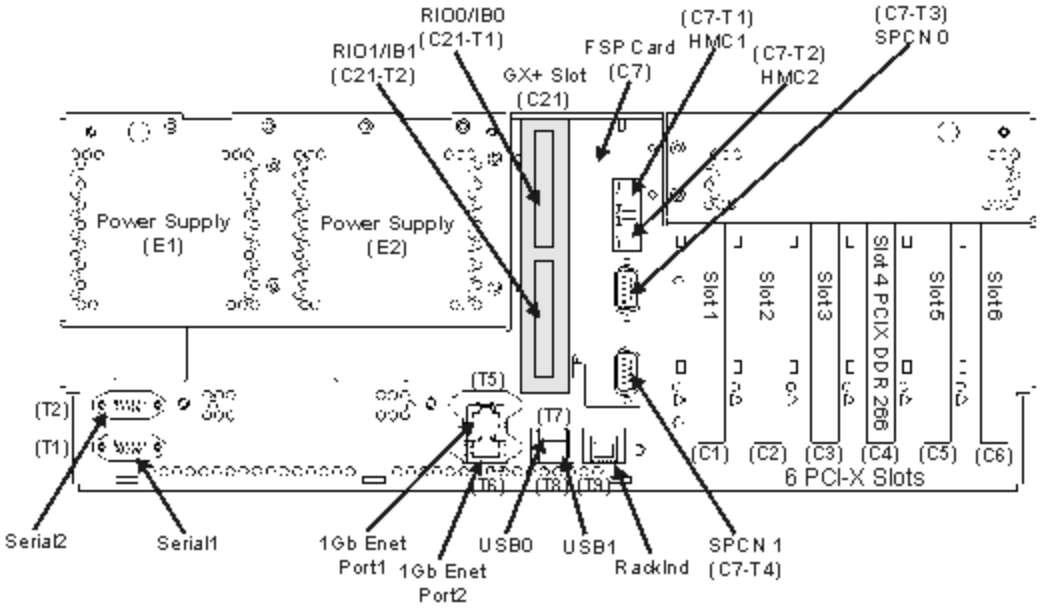


Figure 13: IBM TS1120 (3592 C06) Controller back panel

When the TS1120 (3592 C06) Controller is installed, Ethernet ports T5 and T6 are connected to the network. One or more of the six PCI adapter slots may be populated with fiber optic cards, depending on the features installed.

The following ports are defined for service use only:

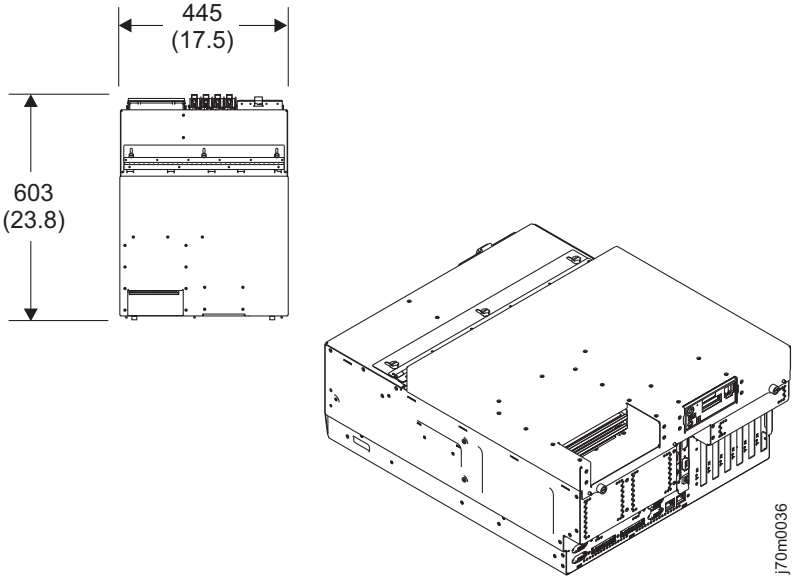
Serial ports (T1, T2)
USB ports (USB0, USB1)
Rack Indicator (T9)
FSP (C7) Ethernet ports (C7-T1, C7-T2)
FSP (C7) Serial ports (C7-T3, C7-T4)
GX+ Slot (C21) connections (covered by plate: C21-T1 and C21-T2)
Ethernet connector (located in operator panel on front of TS1120 (3592 C06) Controller)

IBM 3592-J70 Controller specifications

CAUTION: To prevent a possible electrical shock when adding or removing any devices to or from the system, ensure that the power cords for those devices are unplugged before the signal cables are connected or disconnected. If possible, disconnect all power cords from the existing system before you add or remove a device. *(RSFTD203)*

English measurements are shown in parentheses.

Table 49: J70 Controller specifications



J70 Controller

SPECIFICATIONS

Dimensions:

Width: 445 mm (17.5 in.)
Depth: 603 mm (23.8 in.)
Height: 222 mm (8.7 in.)

Service Clearances:

Refer to the frame or rack installation for clearances.

Weight:

29 kg (63 lb.) without mounting hardware

39 kg (86 lb.) with mounting hardware

Heat Output:

0.68 kw (2.05 kBTU/hr)

Exhaust Capacity:

1.4 m^3/min (50 CFM)

Power Requirements:

kV·A 0.68 (Maximum)
Phases 1

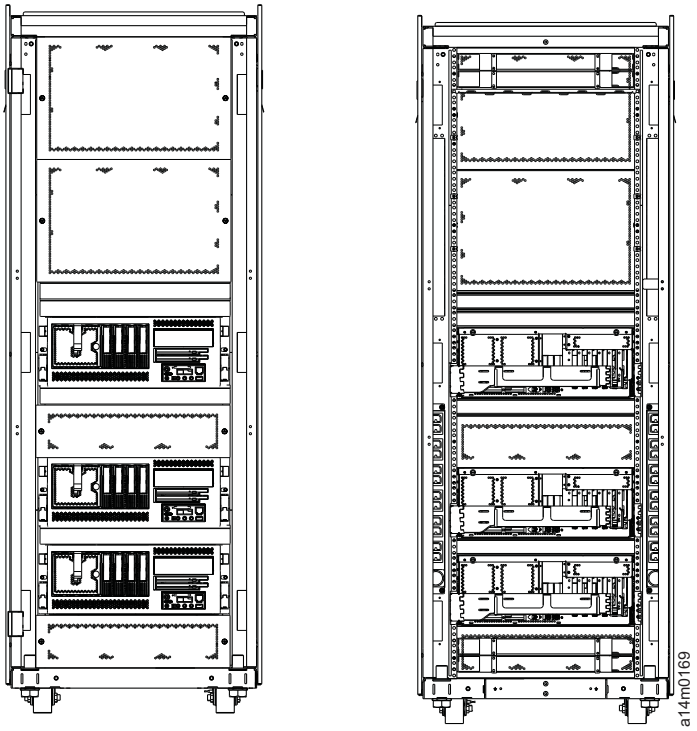
Note: An appropriate internal line cord is attached at the factory that plugs into the rack, library, or frame and takes advantage of its external power cord.

3952 F05 Tape Frame specifications

To prevent a possible electrical shock when adding or removing any devices to or from the system, ensure that the power cords for those devices are unplugged before the signal cables are connected or disconnected. If possible, disconnect all power cords from the existing system before you add or remove a device. (RSFTD203)

The weight of this assembly is such that it requires two or more persons to facilitate safe handling.

3952 F05 (3494 Outbound Controller Frame)



FRAME SPECIFICATIONS

English measurements are in parentheses.

Dimensions:

Width 644 mm (25.4 in.)

Depth 1102 mm (43.4 in.)

Height 1804 mm (71.0 in.)

Weight with one C06 Controller: 279.5 kg (616 lb.)

Heat Output with one C06 Controller: 0.63 kw (2046 BTU/hr)

Airflow Rate with one C06 Controller: 1.4 m^3/min (50 CFM)

Power Requirements with one C06 Controller:

1190 Watts
Phases 1

Power Supply Requirements with C06 Controller:

Plug Type R&S 3750
Receptacle Type R&S 3753
Inline Connector R&S 3933

Notes:

- The weight includes the weights of the power supply, one controller, and associated cables.
- Add 39 kg for each additional C06 Controller and associated mounting hardware.
- Add 10.4 kg for each additional Fibre channel switch and associated mounting hardware.
- A 3952 Model F05 frame with one C06 Controller with an overvoltage of 10% above the 240 V maximum can have a maximum leakage current of 7.0 ma.
- The appropriate line cord is attached at the factory based on the destination country or region.

When FC 5593 is installed, two additional routers are present in the 3952 F05 to provide redundant out-of-band paths between the tape controller and the EKM.

3952 Model F05 Layout Specifications

Measurements are in millimeters. English measurements (in inches) are in parentheses.

Use the tip plate when installing the C06/C07 Controller in the Model F05 frame.

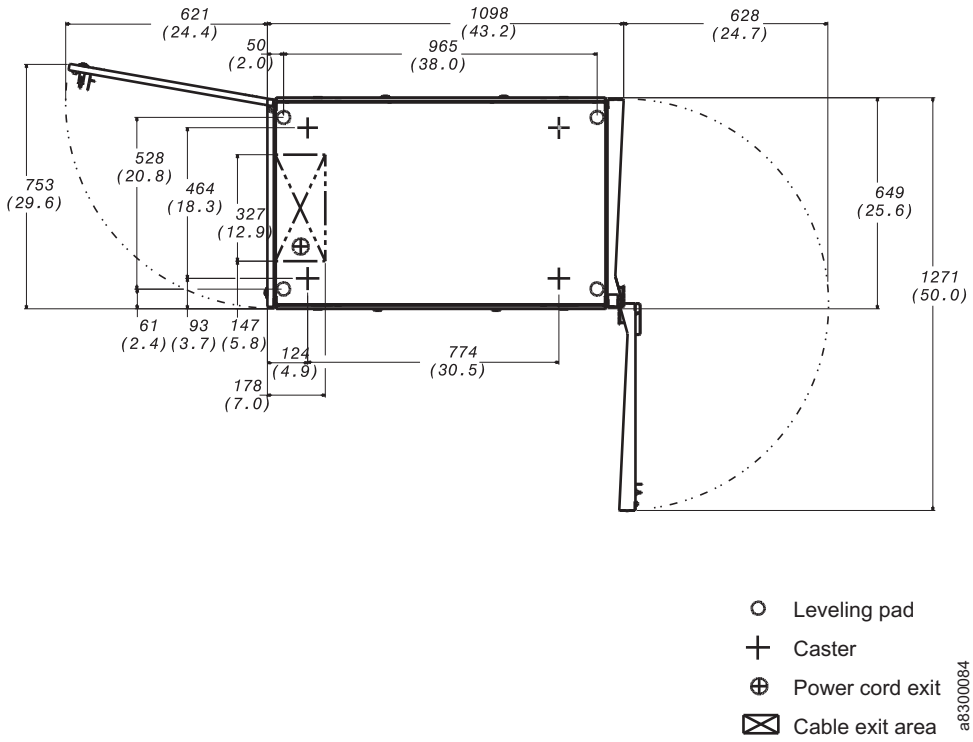


Figure 14: Top View of 3952 Model F05 Frame Layout

Chapter 5. Planning considerations

These topics describe the necessary planning for the IBM 3592 Enterprise Tape System.

A full planning agenda includes the following:

- "Host configuration for the IBM 3592-C07 Controller and the TS1120 (3592 C06) Controller" on page 120
- "Planning for the non–disruptive addition of drives" on page 121
- "Planning for data encryption on TS1120 and later tape drives" on page 122
- "Planning for supplies and equipment" on page 126
- "Planning for operator training" on page 127
- "Planning for drive cleaning" on page 127
- "Planning for applications programming" on page 128

Physical planning is a customer responsibility. Current levels of the open systems device drivers should be obtained to ensure the 3592 tape drives are supported. The 3590 Model 60 controller and 3494 Tape Library may require microcode updates by the IBM Service Representative for the proper installation and operation of attached 3592 tape drives.

Host configuration for the IBM 3592-C07 Controller and the TS1120 (3592 C06) Controller

Below is a sample IOCP deck which would be used by the host to install three C07 Controllers named DOPEY, GRUMPY, and DOC. In the sample below LIBPORT ID 1 is the primary LM for the library and LIBPORT ID 2 is the alternate. LIBPORT ID 3 does not have an LM.

```
**********************************************************************
* ELC010 CU'S
* DOPEY ADDRESS 700.16 LIBPORT ID 1 FICON CHPIDS A1,A5,D2,D6 SW 51
* GRUMPY ADDRESS 710.16 LIBPORT ID 2 FICON CHPIDS A1,A5 SW 51
* DOC ADDRESS 720.16 LIBPORT ID 3 FICON CHPIDS D2,D6 SW 51
**********************************************************************
*
*DOPEY
CNTLUNIT CUNUMBR=1A10,PATH=(CSS(1),A1,A5,D2,D6), X
LINK=(CSS(1),2F,5F,8F,BF), X
UNITADD=((00,16)),UNIT=3590
*$HCDC$ DESC='ELC010 DOPEY C07 LAB 1520'
TAPE0700 IODEVICE ADDRESS=(0700,16),CUNUMBR=(1A10), X
UNITADD=00,UNIT=3590, X
PART=(CSS(1),PC5,PC7,PC8,PCB,PCC,PCH,VMT13)
*
*GRUMPY
CNTLUNIT CUNUMBR=2A10,PATH=(CSS(1),A1,A5), X
LINK=(CSS(1),30,60), X
UNITADD=((00,16)),UNIT=3590
*$HCDC$ DESC='ELC010 GRUMPY C07 LAB 1520'
TAPE0710 IODEVICE ADDRESS=(0710,16),CUNUMBR=(2A10), X
UNITADD=00,UNIT=3590, X
PART=(CSS(1),PC5,PC7,PC8,PCB,PCC,PCH,VMT13)
*
*DOC
CNTLUNIT CUNUMBR=1D20,PATH=(CSS(1),D2,D6), X
LINK=(CSS(1),88,CA), X
UNITADD=((00,16)),UNIT=3590
*$HCDC$ DESC='ELC010 DOC C07 LAB 1520'
TAPE0720 IODEVICE ADDRESS=(0720,16),CUNUMBR=(1D20), X
UNITADD=00,UNIT=3590, X
PART=(CSS(1),PC5,PC7,PC8,PCB,PCC,PCH,VMT13)
*
```

Below is a sample IOCP deck which would be used by the host to install one 3590 Model A60 controller named 'LAUREL' and one C06 Controller named 'HARDY' with IBM Model J1A tape drives attached to both:

```
*****************************************************************            Col 80
* 3592     DRIVES:  A60
*               FICON   F4,F5 SW=20
*               ESCON 4D,4E SW=BB
*               LAUREL A60 SERNO 006
*****************************************************************
LAUREL CNTLUNIT  CUNUMBR=0F41,PATH=(4D,4E,F4,F5),                          X
               UNITADD=((00,16)),LINK=(94,94,06,07),                       X
               UNIT=3590
TAPE0780 IODEVICE ADDRESS=(780,16),UNIT=3590,CUNUMBR=(0F41),               X
               UNITADD=00
*****************************************************************
* 3592 DRIVES:   C06
*            FICON NATIVE EC,ED
*            ESCON  14,15,16,17
*            FICON FCV   F2,F3,FE,FF  (FICON-ESCON CONVERTER)
*            HARDY  C06  SERNO 247
*****************************************************************
HARDY CNTLUNIT  CUNUMBR=14C,PATH=(F2,F3,FE,FF,EC),                         X
               UNITADD=((00,16)),LINK=(06,0E,16,1E,32),                    X
               UNIT=3590
TAPE07C0 IODEVICE ADDRESS=(07C0,16),UNIT=3590,CUNUMBR=(14C),               X
               UNITADD=00
```

Notice that the above J1A tape drive IOCP deck sets 'UNIT' equal to '3590', just as you would see in a 3590 IOCP deck. At this level, software ignores the differences between the two drive types.

Also notice that for each controller, the following line appears:

```
               UNITADD=((00,16)),LINK=(06,0E,16,1E,32),                    X
```

This line specifies that each controller allows attachment for up to sixteen 3592 tape drives (sixteen is the maximum number of 3592 tape drives that can be attached to a C06 or C07 Controller). It is recommended that you set 'UNITADD' to allow attachment for up to the maximum number of 3592 tape drives you plan to attach to each controller. See “Planning for the non–disruptive addition of drives” on page 121 for more planning information.

Planning for the non–disruptive addition of drives

This topic describes the non-disruptive addition of drives.

Functional Enhancement Field (FC 0520) updates the tape controller's microcode to support the non–disruptive addition of tape drives to an installed tape controller. In addition, the following steps must be completed during the installation of a tape controller to allow for the non–disruptive addition of tape drives to a tape controller:

- The 'UNITADD' value in the hosts's IOCP deck for the tape controller must be set equal to the maximum number of drives you plan to add to the controller. See “Host configuration for the IBM 3592-C07 Controller and the TS1120 (3592 C06) Controller” on page 120 for an example of an IOCP deck with 'UNITADD=((00,16))', which allows up to sixteen 3592 tape drives to be added to the installed controller (sixteen is the maximum number of 3592 tape drives that can be attached to a TS1120 (3592 C06) Controllers, or J70 Controller). By setting the 'UNITADD' value to the maximum number of 3592 tape drives you plan to install, the host assigns addresses sequentially for all drives, and the non-disruptive addition of tape drives is possible only when the tape drives' addresses have been assigned sequentially.
- Record the 'UNITADD' value for later reference so that you can provide it to IBM service representatives.

Planning for data encryption on TS1120 and later tape drives

IBM currently supports encryption key management in its self-encrypting tape storage solutions with two encryption key servers (EKSs). The following links have information on downloading, installing, and using these products.

- Tivoli Key Lifecycle Manager
- IBM Security Key Lifecycle Manager for z/OS

Note: Contact your IBM Representative for additional information about encryption on TS1120 and later tape drives.

Encryption Key Manager Setup Tasks

The following topics provide the setup tasks required for the IBM Encryption Key Manager component.

Note: The following information is only for the IBM Encryption Key Manager component. If you are using one of the other IBM supported encryption key servers, refer to the appropriate product documentation. See “Planning for data encryption on TS1120 and later tape drives” on page 122.

Before you can encrypt tapes, the Encryption Key Manager must first be configured and running so that it can communicate with the encrypting tape drives. The Encryption Key Manager need not be running while tape drives are being installed, but it must be running in order to perform encryption.

These are the tasks you must perform before using the Encryption Key Manager. See *IBM Security Key Lifecycle Manager for z/OS* for details.

- Decide what system platforms to use as Encryption Key Manager servers.
- Upgrade the server operating system if necessary.
- Upgrade the Java™ Virtual Machine if necessary.
- Install Java Unrestricted Policy Files.
- Upgrade the Encryption Key Manager JAR. This can be found at the IBM Security Key Lifecycle Manager for z/OS (or visit the IBM Support Portal and click **Downloads** and look for IBM Security Key Lifecycle Manager for z/OS).
- Decide on keystore type.
- Create keys, certificates, and key groups.
- If necessary, import keys and certificates (See previous step).
- Define the configuration properties file.
- Define tape drives to the Encryption Key Manager or set **drive.acceptUnknownDrives** configuration property value on.
- Start the Encryption Key Manager server.
- Start the command line interface client.

Planning for application-managed tape encryption

The setup tasks that are required for application-managed tape encryption.

To run encryption, the following drives are required:

- Encryption-capable TS1120, TS1130, TS1140, TS1150, TS1155, or TS1160 tape drives

Application-managed tape encryption setup tasks

Any task that is not identified as an IBM service task is the responsibility of the customer.

1. Install and cable the TS1120, TS1130, TS1140, TS1150, TS1155, or TS1160 tape drive (IBM service task).
   - Update library firmware (3494, TS3500, TS4500 where applicable)

- Update tape drive firmware (all tape drives in same library or environment)

2. Encryption-enable the TS1120, TS1130, TS1140, TS1150, TS1155, or TS1160 tape drive. Refer to the IBM TS3500 Tape Library Knowledge Center at https://www.ibm.com/support/knowledgecenter/STCMML8/com.ibm.storage.ts3500.doc/ts3500_ichome.html for configuring tape drives on the TS3500. Refer to the IBM TS4500 Tape Library Knowledge Center at http://www.ibm.com/support/knowledgecenter/STQRQ9/%0Acom.ibm.storage.ts4500.doc/ts4500_ichome.html for configuring tape drives on the TS4500. This task is an IBM service task.
3. Install appropriate IBM tape device driver level (Atape, for example) where required by application.
4. Set up encryption policies. Refer to *IBM Tivoli Storage Manager for AIX Administrator 's Guide*.
5. Run a write/read operation to test encryption.
6. Verify encryption of the test volume by Autonomic Management Engine (AME): issue

   ```
   QUERY VOLUME FORMAT=DETAILED
   ```

   Verify that **Drive Encryption Key Manager** is set to **Tivoli Storage Manager**.

Planning for system-managed tape encryption

The required setup tasks for system-managed tape encryption.

To run system-managed encryption, the following items are required.

- Encryption-capable TS1120, TS1130, TS1140, TS1150, TS1155, or TS1160 tape drives.
- Keys and corresponding certificates.
- IBM Encryption Key Manager component.
- Routers and cables for out-of-band Encryption Key Manager-to-TS1120, TS1130, TS1140, TS1150, TS1155, or TS1160 tape drive path (System z platforms only).

Setup tasks for system-managed tape encryption on IBM System z platforms

Any task that is not identified as an IBM service task is the responsibility of the customer.

1. Install and cable the TS1120, TS1130, TS1140, TS1150, TS1155, or TS1160 tape drive (IBM service task).
   - Update tape drive firmware (all tape drives in same environment)
   - Update 3494, TS3500, and 3953 tape system library firmware (System z platforms or 3953 in heterogeneous environment)
   - Update C06 and J70 Controller firmware (System z platforms or tape controllers in heterogeneous environment) (optional)
   - Update TS7700 Virtualization Engine microcode.
2. Encryption-enable the TS1120, TS1130, TS1140, TS1150, TS1155, or TS1160 tape drive. Refer to the IBM TS3500 Tape Library Knowledge Center at https://www.ibm.com/support/knowledgecenter/STCMML8/com.ibm.storage.ts3500.doc/ts3500_ichome.html for configuring TS1120, TS1130, TS1140, or TS1150 tape drives on the TS3500. The 3494 Web Specialist can now be used to enable encryption on the E05 or E06 tape drive in a 3494 tape library. Refer to the *IBM Automated Tape Library (3494) Operator 's Guide*. For TS7700 attached drives, specify the system-managed encryption method. For others, this task is an IBM service task.
3. Install tape controller code update, Feature Code 5595 (IBM service task).
4. Install, cable, and configure routers to the Encryption Key Manager, Feature Code 5593 (for out-of-band path to the Encryption Key Manager only) (IBM service task).
   - Define Primary/Secondary Encryption Key Manager IP ports for the tape controller.
5. Update z/OS and DFSMS host software with appropriate PTFs.
6. Install Feature Code 9900 License Key on the TS7700.
7. Set up encryption policies.

- Update DFSMS Data Class to specify encryption (recording format EE2) and other optional parameters (such as media type, performance scaling).
- Specify the key labels through the DD statement, data class, or Encryption Key Manager defaults.
- Update other DFSMS policies to steer allocation to the correct library.
- Encryption on the TS7700 VE is controlled on a storage pool basis. Use the Maintenance Interface (MI) web interface for the **TS7700 VE Pool Encryption Settings** panel (in the Configuration group) to specify the key labels and modes to use for each storage pool.

Refer to *IBM z/OS DFSMS Software Support for IBM TS1130, TS1140, and TS1150 Tape Drives (3592)*.

8. For in-band key management, use the **IECIOSxx PARMLIB** member or SETIOS command to define Primary/Secondary Encryption Key Manager. Also, define the IOSAS OMVS segment to RACF.
9. Make the appropriate HCD changes.
10. Determine whether coexistence support is needed.
11. Contact your tape management system or application vendor for any required code changes and any installation exit changes that are needed.
12. Set up the system-managed encryption method. For 3494 or stand-alone drives, have your IBM service representative update the drives. For TS3500, update with the IBM tape library specialist.
13. Schedule an IPL.
14. Verify encryption:

    For in-band path to the Encryption Key Manager:

    a. Use the `DISPLAY IOS,EKM` command (with the VERIFY option) to verify the in-band path to the Encryption Key Manager.
    b. Verify that a job (or application) requesting encryption (through data class) has its data encrypted.

    For out-of-band path to the Encryption Key Manager:

    a. Use RAS functions to verify (IBM service task) Encryption Key Manager paths and encryption configuration.

Setup tasks for system-managed tape encryption on open systems platforms

Any task that is not identified as an IBM service task is the responsibility of the customer.

1. Install and cable the TS1120, TS1130, TS1140, TS1150, TS1155, or TS1160 tape drives (IBM service task).
   - Update tape drive firmware (all tape drives in same environment)
   - Update 3494, TS3500, and TS4500 tape library firmware, where applicable
2. Encryption-enable the TS1120, TS1130, TS1140, TS1150, TS1155, or TS1160 tape drives. Refer to the IBM TS3500 Tape Library Knowledge Center at https://www.ibm.com/support/knowledgecenter/STCMML8/com.ibm.storage.ts3500.doc/ts3500_ichome.html for configuring tape drives on the TS3500. Refer to the IBM TS4500 Tape Library Knowledge Center at http://www.ibm.com/support/knowledgecenter/STQRQ9/%0Acom.ibm.storage.ts4500.doc/ts4500_ichome.html for configuring tape drives on the TS4500. The 3494 Web Specialist can now be used to enable encryption on the E05 or E06 tape drive in a 3494 tape library. Refer to *IBM Automated Tape Library (3494) Operator's Guide*. This task is an IBM service task.
3. Update the IBM device driver to the current level (IBM Fix Central website). Refer to the *IBM Tape Device Drivers Installation and User's Guide* for details.
4. Update the Encryption Key Manager Proxy Config file with Encryption Key Manager IP addresses.
5. Update device attributes
   - Use System Encryption FCP Proxy Manager.
   - System Encryption for Write Commands at BOP.

   Refer to the *IBM Tape Device Drivers Installation and User's Guide*.

6. Use *tapeutil* functions to verify Encryption Key Manager paths and encryption configuration.

Planning for library-managed tape encryption

The required setup tasks for library-managed encryption.

To complete encryption, the following items are required:

- Encryption-capable TS1120, TS1130, TS1140, TS1150, TS1155, or TS1160 tape drives
- Keystore
- IBM Encryption Key Manager component

Library-managed tape encryption tasks

Any task that is not identified as an IBM service task is the responsibility of the customer.

1. Install and cable the TS1120, TS1130, TS1140, TS1150, TS1155, or TS1160 tape drive (IBM service task).
   - Update tape system library firmware (3494 or TS3500)
   - Update tape drive firmware (all tape drives in same library)
   - For TS1120 or TS1130 tape drives in a 3494 or TS3500, or TS1140 , TS1150, TS1155, or TS1160 drives in a TS3500, or TS4500, order Feature Code 9900 for Encryption Configuration (IBM service task)
2. Use the IBM Tape Library Specialist to enable TS1120, TS1130, TS1140, TS1150, TS1155, or TS1160 tape drives and 3494, TS3500, or TS4500 tape library for library-managed tape encryption (refer to the appropriate tape library operator guide.)
   - Add Encryption Key Manager IP addresses
   - Specify key label
   - Set up scratch encryption policy
3. Set up key mapping for ILEP (optional)
4. Use library diagnostic functions to verify Encryption Key Manager paths and encryption configuration.

Tape drive installation process for encryption

Before the IBM service representative installs or upgrades the IBM TS1120, TS1130, TS1140 or TS1150 tape drives for encryption, you must:

- Decide which method of encryption management to use (application-managed encryption, system-managed encryption, or library-managed encryption).
- Install and configure the Encryption Key Manager.

Encryption setup procedure for IBM Service

Note: The TS1140, TS1150, TS1155, and TS1160 tape drives are not supported in the 3494, TS3400 (3577), nor in the 3592-C20 library environments. They are only supported in the 3584 (TS3500 and TS4500) tape libraries, and in stand-alone rack mount usage.

The following steps are completed by the IBM Service Representative:

1. Record the serial numbers of all TS1120 and later tape drives and provide these numbers to the customer (optional if the customer plans to set the Encryption Key Manager configuration to `drive.acceptUnknownDrives=true` for automatic addition of tape drives to tape drive table).
2. Install the TS1120 and later tape drives.
   a) If new TS1120 and later encryption-capable drives are added to an existing frame, refer to *3494 Maintenance Information* or *3584 Maintenance Information* for installation instructions. When installation is complete, go to step 3.

b) If current TS1120 and later drives are replaced with new ones, refer to *3494 Maintenance Information* or *3584 Maintenance Information* for drive FRU replacement instructions. When replacement is complete, go to step 3.

c) If current TS1120 and later drives are upgraded, refer to *Feature Code 5592 MES Installation Instructions*. When upgrade is complete, go to step 3.

3. Configure the TS1120 and later tape drives for encryption.
   a) If the TS1120 and later tape drives are installed in an Enterprise System and connected to a C06 or J70 Controller, you must use system-managed encryption only. If the drives are installed in a stand-alone frame, go to step 4. If the drives are installed in a 3584 library, configure and encryption-enable the tape drives with the Tape Specialist web interface. When the tape drives are configured, go to step 5.
   b) If the TS1120, or TS1130 tape drives are installed in a 3494 Open System, the 3494 Web Specialist is now used to enable-encryption them. Refer to *IBM Automated Tape Library (3494) Operator 's Guide*. Then, go to step 5.
   c) If the TS1120 and later tape drives are installed in a 3584 Open System, the customer configures and encryption-enables the tape drives. They use the Tape Specialist web interface. When tape drives are configured, go to step 5.
4. Encryption-enable the tape drives by following the procedure for "Setting Drive Encryption" in *IBM 3592 Models J1A, E05, E06, EU6, E07/EH7, E08/EH8, 55F, and 60F Maintenance Information*. When the tape drives are encryption-enabled, go to step 6.
5. Use the Tape Specialist web interface to verify that the tape drives are encryption-enabled. For example, select **Manage Library** > **By Logical Library** > **Select Library** > **Modify Encryption Method** > **GO**.
6. If the tape drives are encryption-enabled for Enterprise Systems, configure the controllers to use the new drives. See the *3592-C07 Service Knowledge Center* for configuration instructions. See the *IBM 3592 Models J1A, E05, E06, EU6, E07/EH7, E08/EH8, 55F, and 60F Maintenance Information* and *Installation and Configuration Guide* for configuration instructions. Once the controllers are configured to use the drives, go to “7” on page 126. If the tape drives are installed in a rack, go to “8” on page 126.
7. Run **Library Verify**.
8. Go to the end-of-call procedures in the appropriate *Maintenance Information*.

Planning for supplies and equipment

The topics in this section describe planning considerations for supplies and equipment.

3592 supplies

This topic describes 3592 supplies.

Refer to “Media supplies” on page 100 for ordering additional media supplies to meet your needs. In addition to a sufficient quantity of data cartridges, cleaning cartridges, and cartridge labels, the following supplies are recommended:

- Lint-free cloth
- Leader Pin Replacement Kit (P/N 18P8887)

Cartridge weights

This topic describes planning considerations for cartridge weights.

Use cartridge weights for floor planning purposes only.

- IBM Enterprise Tape Cartridge 3592 weight is approximately 239 grams (0.53 lb.)
- IBM Enterprise Economy Cartridge 3592 weight is approximately 178.2 grams (0.39 lb.)
- IBM Enterprise Extended Cartridge 3592 weight is approximately 250 grams (0.55 lb.)

- 3592 Cleaner cartridge weight is approximately 190.7 grams (0.42 lb.)
- IBM Enterprise Advanced Cartridge 3592 weight is approximately 241 grams (0.53 lb.)
- IBM Enterprise Advanced Economy Cartridge 3592 weight is approximately 155 grams (0.34 lb.)

Planning for operator training

This topic provides a list of common operator tasks.

Typical operator tasks can include:

- Switching the tape system on or off
- Placing labels on the tape cartridge
- Setting or resetting the write-protect switch on the tape cartridge
- Initializing a tape volume
- Cleaning the drive with the cleaning cartridge
- Disposition of tape cartridges
- Analyzing problems

Refer to the *IBM 3592 Tape Drives and TS1120 Controller Operator Guide* for more information on operator tasks.

Planning for drive cleaning

This topic provides information for cleaning a tape drive.

A 3592 cleaning cartridge is shipped with the first drive in each installation, and additional cleaning cartridges are available through IBM. The cleaning cartridge contains a Cartridge Memory (CM) device, which automatically keeps track of the number of times it is used. Cleaning cartridges need to be replaced after 50 uses. One cleaning cartridge per drive usually lasts three months. Adjust your needs based on usage. The 3592 cleaning cartridges are not interchangeable with 3590 cleaning cartridges, so you must have both types of cleaning cartridges if you have both types of drives in your library. Refer to the following sources for more information about drive cleaning:

- To clean the 3592 tape drives, refer to the appropriate section in the *IBM TS1120, TS1130, TS1140, TS1150, TS1155, and TS1160 Tape Drives and TS1120 Controller Operator Guide*.
- For information about automatic cleaning, refer to the appropriate section in your tape library's Operator Guide.

The following table lists cleaning times for the 3592 drives.

Table 50: Cleaning times for 3592 drives

3592 Drive	**Clean Cycle Time (start of clean to end of unload)**
J1A tape drive	3 minutes, 30 seconds
E05 tape drive	4 minutes, 35 seconds
E06/EU6 tape drive	4 minutes, 25 seconds
E07/EH7 tape drive	4 minutes, 25 seconds
E08/EH8 tape drive	4 minutes, 25 seconds
55F tape drive	4 minutes, 25 seconds
60F tape drive	4 minutes, 25 seconds

Planning for applications programming

The topics in this section describe planning considerations for applications programming.

The following considerations apply to tape programming unique to applications.

Data Security Erase

This topic describes the Data Security Erase command.

A Data Security Erase command issued to a controller will result in a SCSI Erase command being issued to the drive with the Long bit set to B'1'.

Missing Interrupt Handler

This topic describes missing interrupt handlers.

Note: The 3590 tape drives, models B, E, and H are no longer available for ordering but are covered for existing product support.

Most System z operating environments include a timer setting for input/output (I/O) operations. A timer setting for I/O operations is known either as a *missing interrupt handler* (MIH) or a *missing interrupt time*. If an I/O operation fails to complete within the time allotted for it by the MIH setting, the MIH releases critical resources, which the I/O operation might otherwise monopolize.

Table 51 on page 128 shows the MIH value that you must set for either standard length cartridges or extended length cartridges for your installation. For some installations, you do not need to set the MIH, since it is automatically set for you. 'Auto Set' appears in Table 51 on page 128 for installations that you must not set the MIH value.

Table 51: Missing Interrupt Handler (MIH) values

Emulation Mode	**3590 Model Drives**						**3592 Drives**
	B		**E**		**H**		**J1A, E05, E06, E07**
3590 Mode	Auto Set		Auto Set		Auto Set		Auto Set
3490 Mode	Standard Length MIH	Extended Length MIH	Standard Length MIH	Extended Length MIH	Standard Length MIH	Extended Length MIH	Auto Set
	43 minutes	83 minutes	39 minutes	69 minutes	52 minutes	93 minutes	

Note: If you use a mix of both standard and extended length cartridges, use the MIH value listed under the 'Extended' column for your installation.

For those installations listed in Table 51 on page 128 that require setting the MIH, the system administrator must set the MIH value with a console command or a parameter file (such as PARMLIB in the case of z/OS).

For installations that do not distinguish between E05, E06, EU6, E07/EH7, E08/EH8 or J1A tape drives, or 3590 Model B, Model E, and Model H tape drives, use the longest time, depending on your usage of standard or extended length cartridges.

Software tools

The topics in this section describe software tools.

Volume Mount Analyzer

This topic describes the volume mount analyzer.

Use the volume mount analyzer, available as a component of DFSMS software, to plan for and optimize the 3592 tape installation. It provides reports on datasets by size and frequency of use. These reports determine if tape is the best storage media for the analyzed datasets. It also determines if its frequency of access warrants it residing within a tape library.

Offboard data string search

This topic describes offboard data string searching.

Note: This topic applies only to E05, E06, E07/EH7, E08/EH8, 55F, and 60F tape drives installed in open systems.

The E05, E06, E07/EH7, E08/EH8, 55F, and 60F tape drives can search the data content of host records for string matches. This new function is called offboard data string searching because the data search workload can be run offboard from the host. This feature is useful, for example, to find records on a tape that contain a particular ASCII or EBCDIC character string. The tape drive can complete this search at maximum data rate (400 MB/s for 60F, 360 MB/s for E08/EH8 and 55F, 250 MB/s for E07/EH7, 160 MB/s for E06, or 100 MB/s for native E05 tape drives). It would take much longer for a host to read the data, buffer the data to disk, then parse the actual data stream with host software routines. At a minimum, the E05, E06E07/EH7, E08/EH8, 55F, and 60F tape drive search logic can be used to return only records that meet a smaller prerequisite search criteria for processing. Then, these records can be parsed in more detail by the host software. In this manner, the amount of data transfer and host search times can be greatly reduced.

Two steps are required to complete an offboard data string search.

1. Program the wanted compare strings and associated logic.
2. Start the string search and receive the results.

You can program the compare string search content and options by using the `Mode Select` command or the `Send Diagnostic` command. Refer to *IBM Enterprise Tape System 3592 SCSI Reference* for the details of the programming fields. The basic programming capabilities of the compare string are

- All compares are run within a host record and reset at record boundaries.
- An individual search string can be 1 - 16 bytes.
- Each individual string can wildcard a bit position in all bytes of a string or a byte position within the string.
- Up to 8 individual strings can be programmed (each string 1 - 16 bytes as stated). All active strings are compared in parallel to form a compound string match.
- Any combination of AND, OR, and NOT logic can be used to qualify a compound string match based on the comparison status of individual strings. For example, if Strings 1 - 3 are active, compound match criteria can be as follows:

```
COMPOUND MATCH = ((STRING1 AND NOT STRING2) OR STRING3);
```

Multiple methods are available to start the search feature and receive results. The two basic methods are

Explicit searches
: Explicit search methods use the `Space`, `Read`, or new `Search` command to complete an immediate search from the current position. In this method, the search can be programmed to halt at first match, return the first match record, or return a list of matching records.

Snooping searches
: Snooping search methods are where the search is being run concurrently to another operation, such as a write or read operation. When the search is initiated, snooping searches continue to be enabled. Check conditions are generated when the programmed conditions are met (such as match list full) to allow for host collection of data.

Other considerations

The topics in this section describe additional planning considerations.

Application-related features of the 3590 A60, J70, C06, and C07 Controllers

Capacity utilization

This topic describes planning considerations for capacity utilization.

Customers operating the ESCON or FICON attached 3590 system in 3490 emulation mode were previously limited to writing the maximal number of logical blocks allowed by the 3490 architecture, which, for large capacity tapes and small block sizes, can lead to an inability to fill an entire tape volume. With the capacity and performance features installed and with the appropriate levels of z/OS, 3592 and 3590 drives operating in 3490 emulation mode may now address as many logical blocks as drives operating in native 3592 or 3590 mode, permitting full cartridge capacity exploitation regardless of block size or data compressibility. The software interface that provides this capability is provided in the OPEN macro. DFSMS will take direct advantage of this capability in its key applications, such as DFSMShsm. Refer to the closing text for APAR OW49829 for more information on implementing this feature.

Read performance

This topic describes planning considerations for read performance.

The 3592 tape drives, the 3592 controllers, and 3590 Model A60 Controller provide file-positioning interfaces that allow z/OS applications to access data based on file number at the same fast-locate speed achieved when data is accessed by block number. The C06 and J70 Controllers and the 3590 A60 interface is exploited by OPEN, except in the case of ISO/ANSI Version 3 tapes, and it operates transparently to the application. Applications that write many files to a tape will experience significantly enhanced performance on subsequent mounts of the tape for file-oriented access. Block oriented access performance also remains very high speed.

Write performance

This topic describes planning considerations for write performance.

The C06, C07, and J70 Controllers, and A60 controllers provide functions which can substantially improve the performance of applications that write many files on a single tape volume. The controller functions coupled with z/OS support in OPEN / CLOSE / EOV macros remove most of the delays associated with the writing of tape labels for files (for Standard labeled tapes) and inter-file operations (for Standard labeled and for unlabeled tapes). This support is available with no application changes.

Additional benefits for applications which write multiple files can be gained by small application code changes which either take direct advantage of the features of the C06, C07, J70, and A60 Controllers or which take indirect advantage of these features through the use of capabilities of the z/OS DCBE macro. Where appropriate, the forced synchronization of buffered data to the tape medium during the writing of filemarks may be bypassed, resulting in very substantial application level performance improvements. Refer to the closing text for APAR OW49829 for more information on implementing this feature.

Status bytes and sense bytes

This topic describes status and sense bytes.

The 3592 and 3590 drives perform most error recovery internally, without surfacing any direct error condition to the attaching host. The error indications which are surfaced for SCSI and FCP attached hosts are documented in the *IBM TotalStorage Enterprise Tape System 3592 SCSI Reference* (GA32-0466) and *IBM TotalStorage 3590 Tape Subsystem Hardware Reference Guide* (GA32-0331) publications. For ESCON and FICON attached hosts, much of the recovery which cannot be handled in the drive is performed by the controller, such as the J70 Controller or 3590 Model A60. Error indications which must be surfaced by the controller are processed by the host software error recovery programs.

Tape-write-immediate mode

This topic describes the tape-write-immediate mode.

When data is physically transferred to the tape medium it is always immediately reread and verified. The writing of data is normally buffered, however, which defers the physical transfer of the logical blocks to

the tape until the buffer conditions require the off-loading of the data or until a synchronizing command requires the transfer. If immediate validation of a successful transfer of data to the tape is required at the time that each logical block is written, then Tape Write Immediate mode may be programmatically invoked. This results in block-by-block synchronization and verification of successful transfer all the way to the medium, but at a very substantial cost in application performance.

Data compression
This topic describes planning considerations for data compression.

3592 tape drives are capable of data compression. If software is also used to compress or encrypt the data before sending it to the drive, the drive data compression can still be left enabled.

Planning for data migration

This topic describes planning considerations for data migration.

Data migration is the movement of data to a new tape cartridge type during the normal processing of jobs.

The following topics describe techniques to categorize a tape system, determine a data movement schedule, balance tape drive requirements, and explore alternatives to form a general migration strategy.

Most tape libraries comprise groups of tapes that are defined by their common usage. Determining these usage groups is the first step in developing a migration strategy.

Each group is unique because of special criteria that are applied to its use and handling in a data processing environment. The criteria can include life cycle, security requirements, special handling, or various application dependencies. See Table 52 on page 131 for a description of different tape categories and their characteristics.

For more information about migration issues, see *z/OS DFSMS Software Support for IBM TS1130 and TS1140 Tape Drives (3592)*, SC26-7514, and *z/OS DFSMS Migration*, GC26-7398.

Table 52: Tape characteristics by tape usage category

Tape Category	Tape Characteristics
Archive	• Contain records held for historical, legal, regulatory, or disaster recovery purposes. • Have a retention period usually more than a year and are often stored off-site. • Processing of these tapes can be done in locations other than the site where they were created. This off-site processing can occur as a part of a comprehensive disaster plan or for various legal or regulatory requirements.
Interchange	• Prepared for use in other locations. • May be used in other computer systems or for special purposes like microfilm production. • May be tapes prepared at another location to be used on the local system, for example, tapes created on data collection equipment.

Table 52: Tape characteristics by tape usage category (continued)	
Tape Category	**Tape Characteristics**
Disk backup	• Created in normal backup jobs. • Represents several generations stored in a system at any given time. • Used to recover files in the event of a program or system error or other malfunction. The restore function is seldom used, but when it is, the integrity of the copied data is usually critical. • Files usually have a high turnover rate and may require interchange with other sites.
Journal	• Contain transactions recorded against another dataset. • Allow their companion datasets to be reconstructed by applying the journal data to a previous version of the companion datasets. • Used in data base and online systems applications.
Scratch	• Called the scratch pool, it contains no active data. Often a regular flow of new, unused tapes entering a system to be used for growth and replacement of old tapes. This may be important in determining the number of tape cartridges to order. • Used for the creation of new files during normal processing when the data is to be kept at job step or job end.
Process	• Created during periodic execution of an installation's application programs. • Represent the highest volume of files in a system. For example, multiple generations of a tape master file can be considered process tapes. • Range of criteria and time frames; most commonly is the daily, weekly, and monthly processing cycle.

Managing multiple tape formats and lengths

This topic describes managing multiple tape formats and lengths.

For your migration strategy, include a consideration of multiple tape formats and the choice of cartridge system tapes. Depending on the mix of IBM tape systems and features available, consider the tape formats on which the tape system writes data. Consider also whether mixed media and mixed recording formats are present in the existing tape libraries.

A complete migration or conversion from 3490/3490E or 3590 created tape cartridges involves copying all 3490 and 3590 cartridges to the IBM tape cartridge format. A partial conversion involves managing separate storage locations and drive locations for the different media types and recording formats.

Migrated J1A tape drive volumes are readable only on J1A, E05, E06, EU6, and E07/EH7 (with code level D3I3_5CD or higher) tape drives. Migrated E05 tape drive volumes are readable only on E05, E06, EU6, and E07/EH7 tape drives. Migrated E06 tape drive volumes are readable only on E06, EU6, and E07/EH7 tape drives. Minimum code level for E07/EH7 tape drive is D313_5CD.

Migrated JA, JJ, JR, and JW volumes are readable on J1A, E05, E06, EU6, E07/EH7 (with code level D3I3_5CD or higher) tape drives. Migrated JB and JX volumes are readable only on E05, E06, EU6, and E07/EH7 tape drives. Migrated JC, JD, JK, JL, JY, and JZ volumes are readable only on E07/EH7, E08/EH8, 55F, and 60F tape drives. Minimum code level for the E08/EH8 tape drive is D3I4_460. Minimum code level for the 60F tape drive is D3I5_44F (the firmware level at release).

Hardware configuration definitions (HCD)

This topic describes planning considerations for Hardware Configuration Definitions (HCD).

There is no need to change the hardware configuration definitions. You might use the same device addresses with the 3592 tape drive models that were used with the 3590 Models. Some maintenance avoids the need to perform input/output definition file (IODF) activate tasks. To perform the migration, ensure that you invoke the following procedure for each subsystem or set of subsystems that are upgraded in a particular maintenance window:

- Vary the 3590 drives offline.
- Remove the 3592 device addresses from the IODF and activate it[1].
- Perform the upgrade.
- Add the 3592 device addresses to the IODF and activate it[1].
- Vary the 3592 devices online to MVS™.

Note: [1]Application of maintenance cancels the requirement for these steps. Check the PSP bucket.

JES3 considerations

This topic describes planning considerations for JES3.

For 3592 tape drives installed in a 3494 or 3584 tape library, update the JES3 definitions.

SMS definitions

This topic describes SMS definitions.

For 3592 tape drives installed inside a 3494 or 3584 tape library, the following considerations apply. For detailed information, refer to the current level of the DFSMS *Object Access Method Planning, Installation, and Storage Administration Guide for Tape Libraries*.

- Define a new data class to direct new tape allocations to 3592 drives. Specify the appropriate recording technology to direct new allocations. Also, modify the ACS routines to assign the new data class.

StorageTek ACS-compatible frame considerations

This topic describes planning considerations for StoragetTek ACS-compatible frames.

For more information on 3592 tape drives installed on a StorageTek ACS, refer also to the *IBM TotalStorage Silo Compatible Tape Frame 3592 Introduction, Planning, and User's Guide*.

For 3590 E tape drives used in 3490E emulation mode for DFSMShsm, there are some major differences as compared to setup requirements with the B drives.

HSM does not allow mixed device types in an esoteric group. HSM considered the 3590 Model B as a UCB-type 3490E. Thus, it is possible to have esoteric groups defined that manage mixed technology and media relationships. An example would be 3592 drives in 3490E emulation mode and StorageTek 9490s with host software component (HSC). However, with support for 3592, HSM recognizes the actual underlying drive type as a 3592 model. It will not tolerate esoteric names that mix these 3592 drives (even in 3490E emulation mode) with devices that are actually type 3490E.

Refer to HSM considerations in the current level of the DFSMShsm publications.

Other migration considerations

This topic describes additional migration considerations.

Migrations can take place by directing new allocations to the 3592 drives and letting old data sets expire on cartridges written on 3590 drives. There is no need to copy the data sets unless the additional cartridge storage provided by the 3590 tape drives is required immediately.

Chapter 6. Device attachment planning

Fibre Channel attachment planning

This topic describes Fibre Channel attachment.

Each 3592 tape drive comes with dual-ported switched fabric Fibre Channel attachments, for attachment to multiple servers or a single server with redundancy. The J1A tape drive has 2 Gb dual-active ports, the E05 and E06 tape drives have 4 Gb dual-active ports, the E07/EH7, E08/EH8, and 55F tape drives have 8 Gb dual-active ports, and the 60F tape drives have 16 Gb dual-active ports. The J1A tape drive can also attach to the TS1120 (3592 C06) Controller, the J70 Controller, or the 3590 A60 controller for attachment to ESCON or FICON channels on IBM System z servers. The E05 and E06 tape drives can attach to the C06, or J70 Controllers but not to the 3590 A60 controller. The E07 tape drive can attach to the C06 Controller. For a list of supported environments, see Chapter 1, “Introduction,” on page 1. The Open Systems Device Driver (FC 9200) on the 3592 tape drive supports all Open Systems supported environments.

Host hardware and software considerations

This topic describes planning considerations for host hardware and software.

The 3592 tape drive is supported in a wide range of environments including selected iSeries, AS/400, pSeries, RS/6000, xSeries, zSeries Linux, Sun, and Hewlett Packard servers, as well as Intel-compatible servers running Linux or Microsoft Windows NT, Windows 2000, or Windows Server 2003. For the latest details on specific hardware, software, and Fibre Channel support for the 3592 refer to the IBM Tape Drives website.

Other non-IBM systems

This topic describes planning considerations for other non-IBM systems.

Several non-IBM systems vendors support attachment of the 3592 tape drive. You should check with the non-IBM system vendor for specifics on hardware and software support requirements as any device drivers needed to support attachment to these systems must be provided by the non-IBM vendor. FC 9213 should be specified on the 3592 when this type of attachment is used.

SAN attachment

This topic describes SAN attachment.

Software requirements for attachment to various Fibre Channel fabric components depends on the server and adapter being used. Refer to the list of supported servers for software requirements for various configurations at the IBM Tape Drives website.

Attention: Tape and disk over the same adapter is not advised due to performance and stability concerns caused by the differing traffic profiles.

Native Fibre attachment

This topic describes native Fibre attachment.

The 3592 tape drive is supported by a variety of Fibre Channel switches and Fibre Channel directors. The support is dependent on server, operating system, and host bus adapter that is being used. For a current list of supported products or more information on the support and prerequisites, refer to the IBM Tape Drives website.

FICON attachment

This topic describes planning considerations for FICON attachment.

For more information on the FICON director support and prerequisites within a SAN, refer to the IBM Tape Drives website.

AIX High Availability Data Path Failover and Dynamic Load Balancing

This topic describes AIX High Availability Data Path Failover and Dynamic Load Balancing.

AIX High Availability Data Path Failover is designed to provide a failover mechanism in the AIX Atape device driver, that enables you to configure multiple redundant paths in a SAN environment with the 3592 tape drive. In the event of a path or component failure, the failover mechanism is designed to automatically provide error recovery to retry the current operation using an alternate, preconfigured path without aborting the current job in progress. This allows you flexibility in SAN configuration, availability and management.

A function in the AIX Atape device driver, Dynamic Load Balancing, is also available for the 3592 tape drives used in an AIX SAN environment. The dynamic load balancing support is designed to optimize resources for devices that have physical connections to multiple Host Bus Adapters (HBA) in the same machine. When an application opens a device that has multiple HBA paths configured, the device driver determines which path has the HBA with the lowest usage, and assigns that path to the application. The device driver is designed to dynamically track the usage on each HBA as applications open and close devices, and balance the number of applications using each HBA in the machine. This may help optimize HBA resources and improves overall performance. For more information, see the *IBM TotalStorage Tape Device Drivers Installation and User's Guide*, GC35-0154, available at the IBM Fix Central website.

FICON attachment planning

This topic describes planning considerations for FICON attachment.

The 3592 can be attached in a FICON or FICON/FCP heterogeneous SAN as well as in a pure FCP SAN. For more information on FICON attachment, see "FICON and ESCON attachment" on page 136 and also refer to *IBM Tape Solutions for Storage Area Networks and FICON*, SG24-5474.

This section describes the planning necessary for FICON attachment. The following topics describe the planning:

- Configurations with FICON System Attachment

Configurations with FICON system attachments

This topic describes planning considerations for configurations with FICON system attachments.

The tape controllers attach to the FICON channels on a System z server.

For the TS1120 (3592 C06) Controller, each 4 Gb FICON adapter (FC 3441, FC 3442, and FC 3443) provides up to 128 logical attachments. For the J70 Controller, each 2 Gb FICON adapter (FC 3434 and FC 3435) provides up to 128 logical attachments. For A60 control units using 1 Gb FICON adapters on FICON switches, each subsystem 1 Gb FICON adapter (FC 3432 and FC 3433) provides up to 64 logical attachments. A given system may simultaneously attach a device through both ESCON and FICON.

For information on controller cable features, see "Controller cable features" on page 82.

Simultaneous accessibility for System z, through ESCON and FICON, requires configuring the same device address for both path types.

Fiber Transport Services

The topics in this section describe planning considerations for Fiber Transport Services.

Additional cables, fabric components, and cabling solutions

This topic describes planning for additional cables, components, and solutions.

Conversion cables from SC Duplex to LC Duplex are available as features on the z900 for customers currently using cables with SC Duplex Connectors that now require attachment to fiber components with LC Duplex connections. Please refer to the IBM 2064 sales manual for more information on these conversion kits.

The z800 and z990 servers do not offer any fiber conversion kits as product features.

Fiber optic cables, cable planning, labeling, and installation are the responsibility of the client for new installations and upgrades. Fiber optic conversion kits and Mode Conditioning Patch (MCP) cables are not

orderable as features on z990. Installation Planning Representatives (IPRs) and System Service Representatives (SSRs) will not perform the fiber optic cabling tasks without a services contract.

To better serve the cabling needs of z800, z900 and z990 systems, IBM Networking Services has enhanced their fiber optic cabling services.

IBM Networking Integration and Deployment Services for System z fiber cabling and for enterprise fiber cabling help to ensure IBM has a comprehensive set of services for all clients, from product-level to enterprise-level—services geared for today and tomorrow. These services take into consideration the requirements for all of the protocols/media types supported on System z , (such as ESCON, FICON, Coupling Links, OSA) whether the focus is the data center, the Storage Area Network (SAN), Local Area Network (LAN), or the end-to-end enterprise. For more information on these services, visit the IBM Integrated communications services website.

Under the fiber optic cabling services umbrella there are three options to provide individual fiber optic cables (jumper cables, conversion kits, MCP cables) for connecting to z800, z900, or z990.

- Option 1 - Fiber optic jumper cabling package (available for z800 and z900 systems). IBM does the detailed planning. This option includes planning, new cables, installation, and documentation. An analysis of the System z channel configuration, I/O devices, and any existing fiber optic cabling is required to determine the appropriate fiber optic cables.
- Option 2 - Fiber optic jumper cable migration and reuse for a System z upgrade (new option). This option includes planning, reuse of existing cables, and documentation. IBM organizes the existing fiber optic cables based upon the z990 connection details. Relabeling, rerouting, and reconnection to the appropriate z990 channels is performed. New cables are not offered as a part of this option.
- Option 3 - Fiber optic jumper cables and installation. The client informs IBM what is required as the client does the detailed planning. This service includes new cables, installation, and documentation. Planning and identifying the required cables are the client's responsibilities.

Options 1 and 2 can be combined within one statement of work to provide complete upgrade coverage.

FICON and ESCON attachment

The C07, C06, and J70 Controllers have up to four FICON attachments (8 Gb for the C07 and C06 Controllers, 2 Gb for the J70 Controller), twice the number that the IBM TotalStorage Enterprise Tape Controller 3590 Model A60 offers. The C07 Controller allows from one to four FICON adapter cards. The C07 Controller can intermix long-wavelength, or short-wavelength FICON attachments on the same controller. Each port can support up to 128 logical paths. The C06 and J70 Controllers also have up to eight ESCON attachments, or an intermix of ESCON and FICON attachments. The C06 and J70 Controllers can intermix ESCON, FICON long-wavelength, or FICON short-wavelength attachments on the same controller. A Dual ESCON Attachment for the C06 (FC 3440) or J70 Controller (FC 3413) provides a dual-ported ESCON host adapter. Up to four of these features can be ordered for a total of up to eight ESCON port attachments. Each port can support up to 64 logical paths.

The number of FICON long-wavelength adapters on the C07 Controller and TS1120 (3592 C06) Controller is specified with feature FC 3442 or FC 3443 and on the J70 Controller with FC 3434 (FICON Attachment Long Wavelength). The number of FICON short-wavelength adapters on the C07 or C06 Controller is specified with feature FC 3441 and on the J70 Controller with FC 3435 (FICON Attachment Short Wavelength). Each FICON attachment (features FC 3434, FC 3435, FC 3441, FC 3442, and FC 3443) can connect up to 128 logical channels. The C07 Controller only allows FICON attachment features. The FICON attachment features and the ESCON attachment features can be intermixed on a C06 and J70 Controller but at least one of these features must be specified. Permitted combinations of features FC 3413, FC 3434, and FC 3435 are as follows:

Table 53: Permitted combinations of FICON/ESCON attachments			
Number of Feature FC 3434 + FC 3435 or FC 3441 + FC 3442 + FC 3443	**Allowed Number of Feature FC 3413 or FC 3440**	**Number of FICON Attachments**	**Number of ESCON Attachments**
0	4	0	8
1	3	1	6
2	2	2	4
3	1	3	2
4	0	4	0

3592 and 3590 tape control unit native FICON support

For information on IBM System z support for the controllers and 3592 tape drives (z/OS, z/VM, z/VSE®, and z/TPF), refer to the announcement material for the tape drive as well as the 3592 Preventive Service Planning (PSP) bucket.

Fibre Channel attachment planning

This topic describes planning considerations for Fibre Channel attachment.

This section describes necessary planning for various Fibre Channel attachments to non-System z environments. Planning includes the following topics:

- "Multiple Fibre Channel ports" on page 138
- "Fibre Channel physical interface characteristics" on page 138
- "Supported topologies" on page 138
- "Address assignments" on page 138
- "Fibre Channel Worldwide ID and LUN assignments" on page 139
- "Removing, installing, or resetting a 3592 on an active Fibre Channel" on page 139
- "Sharing on a Storage Area Network" on page 139

RS/6000 or pSeries environment for Fibre

This topic describes Fibre Channel attachment for RS/6000 or pSeries.

3592 tape drives are supported on AIX 4.3.3 and later versions. Specific device support for AIX is provided by specify number 9200, the Open Systems Device Drivers, which is ordered on the 3592 drive. This support is also included in FC 9200 for the 3494 Tape Library. For more information on device drivers, go to IBM Fix Central.

AIX High Availability Data Path Failover and Dynamic Load Balancing support through SAN connections is available through the AIX Atape device driver, provided by the Open Systems Device Drivers (FC 9200), which is ordered on the 3592 tape drive. If you are adding these tape drives to a currently installed Model C20 or 3494 Tape Library, you should obtain a new level of the device driver from the Web site listed above. This capability allows you to configure multiple redundant paths in a SAN environment to 3592 tape drives having Fibre Channel Attachment. In the event of a path or component failure, the failover mechanism is designed to automatically seek to retry the current operation using the alternate, preconfigured path without aborting the current job in progress. This can provide improved availability in your SAN configuration and management.

Tivoli Storage Manager provides 3592 support with highly automated, centrally scheduled, policy-managed backup and archival facilities. These features protect data in distributed environments that use AIX systems as servers.

Multiple Fibre Channel ports

This topic describes considerations for multiple Fibre Channel ports.

The 3592 tape drive has two independent Fibre Channel interfaces, or ports. Both ports run the SCSI protocol with Fibre Channel tape support. Two ports allow concurrent attachment of two independent Fibre Channel configurations to each drive. One or both ports can be attached to a variety of Open Systems servers, switches, hubs, and directors. See the IBM SAN fabric website for details.

Plug any unused ports.

Fibre Channel physical interface characteristics

This topic describes Fibre Channel physical interface characteristics.

The 3592 drive supports industry standard shortwave LC-Duplex fiber-optics cables. This allows cable lengths of up to 500 meters with 50 micron core fiber.

For drive Fibre Channel cable feature codes, see “Feature definitions - 3592 tape drive standard features” on page 41.

Supported topologies

This topic lists supported topologies.

The 3592 Fibre Channel supports Switched Fabric and Point-to-Point Loop topologies.

Switched Fabric

Two or more Fibre Channel end points interconnect through a switch. The Fibre Channel architecture supports up to 256 ports through each switch.

Switches include a function called *Zoning*. This function allows the user to partition the switch ports into port groups. It then assigns group access to other groups. This prevents group interferences. See “Sharing on a Storage Area Network” on page 139 for this function's potential needs.

Switched fabrics allow all of its ports simultaneous use of the full Fibre Channel architecture bandwidth.

For more information on Fibre Channel fabric support, visit the web at IBM Storage SAN switches.

Point-to-point loop

Point-to-point *loop* is similar to point-to-point topology. Both have two Fibre Channel end points connected together. The difference is in the protocol.

Therefore, when only two Fibre Channel end points connect together, either protocol is usable. Both end points must, however, use the same protocol. The 3592 supports point-to-point loop. SAN Data Gateway will utilize either protocol. Most Fibre Channel adapters default to the loop protocol when not directly connected to a fabric.

Address assignments

This topic describes planning considerations for address assignments.

The 3592 tape drives must have a fibre address to communicate over the Fibre Channel interface. The 3592 allows both hard and soft addressing. Most fiber hosts (initiators) support hard addressing, and do not support soft addressing. See your device driver documentation for more information.

Selecting the hard addressing option enables you to also select the driver’s Arbitrated Loop Physical Address (AL_PA). The higher the number, the lower the priority. Most hosts will attempt the lowest AL_PA number (highest priority). The drives should have a higher AL_PA (lower priority). Multiple drives connected in an arbitrated loop require the drive closest to the host to have a lower AL_PA number (higher priority) than the next drive. Follow this protocol throughout the loop.

The soft address feature allows the drive to arbitrate the AL_PA number with other fibre devices.

When sharing a drive between different systems, take caution to keep both hosts from attempting to use the drive at the same time. For more information, see “Sharing on a Storage Area Network” on page 139.

Fibre Channel Worldwide ID and LUN assignments

This topic describes planning considerations for Fibre Channel Worldwide ID and LUN assignments.

Each fibre channel card on 3592 tape drives has four names (Node 0, Node 1, Port 0, and Port 1) that are hard coded into the electronics of the card by IBM manufacturing. These names are similar to a serial number and are unique throughout the world. Some customer fibre channel networks that have switches with the "zoning" function will use these names, in addition to using the Port Addresses for communications between the host and the drive.

When a 3592 tape drive is first installed in a rack or frame, the drive is configured by the installer using the service panel. The World Wide (WWID) node names, port names, and serial number are stored in Vital Product Data (VPD) and BVPD (Backup VPD). If a replacement drive is installed, it will automatically inherit the WWID, Arbitrated Loop Physical Address (AL_PA), serial number, and other configuration data for both fibre ports from the drive that was replaced. The service representative will perform any necessary updates of the VPD when installing a replacement drive.

The 3592 tape drive provides one Logical Unit Number (LUN) at LUN address 0.

Removing, installing, or resetting a 3592 on an active Fibre Channel

This topic describes planning considerations for Fibre Channel.

An active Fibre Channel bus supports a 3592 attachment. This is due to the nature of Storage Area Networks (SAN) and also applies when attaching directly to a system.

An active Fibre Channel bus supports 3592 resetting and power cycling. The preferred and safest method is to take all Fibre Channel ports offline before resetting the drive.

When service representatives add or remove 3592 devices within a live system or SAN, they will follow the guidelines below:

- The added or removed device must not be involved in bus activity. It must be quiesced.
- Fibre Channel cables may then be removed from the 3592 interface connector.
- The 3592 device can then be removed from the rack or frame, if necessary.
- After all the changes are complete, a reconfiguration of all systems must be done to update the configurations.

Sharing on a Storage Area Network

This topic describes sharing on a Storage Area Network (SAN).

With SAN components, the possibilities for connecting multiple systems and multiple drives have increased. Not all software and systems are designed to share drives. Check that the systems and software support this sharing before installing a drive in a fashion that would allow two systems to see that drive.

If your software does not support sharing, be aware that Fibre Channel switches have a zoning capability to form a SAN partition. Use this zoning to keep systems that do not cooperate from seeing the same drives. You can remove partitioning via zoning as software and system levels become available.

Chapter 7. Controller-attached emulation mode operational considerations

This chapter provides an overview of considerations that are related to device-type emulation with IBM 3592 tape drives. It helps you understand the kinds of situations that require special attention or can potentially pose usage restrictions with emulation mode operation. For a detailed treatment of these considerations, refer to *z/OS DFSMS Software Support for IBM TS1130 and TS1140 Tape Drives (3592)*, SC26-7514.

Note: For the discussions in this chapter, emulation applies only to controller-attached environments.

General considerations for controller-attached emulation mode operation

This topic describes operational considerations for controller-attached emulation mode.

The TS1120 (3592 C06) Controller, J70 Controller, and 3590 Model A60 Controller permit the attached host to interact with the 3592 tape drives that use either the native 3590 or 3490E emulation interfaces. Either a 3590 emulation or a 3490E emulation feature can be set by service personnel for any of these tape controllers. All attached hosts in the I/O configuration require definition of control unit and drives. The host must be defined with the unit type that matches the device-type definition which is active on the control unit for that subsystem. E05, E06, EU6, E07, and J1A tape drive support is provided only as an emulation of 3590 Bxx or 3490 E (J1A tape drive only) support.

Note: Write-once, read-many (WORM) and Economy Cartridge functionality is supported in 3590 emulation, but not in 3490E emulation.

Emulation-mode operation requires understanding of characteristic differences. The host perceives the drive as the emulated device type. However, the actual drive and associated media have some characteristics that may be different from that of the emulated device type. Generally, host programs use the 3592 tape drives in emulation mode with no problems and with full exploitation of device and media capabilities.

Attention: The actual drive recording format writes data on the 3592 media in the Enterprise Tape 3592 format, regardless of device-type definition.

In 3494 and 3584 libraries, the controller–attached 3592 tape drives are always in 3590 emulation mode. The DFSMS/MVS SMS Tape support manages the recording technology differences between the Model H and Model E and Model B drives. DFSMS/MVS SMS tape support also tracks the recording density of the Storage Management Subsystem (SMS) managed volumes. Thus, special attention to the emulation mode considerations applies for 3592 tape drives in the following environments:

- z/OS environment for drives that are not installed in IBM 3494 or 3584 libraries
- VM/ESA or VSE/ESA environments for drives either inside or outside 3494 or 3584 libraries

Library maintenance

This topic describes operational considerations for library maintenance.

The SD/2 library maintenance “dot method” is NOT valid in an environment where the 3592 native drives report to Sys1.logrec in 3490 emulation mode. The 3480/3490 SD2 library maintenance algorithm was designed to use hardware and the temporary error threshold that is only valid with real 3480/3490 drives. SARS algorithms that are in the 3592 microcode contain required thresholds for 3592 drives.

If 3592 drives are reporting to SD/2 in 3490 emulation mode, the service representative should change the SD/2 tape configuration entry for the affected drives. This is accomplished by unchecking (turning off) the library entry on all subsystems reporting in 3490 emulation mode.

Drive allocation/selection

This topic describes operational considerations for drive allocation and selection.

With tape drives that emulate another device type, the unit type becomes ambiguous when there are actual drives of the same type that are host attached. For example, any 3592 drive that is in 3490E-emulation mode has the same unit type as an actual 3490E drive. A 3592 drive that is in 3590-emulation mode has the same unit type as an actual 3590 Model B (in 3590 mode). Application software maintains the relationships between pieces of media and the subset of drives on which they can be mounted. In turn, the software must influence the selection of an appropriate tape drive.

z/OS considerations (MVS/ESA)

This topic describes the operational considerations for z/OS.

The different IBM tape devices can coexist in a heterogeneous environment with other tape drive technologies. In an IBM tape library environment (automated or manual), the system-managed tape library support can be used to manage device allocation to an appropriate device. Allocations are managed to an appropriate device based on the media interchange parameters specified in data class. Then in the stand-alone (non-system managed environment), the requirement is placed on the installation to manage and separate, as appropriate, the different drive technologies and capabilities using user-defined esoterics.

In addition to this, in the system-managed tape library environment, all drives under the same control unit must have the same recording format capabilities and report under the same ERDS physical identifier (EPI). This ensures that all of the devices under the same control unit are homogeneous and that each device under the same control unit is capable of handling the allocation request. Then, in the stand-alone (non-system managed environment), though a mix of drives is allowed by the control unit, the recommendation is to have homogeneous devices under the same control unit for easier separation and management.

For more information see:

- Section on Data Facility Storage Management Subsystem (DFSMS) in the z/OS V1R12.0 Information Center at http://publib.boulder.ibm.com/infocenter/zos/v1r12/index.jsp
- *z/OS DFSMS Object Access Method Planning, Installation, and Storage Administration Guide for Tape Libraries*, SC35-0427
- Other publications on DFSMS for System z are listed here, z/OS V1R10.0 elements and features - DFSMS

VM/ESA and z/VM considerations

This topic describes operation considerations for VM/ESA.

If 3590 Model H, Model E, and Model B are added in 3490E emulation mode, the ASSGN JCL statements that specifies "3490 H or E" cannot work properly. The same applies if either Model H, Model E, or Model B is added when there are also actual 3490E drives present. If Model H, Model E, and Model B are added in 3592 mode, then ASSGN JCL statements that specify "3592" cannot work properly.

VSE/ESA considerations

This topic describes operation considerations for VSE/ESA.

If 3590 Model H, Model E, and Model B are added in 3490E emulation mode, the ASSGN JCL statements that specifies “3490 H or E” cannot work properly. The same applies if either Model H, Model E, or Model B is added when there are also actual 3490E drives present. If Model H, Model E, and Model B are added in 3592 mode, then ASSGN JCL statements that specify “3592” cannot work properly.

Media capacity exploitation

This topic describes operational considerations for media capacity exploitation.

A majority of applications that write data on tape are not sensitive to unit type in internal processing used to determine end-of-volume. However, some applications (for example, DFSMShsm) use unit type as a factor in calculating the capacity for a particular piece of media. Check the 3590 PSP bucket for maintenance required for IBM applications. Contact independent software vendors to verify that other software products will exploit the full tape capacity when drives are in emulation mode. With 3490E-emulation mode, another factor with the potential to affect full capacity utilization is the 22-bit blockid that is used with 3490 interfaces. With small block sizes, the full capacity of the tape is not used before the subsystem encounters logical end-of-volume.

Tapes written with DFSMShsm using the extended capacity capability can only be read on tape devices that support this capability. Devices supporting this extended capacity include:

- 3590 tape drives in 3490 emulation mode attached to Model A60 Controllers that have this new hardware enhancement and are attached to a system running DFSMS/MVS Version 1 Release 5 or above with all applicable maintenance applied
- 3590 B, E, and H Model tape drives that are not in 3490 emulation mode if the tapes are first redefined as native 3590 via the DFSMShsm ADDVOL command by a system that supports this new extended capacity

MVS/ESA considerations

This topic describes operational considerations for MVS/ESA.

OAM

This topic describes OAM enhancement.

An OAM enhancement will allow full 3592 cartridge capacity exploitation when 3592 drives are attached with the 3490E emulation feature.

VM/ESA and z/VM considerations

This topic describes operation considerations for VM/ESA.

VM/ESA commands and functions for writing tape data can make full use of 3592 media capacity. Specifying the largest possible block size when issuing CMS commands ensures optimum use of media capacity and promotes the best exploitation of 3592 performance.

VSE/ESA considerations

This topic describes operational considerations for VSE/ESA.

Typically, applications use the physical end-of-volume to determine that a tape is full. Applications fully use capacity of media, regardless of emulation mode or track density.

Catalog considerations

The topics in this section describe catalog considerations.

Emulated device types

This topic describes operational considerations for emulated device types.

Inventories and catalogs that track the generic unit name of the device on which data sets are written reflect the emulated device type. In the event that the emulation mode of installed drives changes, the volumes themselves may need to be inventoried again. Application catalogs and inventories may require manual update to reflect the new generic unit type. Thus, effective management of 3592 cartridges includes dedicating a volume serial numbers range for 3592 cartridges only. The emulated generic unit

type in catalogs should also be reviewed in the context of resource availability at disaster recovery facilities.

z/OS considerations (MVS/ESA)

This topic describes operational considerations for z/OS.

With TSM/MVS, data written on the medium, as well as in the product inventory, identifies the cartridge as the emulated type (3490E or 3590). A read-compatibility capability allows cartridges that are written in 3490E emulation mode and marked as “3490E” to be read on a 3590-mode drive.

Media interchangeability

This topic describes operational considerations for media interchangeability.

Data is always written on the 3592 media in the recording format of the actual drive. Tape drive media is written in the Enterprise Tape 3592 format regardless of device-type definition.

- EFMT1 for the E05 and J1A tape drive
- EFMT2 for the E05 tape drive (or EEFMT2 for encrypted data)
- EFMT3 for the E06 tape drive (EEFMT3 for encrypted data)
- EFMT4 for the E07/EH7 tape drive (EEFMT4 for encrypted data)
- EFMT5 for the E08/EH8/55F tape drive (EEFMT5 for encrypted data)
- EFMT6 for the 60F tape drive (EEFMT6 for encrypted data)

Keep in mind that an application can write metadata on the media to identify the cartridge with a specific unit type. With emulation mode, this is the emulated unit type. With a 3490E-emulation mode drive, reading a tape that is written on a 3592-mode device might be constrained. It might be limited by the 22-bit blockID limit if the block-count written in 3592-mode is greater than the maximum count supported by 22 bits (4,194,303).

3490E-emulation compared to actual 3490E

This topic describes 3490E-emulation.

A J1A tape drive in 3490E-emulation mode has the following behavioral differences when compared to an actual 3490E.

Note: 3490E emulation mode is only supported with the J1A tape drive. The J1A tape drives are no longer available for ordering but are covered for existing product support.

- **The Block ID, returned from the 3490 Axx with the 3490E emulation host feature, does not provide wrap, segment, and format-mode indicators in bits 0–9.**

  The wrap and segment notations in 3490E media format cannot be presented in a meaningful context for 3590 or 3592 media. The 3590 drive as part of the 32-bit block ID interprets a non-zero value in any of these bits. Tapes written on drives that are attached in emulation mode must be readable in the future by 3590 drives that are attached in 3590 mode. To ensure readability, the Axx presents the wrap, segment, and format-mode bits in emulation mode to the host as 0. Thus, using wrap and segment fields to sense the approaching physical end-of-tape is not effective. Applications and products which use wrap, segment, or format-mode bit settings as returned from the tape subsystem may experience unpredictable results.

  The A60 controller offers the option of using 3592 block ID architecture when the subsystem is in 3490E emulation mode. See “Application-related features of the 3590 A60, J70, C06, and C07 Controllers” on page 130 for more details.
- **The Erase gap command is functionally a No-Op.**

There are technology differences between the 3490E and 3592 media formats. The 3490E Erase Gap channel command word is effectively a No-Op, but it causes synchronization of the drive buffers.

- **DDR swap to another drive may fail in certain cases that would be successful with actual 3490E drives.**

  Differences between 3490E and 3590 handling of buffered data during certain error scenarios have the potential to result in unsuccessful completion of DDR swap during error recovery.

- **Error reports may be inconsistent with 3490E.**

  Not all error scenarios that are possible with a 3590 A60 control unit with the 3490E emulation feature are parallel to an IBM 3490E control unit error and vice versa. Thus, the error reported may require contextual interpretation.

  – ERA Code 3C

    This error code reports data lost in connection with a Manual Unload.

  – ERA Code 2E, Not Capable

    This error code report an attempt to load a cartridge type other 3592.

  – ERA Code 2F, Limited Shared Access Violation

    This error code repeats when a second host attempts tape-motion commands in the middle of a first host's active use of a tape volume.

  – ERA Code 48, Unsolicited Informational Data

    An error encountered in the 3590 A60 Control Unit generates ERA Code 48. Also when a 3590 service information message (SIM) or 3590 media information message (MIM) has been logged.

- **A 3590 A60 subsystem is not installable in a 3494 library in 3490E emulation mode.**

  The 3590 A60 control unit with the emulation feature provides a standalone 3590 tape subsystem configuration or integration of 3590 tape subsystem in StorageTek libraries.

- **Operator actions for standalone tape utilities may have some variations when compared to those for 3490E.**

  There are differences between 3490E and 3590 tape unit controls. For example, there is no manual rewind function on a 3590. So, an operator must perform a manual unload and then reload the cartridge to restart a stand alone operation.

- **Recovering data beyond the logical end-of-data (EOD) mark requires a different technique.**

  Sometimes unusual circumstances create a need to recover data located beyond the logical end-of-data mark of a 3590 cartridge. For example, a volume has been scratched for reuse. Subsequently, a need arises to read old data from an area not yet rewritten on the tape.

  In such situations, some differences in technique and error handling will be experienced as compared to performing a comparable operation on an actual 3490E. The essential distinction lies in the respective format characteristics of 3490E and 3590 media. With 3490E, it is possible to refer to a physical location on tape through wrap and segment designations. With 3590, only logical reference (to Block ID) is possible in specifying relative locations on the media.

  Spacing or reading beyond the logical end-of-data (EOD) mark on a 3590 cartridge initially results in an end-of-data-encountered error. A subsequent record sequence error occurs when there is spacing or reading beyond the logical end-of-data mark upon encountering the first out-of-sequence block ID. This error may recur if there are additional EOD marks and subsequent old data fragments.

  The native 3590 command interfaces provide options to ignore sequence errors. Thus, recovery of data can be accomplished without encountering record sequence errors with SCSI, ESCON, or FICON, attachment of drives as a 3590 device type.

Overwritten data, beyond the last-recorded logical EOD, cannot be recovered locally whether in 3490E-emulation or 3590 mode. Data written in 128-track format, and overwritten in 256-track format (or vice versa) beyond the last-recorded logical EOD, cannot be recovered locally.

Appendix A. Host reporting

Statistical Analysis and Reporting System

The Statistical Analysis and Reporting System (SARS) assists in determining whether read and write errors are caused by the media (tape) or the hardware in the drive. The 3592 microcode contains a Volume SARS (VSARS) algorithm and a Hardware SARS (HSARS) algorithm to analyze errors. SARS algorithms report messages through SIMs and MIMs.

Algorithms are executed in the 3592 just before a tape is unloaded. To distinguish error patterns and trends, the SARS *volume* algorithms require the tape to be mounted on different drives while the SARS *hardware* algorithms require different volumes to be mounted on one drive. As degraded hardware passes through predefined error thresholds, cleaning and service repair messages or error codes are presented. Similarly, if tape volumes continue to perform poorly on different drives, re-write or discard-media messages are presented.

The SARS reporting of Service Information Message (SIM) and Media Information Message (MIM) functions can be disabled if host software does not support SIMs and MIMs.

Service and Media Information Messages (SIMs and MIMs)

SIM and MIM functions are primary factors for improved product availability.

- A SIM alerts you when an abnormal operational condition in the 3592 requires service attention. Information in the SIM identifies the affected drive, the failing component and severity of its fault condition, and the expected operational impact of the pending service action. This information helps the user to initiate and expedite appropriate recovery and service procedures so normal operation is restored with maximum efficiency and minimal disruption.

  A SIM contains the machine type, machine serial number, and Field Replaceable Unit (FRU) which allows the dispatch of the appropriate service personnel and the replacement parts required to correct the machine fault. This procedure helps improve service response time and helps reduce the time required for machine repair.
- A MIM identifies problems with the media (tape) and the volume number of the *bad* cartridge. This allows the customer to do maintenance within the tape library and to prevent unnecessary service calls when the fault is media.

You can select, depending on your software, the severities you wish to see. For example, you may only want to see the *acute* SIM/MIM, or prefer to see all SIMs and MIMs sent to the host. SIM/MIM filtering by severity can be done through configuration options. The four severity codes are listed below:

- Severity 0 (FID4) code means the device requires service, but normal drive function is not affected.
- Severity 1 (FID3) code indicates moderate severity.
- Severity 2 (FID2) code indicates serious severity.
- Severity 3 (FID1) code indicates acute severity.

A MIM specifies what is wrong with the cartridge that is indicated. The three MIM severity codes are listed below:

- Severity 1 indicates moderate severity.
- Severity 2 indicates serious severity.
- Severity 3 indicates acute severity.

SIMs and MIMs can be reported multiple times. A configuration option allows reporting the same SIM/MIM more than once. The time between repeat SIMs/MIMs is eight hours. For example, if the

configuration option is set to two, a SIM will be reported when an error occurs, it will be repeated again eight hours later, and, then again, eight hours after that message. The default is to not repeat SIMs/MIMs.

SIM/MIM presentation

SIMs and MIMs reporting varies for different systems. Refer to the *Statistical Analysis and Reporting System User Guide* which can be accessed on the web at IBM Tape systems: Resources. This book is only available online, and cannot be ordered as a printed version.

There are specific SIM and MIM presentations for the following systems:

System
Presentation

System z
IEA480E and IEA486E messages, as well as EREP reports

z/VM (VM/ESA)
HCP6359I and HCP6357I messages, as well as EREP reports

z/VSE (VSE/ESA)
OP64I, OP65I, and OP20 messages, as well as EREP reports

TPF
CEFR0354I, CEFR0355W, CEFR0356W, CEFR0357E, CEFR0347W, CDFR0348W, and CDFR0349E messages, as well as EREP reports

TSM (formerly ADSM)
ANR8972E, ANR8830E, and ANR8831W messages

AIX
SIM/MIM messages are logged to EREP reports

HP
When enabled, SIM and MIM messages are logged to /var/adm/atdd/atdd_d.log

SUN
When enabled, SIM and MIM messages are logged to /var/adm/messages

Linux
Via taped DAEMON, SIM/ and MIM messages are logged to /var/log with file names of the form <drive serial #>.<time stamp>.simmim

Appendix B. Accessibility

Accessibility features help users who have a disability, such as restricted mobility or limited vision, to use information technology products successfully.

Accessibility features

These are the major accessibility features associated with the IBM 3592 tape drives and TS1120 (3592 C06) Controller documentation:

- You can use screen-reader software and a digital speech synthesizer to hear what is displayed on the screen. PDF documents have been tested using Adobe Reader version 7.0. HTML documents have been tested using JAWS version 9.0
- This product uses standard Windows navigation keys

Keyboard navigation

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 3592 tape drives and TS1120 (3592 C06) Controller information from the keyboard by using the shortcut keys for your browser or screen-reader software. See your browser or screen-reader software Help for a list of shortcut keys that it supports.

IBM and accessibility

See the IBM Human Ability and Accessibility Center for more information about the commitment that IBM has to accessibility.

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- Directive 2014/30/EU (European Union EMC Directive)
- Agreement of Voluntary Control Council for Interference by Information Technology Equipment (Japan VCCI)
- Act No. 8867 (Republic of Korea Radio Waves Act)
- New Zealand Radiocommunications Regulations 2001
- Australia Radiocommunications Act 1992
- CNS 14348-2006 (Taiwan BSMI regulation for EMC)
- Regulation 2004/108/AT (Turkey Electromagnetic Compatibility Regulation)
- EMC Regulations of the Eurasian Economic Union

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The following symbols are used in this manual:

Symbol
description

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Displays on the service panel to indicate that trace data is stored in the device. Also printed in text as an *Attention* notice.

Displays on the service panel when flash dump trace data is available in flash memory.

Printed in text and in figures to indicate an ESD-sensitive part.

Printed in text and in figures to indicate that a Class I Laser device is installed.

Displays on the service panel to indicate that the slide bar on the cartridge is set to the file-protected position.

Displays on the service panel to indicate that the host file-protected the volume.

Displays on the service panel to indicate that the slide bar on the cartridge is set to the **not** file-protected position.

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CAN ICES-3 (A)/NMB-3(A)

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Germany Electromagnetic Compatibility Directive

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Glossary

This glossary defines the special terms, abbreviations, and acronyms used in this publication and other related publications. If you do not find the term you are looking for, see the *IBM Glossary of Computing Terms* located at the IBM Terminology website.

A

access method
A technique for moving data between processor storage and input/output devices.

ACF
See *Automated Cartridge Facility*

ACS
Automatic Cartridge System

ADSM
See *TSM*

AES
Advanced Encryption Standard. A block cipher adopted as an encryption standard by the US government.

Advanced Interactive Executive
IBM's implementation of the UNIX operating system. The RS/6000 and pSeries, among others, run the AIX operating system.

AEN
Asynchronous event notification is the ability of a device to initiate communications with attached hosts.

AIX
See *Advanced Interactive Executive*

ALPA
Arbitrated Loop Physical Address

alphanumeric
Pertaining to a character set that contains letters, numerals, and possibly other characters, such as punctuation marks.

APAR
authorized program analysis report

archiving
The storage of backup files and associated journals, usually for a given period.

arbitrated loop
see *Fibre Channel arbitrated loop (FC-AL)*

archiving application
The retention of records, in machine-readable form, for historical purposes.

automatic cartridge facility (ACF)
An optional feature for the 3590 tape drive. It allows both the automatic loading and unloading of tape cartridges.

automatic mode
A mode of operation that can be selected on the ACF cartridge loader. This mode allows the automatic feeding and loading of tape cartridges requiring no operator action.

B

BVPD
Backup Vital Product Data

backhitch
Magnetic tape that makes a slight backward motion just prior to moving forward.

backup and recovery application
The short-term retention of records used for restoring essential business and system files when vital data has been lost because of program or system errors or malfunctions.

bar code
A code representing characters by sets of parallel bars of varying widths and separation which are read optically by transverse scanning.

bar code label
A specially coded label that can be affixed to a tape cartridge and which enables a device to identify the cartridge and its volume serial number. The bar code label must be affixed to a tape cartridge to enable the library to identify the cartridge and its volume serial number.

beginning of tape (BOT)
The location on a magnetic tape that indicates the beginning of the permissible recording area.

bit
A binary digit that may have the value of either 0 or 1.

block
A collection of contiguous records recorded as a unit. Blocks are separated by inter-block gaps, and each block may contain one or more records.

BOT
beginning of tape

BOV
beginning of volume

BRMS
Backup Recovery and Media Services

browser
A client program that initiates requests to a web server and displays the information that the server returns.

BTLS
Basic Tape Library Support

buffer
A routine or temporary storage location used to compensate for a difference in rate of flow of data, or time of occurrence of events, when transferring data from one device to another.

byte
A binary number containing exactly eight bits.

C

capacity
See *media capacity*.

capacity scaling
A logical method of reducing the overall length of media available for write and read operations, providing faster data-access times.

cartridge loader
A standard function for the tape drive. It allows the automatic loading of tape cartridges.

certificate
A digital document that binds a public key to the identity of the certificate owner, thereby enabling the certificate owner to be authenticated.

channel
A device to device connection between the processing unit and the I/O control unit.

channel command
An instruction that directs a data channel, control unit, or device to perform an operation or set of operations.

channel path
The physical path between the channel and the control unit. Synonymous with channel.

cleaning cartridge
A tape cartridge that is used to clean the heads of a tape drive. Contrast with *data cartridge*.

CM
Cartridge Memory

command
A control signal that initiates an action or the beginning of a sequence of actions. See also *channel command*.

control unit (CU)
A device that controls input and output operations of one or more devices.

control unit function
A device that contains the functional logic for controlling the input and output operations at one or more devices.

conversion
The process of changing from one method of data processing to another or from one data-processing system to another.

CPU
central processing unit

D

data
Any representations such as characters or analog quantities to which meaning is, or might be, assigned.

database
A set of data, consisting of at least one file, sufficient for a given purpose or for a given data-processing system.

data cartridge
A tape cartridge dedicated to storing data. Contrast with *cleaning cartridge*.

data channel
A device that connects a processor and main storage with the I/O control unit. Synonymous with input/output channel and I/O channel.

data compression
An algorithmic data-reduction technique that encodes data from the host and stores it in less space than un-encoded data. The original data is recovered by an inverse process called decompression.

data-compression ratio
The number of host data bytes divided by the number of encoded bytes. It is variable depending on the characteristics of the data being processed. The more random the data stream, the lower the opportunity to achieve compression.

data transfer rate
The average number of bits, characters, or blocks per unit time passing between corresponding equipment in a data transmission system. The rate is expressed in bits, characters, or blocks per second, minute, or hour.

dataset
The major unit of data storage and retrieval, consisting of a collection of data in one of several prescribed arrangements and described by control information to which the system has access.

DDR
Dynamic device reconfiguration

degauss
To make a magnetic tape nonmagnetic by means of electrical coils carrying currents that neutralize the magnetism of the tape.

DFSMS
Data Facility Storage Management Subsystem

DK
Data Key. An alphanumeric string used to encrypt data.

drive head
The component of a drive that records an electrical signal onto magnetic tape, or reads a signal from tape into an electrical signal.

drive loaded
A condition of a tape drive in which a tape cartridge has been inserted in the drive, and the tape has been threaded to the beginning-of-tape position. Also known as a mount.

dump
To write the contents of storage, or of a part of storage, usually from an internal storage to an external medium, for a specific purpose such as to allow other use of storage, as a safeguard against faults or errors, or with debugging.

E

ECC
Error-correction code

EEDK
Externally Encrypted Data Key. A Data Key that has been encrypted (wrapped) by a Key Encryption Key prior to being stored in the data cartridge. See *KEK*.

effective data rate
The average number of bits, bytes, characters, or blocks per unit time transferred from a data source to a data sink and accepted as valid. The rate is expressed in bits, bytes, characters, or blocks per second, minute, or hour.

EEFMT2
Enterprise Encryption Format 2 recording technology. AES 256-bit encrypted data written recorded at the performance and capacity format used by the native E05 tape drive.

EEFMT3
Enterprise Encryption Format 3recording technology. AES 256-bit encrypted data written recorded at the performance and capacity format used by the native E06 tape drive.

EEFMT4
Enterprise Encryption Format 4 recording technology. AES 256-bit encrypted data written recorded at the performance and capacity format used by the native E07 tape drive.

EEFMT5
Enterprise Encryption Format 5 recording technology. AES 256-bit encrypted data written recorded at the performance and capacity format used by the native E08 tape drive.

EEFMT6
Enterprise Encryption Format 6 recording technology. AES 256-bit encrypted data written recorded at the performance and capacity format used by the native 60F tape drive.

EFMT1
Enterprise Format 1 recording technology. The performance and capacity format used by the J1A tape drive and the E05 tape drive when emulating J1A tape drive to record at increased density.

EFMT2
Enterprise Format 2 recording technology. The performance and capacity format used by the native E05 tape drive to record at increased density.

EFMT3
Enterprise Format 3 recording technology. The performance and capacity format used by the native E06 tape drive to record at increased density.

EFMT4
Enterprise Format 4 recording technology. The performance and capacity format used by the native E07 tape drive to record at increased density.

EFMT5
Enterprise Format 5 recording technology. The performance and capacity format used by the native E08 tape drive to record at increased density.

EFMT6
Enterprise Format 6 recording technology. The performance and capacity format used by the native 60F tape drive to record at increased density.

EIA
A unit of measure established by the Electronic Industries Alliance, equal to 44.45 mm (1.75 in).

EHPCT
extended high-performance cartridge tape

emulation
imitation of another device

enable
To provide the means or opportunity. The modification of system, control unit, or device action through the change of a software module or a hardware switch (circuit jumper) position.

encryption capable
A TS1120 and later tape drive that is functionally able, but not yet set up by IBM, to encrypt and decrypt data. All TS1150, TS1140, and TS1130 tape drives are encryption-capable. All TS1120 tape drives with Feature Code 5592 or 9592 are encryption-capable.

encryption enabled
An encryption-capable TS1120 and later tape drive that has been set up by IBM to encrypt and decrypt data.

encryption key manager (EKM)
A software program that assists encrypting tape drives in generating, protecting, storing, and maintaining encryption keys that encrypt information that is written to and decrypt information that is read from tape media.

encryption key server (EKS)
A software application supplying public and private keys and certificates for use in encrypting and decrypting data on the TS1120 and later tape drives.

Environmental Record Editing and Printing (EREP)
The program that formats and prepares reports from the data contained in the error recording data set.

EOD
end-of-data

EOV
end-of-volume

The point on a tape volume beyond which writing of logical blocks or tape marks is not allowed.

error-recovery procedures (ERP)
Procedures designed to help isolate and, where possible, to recover from errors in equipment. The procedures are often used with programs that record the statistics of machine malfunctions.

ESA
expanded storage array

ESCON
Enterprise System Connection architecture

F

Fabric, Fibre Channel
An interconnection that receives addressed information which, in turn, routes the information to its appropriate destination.

FC
feature code

Fibre Channel
A technology for transmitting data between computer devices at a data rate of up to 8 Gbps. It is especially suited for attaching computer servers to shared storage devices and for interconnecting storage controllers and drives. Often the term is used to refer to an optics cable utilizing filaments to transmit data.

Fibre Channel arbitrated loop (FC-AL)
In this topology, two or more Fibre Channel end points are interconnected through a looped interface. Information is routed through the loop to its destination.

Fibre Channel hub
In this topology, the hub provides ports similar to switch ports and uses a Fibre Channel arbitrated loop structure.

Fibre Channel switch (switched fabric)
In this topology, two or more end points are interconnected through one or more switches.

Fibre Channel topologies
Shared loop host and storage controllers

Fiber Connectivity (FICON)
A high-speed input/output (I/O) interface for mainframe computer connections to storage devices.

FICON
See *Fiber Connectivity*

FID
Failure ID

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 may contain other field replaceable units; for example, a brush and a brush block that can be replaced individually or as a single unit.

file
A set of related records, treated as a unit, for example, in stock control, a file could consist of a set of invoices.

file protected
Pertaining to a tape volume from which data can be read only. Data cannot be written on or erased from the tape. See *write-protect.*

format
The arrangement or layout of data on a data medium.

formatted tape volume
A tape volume that has been initialized with certain formatting information (such as servo tracks), which is required to exist for the recording technique used on the volume before any data can be recorded. Depending on the format and medium, formatting may or may not be required to use the medium for data recording purposes.

FRU
Field replaceable unit

FTP
File transfer protocol

FTP site
Any electronic repository of information that uses the File Transfer Protocol (FTP) for transferring files to and from servers. Use of an FTP site generally requires a user ID and possibly a password.

G

GB
Gigabyte; 1,000,000,000 bytes

GBIC
See *gigabit interface converter*

gigabit interface converter (GBIC)
A device that converts data from electrical signals to optical signals.

GiB
One gibibyte (GiB) = 2^{30} bytes = 1,073,741,824 bytes.

H

HBA
Host Bus Adapter

HCD
hardware configuration definition

High Performance Tape Subsystem
An IBM tape subsystem using 3592 tape drives and, in some configurations, a 3592 tape controller.

host
The controlling or highest-level system in a data communication configuration. Synonymous with *server*.

host system
A data-processing system that is used to prepare programs and the operating environments for use on another computer or controller.

HPCT
high-performance cartridge tape

HSC
host software component

I

immediate mode
In tape-write-immediate mode, channel end and device end are presented separately.

index
A function performed by the cartridge loader that moves cartridges down the input or output stack one cartridge position. A cartridge loader can perform multiple consecutive indexes.

initiator
A device that requests an I/O process to be performed by another device (a target). In many cases, an initiator can also be a target. processing unit, that handles the transfer of data between main storage

input/output channel
In a data-processing system, a functional unit, controlled by the processing unit, that handles the transfer of data between main storage and peripheral equipment.

install
To set up for use or service. The act of adding a product, feature, or function to a system or device either by a singular change or by the addition of multiple components or devices.

interchange
The ability to process (read or write) a given tape volume on any one of a set of tape devices that support the form factor and recording format on the tape volume.

interchange application
The preparation of tapes for use on other systems or devices, either local or remote, or the use of tape data prepared by another system.

interposer
An interposer is used to connect two dissimilar cable or device connectors.

invoke
To petition for help or support. The request for a feature or function to be utilized in future processing activities by using software or hardware commands.

I/O
input/output

IODF
input/output definition file

IPRs
Installation Planning Representatives

ISP
independent service provider

ISV
independent software vendors

J

job control language (JCL)
Problem-oriented language designed to express statements in a job that are used to identify the job or describe its requirements to an operating system.

K

KB
Kilobyte; 1,000 bytes

KEK
Key Encrypting Key. An alphanumeric string used to encrypt the Data Key. See *EEDK*.

KiB
One kibibyte (KiB) = 2^{10} bytes = 1,024 bytes.

keystore
A database of private keys and their associated X.509 digital certificate chains used to authenticate the corresponding public keys.

L

label
A label is a control file that is associated with a data file which provides volume and file identification information. The label is a software construct that appears as any other file to the I/O subsystem.

LC
Lucent connector. A type of fibre cable connector. See also SC, Standard Connector.

LCD
See *liquid crystal display*

leader pin
A small metal rod attached to the end of the magnetic tape. During tape processing, the leader pin is grasped by a threading mechanism, which pulls the pin and the tape out of the cartridge, across the drive head, and onto a take-up reel. The head can then read or write data from or to the tape.

LED
Common abbreviation for light-emitting diode.

liquid crystal display (LCD)
A low-power display technology used in computers and other I/O devices.

loader
See *cartridge loader*

load point
The beginning of the recording area on magnetic tape.

logical-backward direction
Tape movement is in the logical backward direction when the tape position is moving away from EOV and toward BOV. Logical backwards is defined independently of the physical forward or physical backward directions.

logical block
A logical block is an independently accessible unit of information created by the program within a file. A logical block may be either a data-logical block or a mark-logical block.

logical end of tape
A point on the tape where written data normally ends.

logical-forward direction
Tape movement is in the logical forward direction when the tape position is moving away from BOV and toward EOV. Logical forward is defined independently of the physical forward or physical backward directions.

logical record
A logical record is a string of concatenated data bytes that is passed between an application program and a control program or access method as the result of an I/O request.

LUN
Logical Unit Number

logical-write protection
Logical-write protection is a function provided by the device that allows a program to write-protect a tape volume through some device command. Logical-write protection persists for the duration of a tape mount or until deactivated by the program.

long wave
A Fibre Channel cable that has a 1400 nm wave length.

M

magnetic recording
A technique of storing data by selectively magnetizing portions of a magnetizable material.

magnetic tape
A tape with a magnetizable surface layer on which data can be stored by magnetic recording.

manual mode
A mode of operation that can be selected on the cartridge loader. This mode allows a single tape cartridge feed, performed by the operator.

MB
Megabyte (often expressed as a data rate in MB/s or MB/second, for megabytes per second).

MB/s
One megabyte per second = 10^6 bytes per second = 1,000,000 bytes per second.

Mb
Megabit. One Megabit = 10^6 bits = 1,000,000 bits.

Mb/s
One megabit per second (Mb/s) = 10^6 bits per second = 1,048,576 bits per second.

mebi
Binary prefix for 2^{20}.

media capacity
The amount of data that can be contained on a storage medium, expressed in bytes of data.

mega
Prefix for 'million' (10^6).

megabyte (MB)
One million bytes.

megabytes per second (MB/s or MBps)
A measure of bandwidth on a data transmission medium, where 1 MBps = 1,000,000 bytes per second.

MES
Miscellaneous equipment specification.

metric system
Deprecated term for the *SI* system.

MI
Maintenance information.

MiB
Mebibyte. One mebibyte (MiB) = 2^{20} bytes = 1,048,576 bytes.

Mib
Mebibit. One mebibit (Mib) = 2^{20} bits = 1,048,576 bits.

Mib/s
One mebibit per second (Mib/s) = 2^{20} bits per second = 1,048,576 bits per second.

microcode
A code, representing the instructions of an instruction set, that is implemented in a part of storage that is not program-addressable.

microprocessor
An integrated circuit that accepts coded instructions for operation; the instructions may be entered, integrated, or stored internally.

microprogram
A sequence of elementary instructions that correspond to a specific computer operation, that is maintained in special storage, and whose execution is initiated by the introduction of a computer instruction into the instruction register of a computer.

A group of micro instructions that when executed perform a preplanned function.

migration
See *conversion*

MIM
Media information message

missing interrupt handler (MIH)
An MVS and MVS/XA facility that keeps track of I/O interrupts, informing the operator and keeping a record whenever an expected interrupt fails to occur in a preset time interval.

mount
The act of making a tape volume available for processing by a specific tape device.

mounted
The state of a tape volume while it is available for processing by a specific tape device.

multiplexer channel
A channel designed to operate with a number of I/O devices simultaneously.

N

native data capacity
The amount of data that can be stored without data compression on a cartridge.

nonremovable media
Recording media that cannot be added to or removed from a recording device.

O

Oe
Oersted. The unit of magnetic intensity in the centimeter-gram-second system.

OEM
Original equipment manufacturer

operating environment
The temperature, relative humidity, and wet bulb temperature of the room in which the tape library routinely conducts processing.

output stack
The part of the cartridge loader that receives and holds processed cartridges.

P

partitions
One or more non-overlapped mini-volumes, each with its own beginning and ending points, contained within a single physical tape volume.

physical-backward direction
Tape movement is in the physical backward direction when the physical tape is moving in the direction that is defined as backward for the device processing tape. Physical backward is defined independently of the logical forward or logical backward directions.

physical end of tape
A point on the tape beyond which the tape is not permitted to move.

physical-forward direction
Tape movement is in the physical forward direction when the physical tape is moving in the direction that is defined as forward for the device processing tape. Physical forward is defined independently of the logical forward or logical backward directions.

physical-write protection
A facility provided by the mechanical housing of the tape volume that allows a human being or robotics device to write-protect a tape volume. Physical-write protection persists until the state of the facility on the tape volume is changed.

POST
Power On Self-Test. A series of diagnostic tests which are run automatically each time power is provided to the device.

PostScript
A standard specified by Adobe Systems, Incorporated, that defines how text and graphics are presented on printers and display devices.

processing application
The execution of a systematic sequence of operations performed on data to accomplish a specific purpose.

PSP
product service planning

PTF
Program temporary fix

public/private keys
A cryptography system that uses two keys: a public key known to everyone and a private or secret key known only to the recipient of the message. The public and private keys are related in such a way that only the public key can be used to encrypt messages and only the corresponding private key can be used to decrypt them. Also known as asymmetric keys.

Q

queuing
The ability of a device to accept multiple commands; implementation is either tagged or untagged. Tagged queuing allows a device to accept multiple commands from a host. Untagged queuing allows a device to accept only a single command that must be completed before accepting another command from the same host.

quiesce
To bring a device or system to a halt by a rejection of new requests for work.

R

random access
Random access refers to the processing of information on a volume in a manner that requires the device to access nonconsecutive storage locations on the medium.

read-type commands
Any commands that cause data to be read from tape.

record
A collection of related data or words, treated as a unit; for example, in stock control, each invoice could constitute one record.

recording density
The number of bits in a single linear track measured per unit of length of the recording medium.

rekey
The process of changing the asymmetric Key Encrypting Key (KEK) that protects the Data Key (DK) stored on an already encrypted tape, thereby allowing different entities access to the data.

relative humidity
The ratio of the amount of water vapor actually present in the air to the greatest amount possible at the same temperature.

removable media
Recording media that can be added to or removed from a recording device.

RSA
Rivest-Shamir-Adleman algorithm. A system for asymmetric, public-key cryptography used for encryption and authentication. It was invented in 1977 by Ron Rivest, Adi Shamir, and Leonard Adleman. The security of the system depends on the difficulty of factoring the product of two large prime numbers.

S

SAN
Storage Area Network

SAPR
Solutions Assurance Product Review

SARS
Statistical Analysis and Reporting System

SC
Standard connector used for fibre cables. See also LC, Lucent Connector.

SCSI
Small computer system interface

SCSI device
A host adapter or a target controller that can be attached to the SCSI bus.

SEK
Session Encrypted Key. A Data Key that has been encrypted (wrapped) for secure transfer between the encryption key server and the TS1120 and later tape drives. See *SK*.

server
A functional unit that provides services to one or more clients over a network. Examples include a file server, a print server, and a mail server. The pSeries, iSeries, HP, and Sun are servers. Synonymous with *host*.

sequential access
Refers to the processing of information on a volume in a manner that requires the device to access consecutive storage locations (for example, logical blocks) on the medium.

SK
Session Key. An alphanumeric string used to encrypt the Data Key for secure transfer between the encryption key server and the TS1120 and later tape drives. See *SEK*.

ship group
The group of supplies, cables, or documentation that is shipped with the machine.

shipping environment
The temperature, relative humidity rate, and wet bulb temperature of the environment to which the tape library is exposed when being transferred from one location to another.

short wave
A Fibre Channel cable that has an 850 nm wave length.

SIM
Service information message

SKLM (IBM Security Key Lifecycle Manager)
IBM's EKM application that assists encrypting tape drives in generating, protecting, storing, and maintaining encryption keys that encrypt information that is written to and decrypt information that is read from tape media.

SPE
Small programming enhancement

special feature
A specific design addition to an IBM product that is quoted in the IBM Sales Manual and ordered separately.

SSR
IBM service support representative

standard function
The significant design elements of an IBM product that are included as part of the basic standard product.

subsystem
A secondary or subordinate system, usually capable of operating independently of, or asynchronously with, a controlling system.

system mode
A mode of operation that can be selected on the cartridge loader. This mode allows the automatic feeding and loading of premounted blank or scratch tape cartridges in response to nonspecific volume requests, while specific volume requests require operator insertion of the requested tape cartridge.

T

TapeAlert
A patented technology from Hewlett-Packard that monitors the status of a tape device and media, and detects problems as they occur.

TapeAlert flags
Status and error messages that are generated by the TapeAlert utility and display on the host console. The messages indicate the type of problem and tell how to resolve it.

tape cartridge
A container holding magnetic tape that can be processed without separating it from the container.

tape device
A computer peripheral device that supports reading or writing of a removable recording medium called a tape volume. A tape device has a model number.

tape drive
A device that is used for moving magnetic tape and includes the mechanisms for writing and reading data to and from the tape.

tape format
The tape format defines the way that information is physical recorded and arranged on a tape volume. It includes the physical representation for all constructs associated with the tape data model as well as other constructs that are format dependent.

tape library
A structure that provides for the storage of tape volumes and facilitates the movement of tape volumes between the storage structure and the tape device.

tape mark
A tape mark is a mark logical block that can be recorded on the medium under program direction. Tape marks are used by the program to delineate collections of data logical blocks on a given volume.

tape mount
The operation associated with mounting a tape volume on a tape device.

tape synchronous mode
The tape-synchronous mode transfers records whose length is greater than the limits defined for buffered records. The device operates in the tape synchronous mode, if the format being processed is supported.

tape unit
A device that contains tape drives and their associated power supplies and electronics.

tape volume
The recording medium and associated mechanical package that houses the media used by a tape device. See also *volume*.

target
A SCSI device that performs an operation requested by the initiator. In many cases, a target can also be an initiator.

TB
Terabyte. One terabyte = 1,000,000,000,000 bytes.

terminator
A part used to end a channel or connection on a computer system.

TPF
transaction processing facility.

TSM
Tivoli Storage Manager.

TSMC
TotalStorage Master Console.

U

Ultra
The ANSI SCSI standard allowing up to 40 MB/s transfers on a SCSI bus.

unformatted tape volume
A tape volume that has not been initialized with certain formatting information (for example, servo tracks), which is required to exist for the recording technique used on the volume before any data can be recorded. Depending on the format and medium, formatting may be required to use the medium for data recording purposes.

uniform resource locator (URL)
The address of an item on the World Wide Web. It includes the protocol followed by the fully qualified domain name (sometimes called the host name) and the request. The web server typically maps the request portion of the URL to a path and file name. For example, if the URL is http://www.storage.ibm.com/tape/index.html, the protocol is http; the fully qualified domain name is www.storage.ibm.com; and the request is /tape/index.html.

unique cartridge identifier (UCID)
See *WWCID*.

URL
See *Uniform resource locator*.

V

VOLSER
Volume serial number. The serial number of the specific tape cartridge.

volume
A certain portion of data, together with its data carrier, that can be handled conveniently as a unit.

A data carrier that is mounted and demounted as a unit, for example, a reel of magnetic tape, a disk pack.

volume identifier (volid)
An identifier that uniquely identifies a tape volume within an installation. The volume identifier might be shown on an external label on the tape volume and could also be recorded on an internal label of the media itself. On some devices, the same volid might be associated with multiple units of media or the different volids might be associated with the same unit of medium.

VPD
Vital Product Data

W

World-wide Unique Cartridge Identifier
See *WWCID*

write-once, read-many (WORM)
A technology to allow data to be written once to storage media. After that, data is permanent and cannot be altered, but can be read any number of times.

write protected
A tape volume is write protected if some logical or physical mechanism causes the device processing the tape volume to prevent the program from writing on the volume.

write-type commands
Any commands that cause data to be written on tape or affect buffered write data.

WWID
An identifier that uniquely identifies a hardware component, such as the port and node of a drive.

WWCID
An identifier that uniquely identifies a cartridge.

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