

Disaster Tolerant Solutions

Guide to Operations for DIGITAL UNIX

EK-SWXDT-OP. A01

Compaq Computer Corporation

November 1998

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Table of Contents

- 1 INTRODUCTION TO DISASTER TOLERANT SOLUTIONS**
 - 1.1 Overview.....1-1**
 - 1.2 DT Subsystem Sites1-1**
 - 1.3 DT Configurations.....1-2**

- 2 DT THEORY OF OPERATION**
 - 2.1 Overview.....2-1**
 - 2.1.1 Hardware Implementation2-1
 - 2.1.2 Configurations.....2-1

 - 2.2 DT Hardware Components2-4**
 - 2.2.1 Primary FrontEnd Controllers.....2-4
 - 2.2.2 Secondary FrontEnd Controllers2-5
 - 2.2.3 BackEnd Controllers.....2-5
 - 2.2.4 DWZGA SCSI Bus Extender2-5
 - 2.2.5 DWZZH-21 SCSI hub signal converters.....2-6

 - 2.3 Disaster Tolerant Software Components2-6**
 - 2.3.1 ACS2-6
 - 2.3.2 SWCC2-6
 - 2.3.3 DTSM2-7
 - 2.3.3.1 DTSM Agent2-7
 - 2.3.3.2 DT System Failure Modes.....2-8

 - 2.4 Failover and Failback.....2-10**
 - 2.4.1 Primary to Secondary Site Failover2-10
 - 2.4.2 Failback to Primary Site.....2-10

 - 2.5 Device Naming Conventions.....2-11**

- 3 OPERATOR TASKS**
 - 3.1 Failover and Failback.....3-1**
 - 3.1.1.1 Failover3-1
 - 3.1.2 Failback.....3-1

3.2 Power up and Power Down	3-1
3.2.1 Initial Power up (no configuration)	3-1
3.2.2 Power Up (after configuration).....	3-2
3.2.3 Power Down	3-2
3.3 Removing and Replacing Disk SBBs.....	3-3
3.3.1 Removing and Replacing Power Supply SBBs	3-4
3.3.2 Removing and Replacing AC Power Controller SBBs.....	3-5
3.3.3 Removing and Replacing External Cache Battery SBBs.....	3-5
3.4 Installing the Controller Program Card.....	3-6
3.5 Basic Configuration Sequence of Events.....	3-6
3.5.1 Secondary BackEnd Controller Configuration.....	3-8
3.5.2 Primary BackEnd Controller Configuration	3-10
3.5.3 Primary FrontEnd Controller Configuration.....	3-10
3.5.4 Secondary FrontEnd Controller Configuration	3-14
3.5.5 Verifying System Operation.....	3-15
3.6 Installing Software Components	3-15
3.6.1 Installing SWCC	3-15
3.6.1.1 Installing SWCC Client Applet and HSZ80_DT Client Applet Managers ..	3-15
3.6.1.2 Installing SWCC Agent on Primary and Secondary Site Hosts	3-16
3.6.1.3 Configuring Storage with SWCC Client Software	3-19
3.6.2 Installing DTSM.....	3-19
3.6.2.1.1 Setting-Up Environment Variables and Aliases	3-21
3.6.2.1.2 Configuring the DTSM Agent.....	3-22
3.6.2.1.3 Configuring the DT Subsystem.....	3-22

4 DT STORAGE SYSTEM TROUBLESHOOTING

4.1 DT Specific Component Functionality	4-1
4.1.1 HSZ80 Array Controller	4-1
4.1.2 DWZGA SCSI Bus Extender	4-1
4.1.3 DWZZH-21 SCSI Hubs.....	4-1
4.2 Failure Notification.....	4-2
4.2.1 HSZ80 Array Controller Notification.....	4-2
4.2.2 Error Reporting and Fault Analysis for All Controllers.....	4-2
4.2.3 DWZGA Notification.....	4-2
4.2.4 Error Reporting and Fault Analysis for DWZGA SCSI Extenders.....	4-2
4.2.5 SWCC Failure Notification	4-3
4.2.6 DTSM Failure Notification	4-3
4.2.7 DT Failure Modes as Related to Component Failures.....	4-4
4.2.7.1.1 Loss of One Member in a Dual Redundant Controller Pair	4-4
4.2.7.1.2 Loss of PFECs, DT Failover to Secondary Site	4-5
4.2.7.1.3 SCSI Bus 1 failure.....	4-6
4.2.7.1.4 SCSI Bus 2 failure.....	4-7
4.2.7.1.5 Loss of SCSI Bus 1 and 2	4-8
4.2.7.1.6 Loss of SCSI Bus 5.....	4-9
4.2.7.1.7 Loss of SCSI Bus 6.....	4-10
4.2.7.1.8 Loss of SCSI Bus 5 and 6	4-11
4.2.7.1.9 Loss of SCSI Extenders	4-12

4.2.7.1.10 Loss of SFECs.....	4-13
4.2.8 Failure at Remote Site after Failover.....	4-14
4.2.8.1 Loss of Remote Host	4-14
4.2.8.2 Lost of SFEC, SBEC1, or SBEC2	4-14
4.2.9 Loss of Network.....	4-14

FIGURES

FIGURE 1-1 DT BLOCK DIAGRAM.....	1-2
FIGURE 1-2 1x1 DT CONFIGURATION	1-3
FIGURE 1-3 2x2 DT CONFIGURATION.....	1-4
FIGURE 2-1 BLOCK DIAGRAM OF 1x1 DT SOLUTION	2-2
FIGURE 2-2 BLOCK DIAGRAM OF 2x2 DT SOLUTION	2-3
TABLE 1 DT SYSTEM FAILURE MODES	2-9
FIGURE 2-3 DEVICE NAMING CONVENTION EXAMPLE FOR DT SYSTEMS	2-12
FIGURE 3-1. DISK SBB ADDRESSING SCHEME	3-3
FIGURE 3-2 EXAMPLE OF DISK CONFIGURATION	3-7
FIGURE 3-3 EXAMPLES OF JBODS, MIRRORSETS, AND RAIDSETS.....	3-7
FIGURE 4-1 BASIC DT SUBSYSTEM BLOCK DIAGRAM	4-4
FIGURE 4-2 LOSS OF PFEC	4-5
FIGURE 4-3 LOSS OF SCSI BUS 1	4-6
FIGURE 4-4 LOSS OF SCSI BUS 2	4-7
FIGURE 4-5 LOSS OF SCSI BUS 1 AND 2	4-8
FIGURE 4-6 LOSS OF SCSI BUS 5	4-9
FIGURE 4-7 LOSS OF SCSI BUS 6	4-10
FIGURE 4-8 LOSS OF BOTH SBECs.....	4-11
FIGURE 4-9 LOSS OF BOTH SCSI EXTENDERS.....	4-12
FIGURE 4-10 LOSS OF SFEC	4-13
TABLE 4-1 REMOTE SITE DT FAILURE MODES AFTER FAILOVER.....	4-14

Preface

This manual discusses the Disaster Tolerant Storage Solution for Digital UNIX. It covers a product introduction, theory of operation, operator tasks, and troubleshooting. It is intended for use by personnel responsible for maintaining DT sites.

Intended Audience

This manual is intended for System Managers, Administrators, Operators, and other personnel responsible for the setup, configuration, and maintenance of a DT Storage System.

Structure

Chapter 1	Introduction to Disaster Tolerant Solutions
Chapter 2	Theory of Operation
Chapter 3	Operator Tasks
Chapter 4	Failure Modes of a DT Storage Solution

Introduction to Disaster Tolerant Solutions

1.1 Overview

COMPAQ's StorageWorks Solutions, continuing COMPAQ's concern with maintaining critical customer data in the event of a catastrophic failure at a customer site, now offers a Disaster Tolerant (DT) storage solution to customers. This section provides a definition of DT storage and shows several views of DT configurations.

Disaster tolerance is defined as the combination of hardware and software technologies that provide recovery of data access after a primary site failure or catastrophe. A Disaster Tolerant storage solution is defined as one that can continue processing data, after a failure, at a site remote from the customer's primary site.

1.2 DT Subsystem Sites

A DT storage subsystem consists of a primary site and a secondary site. The primary site is located up to 15 kilometers away from the secondary site. Refer to Figure 1-1, while reading this section, for a basic block diagram of a DT subsystem. Data processing is moved from the primary site to the secondary site in the event of a disaster at the primary site. This moving of data processing from the primary site to the secondary site is called failover. When problems at the primary site have been resolved, data processing is moved back to the customer's primary site, called failback. The secondary site must have a host processor capable of running the same application that is being run on the primary site host. The network interconnect connects the primary and secondary site hosts. DWZGA SCSI bus extenders are used to extend the storage SCSI bus up to 15 kilometers.

The primary site host is connected to a pair of dual redundant HSZ80 array controllers, called the primary front end controllers (PFEC). PFECs reside in a BA370 enclosure installed in a SW600 cabinet called the primary front end cabinet (PFE cabinet). The PFE cabinet HSZ80 controllers are known as primary front end controllers A and B (PFECA and PFECB). The PFEC pair is able to manage up to a four-way mirrorset of dual HSZ80 controllers and their disk SBBs located at the primary and secondary sites. Those dual HSZ80 controller pairs are called the back end controllers.

The back end controller pair located at the primary site is called the primary back end controller (PBEC). One controller pair is labeled primary back end controllers PBEC1A and PBEC1B. The other pair is labeled PBEC2A and PBEC2B)

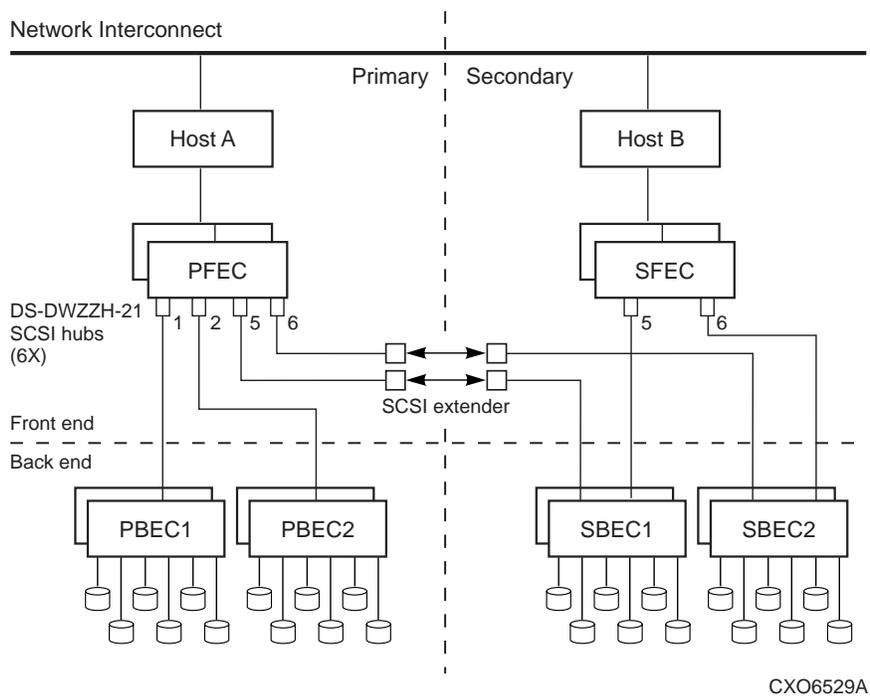
The back end controller pair located at the secondary site is called the secondary back end controller (SBEC). One controller pair is labeled secondary back end controllers SBEC1A and SBEC1B. The other controller pair is labeled SBEC2A and SBEC2B.

Introduction to Disaster Tolerant Solutions

The secondary site also has a secondary front end cabinet containing dual redundant HSZ80 controllers called the secondary front end controller (SFECA and SFECA). The SFEC is responsible for maintaining customer data processing after a failure. The SFEC is not used during normal operation.

Two of the back end controller pairs reside at the secondary site and are accessed by the PFEC through the DWZGA SCSI extenders. The host at the secondary site is connected to the SFEC, which provides the secondary host with access to the SBEC's storage when the primary site is down and the storage system has failed over. This configuration of redundant hosts and storage at the primary site, as well as the use of multiple copies of data, ensure continued data processing without failover except in the event of a severe failure.

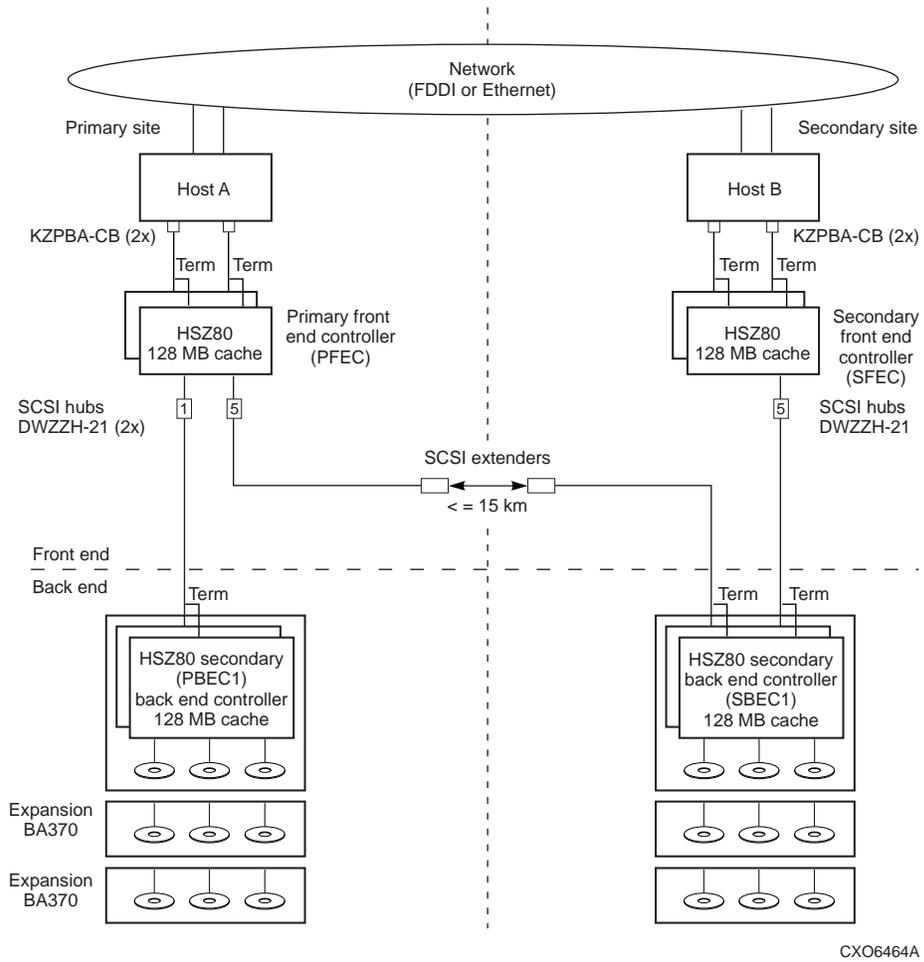
Figure 1-1 DT Block Diagram



1.3 DT Configurations

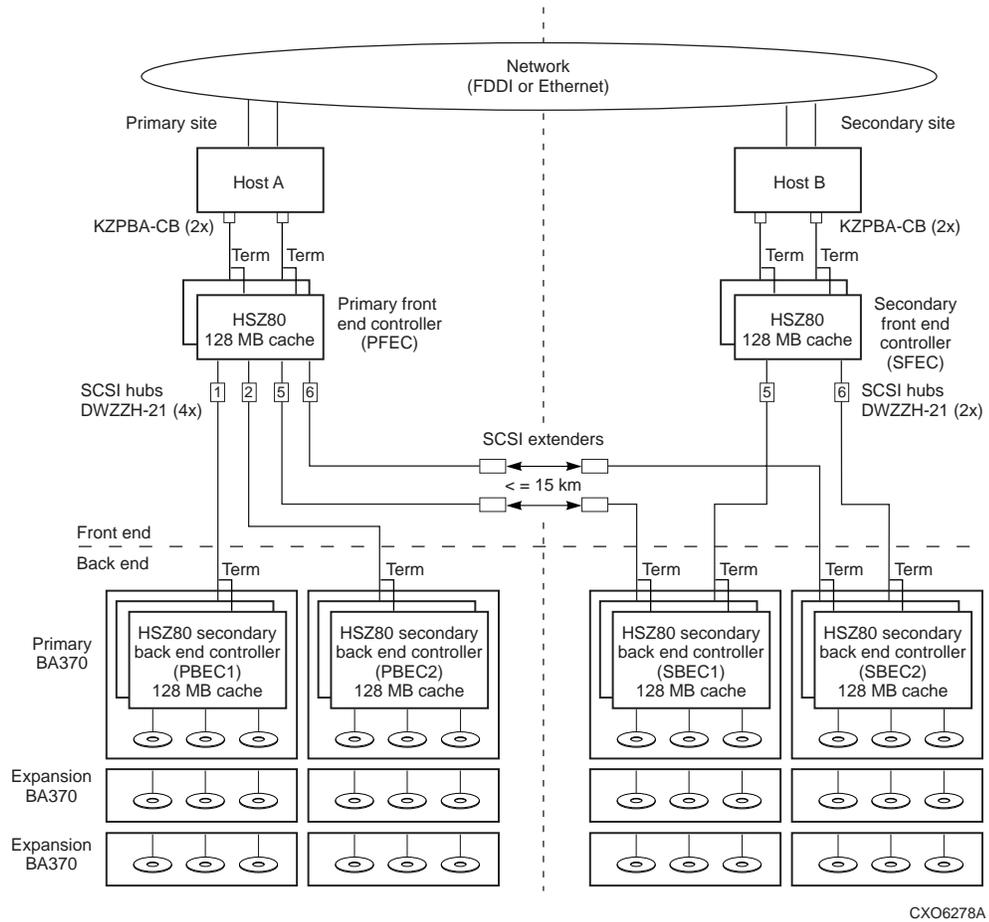
There are two DT configurations. A 1x1 DT configuration offers two-way mirroring of data with one BA370 enclosure in the secondary and primary backend cabinets, with added storage expansion in adjacent cabinets. Figure 1-2 shows a representation of a 1x1 DT configuration.

Figure 1-2 1x1 DT Configuration



A 2x2 DT configuration offers four-way mirroring of data by adding a second BA370 in the top position of the primary and secondary backend cabinets, additional support hardware, and additional storage in adjacent expansion cabinets. Figure 1-3 shows a representation of a 2x2 DT configuration.

Figure 1-3 2x2 DT Configuration



DT Theory of Operation

2.1 Overview

During normal data processing, data written at the primary site is simultaneously written at the secondary site, providing multiple copies of the data. This is known as mirroring, or RAID 1. When a primary site disaster occurs, data processing is moved to the secondary site where the mirror copy of the data resides. This mirroring of data at the secondary site allows data processing to be resumed at the secondary site. Operating system software detects hardware and software failures that effect the primary storage. A DT storage system enables continued data processing after the loss of one or more components. As long as the primary and the secondary site both have a copy of the data, processing continues at the primary site. With a loss of a host at the primary, data processing can be restarted on the host at the secondary site.

2.1.1 Hardware Implementation

The hardware used to implement a DT storage solution is segmented between the primary and secondary sites. Each site has a SW600 frontend cabinet and a SW600 backend cabinet, with the primary site frontend cabinet housing the PFEC and the primary site backend cabinet housing the PBECs. The secondary site frontend cabinet houses the SFEC and the secondary site backend cabinet houses the SBECs. Depending upon the configuration, BA370 enclosures are installed within the SW600 cabinets with BA370 hardware components installed in the enclosures. DT configurations are described in the following section.

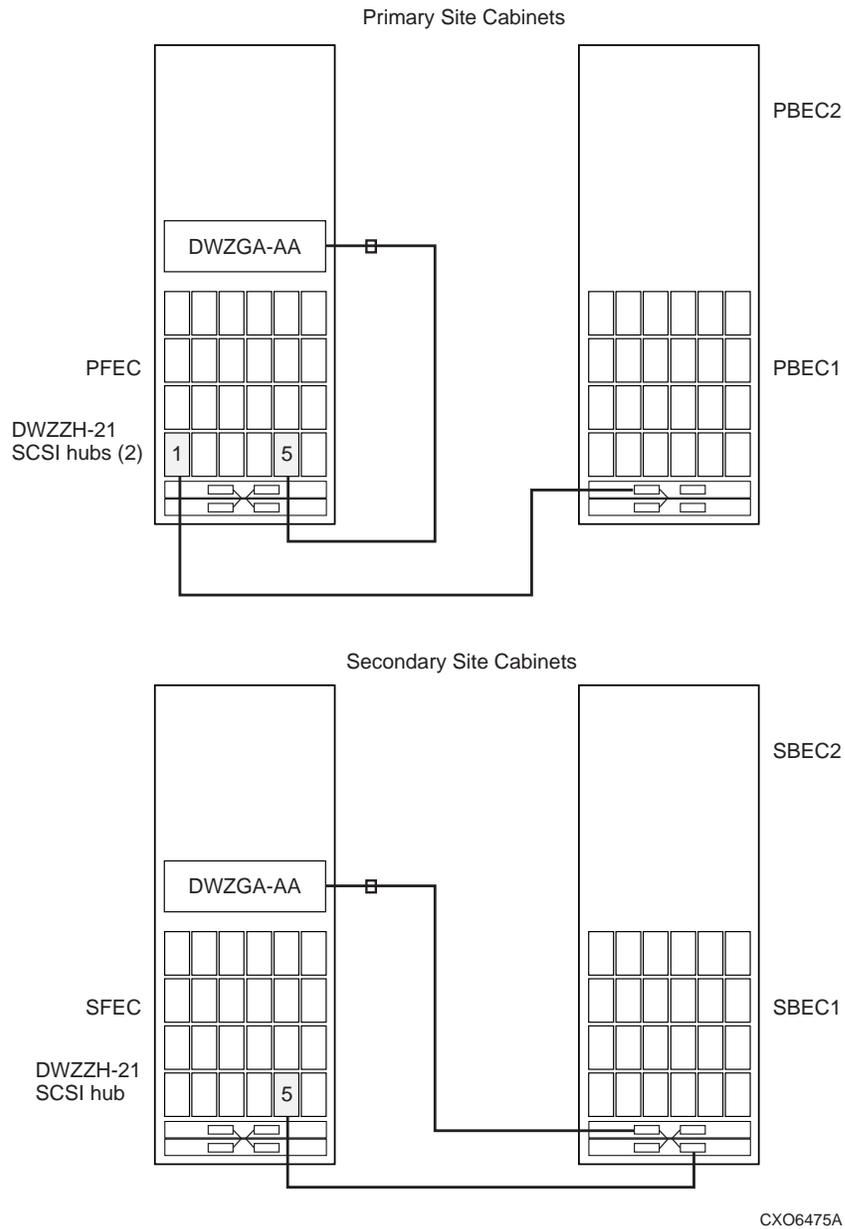
2.1.2 Configurations

DT configurations are defined as a 1x1 or a 2x2 configuration.

A 1x1 primary site configuration, shown in Figure 2-1 consists of frontend and backend cabinets. The primary frontend cabinet contains a pair of dual redundant HSZ80 controllers, two DWZZH-21 SCSI hubs, one DWZGA-AA SCSI bus extender, and the associated cabinet cables. The primary backend cabinet; a SW600 cabinet containing one BA370 enclosure which contains a dual redundant HSZ80 controller pair and disk Storage Building Blocks (SBB).

A 1x1 secondary site configuration, consists of frontend and backend cabinets. The frontend cabinet contains a pair of dual redundant HSZ80 controllers, one DWZZH-21 SCSI hubs, one DWZGA-AA SCSI bus extender, and the associated cabinet cables. The backend cabinet; a SW600 cabinet containing one BA370 enclosure which contains a dual redundant HSZ80 controller pair and disk Storage Building Blocks (SBB).

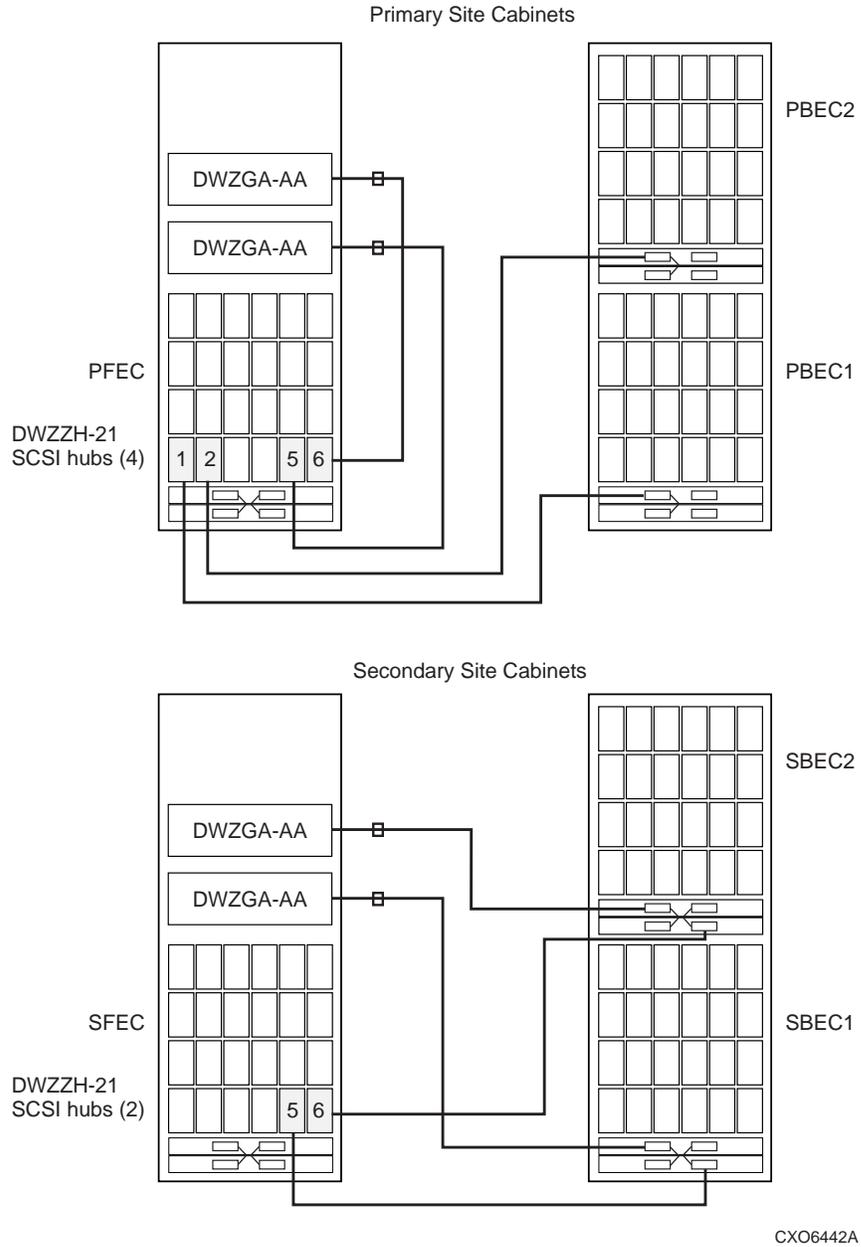
Figure 2-1 Block Diagram of 1x1 DT Solution



A 2x2 primary site configuration, shown in Figure 2-2 consists of frontend and backend cabinets. The primary frontend cabinet contains a pair of dual redundant HSZ80 controllers, four DWZZH-21 SCSI hubs, two DWZGA-AA SCSI bus extenders, and the associated cabinet cables. The primary backend cabinet; a SW600 cabinet containing two BA370 enclosures which contain a dual redundant HSZ80 controller pair and disk Storage Building Blocks (SBB).

A 2x2 secondary site configuration, consists of frontend and backend cabinets. The frontend cabinet contains a pair of dual redundant HSZ80 controllers, two DWZZH-21 SCSI hubs, two DWZGA-AA SCSI bus extenders, and the associated cabinet cables. The backend cabinet; a SW600 cabinet containing two BA370 enclosures which contain a dual redundant HSZ80 controller pair and disk Storage Building Blocks (SBB).

Figure 2-2 Block Diagram of 2x2 DT Solution



2.2 DT Hardware Components

This section describes the hardware components used in the DT storage solution. Components discussed are the following:

1. Primary Frontend Controllers (PFECs)
2. Secondary Frontend Controllers (SFECs)
3. Backend controllers (PBECs and SBECs)
4. DWZGA SCSI bus extenders
5. DWZZH-21 SCSI hub signal converters

2.2.1 Primary FrontEnd Controllers

The HSZ80 stacked controller PFEC pair is used as the mirroring engine for the DT storage subsystem primary site, providing fully synchronous replication of data to the remote site storage. The controllers used for the PFEC are configured as dual redundant, providing additional redundancy for access to the storage devices used as the DT mirror set members, as well as allowing easier code updates to the HSZ80 controllers with little impact to the DT mirror set members. The PFEC pair provides dual Ultra-Wide differential (UWD) host ports per controller and presents each DT mirrorset as a single logical device or unit to the host system.

The virtual unit number presented to the host system is a multiple member mirror set of storage devices located both at the primary and at the secondary sites. The DT mirrorsets managed by the PFEC may be partitioned into smaller logical devices before being presented to the host to facilitate storage management.

RAID storage sets supported by the PFEC are RAID 1 storage sets, with optional partitioning of the mirrorsets. RAID0, RAID5, and individual disks, called Just a Bunch of Disks (JBOD), are not supported devices on the PFEC. The maximum number of storage devices that the PFEC supports is 72. Conforming to the four-member mirrorset limitation, this limits the total number of DT mirrorsets to 18. Partitioning allows these 18 mirror sets to be partitioned into a maximum of eight partitions per DT mirror set, with a maximum of 128 total units being presented to the host system.

The PFEC is connected to the host via the two UWD host ports. Each host port pair is connected to separate host adapters in the host. Transparent failover supports failover of units between controllers. The host ports operate independently and do not provide failover between host ports on a controller.

As stated before, the PFEC is used to create the mirrorsets for DT storage. The disk drives used by the mirrorsets are units managed and presented by the backend controllers.

The 1x1 configuration connects a PBEC to device port 1 on the PFEC. A high-speed SCSI bus extender (DWZGA) is connected to port 5, through the DWZZH-21, of the PFEC. The DWZGA extender is connected to a second DWZGA extender located at the secondary site in a secondary frontend cabinet. The secondary DWZGA is connected to the SBEC host port 1. The 1x1 solution provides support for a two member DT mirror set, with each member being accessed on a separate path. Customers that require more than one copy of the data at each location will benefit from the 2x2 configuration. In addition, expansion cabinets may be added to the configuration to expand storage capabilities.

The 2x2 configuration connects two pairs of PBECs, through DWZZH-21s to device ports 1 and 2, of the PFEC and connects the DWZGA SCSI extenders to device ports 5 and 6 of the PFEC. The 2x2 configuration enables two copies of customer data to reside at the primary

site and two copies to reside at the secondary site. This four-way mirroring ensures that data is maintained at both sites in the event of a single device or connection failure.

2.2.2 Secondary FrontEnd Controllers

The secondary frontend is only active after failover. The SFEC presents the same storage that was presented by the PFEC. The only difference being the DT mirrorsets consists of members from the SBECs only. For example, after failover of a 2x2 configuration, the mirrorsets contain two members instead of four.

Storage presented to the primary host must maintain the same naming conventions and unit numbers when presented to the secondary site host. The backend storage device units present the same storage as disk drives configured on the SFECs, with the same port, target and LUN that was used on the PFECs. SBEC1 is connected to PFEC device port 5 and to SFEC device port 5. For a 2x2 configuration, SBEC2 is connected to device port 6 on the PFEC and to device port 6 on SBEC2.

2.2.3 BackEnd Controllers

The dual redundant HSZ80 Array backend controllers are connected to the storage devices and provide a full range of device management and support. Backend controllers are installed in a BA370, then mounted in standard SW600 cabinets. The PBECs reside at the primary site and the SBECs reside at the secondary site. The backend controllers provide the frontend controllers with the logical units used to create the DT mirrorsets. Storage devices attached to the backend controllers must be RAID1, RAID5 or JBOD devices. RAID0 (stripe sets), RAID0+1 (striped mirrorsets), and partitioning are not supported on backend controllers. For maximum availability, the use of RAID5 protected storage should be used for the DT mirrorset members.

For a 1x1 configuration, PBEC1's host port 1 is connected to the PFEC through device port 1. SBEC1's host port 1 is connected to the DWZGA SCSI bus extender, which is in turn connected to device port 5 of the PFEC. SBEC1's host port 2 is attached to the SFEC's device port 5. DWZZH-21 SCSI hub signal converters convert the backend controllers host port UWD SCSI signal to the frontend controllers device port UWSE, and visa versa.

For a 2x2 configuration PBEC1's host port 1 is connected to the PFEC through device port 1 and PBEC2's host port 1 is connected to device port 2 of the PFEC. SBEC1's host port 1 is attached to the DWZGA SCSI bus extender, which is attached to the PFEC device port 5. Again, DWZZH-21 SCSI hub signal converters convert the backend controllers host port UWD SCSI signals to the frontend controllers device port UWSE signals and visa versa. Host port 2 of SBEC1 is attached to the SFEC's device port 5. SBEC2's host port 1 is connected to the second DWZGA SCSI bus extender, which is attached to the SFEC's device port 6. Again, DWZZH-21 SCSI hub signal converters convert the backend controllers host port UWD SCSI signals to the frontend controllers device port UWSE signals. Host port 2 of SBEC2 is attached to the SFEC's device port 6. The PFEC connects to host port 1 and the SFEC connects to host port 2 to allow for managed failover.

2.2.4 DWZGA SCSI Bus Extender

The DWZGA SCSI bus extenders used in DT system configurations provides UWD SCSI bus connections of up to 15KM. The DWZGA provides a maximum data bandwidth rate of 25MB/Sec, with a measured bandwidth of greater than 12MB/Sec. The DWZGA provides support for wide SCSI addressing and SCSI-2 LUN support.

DWZGA units come installed in the frontend cabinets, one per frontend cabinet for a 1x1 configuration and two per frontend cabinet for a 2x2 configuration. The DWZGA located at the primary site (local DWZGA) is connected to the PFEC via a HD68 pin connector on the rear of the unit, with a differential SCSI terminator. Single mode fiber optic cable is

connected to the SC connector to the right of the SCSI connectors. This fiber optic channel connection supports long wave single-mode fiber optic cable.

The DWZGA located at the secondary site (remote DWZGA) is connected to the target storage devices through the HD68 pin connector located on the rear of the DWZGA unit. Just as with the local DWZGA, the adjacent HD68 pin connector must be terminated. The fiber optic cable from the local DWZGA's SC connector is connected to the remote DWZGA's SC connector, located just to the right of the SCSI connectors.

The DWZGA provides full loopback of all data transfers across the fiber cable. When data is transmitted across the fiber link, the receiving DWZGA loops the data back to the sending DWZGA. The sending DWZGA performs a compare operation between the data sent and the data received from the receiving DWZGA. Failure of the data to compare causes a hard error to be logged internal to the DWZGA. Refer to Appendix C for additional DWZGA SCSI Extender information.

2.2.5 DWZZH–21 SCSI hub signal converters

The hubs convert SCSI Single Ended to SCSI Differential and visa versa. The hubs have two Single Ended SCSI connections located on the front of the hub, but only one is used for this solution. The other connection is left open. Power is provided by the BA370 enclosure.

2.3 Disaster Tolerant Software Components

The section describes the software components necessary to configure and manage a DT storage subsystem. The software components discussed are the following:

1. Array Controller Software (ACS).
2. Storage Works Command Console (SWCC).
3. Disaster Tolerant Storage Manager (DTSM).

2.3.1 ACS

The HSZ80 Array Controller Software (ACS) is the software component of the HSZ80 array controller. ACS software executes in the HSZ80 controller and processes I/O requests from the host, performing the device level operations required to satisfy the requests. DTSM interacts with ACS via the SWCC agent when there is a need to execute controller specific commands.

The ACS CLI has new commands and qualifiers to support of DT mirroring. Descriptions of the commands are included in the *HSZ80 Array Controller ACS Version 8.1 User's Guide*. These new controller CLI qualifiers are:

- REMOTE qualifier
- ERROR_MODE command
- SET mirrorset DT_SUPPORT qualifier

2.3.2 SWCC

SWCC provides local and remote management of StorageWorks controllers and storage. SWCC consists of two major components: the SWCC client and the SWCC agent. SWCC can be used to configure and manage the DT storage subsystem.

The SWCC client is a graphical user interface (GUI) that displays the logical and physical layout and status of a selected subsystem in graphical form.

The agent is a host-resident program that is an interface between the client and the host's storage controller.

2.3.3 DTSM

DTSM is responsible for monitoring and managing all DT operations involved with the DT storage subsystem. The DTSM consists of an agent and a user interface.

A DTSM agent runs on both the primary and secondary hosts that make up the DT system. The DTSM agent issues commands to ACS via the SWCC agent. If a system component fails, a notification is sent to DTSM which determines if the failure is a DT component failure.

The user interface is a CLI that runs on any host and allows users to connect to and manage DT systems.

2.3.3.1 DTSM Agent

The DTSM agent is responsible for both monitoring and performing all operations that relate to the DT storage subsystems. DTSM cannot perform failover and failback operations autonomously. The operator initiates those actions manually. The DTSM agent performs the following functions:

1. Accepts connections from other DTSM agents.

DTSM communicates with other DTSM components during normal operation. The DTSM agent supports as many connections as needed. DTSM acts as a server. If a DTSM component requires communication with the DTSM agent, a connection is made, the command is sent, the data is received, and the connection is closed.

2. Executes operator initiated commands from the DTSM user interface.

When the user CLI interface is used, a connection is established between the DTSM agent and the user interface for the duration of the user session. The user CLI interface sends requests to the DTSM agent. Status and data generated by the request is returned to the user interface.

3. Executes commands from other DTSM agents.

An agent receives requests from other agents, executes the request and sends data and/or status back to the requesting agent.

4. Performs failover operations.

Failover is always performed at the secondary site because loss of the primary site host may be the cause of the failure. Failover operations are manually initiated by an operator.

DTSM notifies the operator of a failure and the options that can be taken to correct the failure. The operator chooses to initiate the failover from the DTSM user interface.

5. Performs failback operations.

A failback operation requires the DTSM agent to reconfigure the DT storage subsystem at the secondary site so that the primary site has access to the good data stored at the secondary site. That is; failback is performed at the primary site allowing data to be pulled from the secondary site to the primary site. Failback operations are initiated manually through the DTSM user interface.

6. Monitors the DT storage subsystems.

Once started, the DTSM agent monitors all components on the DT storage subsystem. At regular intervals, the DTSM agent queries SWCC for the status of the DT storage system. If SWCC detects a problem with storage, a notification message is sent by SWCC to DTSM. The agent recognizes the notification and performs the proper notification to the user.

DT Theory of Operation

7. Monitors DTSM components.

Failures of other DTSM components need to be detected by the DTSM agent. A monitor thread is used to ping each DTSM agent at regular intervals to ensure that they are operational.

8. Performs notification of DT specific storage subsystem failures to the operator.

If the DTSM agent monitoring function detects any problems, it must notify the operator via the user interface. The DTSM notification process uses a notification script that a user can customize for his particular site needs.

9. Start up.

Start up is typically an automatic function. After configuration is complete, the system startup scripts are modified to execute the DTSM Startup command, allowing DTSM to start up whenever the system is initiated.

10. Shutdown

When DTSM is shutdown, a set of operations occurs to bring down the DTSM agent correctly. All DTSM threads are stopped and shutdown messages are sent to all other DTSM agent partners. DTSM is also stopped as part of a system shutdown. Shutdown can be performed manually by the operator also by using the DTSM Shutdown command.

2.3.3.2 DT System Failure Modes

Table 1 shows the possible failure modes of a DT system. The expected results are shown if a major device fails in the system. This table, when used in conjunction with Figure 1-1, Figure 1-2, and Figure 1-3 give insight into what failures cause a failover and which do not.

Table 1 DT System Failure Modes

H O S T A	P F E C	S C S I E x t 1	S C S I E x t 2	P B E C 1	P B E C 2	S B E C 1	S B E C 2	Failover Action
X								Loss of primary site, DT failover to remote site.
	X							Loss of PFEC's, DT failover to remote site.
		X						Loss of single mirrorset member, no failover.
			X					Loss of single mirrorset member, no failover.
				X				Loss of single mirrorset member, no failover.
					X			Loss of single mirrorset member, no failover.
						X		Loss of single mirrorset member, no failover.
		X	X					Loss of DT, no access to remote storage.
		X		X				Loss of single mirrorset member, no failover.
		X			X			Loss of two mirrorset members, no failover.
		X				X		Loss of single mirrorset member, no failover.
		X					X	Loss of DT, no access to remote storage.
			X	X				Loss of two mirrorset members, no failover.
			X		X			Loss of single mirrorset member, no failover.
			X			X		Loss of two mirrorset members, no failover.
			X				X	Loss of single mirrorset member, no failover.
				X	X			Loss of DT, no access to primary storage.
				X		X		Loss of two mirrorset members, no failover.
				X			X	Loss of two mirrorset members, no failover.
					X	X		Loss of two mirrorset members, no failover.
					X		X	Loss of two mirrorset members, no failover.
						X	X	Loss of DT, no access to remote storage.
		X	X	X				DT failover, better redundancy at remote site.
		X	X		X			DT failover, better redundancy at remote site.
		X	X			X		Loss of DT, no access to remote storage.
		X	X				X	Loss of DT, no access to remote storage.
		X		X	X			DT failover, better redundancy at remote site.
		X		X		X		Loss of two mirrorset members, no failover.
		X		X			X	Loss of three mirrorset members, no failover.
		X			X	X		Loss of two mirrorset members, no failover.
		X			X		X	Loss of three mirrorset members, no failover.
		X				X	X	Loss of DT, no access to remote storage.
			X	X	X			DT failover, better redundancy at remote site.
			X	X		X		Loss of three mirrorset members, no failover.
			X	X			X	Loss of two mirrorset members, no failover.
			X		X	X		Loss of three mirrorset members, no failover.
			X		X		X	Loss of two mirrorset members, no failover.
				X	X	X		Loss of three mirrorset members, no failover.
				X	X	X		Loss of three mirrorset members, no failover.
					X	X	X	Loss of three mirrorset members, no failover.
		X	X	X	X			DT failover, better redundancy at remote site.
		X	X	X		X		Loss of three mirrorset members, no failover.
		X	X	X			X	Loss of three mirrorset members, no failover.
		X		X	X	X		Loss of three mirrorset members, no failover.
		X			X	X	X	DT failover, single member from remote only.
			X	X	X			Loss of three mirrorset members, no failover.
				X	X	X	X	DT Disaster, lost all storage.
		X	X	X	X	X		DT failover, single member from remote only.
		X	X	X	X		X	DT failover, single member from remote only.

2.4 Failover and Failback

The failover and failback of critical storage between sites, while maintaining data consistency, is a key element of the DT storage system. DTSM software controls the failover functionality. This section describes how the failover and failback functionality of a DT system operates under DTSM control.

During normal operation, the PFEC performs all reads and writes of data to the DT subsystem. Failure to complete either a read or write operation indicates a loss of one or more mirrorset members at either the primary or secondary site. If the loss of all mirrorset members at the primary or secondary site occurs, the DT system is no longer disaster tolerant and the DT mirrorsets become inaccessible.

DTSM monitors the DT system and notifies the operator of the loss of any DT component. The DT storage solution requires an operator to initiate or confirm if a failover should be performed. There are two options available to an operator with regard to data recovery when a DT failure occurs:

1. To resume data processing at the primary site without being DT safe. This would occur if storage at the secondary site is unavailable due to a communication failure or a disaster at the secondary site. In this situation, the operator tells DTSM to enable normal access on all DT mirrorsets.
2. To failover to the secondary site. This would occur if storage at the primary site is unavailable.

2.4.1 Primary to Secondary Site Failover

When a primary site is unable to continue data processing, the operator is required to failover to the secondary site. The storage must be reconfigured to disable access by the primary site and enable access by the secondary site host.

The basic steps that DTSM performs for a failover from the primary site to the secondary site are the following:

1. Disable PFEC access to the SBEC's.
2. Enable SFEC access to the SBEC's.
3. Run Configuration on the SFEC to add devices.
4. Build DT mirrorsets using existing mirrorset members from the secondary site.
5. Create device units to the mirror sets.
6. Notify the user that the failover sequence is complete.

Failover is **always performed** from the secondary site because the primary site's failure may not allow the primary site to configure storage.

2.4.2 Failback to Primary Site

Failback is defined as the transfer of data access back from the secondary site to the primary site. The failback process requires significant resources during the copying of data back to the primary site and, depending upon the amount of data to be transferred, could take many hours to perform. Therefore, it is suggested that failback be performed during times when peak workload activities would not be affected.

Of course before a failback is initiated, the primary site must have its hardware and software available to support the DT storage solution, either the original hardware and software at the original primary site or replacement hardware and software at an alternative site. Host systems must have DTSM and the SWCC agent installed as well as the network and fiber

connections operational. The system manager or operator must load and start copies of the SWCC and DTSM agent software.

An operator starts the failback sequence by requesting DTSM to initiate failback.

1. Delete the configuration information at the secondary site.
2. Disable SFEC access to the SBECs.
3. Enable PFEC access to the SBECs.
4. Recreate the device configuration at the primary site.
5. Create the DT mirrorsets using the secondary mirrorset members only.
6. Add the primary mirrorset members to the DT mirrorsets which begins a data copy operation from the secondary site to the primary site members.
7. Notify the user that failback is complete but the DT mirrorsets are not DT safe.
8. Notify the user when the data copy operations are complete and the DT mirrorsets are DT safe.

2.5 Device Naming Conventions

Device naming conventions for DT storage is based on the same format as used with all HSZ array controller family products. Disk devices configured on the controller device ports are assigned names based on their access path to the controller, for example, a disk device located on device port 1 as SCSI ID 1 is labeled DISK10100. The disk devices are then built into storage sets providing either mirroring or RAID5 functionality. Names assigned to the storage sets are user selectable but should be in a consistent and easily recognizable format. These storage sets are then assigned unit numbers, representing the SCSI ID and LUN of the device presented to the host by the controller host port.

It is required that all PBEC's and SBEC's have the exact configuration. (disks, units, etc.). The only difference in configuration is that the SBEC's have a D900 device that the PBEC does not have. The D900 device is used to present a passthrough device to the SFEC.

3.1 Failover and Failback

3.1.1.1 Failover

Failover occurs when losses at the primary site dictate moving execution of the application to the remote site. This can occur if:

1. The entire primary site is lost due to a disaster.
2. The primary site host fails.
3. Access to storage at the primary site is lost.
4. Loss of one or more environmental systems such as air conditioning or power.

Failover is initiated by issuing the failover command from the DTSM CLI at the secondary site. For example

```
DTSM> failover -d <dtsystemname>
```

3.1.2 Failback

Eventually, the application must be migrated back to the primary host once all problems have been resolved. Failback is initiated by issuing the failback command at the primary site. For example:

```
DTSM> failback -d <dtsystemname>
```

3.2 Power up and Power Down

3.2.1 Initial Power up (no configuration)

Power up the system in the following order:

1. Ensure first that all BA370 enclosures, all DWZGA units, and all cabinet power distribution units (PDU) have their power switches in the OFF position.
2. Plug all cabinet PDU power cords into power receptacles.
3. Apply power to all PDUs.
4. Turn on the BA370 power switches for the SBE cabinets.
5. Make sure that all back end controllers are up and functional and front end controllers are not powered up.
6. Ensure that the DWZGAs are not powered on.
7. Make sure that PBECs are connected to the PFEC.

Operator Tasks

8. Start the PFECs by powering on the PFEC BA370.
9. Execute the **SHOW DEVICE** command on the PFEC to verify that CCLs have been added as passthrough disk devices CCLXXXXX. CCL10000 and CCL20000 are valid entries.

If not, troubleshoot the PFEC to PBEC connections and restart front end controllers

10. Verify that the software diskette is inserted into the DWZGA's diskette drive.
11. Apply power to all DWZGA units by first applying power to the rear power switch of each unit followed by applying power to the front panel power switch of each unit. If the fiber optic cables are connected correctly, the fiber connectivity LED located next to the fiber-optic cable connectors on each DWZGA light solid red when power is applied. If the LED does not light, reverse the polarity of the cable at one end and ensure that the LED does light. Failure to light the LED indicates broken fiber-optic cable or a faulty DWZGA.
12. Restart the PFEC by issuing the **RESTART OTHER**, followed by the **RESTART THIS** command.

3.2.2 Power Up (after configuration)

Caution

Power up the backend controllers and the DWZGA SCSI Extenders before applying power to the front end controllers. Powering up in the wrong sequence may cause incorrect configurations.

Power up the system in the following order:

1. Ensure first that all BA370 enclosures, all DWZGA units, and all cabinet power distribution units (PDU) have their power switches in the OFF position.
2. Apply power to all PDUs.
3. Turn on the BA370 power switches for the SBE cabinets.
4. Make sure that all back end controllers are up and functional and front end controllers are not powered up.
5. Apply power to all DWZGA units by first applying power to the rear power switch of each unit followed by applying power to the front panel power switch of each unit.
6. Start the PFECs by powering on the PFEC BA370.

3.2.3 Power Down

Caution

It is essential that when shutting down a DT configuration that the FEC controllers are shutdown before shutting down the BEC controllers.

1. Issue a **SHUTDOWN OTHER** command, followed by **SHUTDOWN THIS** command on the PFEC.
2. Turn off the DWZGA.
3. Turn off the power to the PFEC BA370 enclosure.

4. Issue a **SHUTDOWN OTHER** command, followed by **SHUTDOWN THIS** command on each of the PBECs.
5. Power off the PBEC BA370 enclosures.

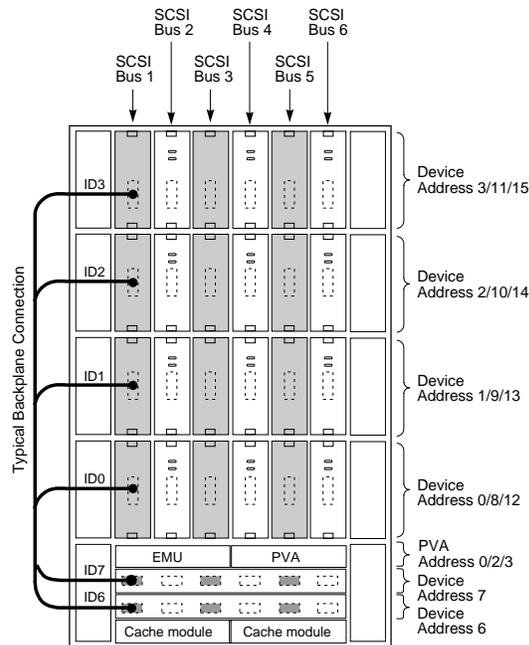
3.3 Removing and Replacing Disk SBBs

In the event of a failing disk SBB in a back-end cabinet, disk SBBs may be removed and replaced from BA370 DT back-end enclosures with controller compatible 16-bit (-VW suffix) disk SBBs. The recommended disk SBB installation sequence is to install disk SBBs from left to right, bottom to top (as viewed facing the front of the cabinet). You need to be aware of the following configuration rules:

- Always install the same type of disk SBBs in each of the back end cabinets.
- There are no disk SBBs installed in the front end cabinets.
- All devices and buses in the same column are on the same SCSI bus.
- All devices in the same row (device shelf) have the same device address.
- Device addresses are determined by the backplane connector into which the device is inserted, unless the disk SBB has a device address switch.

Device addresses for each SBB in each expansion cabinet are determined by the PVA address. The main cabinet's PVA address is set to PVA address 0 and the device addresses in that cabinet have addresses 0 through 3. The PVA address in the first expansion cabinet, in this case the back end cabinets, is set to PVA address 2 and device addresses in that cabinet have addresses 8 through 11 assigned. The PVA in the next expansion cabinet is set to PVA address 3 and devices in that cabinet are from 12 through 15. Figure 3-1 illustrates the addressing scheme. Both PFEC and SFEC BA370 enclosures must have the PVA address set to 0.

Figure 3-1 Disk SBB Addressing Scheme



Detailed information about SBB disk configuration rules and restrictions can be found in the *SWXSC-AA Office Expansion RAID Enclosure User Guide (EK-SMCPD-UG)*.

There are three methods for removing and replacing disk SBBs: hot swap, warm swap, and cold swap. HSZ80 array controllers support all three methods. The methods are defined as the following:

1. Hot swap—Power and data are present on the SBB enclosure connector. Use hot swap to remove and replace disk SBBs from a system that is online and active.
2. Warm swap—Power is present on the SBB enclosure connector, but data on the bus is not. Before performing a warm swap of a disk SBB, you must quiesce the bus at the controller, observe the amber status LED on the SBB and ensure that it is **not flashing** and is in its steady OFF state.
3. Cold swap—Neither power or data is present on the SBB enclosure connector because cold swaps require that power be removed from the BA370 enclosure in all subsystem enclosures.

Before you replace a disk SBB, be sure that the disk SBB is the same model as the one being replaced. Always use both hands to support a disk SBB. Properly ground yourself before removing and replacing a disk SBB.

Use the following procedure to remove and replace a disk SBB:

1. Press the mounting tabs together to release the disk SBB from its place in the enclosure and use both hands to pull the disk SBB out of the shelf.
2. Insert the replacement disk SBB into the guide slots of the enclosure and push it in until the disk SBB seats fully and the mounting tabs engage the shelf.
3. After power is applied, the green device activity LED is either ON, FLASHING, or OFF. The amber device fault LED is OFF.

Additional rules for installing disk SBBs include:

1. All devices and ports in the same column are on the same SCSI bus or port.
2. All devices in the same row (device shelf) have the same device address.
3. Device address 4 and 5 are used only if the disk SBB has a device address switch.
4. Device addresses are determined by the backplane connector into which the disk SBB is inserted unless the disk SBB has a device switch.
5. Device addresses for each disk SBB in each back-end cabinet are determined by the PVA address. The front-end cabinet's PVA address is set to PVA address 0 and device addresses in that cabinet have addresses 0 through 3.

Refer to the *SWXSC-AA Office Expansion RAID Enclosure User Guide (EK-SMCPD-UG)*, for more detailed information on installing disk drive SBBs.

3.3.1 Removing and Replacing Power Supply SBBs

Power supply SBBs have two green status LEDs. The upper LED indicates AC power status while the lower LED indicates power supply status. Use the following procedure to remove and replace power supply SBBs;

1. Stop all applications running and remove power from the enclosure by turning OFF the AC power controller.
2. Press the mounting tabs of the power supply to release the power supply from the shelf and use both hands and pull the SBB out of the shelf.

3. Insert the replacement power supply SBB into the guide slots and push it in until it seats fully and the mounting tabs engage the shelf.
4. Connect the power cord to the power supply SBB.
5. Apply power to the AC power controller.
6. Observe the power supply SBB LEDs. Both LEDs should be lit, indicating proper power supply operation on the associated bus.

If the top LED is not lit after replacing and applying power, this indicates that the power supply SBB has failed and needs replacing. If both status LEDs are not lit after the installation, either there is a lack of AC power, the AC power controller has failed, or the newly installed power supply SBB has failed.

The *SWXSC-AA Office Expansion RAID Enclosure User Guide* (EK-SMCPD-UG) contains more detailed information on installing power supply SBBs.

3.3.2 Removing and Replacing AC Power Controller SBBs

There are no external indications of a power controller failure on the AC power controller itself. However, both status LEDs on the power supply SBB may indicate a possible power controller failure. Use the following procedure to remove and replace an AC power controller.

1. Press 0 on the AC power controller ON/OFF switch that is to be removed.
2. Remove the power cord from the front of the AC power controller.
3. Loosen the two retaining screws at the top and bottom of the AC power controller.
4. Pull out the AC power controller to be removed.
5. Insert the replacement AC power controller into the slot.
6. Tighten the two retaining screws located at the top and bottom of the AC power controller.
7. Connect the AC power cord to the AC power controller.
8. Press 1 on the replacement AC power controller's ON/OFF switch.
9. Observe the power supply status LEDs for the proper operation.

If the top power supply LED is not lit after replacing the AC power controller and applying power, this is a possible indication that the AC power controller SBB has failed and needs replacing. If both power supply status LEDs are not lit after the installation of the AC power controller, either there is a lack of AC power, the AC power controller has failed, or it is possible that the power supply SBB has failed.

The *SWXSC-AA Office Expansion RAID Enclosure User Guide* (EK-SMCPD-UG), contains more detailed information on installing power controller SBBs.

3.3.3 Removing and Replacing External Cache Battery SBBs

Use the following procedure to remove and replace external cache batteries (ECB):

1. Disconnect the ECB cable between the cache module and the ECB.
2. Press the mounting tabs of the ECB to release the ECB from the rear shelf.
3. Pull out the ECB.
4. Insert the replacement ECB into the guide slots of the rear mounted shelf. Push the ECB in until it seats into the shelf and the mounting tabs engage the shelf.

5. Reconnect the ECB cable between the cache module and the ECB.

Refer to the *SWXSC-AA Office Expansion RAID Enclosure User Guide (EK-SMCPD-UG)*, for more detailed information on installing ECB SBBs.

3.4 Installing the Controller Program Card

Use the following procedure to install the HSZ80 controller program card and to reset the HSZ80 array controller:

1. Turn on subsystem power.
2. Insert the program card while depressing and holding the HSZ80 controller Reset button. The controller initializes and performs all its internal self tests.
3. When the Reset LED flashes at a rate of once every second, the initialization process is complete.
4. Snap the ESD cover into place over the program card. Push inward to lock the cover in place.

3.5 Basic Configuration Sequence of Events

The sequence of events for configuring disks on DT systems is as follows:

1. Apply power to one site's backend cabinet.
2. Configure storage for that backend cabinets.
3. Apply power to the other site's backend cabinets.
4. Configure storage for that backend cabinet as you did for the first backend cabinet.
5. Apply power to the primary site frontend cabinet.
6. Configure storage for the primary site frontend cabinet.
7. Apply power to the secondary site frontend cabinet.
8. Configure passthrough devices for the secondary site frontend cabinet.

The following procedures offer complete details for the configuration of storage for a DT system using the HSZ80 controller CLI. All commands entered require a <CR> after the command.

Although these procedures are only examples using a hypothetical configuration, the steps are the same for all configurations of a DT system. Follow these steps explicitly to eliminate problems further on in the procedures

Note

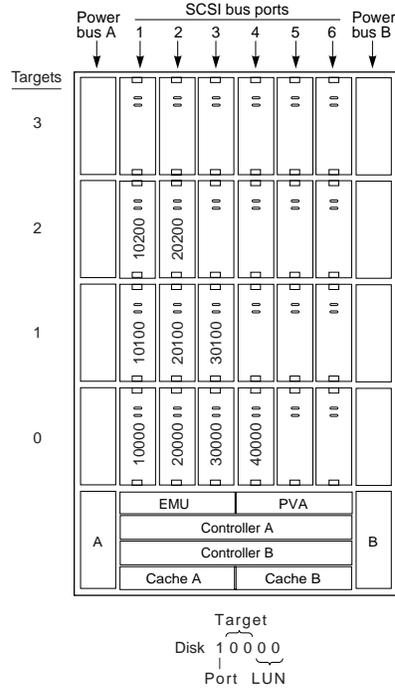
If desired, the SWCC client can be used in place of the HSZ80 controller CLI, but the procedures are not documented here.

The following configuration procedures are divided as follows:

1. SBEC Configuration
2. PBEC Configuration
3. PFEC Configuration
4. SFEC Configuration

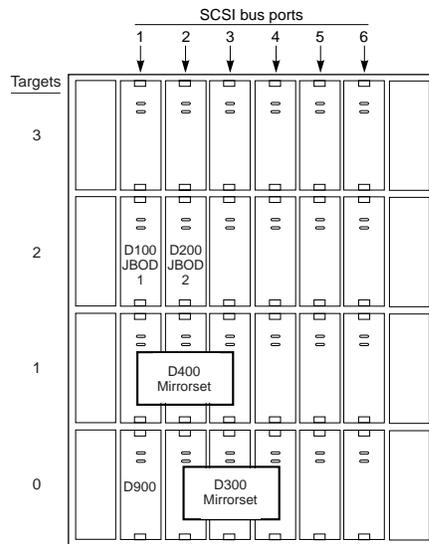
Reference Figure 3-2 and Figure 3-3 when performing the following storage configuration procedures. Figure 3-2 shows the disk configuration used in the configuration example. Figure 3-3 shows the assignment of unit numbers to the disks in Figure 3-2.

Figure 3-2 Example of Disk Configuration



CXO6438A

Figure 3-3 Examples of JBODs, Mirrorsets, and RAIDsets



Unit numbers assigned to JBODs, Mirrorset, and RAIDset

- D100 - JBOD 1
- D200 - JBOD2
- D400 - Mirrorset
- D300 - RAIDset
- D900 - Passthrough JBOD

CXO6437A

3.5.1 Secondary BackEnd Controller Configuration

Use the following procedure to configure storage on the SBEC:

1. Before starting configuration of disk drives, and if no expansion cabinets are attached to the backend cabinets, ensure that the PVA SCSI ID is set to 0 (zero) in all cabinets at both sites. Apply power to only the bottom BA370 to start this procedure. Connect a serial line maintenance terminal to the maintenance port of the top HSZ80 controller of the SBEC controller pair located in the bottom BA370 enclosure. This controller will be known as SBEC1A. The controller directly under SBEC1A will be known as SBEC1B. Insert the controller program card into SBEC1A. Verify that the controller boots. On the serial maintenance terminal connected to the serial maintenance port of SBEC1, enter **SET THIS PROMPT = "SBEC1A "**

Moving the maintenance line from controller to controller allows you to identify which controller of a controller pair you are manipulating. The SBEC1A prompt is now visible on the maintenance terminal.

2. At the next SBEC1A prompt, enter **SET THIS PORT_1_ID = (0,1,2,3,4,5,8) <CR>**, followed by **SET THIS PORT_2_ID = (9)** at the next SBEC1A prompt.
3. At the next SBEC1A prompt, enter **RESTART OTHER** command, followed by a **RESTART THIS** command. These commands restart the SBEC1 controller.
4. At the next SBEC1A prompt, enter **SET THIS COMMAND_CONSOLE_LUN**.
5. At the next SBEC1A prompt, enter **SHO THIS**. Check the returned display and verify that Host Port 1's SCSI targets are designated as 0–5, 8, that Host Port 2's SCSI target is designated as 9, and that the command console LUN (CCL) is enabled.
6. Now plug the controller program card into the controller directly under SBEC1A and allow that controller to boot.
7. At the SBEC1A prompt, enter **SET FAILOVER COPY = THIS**. This command configures the controller pair for dual redundancy. Enter **SHO THIS** at the next SBEC1A prompt and verify that under the controller information displayed, controllers are shown as configured for dual redundancy.
8. Enter at the next SBEC1A prompt **SET OTHER PROMPT = "SBEC1B "**. Now both controllers of the SBEC1 controller pair have specific prompts associated with them.
9. Enter **RUN CONFIG** at the next SBEC1A prompt. This automatically configures attached storage. For this example, RUN CONFIG returns the following information:

```
DISK10000 1 0 0
DISK10100 1 1 0
DISK10200 1 2 0
DISK20000 2 0 0
DISK20100 2 1 0
DISK20200 2 2 0
DISK30000 3 0 0
DISK30100 3 1 0
DISK40000 4 0 0
```

10. You must now define a mandatory passthrough disk on the SBEC controllers. This allows SWCC on the secondary host to communicate with the secondary back-end controllers. This disk is mandatory and must always be designated as D900. Start by

entering at the SBEC1A prompt **INIT DISK10000**, followed by **ADD UNIT D900 DISK10000**.

11. Depending upon system needs and the decision to designate some disk devices as JBOD devices, you must initialize the JBOD designated disks. For this example, DISK10200 and DISK20200 were chosen to be JBOD devices. At the SBEC1A prompt, enter **INIT DISK10200**, followed by **INIT DISK20200** at the next SBEC1A prompt.
12. If customer needs dictate, you now add the designated JBOD devices so that the hosts and the SFEC controller recognizes the JBOD devices. Enter **ADD UNIT D100 DISK10200** at the next SBEC1A prompt, followed by **ADD UNIT D200 DISK20200** at the next SBEC1A prompt.
13. Entering **SHO UNIT** at the next prompt shows the two JBOD units just added, D100 as DISK10200 and D200 as DISK20200.
14. If customer needs dictate, you now add any RAIDsets.

This is an example of the command:

ADD RAIDSET R1 DISK20000 DISK30000 DISK40000

15. Initialize the RAIDset by entering at the next SBEC1A prompt **INIT R1**, followed by entering **ADD UNIT D300 R1** at the next SBEC1A prompt. This last command creates a unit that allows the PFEC to see R1.
16. If customer needs dictate you next add any mirrorsets created by entering at the SBEC1A prompt the following:

ADD MIRRORSET M1 DISK10100 DISK20100 DISK30100

17. Initialize the mirrorset by typing at the next SBEC1A prompt **INIT M1**, followed by entering **ADD UNIT D400 M1**. The last command creates a unit that allows the PFEC to see M1.
18. Entering **SHO DISK** at any controller prompt returns a display, for this example, similar to the following:

NAME	TYPE	PORT	TARG	LUN	Used By
DISK10000	disk	1	0	0	D900
DISK10100	disk	1	1	0	M1
DISK10200	disk	1	2	0	D100
DISK20000	disk	2	0	0	R1
DISK20100	disk	2	1	0	M1
DISK20200	disk	2	2	0	D200
DISK30000	disk	3	0	0	R1
DISK30100	disk	3	1	0	M1
DISK40000	disk	1	0	0	R1

19. Entering **SHO UNIT** at any controller prompt returns a display similar to the following:

LUN	Uses
D100	DISK10200
D200	DISK20200
D300	R1
D400	M1
D900	DISK10000

20. To continue the configuration for a 2x2 DT system, move the serial maintenance line to the upper controller of the upper controller pair (SBEC2 controller pair) located in the secondary back-end cabinet's upper BA370 enclosure. Repeat Steps 1 through 17 for the SBEC2 controller pair, remembering to change the prompt to SBEC2A and SBEC2B where appropriate.

3.5.2 Primary BackEnd Controller Configuration

To configure the PBEC controllers, repeat the SBEC configuration, section 3.5.1, with the exception of Step 10. Use the correct PBEC controller names (PBEC1 and PBEC2) in steps 1, and 8.

3.5.3 Primary FrontEnd Controller Configuration

You must continue the configuration procedure by configuring the primary front-end cabinet controller pair. Use the following procedure.

1. To start the configuration procedure on the PFEC controllers, ensure that the rear and front power switches on the DWZGA units in the PFEC cabinet are in the OFF or 0 (zero) position.
2. Connect the serial display device to the maintenance port on PFECA.
3. Apply power to the PFEC. Remember, you must have powered up the backend cabinets and configure storage on them before applying power to the PFEC. Configure backend storage at both sites before applying power to the PFEC and before performing this PFEC configuration procedure. To apply power to the PFEC, first apply power to the PDUs, then apply power to the power controllers.
4. Plug the controller program card into the top controller of the PFEC controller pair. After the controller boots, enter **SET THIS PROMPT = "PFECA"**.
5. The assignment of SCSI IDs to their proper ports is dependent on system needs and customer configurations. Assign SCSI IDs to the proper ports with the **SET THIS PORT_1_ID = (SCSI IDs)** and **SET THIS PORT_2_ID = (SCSI IDs)** commands.
6. Enter **RESTART THIS** at the next PFECA prompt, restarting the PFECA controller.
7. At the next PFECA prompt, enter **SET THIS COMMAND_CONSOLE_LUN**.
8. At the next PFECA prompt, enter **SET THIS MIRRORED_CACHE**.
9. Enter **SHO THIS** at the next PFECA prompt and verify that Host Port 1 and Host Port 2 of the PFECA sees the proper SCSI IDs assigned in Step 4, and verify Command Console Lun and Mirrored Cache is enabled.
10. Insert the controller program card into the lower controller of the PFEC controller pair and wait for the lower controller to boot.
11. Enter **SET FAILOVER COPY = THIS** at the next PFECA prompt, configuring the controller pair for dual redundancy. Enter **SHO THIS** at the next PFECA prompt to

show the controllers configured for dual redundancy under the controller information displayed.

12. Enter **SET OTHER PROMPT = "PFECB "** at the next PFECA prompt. Now both primary frontend controllers have a specific prompt associated with each controller of the controller pair.
13. Enter **SHO PASSTHROUGH** at the next PFECA prompt and verify that the local CCLs were added as passthrough devices, for this example, CCL10000 and CCL20000 should be present. If the CCLs are not present, troubleshoot the primary site backend controller connections and restart the PFEC controllers.
14. If the CLLs are present, power up the DWZGA units located in the PFEC. Allow the DWZGA units to perform their self-tests and ensure that the fiber LEDs on both DWZGA front panels and rear panels are lit, indicating fiber connectivity.
15. Restart the PFEC controller pair by entering **RESTART OTHER** at the next PFECA prompt, followed by **RESTART THIS** at the next PFECA prompt.
16. Enter **SHO PASS** at the next PFECA prompt and verify that both LOCAL and REMOTE CCLs are present. The returned display shows the following:

		Port	Targ	LUN
CCL10000	passthru_disk	1	0	0
CCL20000	passthru_disk	2	0	0
CCL50000	passthru_disk	5	0	0
CCL60000	passthru_disk	6	0	0

If you do not see a particular CCL device in the returned display, enter **SHO THIS** at the corresponding SBEC controller prompt and check to see if the a CCL is enabled by checking the information under Host Port 1 for "Command Console LUN is Target 0, LUN 0". If this information is not present, indicating the CCL is disabled, enter **SET THIS COMMAND_CONSOLE_LUN** at the corresponding SBEC controller prompt, followed by **SHO THIS**. At the PFECA prompt, enter **CLEAR UNKNOWN CCLxxxxx**, followed by **SHO PASSTHROUGH** again at the PFECA prompt. If the CCL is still shown as disabled, or doesn't appear at all, check the SCSI path between the secondary backend controller and the primary frontend controller. This includes checking the SCSI extenders from the backend site and their path through the SCSI hubs and cabling, terminators, and trilinks. Check the SCSI path indicators on the HSZ80 controller front panel for error lights associated with the SCSI path failure on device ports 1, 2 5 and 6. When the faulty component has been replaced and the error associated with that light goes out on a reboot, your SCSI path problem has been corrected. Entering **SHO PASS** should return the CCL enabled information. Entering **SHO THIS** at the corresponding back-end controller prompt allows you to see if the CCL was enabled earlier.

14. Add the passthrough devices as units to be presented to the hosts. At the PFECA prompt, for this example, enter:

ADD UNIT P1 CCL10000

ADD UNIT P2 CCL20000

ADD UNIT P5 CCL50000

ADD UNIT P6 CCL60000.

15. Enter **RUN CONFIG** at the next PFECA prompt. Disks that have been presented to the front-end controllers are displayed, based on the example, as follows:

Operator Tasks

DISK10100 1 1 0
DISK10200 1 2 0
DISK10300 1 3 0
DISK10400 1 4 0
DISK20100 2 1 0
DISK20200 2 2 0
DISK20300 2 3 0
DISK20400 2 4 0
DISK50100 5 1 0
DISK50200 5 2 0
DISK50300 5 3 0
DISK50400 5 4 0
DISK60100 6 1 0
DISK60200 6 2 0
DISK60300 6 3 0
DISK60400 6 4 0

16. You must now configure all devices on Port 5 and Port 6 of the PFEC controllers to be REMOTE. At the prompt, enter **SET DISK 5xxxx REMOTE**, followed by **SET DISK 6xxxx REMOTE**, where xxxx represents the SCSI target and LUN of the device. Entering a **SHO DISK FULL** at the next PFECA prompt verifies that disks on Port 5 and Port 6 are set to REMOTE.

17. Create DT mirrorsets by entering the following commands, each at a separate PFECA prompt:

ADD MIRROR M1 DT_SUPPORT DISK10100 DISK20100 DISK50100 DISK60100

ADD MIRROR M2 DT_SUPPORT DISK10200 DISK20200 DISK50200 DISK60300

ADD MIRROR M3 DT_SUPPORT DISK10300 DISK20300 DISK50300 DISK60300

ADD MIRROR M4 DT_SUPPORT DISK10400 DISK20400 DISK50400 DISK60400

The previous commands add one device from each port to the DT mirrorset; four devices for a four-way mirrorset.

18. After DT mirrorsets have been added, enter **SHO STORAGE** at the next PFECA prompt. The DT_mirrorsets are displayed as per the following:

```

M1      Mirrorset      DISK10100
                               DISK20100
                               DISK50100
                               DISK60100
M2      Mirrorset      DISK10200
                               DISK20200
                               DISK50200
                               DISK60200
M3      Mirrorset      DISK10300
                               DISK20300
                               DISK50300
                               DISK60300
M4      Mirrorset      DISK10400
                               DISK20400
                               DISK50400
                               DISK60400

```

19. Enter **SHO MIRRORSET FULL** at the next PFECA prompt and verify that the DT mirrorsets are enabled and that DT support is enabled by looking under the Switches information in that display for “DT_SUPPORT”. Local disks are designated LOCAL and remote disks are designated as REMOTE.
20. Initialize the DT mirrorsets by entering at the next PFECA prompt **INIT M1**, followed by **INIT M2**, **INIT M3**, and finally for this example **INIT M4**.
21. Add the DT_mirrorsets as units for host recognition by entering:
- ```

ADD UNIT D100 M1
ADD UNIT D200 M2
ADD UNIT D300 M3

```
22. In this example, M4 was chosen to be a partitioned device. If you desire to partition a disk, for this example, create the partition by entering the following commands, each at a separate PFECA prompt:
- ```

CREATE_PART M4 Size=25
CREATE_PART M4 Size=25
CREATE_PART M4 Size=25
CREATE_PART M4 Size=25

```
- The size is determined by the percent of total disk space available. Refer to the *HSZ80 User Guide* for partitioning information.
23. Entering **SHOW M4** returns a display with information about the partitioned device, found under the Partitions information returned in the display.

24. Add the partitioned units to present them to the host by entering the following commands, each at a separate PFECA prompt:

ADD UNIT D400 M4 partition=1

ADD UNIT D401 M4 partition=2

ADD UNIT D402 M4 partition=3

ADD UNIT D403 M4 partition=4

25. Entering **SHOW UNIT** returns a display similar to the following:

LUN	USES
D100	M1
D200	M2
D300	M3
D400	M4 (partition)
D401	M4 (partition)
D402	M4 (partition)
D403	M4 (partition)
P1	CCL10000
P2	CCL20000
P3	CCL50000
P4	CCL60000

26. At the next PFECA prompt, enter **SHOW MIRRORSET FULL**. The display shows DT mirrorsets members in some combination of normal and copy states, with percent completed.
27. After all DT mirrorsets are in a normalized, enter **SET Dxxx ERROR_MODE=FAILSAFE** for all disk units shown in the returned display in Step 25. This puts the DT_mirrorsets into a mode so that if some number of DT_mirrorset members are lost, the controller disallows data transfers to the DT_mirrorset.
28. Entering a **SHO UNIT FULL** at the next prompt shows all DT_mirrorset error mode's set to FAILSAFE.

3.5.4 Secondary FrontEnd Controller Configuration

The final step in configuring storage for a DT system is to configure the storage on the SFEC controllers. The steps in this continuing procedure are similar to previous configuration steps, with the exception of issuing the RUN CONFIG command, which is not issued on the SFEC controllers. Configure storage of the SFEC as follows:

1. Plug the serial maintenance line into the top controller of the SFEC controller pair. Apply power to the SFEC as you did with all other cabinets.
2. Plug the controller program card into the top controller of the SFEC (SFEC1A) and allow it to boot.
3. Enter **SET THIS PROMPT = "SFEC1A "**at the next prompt.
4. Assign SCSI IDs to Host Ports 1 and 2 of the SFEC as dictated by the customer configuration with the **SET THIS PORT_1_ID=(SCSI IDs)** and the **SET THIS PORT_2_ID=(SCSI IDs)** commands.

5. Enter **RESTART THIS** at the next SFEC1A prompt.
6. Insert the controller program card into the bottom controller of the SFEC controller pair and allow it to boot. After the bottom controller boots, enter **SET FAILOVER COPY = THIS**. The controller pair is now configured for dual redundancy.
7. Enter **SET OTHER PROMPT = "SFEC1B "** at the next SFEC1A prompt. Both controllers in the SFEC controller pair now have specific prompts associated with them.
8. Enter **ADD PASS CCL50900 5 9 0** at the next SFEC1A prompt, followed by **ADD PASS CCL60900 6 9 0**, then **ADD UNIT P5 CCL50900**, and finally for this example, enter **ADD UNIT P6 CCL60900**. These commands add REMOTE command console LUNs so that the SFEC controller can recognize all devices in the event of a failover.
9. Enter **SHO UNIT** to display the information set in Step 8.

Configuration of storage for all cabinets is now complete.

3.5.5 Verifying System Operation

Verify system operation by entering **show storage full** at the PFECA prompt. A display is returned that shows all the assigned mirrorsets and their characteristics. Verify all storage is available.

3.6 Installing Software Components

This section explains how to install the two main software components of a DT system; SWCC and DTSM.

3.6.1 Installing SWCC

This section describes how to install SWCC.

Detailed information about SWCC can be found in the *DIGITAL StorageWorks Command Console Getting Started with Command Console (AA-R0HJC-TE)*.

SWCC consists of two components, the client and the agent. The client is the graphical user interface of the Command Console that runs on a local PC. The agent is a companion program to the client that runs on the host system. Agents allow clients to communicate with your storage subsystem over a network. Although operation is very detailed and you should refer to the *DIGITAL StorageWorks Command Console Getting Started with Command Console* for detailed information, the installation process for both the client and the agent follows.

1. Install the SWCC client applets on a local network PC. This consists of two steps.
Installing the SWCC client applet manager.
Installing the HSZ80_DT plug-in client applet.
2. Install the SWCC agent on first the primary site host, then on the secondary site host.

3.6.1.1 Installing SWCC Client Applet and HSZ80_DT Client Applet Managers

The following procedure details the installation of the SWCC client applet manager on a local network PC and the installation of the HSZ80_DT plug-in applet on the local network PC.

1. Insert the DTSM VX.x/SWCC V2.x CD-ROM into any PC on the network.
2. Under the **Start** menu, click **Programs** and locate the Windows Explorer program. Open Explorer and click on the CD-ROM player (D:) located in the All Folders window and select **SWCC 2.0**.

3. Under the Contents window, click **setup.exe**. The SWCC Welcome Screen is displayed. Click **Next**.
4. The SWCC Destination Directory window is displayed, showing the default destination directory, C:\ProgramFiles\swcc, where SWCC will be installed. Press **Return** and click **Next**.
5. The SWCC Folder Selection window is displayed next, showing the default folder, Command Console 2.2, where SWCC will be installed. Press **Return** and click **Next**.
6. The SWCC SetUp window is displayed next. When the SWCC client applet manager is 100% installed, the Explorer window is redisplayed.
7. Now install the HSZ80_DT plug-in client applet on top of the SWCC 2.0 client applet manager by clicking on **HSZ80_DT** in the Explorer directory contents.
8. Install the HSZ80_DT applet, the SWCC agent, and the DIGITAL UNIX agent by clicking on **setup.exe** in the Explorer window directory contents.
9. The SWCC Welcome Screen is displayed. Click **Next**. You are then asked if you want the README.txt file. You may answer **yes** or click **Next**.
10. The Select Components screen is displayed if you clicked **Next**, offering the following three choices.
 - **Storage Window Installation**
 - **Agent Installation**
 - **View Documentation using a PDF file format reader**
11. Click the first option, **Storage Window Installation**. Click **Next** after your choice.
12. A message window is displayed, informing you that the directory was found for the Command Console. Click **OK**.
13. The SWCC SetUp Installation window is displayed. Once the HSZ80_DT plug-in client installation is 100% complete, as indicated by the bar in the SetUp Installation window, you are asked once again if you would like to view the README.txt file. Clicking **Yes** displays the README.txt file to the screen. Installation of the HSZ80_DT plug-in client applet is now complete.

3.6.1.2 Installing SWCC Agent on Primary and Secondary Site Hosts

The following procedure explains how to install the SWCC agent on a host. Install the SWCC agent with this procedure on both the primary site host and on the secondary site host.

1. In the CD-ROM directory, click on **HSZ80_DT**, followed by clicking on **setup.exe**. A SWCC Welcome window appears. Click **Next** here. You are then asked if you would like to view the README.txt file. You can chose to view the README.txt file or click **Next** here.
2. The SWCC Select Components window appears. Click on **Agent Installation**, followed by **Next**.
3. The SWCC Remote Agent Installation window is displayed asking you which version of DIGITAL UNIX agent you want to install. Click **Digital UNIX 4.0d**, followed by **Next**.
4. The SWCC Installation Information for Remote “Digital UNIX 4.0d” Agent window is displayed. The function of this window is to FTP the agent components to the host system designated by this window. The agent components are placed in a /tmp directory. You must supply a host name, a username, and a password in this window. Usually, the first host name supplied is the primary site host’s name. An example of a fully qualified

DIGITAL UNIX host name is garcia.cxo.dec.com. Click **Next** after you have supplied all information.

5. Once the agent software has been downloaded, a Telenet window is displayed that allows you to log on to the primary site host system. You must supply a **Username** and **Password** for the host.
6. After the Username and Password have been supplied, the prompt for the primary host appears. For example, **garcia.cxo.dec.com>**. Enter **su** (super user) at the host prompt, followed by the system password.
7. Enter **cd /tmp**, followed by **ls**. The contents of the /tmp directory are displayed, containing a file called install.sh.
8. Enter **sh install.sh**. This starts the agent installation process. Messages are displayed including one that informs you that you must be a root user to continue. You are asked if you wish to continue.
9. Enter a target directory into which the agent is installed or select the default directory. It is suggested you use the default directory, /opt. A notification message appears telling you that the STEAM agent is being installed in /opt/steam directory. You are asked if this is OK. A message is returned informing you that files are being copied and that the services file is being updated from /tmp to /opt/steam, followed by a message informing you that entries are being added to /etc/services for the Client using Port 4998. When you are asked if this is OK, click **Yes**. Next, a message is displayed informing you that entries are being added to the /etc/services directory for the STEAM agent using Port 4999 and is this OK. Click **Yes**, (default). You are informed when all files have been updated.
10. Enter the directory that contains the device specific files. The default is /dev. You are informed of the directory you chose and asked if this is OK.
11. Enter and verify the password for use with the STEAM agent. This is the SWCC password. Remember this password. It is used in the DTSM installation.
12. Messages about SNMP applications are returned followed by a request to enter the name of the agent manufacturer. Enter **DEC**. You are again asked if this is OK, click **Yes**.
13. A message about octet ID is displayed, then you are asked if you want to enter another value. Click **No**, the default
14. You are asked to enter a host name of the client system. The name must conform to the fully qualified UNIX naming conventions, such as garcia.cxo.dec.com. If the host name is in the same TCP/IP area, you can enter only the node name, for example, garcia. If this installation is being done on the primary site, enter the primary site host name. If this installation is being done on the secondary site, enter the secondary site host name.
15. Enter the subsystem access privileges. These control the level of access a client has for communicating with the storage subsystems. The possible options displayed are: **0 = Navigational Tree Monitoring Only**, **1 = Navigational Tree and Storage Windows Monitoring Only**, and **2 = Navigational Tree Monitoring, Storage Window Monitoring, and Configuration**. Enter option **2**.
16. The agent server notifies a client when an error occurs. You must choose the notification scheme by selecting one of the following options displayed in the next window. Available options are **0 = No Error Notification**, **1 = Notification via a TCP/IP Socket**, **2 = Notification via the SNMP protocol**, **3 = Notification via both TCP/IP and SNMP**. When asked to enter the error notification level, enter choice **1**.
17. You are informed of the addition of the client to the agent. Information displayed consists of the previously entered information; the node name of the Host, the access

Operator Tasks

level, and the error notification level. You are asked if the information is correct. After your response, you are asked if you would like to add another client.

- The agent scans for the presence of HSZ80 controllers and updates the storage.ini file. You are given three options, but required to choose **Option 1** in this window. Option 1 automatically scans the SCSI bus and presents storage subsystems found to the host. You are informed that the following subsystem has been found, with the following details embedded in the message:

```
Controller Type   : Firmware Version:V81z
Serial Numbers   : ZG7510034, ZG75100120
EMU type         : Enhanced
Number of Devices: rrz16c
```

Would you like to add this subsystem to the “storage.ini” file? [Y,n]

- You must have a detailed understanding of your DT system in order to successfully enter any information from this point on in this procedure. You must know the names of the frontend controllers and backend controllers for the primary site as well as for the secondary site, because this same information is required when you perform this same procedure at the secondary site.
- Enter the Subsystem Name, using the specific format **Dtsystemname.nodename.controller**. Enter **0** for the Monitoring Interval. When complete, you receive a message informing you that the subsystem you typed in has been added to the storage.ini file.
- The next subsystem found is displayed in the format previously used, with Controller Type, Serial Numbers, EMU Type and Number of Devices as the information displayed. You must enter the subsystem name and monitor interval just as you did for the first subsystem found and answer **Yes** when asked “Would you like to add this subsystem to the “storage.ini” file?”. When performing this procedure on the primary site host, all DT subsystems for both the primary and the secondary site are found with the exception of the SFEC controller. When performing this procedure on the secondary site host, only the SBEC controllers are found. For a 1x1 DT system, you are queried four times. For a 2x2 DT system, you are queried six times for this information for all the frontend as well as all the backend controllers.
- When all the found storage subsystems have been added to the storage.ini file, a message is returned to you that says the STEAM agent has been successfully installed followed by a question asking if you would like to execute the agent now. Answering **Yes** here returns a message informing you the agent has been started followed by a message informing you when the agent installation is complete.
- Now change directories to the opt/steam/etc directory by typing the command **cd opt/steam/etc**. Next, issue a **ls** command to show you the contents of the /opt/steam/etc directory.
- Now you must edit the client.ini file in order for DTSM to communicate with SWCC. Type **ls** to display the contents of that directory. The /opt/steam/etc directory contains the client.ini and storage.ini files. Enter **vi client.ini** at the next prompt. This command allows you to edit the client.ini file.
- The resulting display shows an entry for each client, similar to the following:

```
<name_of_client> | 1 | 2
```

After the last number in the client display, enter a | (bar), followed by entering **6788** in sequence, with no separations, commas, or other separators. This assigns a port over which

DTSM receives status information about the subsystem from SWCC. The line should look like this:

```
<name of client> | 1 | 2 | 6788
```

26. Enter the sequence **Esc : w q** after you have entered 6788 in the client.ini file.
27. In the displayed window, enter **cd ../bin**. This puts you into the /opt/steam/bin directory.
28. Enter **config.sh**. A window is displayed that offers you several tables with options used to manipulate SWCC. Restart the agent by entering choice **3**.

Perform this same procedure on the secondary site host.

3.6.1.3 Configuring Storage with SWCC Client Software

The SWCC client software allows you to configure storage three different ways. Access the three ways by clicking on **Start**, followed by **Programs**, and then **Command Console V2.0**. The resulting box shows a display that allows you to choose a CLI window, a HSZ80_DT Storage window or a StorageWorks Command Console window. Each allows you a different option for configuring storage on the DT subsystem. The CLI window allows you to enter controller CLI commands. The HSZ80_DT Storage window allows you to manage storage via the HSZ80 controller pair through a serial, SCSI, or network (TCP/IP) connection. The StorageWorks Command Console window shows you a graphical representation of the DT storage subsystem and allows you to configure storage from a graphical representation. All information about configuring storage with SWCC resides in either the *DIGITAL StorageWorks Command Console Getting Started with Command Console*, or in the on-line help available to you after the installation of SWCC. It is recommended that you access and read all of the SWCC on-line help available.

3.6.2 Installing DTSM

This section describes how to install the DTSM from the StorageWorks DT Solutions CD-ROM.

1. Enter **setld -i |grep DTSVER100**, press **Enter**, and check the resulting display to see if the DTSM already exists on your system. If it does, remove the current DTSM by issuing the **setld -d DTSVER100** command, and press **Enter**.
2. At the UNIX system prompt, log in either as a root user or enter **su** to switch to superuser.
3. Create a temporary directory using the **mkdir** command. Set your default to the new directory using the **cd** command.
4. Load the CD into the CD ROM player.
5. Mount the CD with **mount -r /dev/<cdrom device> /mnt** and press **Enter**.
6. Change the directory to the DTSM dir by entering **cd /mnt/dtasm** and press **Enter**.
7. Copy the DTSVER100.tar to the new directory.
8. Untar the DTSM tar file using the following command:

```
tar xvf DTSVER100.tar
```

9. Execute the installation by entering **/usr/sbin/setld -l ./ DTSVER100** at the UNIX command prompt and press **Enter**.
10. The installation will inform you when complete. The following is an example script:

```
#
# setld -l ./
```

Operator Tasks

Starting installation of StorageWorks Disaster Tolerant Storage Manager.

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of DFARS 252.227-7013, or in FAR 52.227-19, as
applicable.

The installation will complete in 1 to 2 minutes depending on
processor type.

*** Enter subset selections ***

The following subsets are mandatory and will be installed automatically
unless you choose to exit without installing any subsets:

* StorageWorks Disaster Tolerant Storage Manager

You may choose one of the following options:

- 1) ALL of the above
- 2) CANCEL selections and redisplay menus
- 3) EXIT without installing any subsets

Enter your choices or press RETURN to redisplay menus.

Choices (for example, 1 2 4-6): 1

You are installing the following mandatory subsets:

StorageWorks Disaster Tolerant Storage Manager

You are installing the following optional subsets:

Is this correct? (y/n): y

1 subset(s) will be installed.

Loading 1 of 1 subset(s)....

Java V1.1.6 or later is installed.

StorageWorks Disaster Tolerant Storage Manager

Copying from ./ (disk)

Verifying

1 of 1 subset(s) installed successfully.

Configuring "StorageWorks Disaster Tolerant Storage Manager" (DTSVER100)

DTSM entry has been added to /etc/inittab to start DTSM automatically.

Run DTSM configure command to configure the DTSM Agent and your DT systems.

Installation of the StorageWorks Disaster Tolerant Storage Manager (DTSVER100) subset is complete.

#

3.6.2.1.1 Setting-Up Environment Variables and Aliases

Add the following commands to the .login file in the root directory. These commands may vary based on the Unix shell being used.

```
setenv CLASSPATH ./opt/dtasm/bin
```

```
aliases dtasmagent = "java dtasm-class"
```

```
aliases dtasm = "java DTSMCLI"
```

3.6.2.1.2 Configuring the DTSM Agent

Perform the following steps to configure the DTSM agent, which allows you to configure the DT subsystem.

1. To configure the DTSM agent, enter at the system prompt **dtasm**. The dtasm prompt (dtasm>) appears.
2. At the dtasm prompt, enter **configure**. This starts the configuration of the dtasm agent file. The following screen is displayed. These are the defaults and the recommended settings.

Monitor interval: [300]

Notification Script: [notify .scp]

Password:

SWCC Password: <same as the password you used to setup SWCC>

Information entered on this screen is used to create the config.ini file.

Note

Information entered into the Notification Script field allows DTSM to execute a user supplied, customized notification script.

3.6.2.1.3 Configuring the DT Subsystem

Perform the following steps to continue configuring of the DT subsystem.

1. At the next dtasm prompt, enter the following: **configure -d <dtsystemname>**, where dtsystemname is the user selected name of the DT subsystem.
2. You are asked to fill in a table with information about the DT subsystem. Enter the following:

Stacked or Peer-to-Peer: **S**

Hot or Cold: **C**

Primary Host Name: **nnnnnnn.nnn.nnn.nnn**

Primary Host Address: **xx.xxx.xx.xx**

Secondary Host Name: **nnnnn.nnn.nnn.nnn**

Secondary Host Address: **xx.xx.xx.xxx.xx**

Number of Primary Backend subsystems: 1 or 2: **2**

Number of Secondary Backend subsystems: 1 or 2: **2**

Note

Primary and secondary host names must be fully qualified UNIX host names.
Primary and secondary host addresses must be legal host IP addresses.

When asked for the number of primary and secondary backend subsystems, enter **1** for a 1x1 DT subsystem. Enter **2** for a 2x2 DT subsystem.

After all the above information has been supplied, a message is returned informing you that a connection to SWCC is being made. The supplied information and the SWCC data is used to create the Dtsystemname.ini file.

4. Copy the config.ini and the <dtsystemname>.ini files to the secondary site host by entering the following commands at the next dtsm prompt:

```
cd /opt/dtasm/etc
```

```
ftp (secondary site host name)
```

```
username:
```

```
password:
```

```
>cd /opt/etc
```

```
>put /config.ini
```

```
>put /<dtsystemname>.ini
```

This completes the manual installation of DTSM, the configuration of the DTSM agent, and the configuration of the DT subsystem procedures.

DT Storage System Troubleshooting

This chapter describes possible hardware failure modes of a DT system. Isolation of errors and detailed error analysis on a DT subsystem requires a complete understanding of your DT storage subsystem operation, and while it is not possible to document every error and failure condition, key failure paths are discussed. This chapter approaches troubleshooting from the user or operator point of view. That is, what an operator must do to maintain the integrity of the DT system. Specific troubleshooting information on the components used in the DT subsystem is found in the specific manuals related to the component used and is not covered in this chapter.

This chapter provides overall DT storage subsystem fault isolation and the unique characteristics of the components used in the DT subsystem. Problems with setup, configuration and failover are not covered in this chapter.

4.1 DT Specific Component Functionality

The service and maintenance of a DT subsystem is based on failure isolation to subsystem components. Components within a DT subsystem described here are the HSZ80 array controller mounted in a BA370, the DWZGA SCSI bus extender, and the DWZZH–21 SCSI hubs. A brief introduction to these components follows.

4.1.1 HSZ80 Array Controller

The HSZ80 array controller, mounted in a BA370 with an Environmental Monitoring Unit (EMU), and a Power Verification and Addressing (PVA) unit, provides event and error reporting via the controller serial maintenance port. To help capture random disk errors associated with the back-end controllers, a terminal can be connected to this maintenance port. This allows data collection of errors that may not have been passed to the host without adequate details because of the nature of the back-end controller, that is; disk drive errors reported to the back-end controllers may not include all supporting error information in the host error log.

4.1.2 DWZGA SCSI Bus Extender

The DWZGA SCSI bus extender supports the connection of an optional, standard PC monitor and keyboard for SCSI error and status information. If the link to the remote site SBEC is not operating in a stable manner, the installation of monitors and keyboards on each link provides additional visibility to SCSI traffic, errors, and events.

4.1.3 DWZZH–21 SCSI Hubs

The DWZZH–21 SCSI hub is used in the DT subsystem to provide the conversion of SCSI signals from the UWSE output of the FEC to the UWD input of the host port on the back-end controllers. The DWZZH–21 SCSI hub has two single ended ports and one differential port. The unused SCSI port is UWSE and should not be used to connect additional storage or hosts

to the DT subsystem. A power LED indicates that power is applied to the SCSI hub. For complex troubleshooting of the SCSI bus, you may connect a SCSI analyzer to the unused UWSE port of the hub for data collection as requested by engineering.

4.2 Failure Notification

Events, errors, and failures related to a DT subsystem are provided to the host. Information is available from the HSZ80 controller via the serial maintenance port.

It is important to understand the operation of the DT subsystem and the individual component error logging methods to analyze failures on a DT subsystem. Each component within the DT subsystem provides error and failure information specific to the function being performed. The array controllers maintain and log specific information relevant to the operation and the devices connected to both the host ports and device ports of the controllers. The DWZGA SCSI extender provides information about SCSI errors. DTSM and SWCC provide information on controller detected errors and events and provide visibility to the operator of status changes in the DT subsystem.

4.2.1 HSZ80 Array Controller Notification

The HSZ80 controller provides error and event information to the host in the same format as standard array controllers. DT failures are logged via the front-end controllers to the host by sending a vendor unique ASC/ASCQ to the host. The front-end controller may suspend I/O processing. Device errors detected by the back-end controllers are managed and logged to the maintenance port and passed to the front-end controller. The front-end controller views the error or event as a device error and logs the information to the maintenance port and to the host. While the front-end controller passes the error or event information to the host and maintenance terminal, some error details are not collected from the back-end controllers, and therefore are not available to the host. For complex errors and unknown events, the use of a maintenance terminal or logging program connected to the back-end controllers will provide full error and event details.

4.2.2 Error Reporting and Fault Analysis for All Controllers

The method for collecting and displaying full details and error data from backend controllers is to attach a maintenance terminal to the serial maintenance port of the backend controllers. Although DTSM (DT Storage Manager) and SWCC (StorageWorks Command Console) detects most DT system errors and events, without a serial line attached to the backend controller serial maintenance port, details about why a device was removed from the storage set are lost.

4.2.3 DWZGA Notification

The DWZGA SCSI bus extender provides high-speed connectivity between SCSI-based systems, allowing SCSI commands and data to pass between the primary and secondary sites. The DWZGA unit allows you to connect, via the rear panel connections, an optional keyboard and monitor for maintenance and troubleshooting. Refer to Appendix C for information about the DWZGA.

4.2.4 Error Reporting and Fault Analysis for DWZGA SCSI Extenders

The DWZGA SCSI bus extenders act only as a pass through device for errors and events detected by the backend controllers to the frontend controllers, allowing storage devices attached to the backend controllers a path to provide information to the host system. No internally detected error conditions are sent to the frontend controllers, nor does the DWZGA unit append any other data to device sense data being passed to the host.

Most DWZGA detected errors are associated with a host initiated SCSI command. Error information is collected and passed to the host as a standard check condition with corresponding sense data.

When the DWZGA detects errors in fiber transmission, the transfer is aborted, the DWZGA logs a fatal error and stops processing commands and data.

DWZGA units support the use of an optional monitor and keyboard for SCSI bus operation and performance monitoring. During troubleshooting and service, the monitor provides details on transfer size, basic SCSI errors and internal DWZGA errors. Other than the limited capabilities provided by the monitor and keyboard, the DWZGA does not provide any error status information. You may request internal data dumps from the DWZGA for more information. These dumps are to a floppy disk and the information must be sent to your Customer Service Representative for analysis. Refer to Appendix C for information about the DWZGA.

4.2.5 SWCC Failure Notification

SWCC notifies the user of the loss of any component in the system via an active SWCC Client GUI window on the Command Console monitor. SWCC periodically queries the controllers for status or change of status. Changes in status are indicated by changes to the GUI screen by telling clients connected to the GUI .ini file about changes in status. SWCC requires a user to intervene in the DT process when there is a problem by allowing the user to manipulate controllers and storage through a graphical view of the controllers and their physical and logical storage elements. Refer to the *DIGITAL StorageWorks Command Console Getting Started with Command Console* (AA-R0HJC-TE) and the on-line users help available after you install SWCC for more information.

4.2.6 DTSM Failure Notification

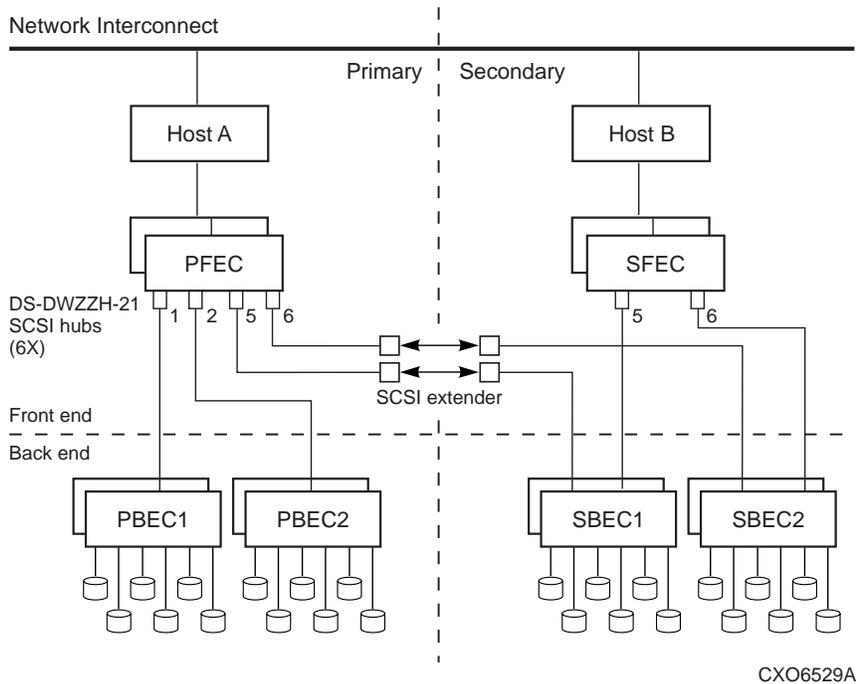
DTSM notifies the user of a loss or a problem with disk drives, controllers, or DT mirrorset members. DTSM executes a customer provided notification script and outputs messages describing the problem on the Digital UNIX Command Console window and/or via E-mail if the problems are severe enough. The user can customize the DT notification script to provide customized DTSM event notification. To do this, modify:

`/opt/dtasm/etc/notify.scp`

4.2.7 DT Failure Modes as Related to Component Failures

Figure 4-1 Basic DT Subsystem Block Diagram shows a basic DT subsystem block diagram with the components discussed in these sections. The following sections portray component failure scenarios of the components and what an operator might do to correct a failure of the DT system.

Figure 4-1 Basic DT Subsystem Block Diagram



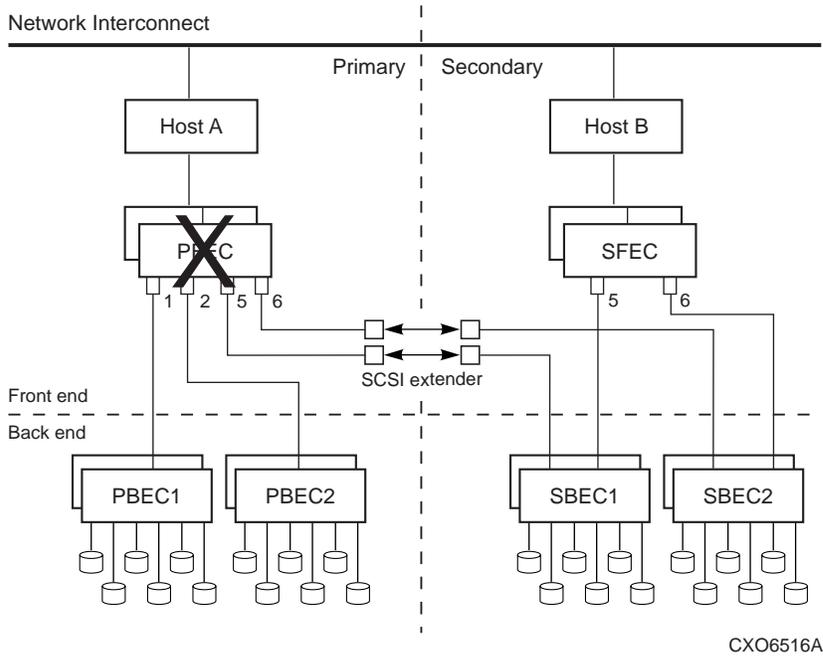
4.2.7.1.1 Loss of One Member in a Dual Redundant Controller Pair

Each of the controller pairs can lose a single member to failure. When this happens, a normal controller failover occurs automatically with the preferred devices being automatically moved to the remaining controller. A decrease in I/O speed may occur. The faulty controller must be replaced using conventional controller troubleshooting techniques.

4.2.7.1.2 Loss of PFECs, DT Failover to Secondary Site

In the event of the loss of both members of the PFEC, as shown in Figure 4-2, the user must perform a failover of storage to the secondary site. Issue the failover command, **failover -d <dtssystemname>** at the secondary site. Normal repairs must be completed for the failed controllers.

Figure 4-2 Loss of PFEC



4.2.7.1.3 SCSI Bus 1 failure

In the case of a SCSI Bus 1 failure, as shown in Figure 4-3, the result is the loss of a single mirrorset member and no failover is required. The user is notified and the hardware failure must be resolved. After replacing or repairing the faulty component, you may need to recreate some portion of backend storage by referring to the steps in Section 3.3 of this manual.

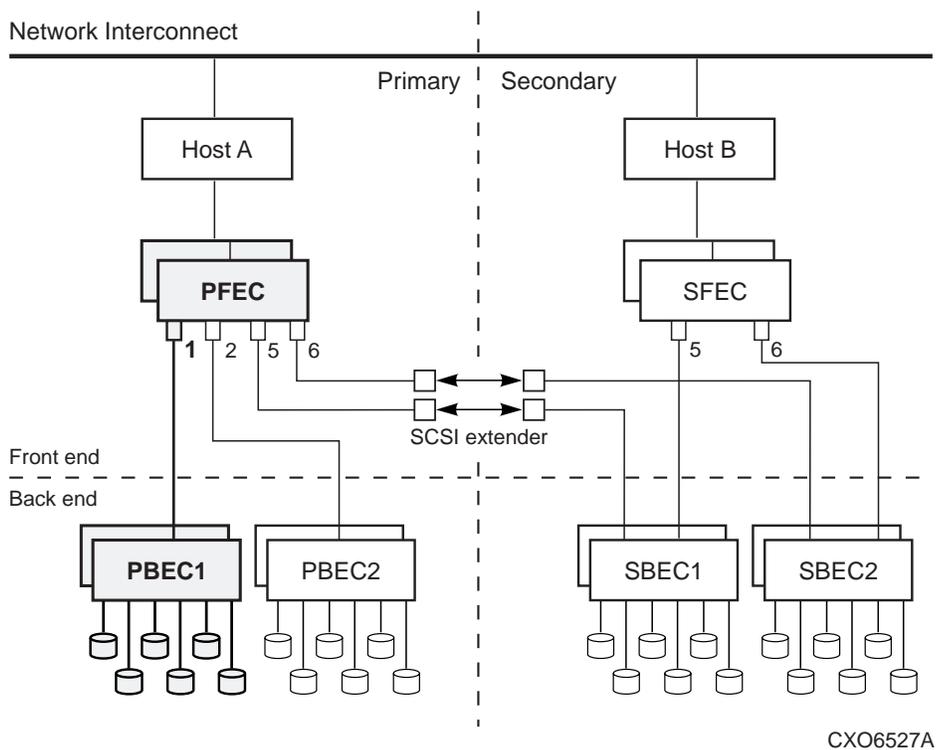
The possible hardware failures are:

- Disk Drive
- Both controller members of PBEC1
- PBE Cabinet hardware including the BA370, EMU, PVA, Power Supplies
- Cables, terminators, tri-link connectors
- PFEC controllers
- DS-DWZZH-21 SCSI Bus 1 hub

Once the hardware and storage has been restored, issue the RESYNCH comand at the primary site to restore full operation, as shown below.

dtsm> resynch -n -d -<dtssystemname> -a

Figure 4-3 Loss of SCSI Bus 1



4.2.7.1.4 SCSI Bus 2 failure

In the case of a SCSI Bus 2 failure, as shown in Figure 4-4, the result is the loss of a single mirrorset member and no failover is required. The user is notified and the hardware failure must be resolved.

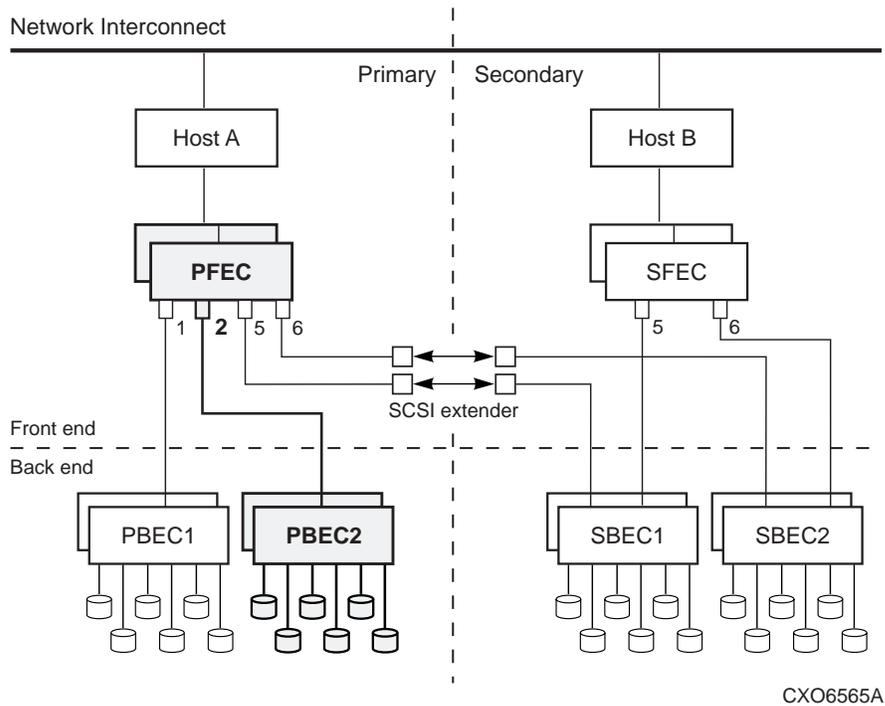
The possible hardware failures are:

- Disk Drive
- Both controller members of PBEC2
- PBE Cabinet hardware including the BA370, EMU, PVA, Power Supplies
- Cables, terminators, tri-link connectors
- PFEC controllers
- DS-DWZZH-21 SCSI Bus 2 hub

Once the hardware and storage has been restored, issue the RESYNCH comand at the primary site to restore full operation, as shown below.

```
dtsm> resynch -n -d -<dtssystemname> -a
```

Figure 4-4 Loss of SCSI Bus 2



4.2.7.1.5 Loss of SCSI Bus 1 and 2

Failure of both SCSI Bus 1 and 2, as shown in Figure 4-5, results in a loss of DT with no access to primary site storage. The operator is notified via SWCC and DTSM of the failure.

The possible hardware failures are:

- Disk Drive
- Both controller members of PBEC1 and PBEC2
- PBE Cabinet hardware including the BA370, EMU, PVA, Power Supplies
- PFEC controllers

The operator can choose one of two options:

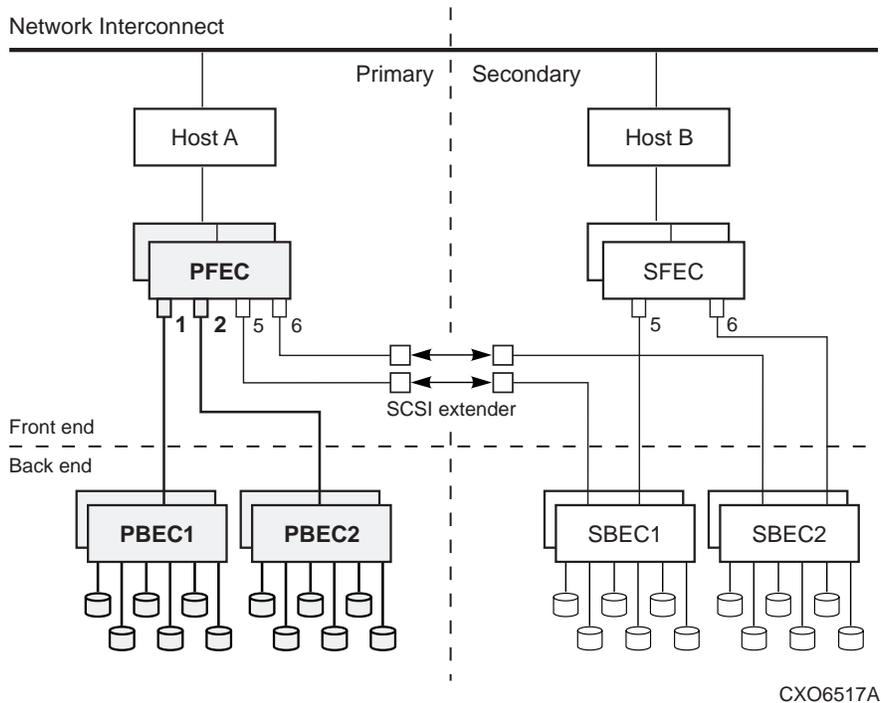
1. Failover and failback after the storage system is repaired (refer to Section 2.4).
2. Continue degraded operation that is not DT safe.

To continue with degraded operation, the operator must set the DT mirrorset units to the NORMAL mode with the `enable -n -d-<dtsystemname> -a` command to continue the application on secondary site storage.

Once the hardware and storage has been restored, issue the RESYNCH comand at the primary site to restore full operation, as shown below.

```
dtsm> resynch -n -d -<dtsystemname> -a
```

Figure 4-5 Loss of SCSI Bus 1 and 2



4.2.7.1.6 Loss of SCSI Bus 5

In the case of a failure on SCSI Bus 5, as shown in Figure 4-6, the result is the loss of a single mirrorset member and no failover is required. The user is notified and the hardware failure must be resolved.

The possible hardware failures are:

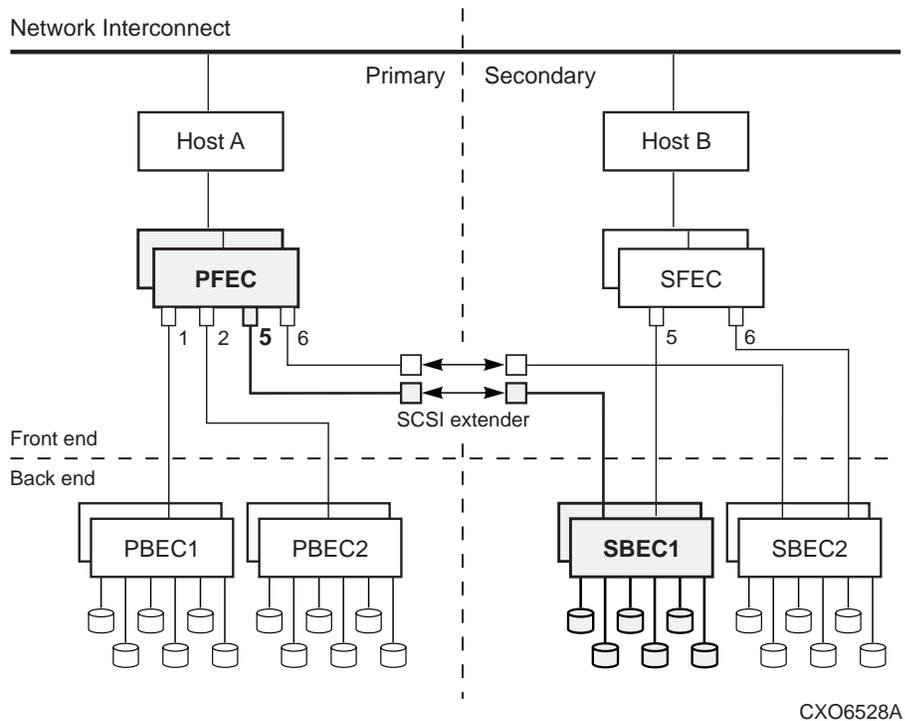
- Disk Drive
- Both controller members of SBEC1
- SBE Cabinet hardware including the BA370, EMU, PVA, Power Supplies
- Cables, terminators, tri-link connectors
- PFEC controllers
- DS-DWZZH-21 SCSI Bus 5 hub
- DWZGA SCSI Bus Extender 1

Loss of a single SCSI extender results in the loss of a single mirrorset member because the connection to that mirrorset member has been lost. This requires no failover. If an extender fails, it must be replaced.

Once the hardware and storage has been restored, issue the RESYNCH comand at the primary site to restore full operation, as shown below.

```
dtsm> resynch -n -d -<dtsystemname> -a
```

Figure 4-6 Loss of SCSI Bus 5



4.2.7.1.7 Loss of SCSI Bus 6

In the case of a failure on SCSI Bus 6, as shown in Figure 4-7, the result is the loss of a single mirrorset member and no failover is required. The user is notified and the hardware failure must be resolved.

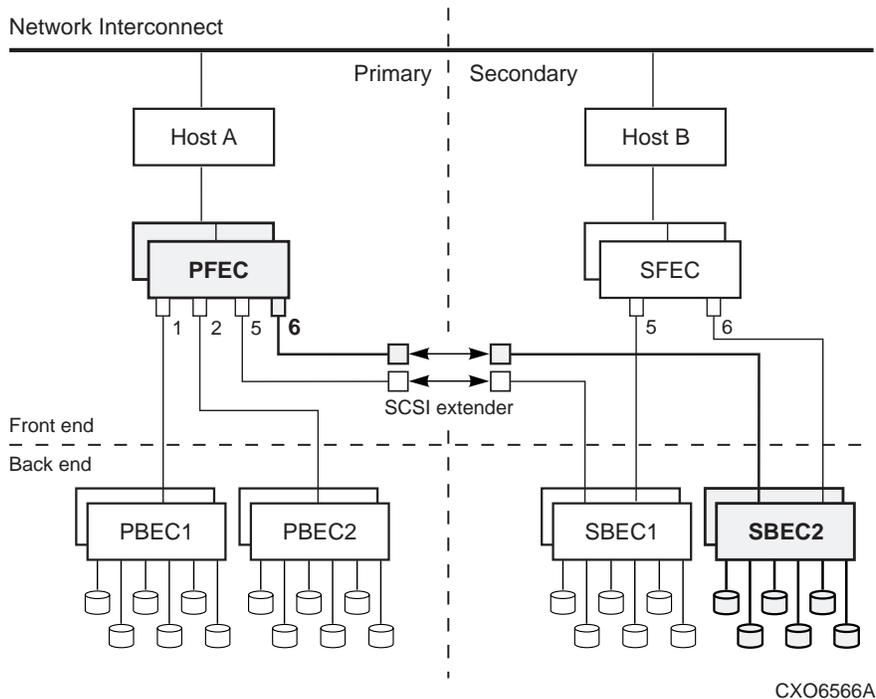
The possible hardware failures are:

- Disk Drive
- Both controller members of SBEC2
- SBE Cabinet hardware including the BA370, EMU, PVA, Power Supplies
- Cables, terminators, tri-link connectors
- PFEC controllers
- DS-DWZZH-21 SCSI Bus 6 hub
- DWZGA SCSI Bus Extender 2

Once the hardware and storage has been restored, issue the RESYNCH comand at the primary site to restore full operation, as shown below.

dtsm> resynch -n -d -<dtsystemname> -a

Figure 4-7 Loss of SCSI Bus 6



4.2.7.1.8 Loss of SCSI Bus 5 and 6

Loss of both SCSI Bus 5 and 6, as shown in, results in the loss of access to secondary site storage.

The possible hardware failures are:

- Multiple Disk Drives
- Both members of SBEC 1 and 2
- SBE Cabinet hardware including the BA370, EMU, PVA, Power Supplies
- PFEC controllers
- DS-DWZZH-21 SCSI Bus 5 and 6 hubs
- DWZGA SCSI Bus Extenders 1 and 2

The operator can choose one of two options.

1. Discontinue operations until the system is restored.

Once the hardware and storage has been restored, issue the RESYNCH comand at the primary site to restore full operation, as shown below.

```
dtsm> resynch -n -d -<dtsystemname> -a
```

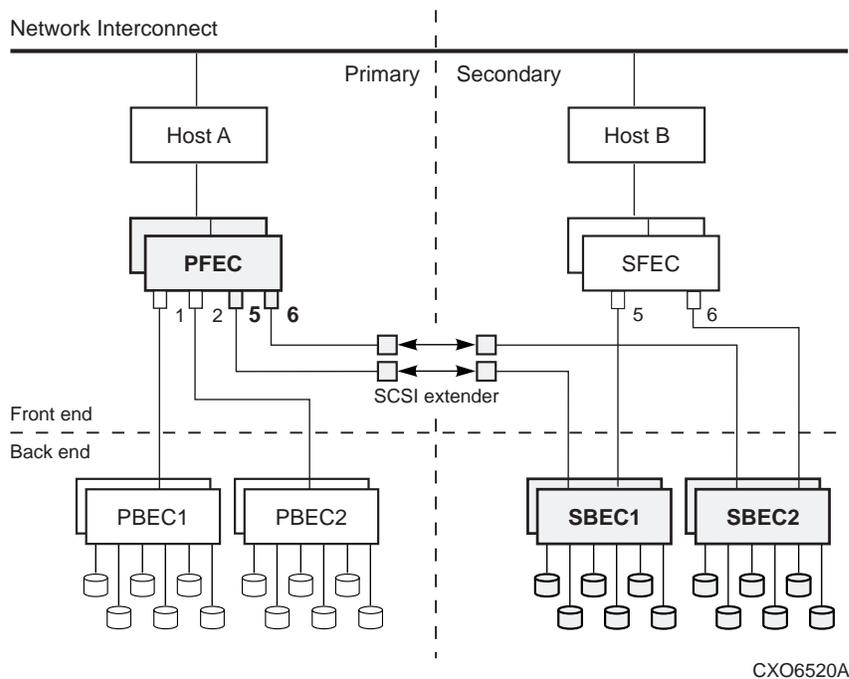
2. Continue degraded operation that is not DT safe.

To continue with degraded operation, the operator must set the DT mirrorset units to the NORMAL mode with the **enable -n -d-<dtsubsystemname> -a** command to continue the application on secondary site storage.

Once the hardware and storage has been restored, issue the RESYNCH comand at the primary site to restore full operation, as shown below.

```
dtsm> resynch -n -d -<dtsystemname> -a
```

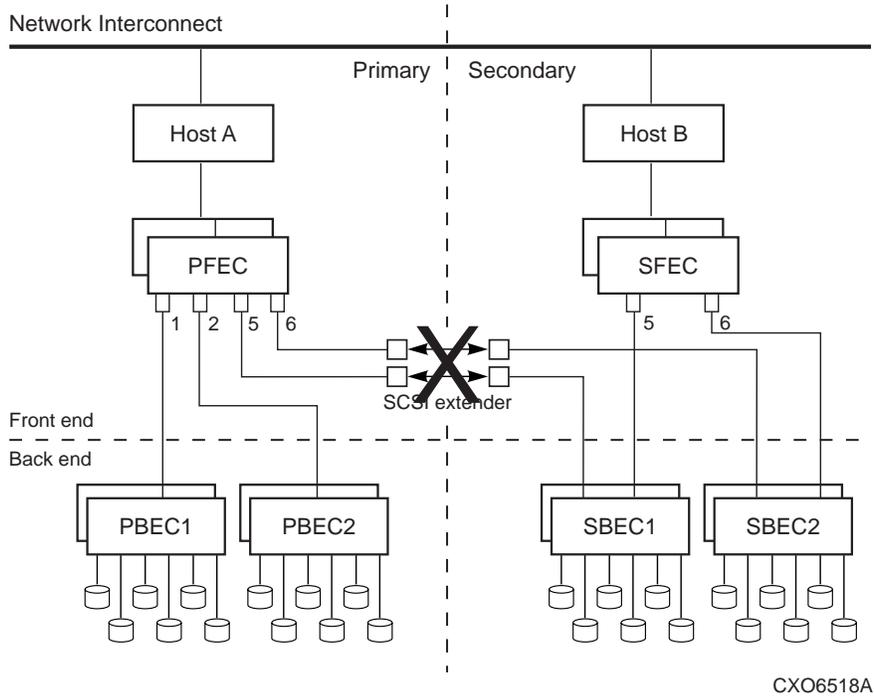
Figure 4-8 Loss of Both SBECs



4.2.7.1.9 Loss of SCSI Extenders

Both SCSI extenders failing, as shown in Figure 4-9, results in the loss of DT with no access to secondary storage. The user must set primary site storage to the NORMAL mode with the **enable -n** command to continue the application on primary site storage. The SCSI extenders must be replaced to restore DT operations.

Figure 4-9 Loss of Both SCSI Extenders

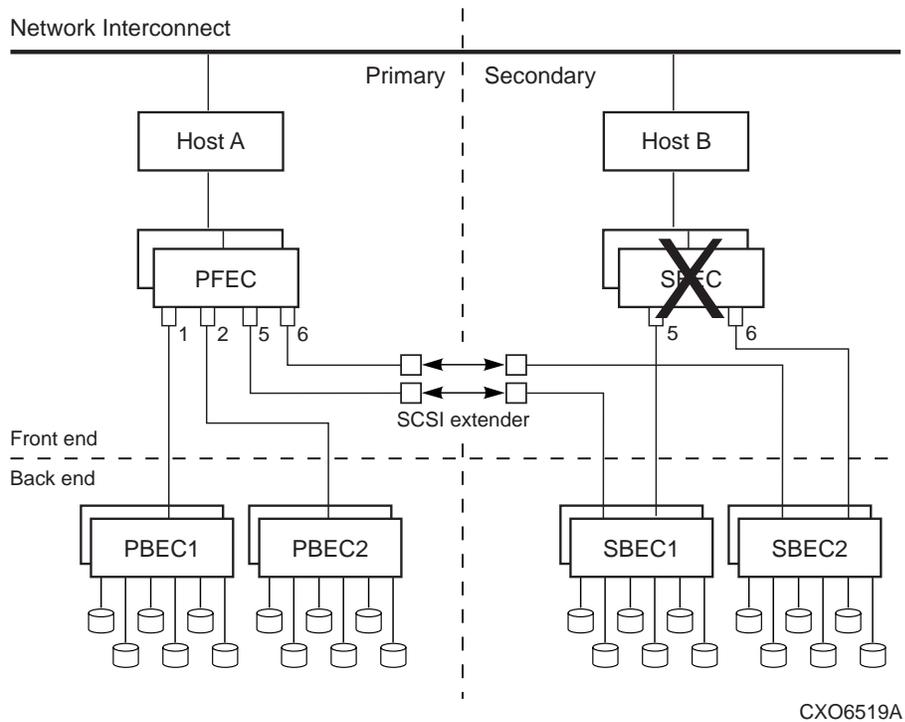


4.2.7.1.10 Loss of SFECs

Loss of a SFEC, as shown in Figure 4-10, can occur either during normal operations, during a failover, or after a failover.

1. If lost during normal operations, notification is sent to the operator and repair actions must be initiated. During this time, the DT storage system is not DT safe. A failover operation is not possible.
2. If lost during a failover, issue the **resynch -fo -d <dtsystemname> -a** command at the secondary site to restore the DT configuration.
3. If lost after a failover, results in the loss of access to storage by the secondary site host. Replace or repair the appropriate hardware, then issue the **resynch -fo -d <dtsystemname> -a** command at the secondary site to restore the DT configuration.

Figure 4-10 Loss of SFEC



4.2.8 Failure at Remote Site after Failover

Failures at the remote site after DT failover are detected the same as in a non-disaster tolerant state. If a failure is detected, ASE/DT notifies the operator of the condition after obtaining the mirrorset status from Command Console. Table 4-1 shows the possible failure modes at the remote site.

Table 4-1 Remote Site DT Failure Modes After Failover

R e m o t e H o s t B	S F E C	S B E C 1	S B E C 2	Failure Mode
X				Loss of remote site.
	X			Loss of access to storage.
		X		Loss of mirrorset, execution continues.
			X	Loss of mirrorset, execution continues.
		X	X	Loss of access to storage.

4.2.8.1 Loss of Remote Host

The operator will be notified that the remote host is not functioning. Repair the remote host. No failover action is required.

4.2.8.2 Lost of SFEC, SBEC1, or SBEC2

If the SFEC, SBEC1, or SBEC2 fails, stop the application and repair immediately. Complete the following steps.

1. Stop processing immediately
2. Repair or replace controllers
3. Recreate the storage, but **DO NOT** init the storage or all data will be lost.
4. At the dtms prompt, issue the following command to add members and initialize:

resynch -fo -d -<dtsystemname> -a

If failures occur that prevent application execution, such as loss of the remote site for any reason or loss of the SFEC or loss of both SBECs, then the application cannot continue until the primary and/or secondary sites are restored. Repair or replace the appropriate hardware.

4.2.9 Loss of Network

If the primary and secondary sites become partitioned then DTSM will notify the operator. In these situations, failover and failback operations are impossible. These problems must be resolved before normal operations can continue.

Network redundancies should help to prevent any network partitions.

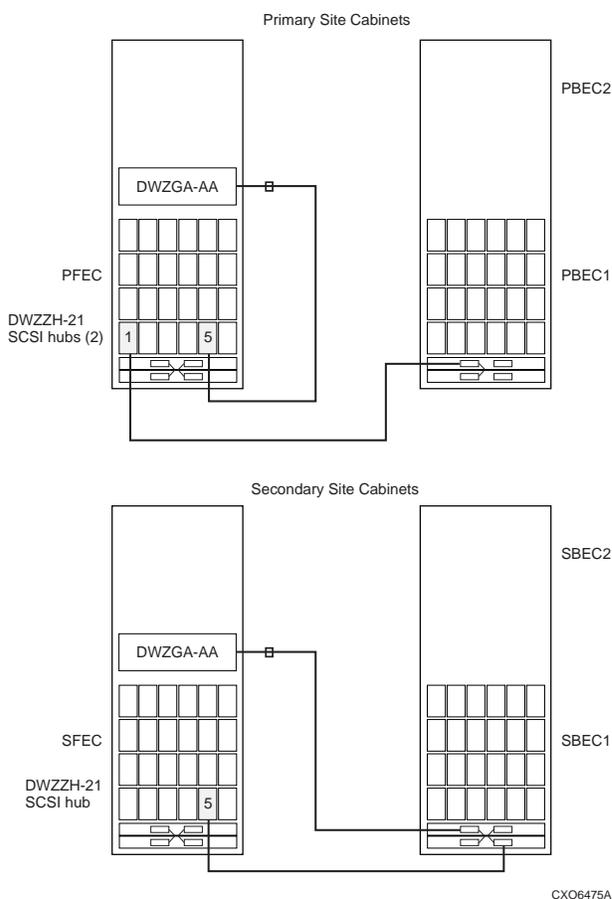
Hardware Components

The following list give the part numbers and quantities of hardware parts in the DT kits. Part numbers and definitions for the 1x1 DT solutions are the following:

- DS-SWXDT-CA — Primary site frontend and backend cabinets, 60Hz.
- DS-SWXDT-DA — Secondary site frontend and backend cabinets, 60Hz.
- DS-SWXDT-CB — Primary site frontend and backend cabinets, 50Hz.
- DS-SWXDT-DB — Secondary site frontend and backend cabinets, 50Hz.

Figure A-1 shows a 1x1 DT configuration block diagram.

Figure A-1 Block Diagram of 1x1 DT Solution

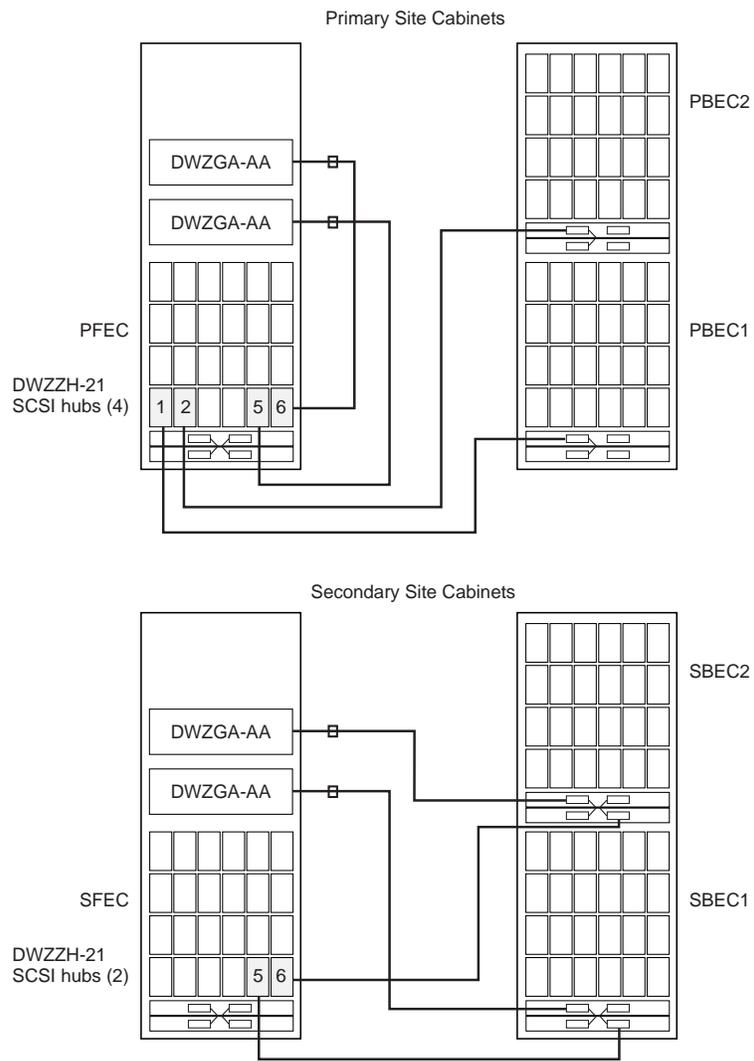


Hardware Components

- DS-SWXDT-AA — Primary site frontend and backend cabinets, 60Hz.
- DS-SWXDT-BA — Secondary site frontend and backend cabinets, 60Hz.
- DS-SWXDT-AB — Primary site frontend and backend cabinets, 50Hz.
- DS-SWXDT-BB — Secondary site frontend and backend cabinets, 50Hz.

Figure A-2 shows a 2x2 DT configuration block diagram.

Figure A-2 Block Diagram of 2x2 DT Solution



CX06442A

1x1 Cabinet Contents

This section lists the cabinet contents of a DS–SWXDT 1x1 DT solution for both the primary and secondary sites. The primary frontend cabinet contents is listed first, followed by the primary backend cabinet contents, followed by the secondary frontend cabinet contents, followed by the secondary backend cabinet contents.

1. 1x1 Primary Frontend Cabinet Contents

One SW600 Datacenter Cabinet with one BA370 Rackmountable enclosure with the following installed:

- Total of two DS–HSZ80–AK HSZ80 redundant RAID controllers with 128MB of cache memory. Each.
- Total of one DS–HS35X–BD dual electronic cache battery (ECB).
- Total of two DS–SW6XP–AA/AB redundant power distribution units (PDU).
- Total of eight DS–BA35X–HH redundant 180 W power supplies.
- Total of two DS–BA35X–HE redundant ac power controller.
- Total of one DS–DWZGA–AA Fiber optic SCSI extender mounted in a rackmount kit.
- Total of two DS–DWZZH–21 SCSI hub assemblies.
- Total of two 17–04377–02 .5M differential SCSI cables.
- Total of two 17–04802–01 1M differential SCSI cables.
- Total of two 17–04377–04 1.5M differential SCSI cables.
- Total of two 17–04377–09 10M differential SCSI cables.
- Total of three 17–04554–01 VHDCI–68 HDM adapters.
- Total of four 12–44100–01 Tri-Link connectors.
- Total of two 12–44101–01 SCSI terminators.

2. 1x1 Primary Backend Cabinet Contents

One SW600 Datacenter Cabinet with one BA370 Rackmountable enclosure with the following installed:

- Total of two DS–HSZ80–AK HSZ80 redundant RAID controllers with 128MB of cache memory, each.
- Total of one DS–HS35X–BD dual electronic cache battery (ECB).
- Total of two DS–SW6XP–AA/AB redundant power distribution units (PDU).
- Total of eight DS–BA35X–HH redundant 180 W power supplies.
- Total of one DS–BA35X–HE redundant ac power controller.
- Total of one 17–04377–02 .5M differential SCSI cables.
- Total of two 12–44100–01 Tri-Link connectors.
- Total of one 12–44101–01 SCSI terminator.

3. 1x1 Secondary Frontend Cabinet Contents

One SW600 Datacenter Cabinet with one BA370 Rackmountable enclosure with the following installed:

- Total of two DS-HSZ80-AK HSZ80 redundant RAID controllers with 128MB of cache memory, each.
- Total of one DS-HS35X-BD dual electronic cache battery (ECB).
- Total of two DS-SW6XP-AA/AB redundant power distribution units (PDU).
- Total of eight DS-BA35X-HH redundant 180 W power supplies.
- Total of two DS-BA35X-HE redundant ac power controllers.
- Total of one DS-DWZGA-AA Fiber optic SCSI extender mounted in a rackmount kit.
- Total of one DS-DWZZH-21 SCSI hub assembly.
- Total of two 17-04377-02 .5M differential SCSI cables.
- Total of one 17-04802-01 1M differential SCSI cable.
- Total of two 17-04377-04 1.5M differential SCSI cables.
- Total of two 17-04377-09 10M differential SCSI cables.
- Total of three 17-04554-01 VHDCI-68 HDM adapters.
- Total of four 12-44100-01 Tri-Link connectors.
- Total of two 12-44101-01 SCSI terminators.

4. 1x1 Secondary Backend Cabinet Contents

One SW600 Datacenter Cabinet with one BA370 Rackmountable enclosure with the following installed:

- Total of two DS-HSZ80-AK HSZ80 redundant RAID controllers with 128MB of cache memory, each.
- Total of one DS-HS35X-BD dual electronic cache battery (ECB).
- Total of two DS-SW6XP-AA/AB redundant power distribution units (PDU).
- Total of eight DS-BA35X-HH redundant 180 W power supplies.
- Total of two DS-BA35X-HE redundant ac power controllers.
- Total of two 17-04377-02 .5M differential SCSI cables.
- Total of four 12-44100-01 Tri-Link connectors.
- Total of two 12-44101-01 SCSI bus terminators.

2x2 Cabinet Contents

This section lists the cabinet contents of a DS–SWXDT 2x2 DT solution for both the primary and secondary sites. The primary frontend cabinet contents is listed first, followed by the primary backend cabinet contents, followed by the secondary frontend cabinet contents, followed by the secondary backend cabinet contents.

1. 2x2 Primary Frontend Cabinet Contents

One SW600 Datacenter Cabinet with one BA370 Rackmountable enclosure with the following installed:

- Total of two DS–HSZ80–AK HSZ80 redundant RAID controllers with 128MB of cache memory, each.
- Total of one DS–HS35X–BD dual electronic cache battery (ECB).
- Total of two DS–SW6XP–AA/AB redundant power distribution units (PDU).
- Total of eight DS–BA35X–HH redundant 180 W power supplies.
- Total of two DS–BA35X–HE redundant ac power controllers.
- Total of two DS–DWZGA–AA Fiber optic SCSI extenders mounted in rackmount kits.
- Total of four DS–DWZZH–21 SCSI hub assemblies.
- Total of two 17–04377–02 .5M differential SCSI cables.
- Total of four 17–04802–01 1M differential SCSI cables.
- Total of four 17–04377–04 1.5M differential SCSI cables.
- Total of two 17–04377–09 10M differential SCSI cables.
- Total of four 17–04554–01 VHDCI–68 HDM adapters.
- Total of four 12–44100–01 Tri-Link connectors.
- Total of two 12–44101–01 SCSI terminators.

2. 2x2 Primary Backend Cabinet Contents

One SW600 Datacenter Cabinet with two BA370 Rackmountable enclosures with the following installed in each.

- Total of two DS–HSZ80–AK HSZ80 redundant RAID controllers with 128MB of cache memory, each.
- Total of two DS–HS35X–BD dual electronic cache batteries (ECB).
- Total of two DS–SW6XP–AA/AB redundant power distribution units (PDU).
- Total of 16 DS–BA35X–HH redundant 180 W power supplies.
- Total of four DS–BA35X–HE redundant ac power controllers.
- Total of two 17–04377–02 .5M differential SCSI cables.
- Total of two 12–44100–01 Tri-Link connectors.
- Total of two 12–44101–01 SCSI terminator.

3. 2x2 Secondary Frontend Cabinet Contents

One SW600 Datacenter Cabinet with one BA370 Rackmountable enclosure with the following installed:

- Total of two DS-HSZ80-AK HSZ80 redundant RAID controllers with 128MB of cache memory, each.
- Total of one DS-HS35X-BD dual electronic cache battery (ECB).
- Total of two DS-SW6XP-AA/AB redundant power distribution units (PDU).
- Total of eight DS-BA35X-HH redundant 180 W power supplies.
- Total of two DS-BA35X-HE redundant ac power controllers.
- Total of two DS-DWZGA-AA Fiber optic SCSI extender mounted in rackmount kits.
- Total of two DS-DWZZH-21 SCSI hub assemblies.
- Total of two 17-04377-02 .5M differential SCSI cables.
- Total of two 17-04802-01 1M differential SCSI cable.
- Total of four 17-04377-04 1.5M differential SCSI cables.
- Total of two 17-04377-09 10M differential SCSI cables.
- Total of four 17-04554-01 VHDCI-68 HDM adapters.
- Total of four 12-44100-01 Tri-Link connectors.
- Total of two 12-44101-01 SCSI terminators.

4. 2x2 Secondary Backend Cabinet Contents

One SW600 Datacenter Cabinet with two BA370 Rackmountable enclosures with the following installed in each:

- Total of two DS-HSZ80-AK HSZ80 redundant RAID controllers with 128MB of cache memory, each.
- Total of two DS-HS35X-BD dual electronic cache batteries (ECB).
- Total of two DS-SW6XP-AA/AB redundant power distribution units (PDU).
- Total of 16 DS-BA35X-HH redundant 180 W power supplies.
- Total; of four DS-BA35X-HE redundant ac power controllers.
- Total of eight 12-44100-01 Tri-Link connectors.
- Total of four 12-44101-01 SCSI terminators.

Refer to the *DIGITAL StorageWorks Ultra SCSI RAID Enclosure (BA370-Series) User's Guide (EK-BA370-UG)* for detailed information on components installed in a BA370 enclosure. Refer to the *DIGITAL StorageWorks HSZ80 Array Controller User's Guide (EK-HSZ80-UG)* for detailed information about the HSZ80 array controller.

DTSM CLI Commands

DTSM CLI Commands and Usage

This section explains the DTSM CLI commands and how to use them with a DT system.

DTSM CLI Interface and Commands

You must be logged in as a root user to use the DTSM CLI commands. The DTSM CLI consists of a looping parser waiting for command input from the user. Any command input is parsed, then executed. The CLI then waits for more user input. The DTSM CLI interface is accessed by typing **dtsm** at the Digital UNIX (DU) prompt. The dtsm prompt **dtsm>** is returned.

Note

The only method of stopping execution of a DTSM command is to stop and restart the DTSM agent. At the UNIX prompt, issue the following command:

/opt/dtsm/bin/dtsminit stop

Aborting a DTSM command could leave your DT system in a misconfigured or unknown state.

The following is a list of DTSM user interface CLI commands. Proper syntax is observed.

1. **Configure** — This command configures the DTSM agent with all the pertinent information that defines the DT system, thus creating the DT configuration file. DTSM uses the DT configuration file during startup to establish communications with DTSM components and to determine the status of DT storage subsystems. Configure does not configure the storage subsystem, SWCC or the array controller software CLI is used for that purpose. To configure the DTSM agent:

configure

To configure a DT subsystem, use the following command:

configure -d <dtsystemname>

2. **Connect** — This command allows an operator to connect to the DTSM agent on a specified host. You must issue this command prior to executing an other commands. The syntax for the connect command is as follows:

connect -h <host>

here the host qualifier is either the secondary or primary site host name.

3. Disconnect — This command allows an operator to disconnect from a DTSM agent. The syntax for the disconnect command is as follows:

disconnect

4. Enable — This command effectively allows you to change the error_mode on a DT mirrorset unit. There are two error modes, NORMAL and FAILSAFE. NORMAL allows an operator to instruct the primary site controller to continue data processing at the primary site after the mirrorset unit is no longer DT safe. FAILSAFE allows an operator to instruct the primary site controller to stop I/O processing. The syntax for both types of error modes is as follows:

enable -n -d <dtsystemname> -u unit1, unit2, unit3, ... unit

enable -f -d <dtsystemname> -u unit1, unit2, unit3, ... unit

where **-n** equates to NORMAL mode and **-f** equates to FAILSAFE mode, and **unit** is the device unit for mirrorsets that are being changed from one error mode to another.

Note

Use **unit a** in place of **unit n** when you want all units.

5. Exit — This command exits DTSM. Syntax is as follows

exit

6. Failback — This command allows an operator to manually failback storage from the secondary site to the primary site. The failback command must be used in conjunction with the connect and disconnect commands. The sequence and syntax for all these commands is as follows:

failback -d <dtsystemname>

7. Failover — This command allows an operator to manually failover primary site storage to the secondary site. The failover command must be used in conjunction with the connect and disconnect commands. The sequence and syntax for all these commands is as follows:

failover -d <dtsystemname>

8. resynch — This command is used to rebuild or resynch a DT mirrorset after a mirrorset member or members have dropped out of a mirrorset, or after a failover or failback operation where the operation failed to create all the mirrorsets. The resynch command syntax varies depending on its usage.

resynch -n -d <dtsystemname> -u unit1,unit2,unit3,...unit

The above use of the resynch command resynchs a DT mirrorset on the primary site FEC in normal mode after a loss of a DT mirrorset member or members, where **-n** equates to NORMAL mode, **-d** is the DTSystemname, and **-u** equates to mirrorset member's unit numbers.

resynch -fo -d <dtsystemname> -u unit1,unit2,unit3,...unit

The above use of the resynch command resynchs a DT mirrorset at the secondary FEC after a failover operation failed to create all the DT mirrorsets, where **-fo** equates to a failover operation, **-d** is the DTSystemname, and **-u** equates to mirrorsets member's unit numbers.

resynch -fb -d <dtsystemname> -u unit1,unit2,unit3,...unit

The above use of the `resynch` command resynchs a DT mirrorset at the primary site FEC after a failback operation has failed to create all DT mirrorsets, where `-fb` equates to a failback operation, `-d` is the DTSystemname, and `-u` equates to mirrorsets member's unit numbers.

To perform a resynch on all DT mirrorsets, use the `-a` flag instead of the `-u` flag with its unit number qualifiers, with all three uses of the `resynch` command, for example;

resynch -n -d <dtsystemname> -a

9. `reset` — This command makes devices connected to the SBEC visible to the PFEC or SFEC(s). In NORMAL mode, the devices are made visible to the PFEC. In FAILOVER mode, the devices are made visible to the SFEC. Syntax for the `reset` command follows.

reset -n -d <dtsystemname>

The above resets the SBEC for the named DT system, where `-n` equates to NORMAL mode and `-d` is the DTSystemname. Use the above if a failover operation fails before any mirrorset were created on the secondary site.

reset -fo -d DTSystemname

The above resets the SBEC for the named DT system, where `-fo` equates to FAILOVER mode and `-d` is the DTSystemname. Use the above if a failback operation fails before any mirrorsets were created on the primary site.

The `-fo` and `-n` flags are mutually exclusive with the `reset` command.

10. `Help` — This command offers help on all other DTSM commands.
11. `Show` — This command shows a DT system status in one of two ways.

show -a

shows basic DTSM agent information, while

show -s -d <dtsystemname>

shows current DT system status on the host connected to that agent.

Using DTSM

This section explains how to use the DTSM CLI commands on a DT system.

Using the connect Command

The first DTSM operations a user performs is to connect to the DTSM agent residing on either the primary or secondary host. At the `dtsm>` prompt enter;

connect -h hostname

The `dtsm>` prompt changes to notify you that you are now on the desired host system. For example;

dtsm hostname>

Entering a **show -a** at the `dtsm hostname>` prompt displays status information about the DTMS agent at the site designated by the **connect -h hostname** command similar to the following example:

```
-----
Monitor Interval      : 300
Notification Script Path : notify_scp
Log File Path        : /var/dtsm/dtsm_25-6-25-98:8:51:2.log
```

DTSM CLI Commands

```
DT Systems          : cxo
```

Using the show Command

To show status and configuration information about the actual DT system, enter the following at the `dtsm>` prompt:

show -d cxo

Where `cxo` is the `DTSYSTEMNAME` of a DT system. A display similar to the following is returned:

```
DT System: DTcxo
```

```
-----  
Type: Stacked
```

```
Failure type: Cold
```

```
Checksum: 145268
```

```
Status: 0
```

```
Primary Host List
```

```
-----  
Host: host1.cxo.dec.com
```

```
-----  
Internet address: 12.12.12.12
```

```
Type: Primary
```

```
Secondary Host List
```

```
-----  
Host: host2.cxo.dec.com
```

```
-----  
Internet address: 23.23.23.23
```

```
Type: Secondary
```

```
Stacked Subsystem
```

```
-----  
PFEC: cxo.host1.pfec
```

```
SFEC: cxo.host2.sfec
```

```
PBEC List:
```

```
-----  
cxo.host1.pbec1
```

cxo.host1.pbec2

SBEC List:

cxo.host2.sbec1

cxo.host2.sbec2

FEC DT Mirrorset List:

Storageset: M100

Unit: See partition information below.

Type: mirrorset

Membership: null

State: null

Disks (may not match physical configuration if disks have dropped out of mirrorset):

DISK10100

DISK20100

DISK50100

DISK60100

Partitions:

Partition: 1

Device: D100

Size (%): 10

Partition: 2

Device: D101

Size (%): 20

Partition: 3

Device: D102

DTSM CLI Commands

Size (%): 25

Partition: 4

Device: D103

Size (%): 45

Status: 0

StorageSet: M200

Unit: D200

Type: mirrorset

Membership: null

State: null

Disks (may not match physical configuration if disks have dropped out of mirrorset):

DISK10200

DISK20200

DISK50200

DISK60200

Partitions:

Status: 0

StorageSet: M300

Unit: D300

Type: mirrorset

Membership: null

State: null

Disks (may not match physical configuration if disks have dropped out of mirrorset):

DISK10300

DISK20300

DISK50300

DISK60300

Partitions:

Status: 0

Storageset: M301

Unit: D301

Type: mirrorset

Membership: null

State: null

Disks (may not match physical configuration if disks have dropped out of mirrorset):

DISK10301

DISK20301

DISK50301

DISK60301

Partitions:

Status: 0

Storageset: M302

Unit: D302

Type: mirrorset

Membership: null

State: null

Disks (may not match physical configuration if disks have dropped out of mirrorset):

DISK10302

DISK20302

DISK50302

DISK60302

Partitions:

Status: 0

BEC JBOD List:

JBOD: DISK10200

Unit: D300

JBOD: DISK20200

DTSM CLI Commands

Unit: D301

JBOD: DISK30200

Unit: D302

JBOD: DISK10300

Unit: D900

BEC StorageSet List:

StorageSet: M1

Unit: D200

Type: mirrorset

Membership: null

State: null

Disks (may not match physical configuration if disks have dropped out of mirrorset):

DISK10100

DISK20100

DISK30100

Partitions:

Status: 0

StorageSet: R1

Unit: D100

Type: raidset

Membership: null

State: null

Disks (may not match physical configuration if disks have dropped out of mirrorset):

DISK10000

DISK20000

DISK30000

Partitions:

Status: 0

DTSM host1>

 To show status of the backend controllers and of the DT mirrorsets, enter the following command at the dtsm>hostname prompt:

show -s -d cxo

A display similar to the following is returned:

 STATUS FOR SYSTEM: cxo

Back End Controller Status

=====

cxo.host1.pbec1 Normal
 cxo.host1.pbec2 Normal
 cxo.host2.sbec1 Normal
 cxo.host2.sbec2 Normal

Mirrorsets

=====

Name: M100
 MEMBERSHIP = 4, 4 members present
 State: NORMAL
 LOCAL DISK10100 (member 0) is NORMAL
 LOCAL DISK20100 (member 1) is NORMAL
 REMOTE DISK50100 (member 2) is NORMAL
 REMOTE DISK60100 (member 3) is NORMAL

Name: M200

MEMBERSHIP = 4, 4 members present
 State: NORMAL
 LOCAL DISK10200 (member 0) is NORMAL
 LOCAL DISK20200 (member 1) is NORMAL
 REMOTE DISK50200 (member 2) is NORMAL
 REMOTE DISK60200 (member 3) is NORMAL

DTSM CLI Commands

Name: M300

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10300 (member 0) is NORMAL

LOCAL DISK20300 (member 1) is NORMAL

REMOTE DISK50300 (member 2) is NORMAL

REMOTE DISK60300 (member 3) is NORMAL

Name: M301

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10301 (member 0) is NORMAL

LOCAL DISK20301 (member 1) is NORMAL

REMOTE DISK50301 (member 2) is NORMAL

REMOTE DISK60301 (member 3) is NORMAL

Name: M302

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10302 (member 0) is NORMAL

LOCAL DISK20302 (member 1) is NORMAL

REMOTE DISK50302 (member 2) is NORMAL

REMOTE DISK60302 (member 3) is NORMAL

DTSM host1>

Using the failover Command

When you are notified that a failover operation must be performed due to unreliable storage at the primary site, you must first connect to the secondary site host before performing the failover operation. Enter the **connect -h secondaryhost** command at the dtsm>prompt. For example:

```
DTSM>connect -h host2
```

You are notified when the connect is successful with the following message:

```
CONNECT: Successful to host HOST2.
```

Enter the **show -s -d DTSystemname** command to show the status of the secondary site DT system. For example:

```
show -s -d Systemname
```

A display similar to the following is returned. Notice that only SBEC1 and SBEC2 are displayed with an absence of DT mirrorsets, indicating that you are on the secondary site DT system.

Back End Controller Status

```
=====
cxo.host2.sbec1   Normal
cxo.host2.sbec2   Normal
```

Mirrorsets

NONE

Now enter the **failover -d DTSystemname** command at the `dtsm>hostname` prompt as follows:

DTSM host2>**failover -d cxo**

The following information is returned:

```
Has all the I/O to the Primary Front End Controller (PFEC)
been terminated? [Y/N]> y
```

Please be patient, this command takes 12+ minutes to complete on a 2X2 DT system and 8+ minutes on a 1X1 DT system.

Look at the Console Log window for progress of this operation.

SUCCESS: FAILOVER completed successfully.

DTSM host2>

Notification messages similar to the following are displayed on the console terminal during the failover operation.

```
StorageWorks DTSM Notification on Thu Jun 25 09:32:27 MDT 1998
Beginning failover operation for cxo DT System
```

```
StorageWorks DTSM Notification on Thu Jun 25 09:32:44 MDT 1998
Failing over the cxo.host2.sbec1 Secondary Backend Controller.
This operation takes time, please be patient...
```

DTSM CLI Commands

StorageWorks DTSM Notification on Thu Jun 25 09:32:51 MDT 1998

Failing over the cxo.host2.sbec2 Secondary Backend Controller.

This operation takes time, please be patient...

StorageWorks DTSM Notification on Thu Jun 25 09:37:36 MDT 1998

Failing over the cxo.host2.sfec Secondary Frontend Controller.

StorageWorks DTSM Notification on Thu Jun 25 09:44:12 MDT 1998

Failover operation for cxo DT System completed.

Using the failback Command

To perform a failback operation, you must first connect to the primary site host with the following command:

connect -h primarysitehost

Now enter the failback command at the dtsm hostname> prompt as follows:

failback -d dtssystemname

The following information is returned after entering the command:

Has all the I/O to the Secondary Front End Controller (SFEC)

been terminated? [Y/N]> y

Please be patient, this operation takes 30+ minutes to complete
on a 2X2 DT system and 15+ minutes on a 1X1 DT system.

Look at the Console Log window for status of this operation.

SUCCESS: FAILBACK completed successfully.

The following are notification messages displayed on the console terminal during the failback operation.

CONSOLE OUTPUT

StorageWorks DTSM Notification on Thu Jun 25 09:48:43 MDT 1998

Beginning failback operation for cxo DT System

StorageWorks DTSM Notification on Thu Jun 25 09:49:53 MDT 1998

Primary front end controllers are being rebooted, this will take about four (4) minutes...

StorageWorks DTSM Notification on Thu Jun 25 09:59:32 MDT 1998

Failing back the Secondary Front End Controller

StorageWorks DTSM Notification on Thu Jun 25 09:59:33 MDT 1998

Beginning failback operation for cxo DT System Secondary Front End Controller
r Be patient, it may take a long time to complete...

StorageWorks DTSM Notification on Thu Jun 25 09:59:58 MDT 1998

Failing back the cxo.host2.sfec Secondary Frontend Controller.

StorageWorks DTSM Notification on Thu Jun 25 10:02:50 MDT 1998

Failing back the cxo.host2.sbec1 Secondary Backend Controller.

StorageWorks DTSM Notification on Thu Jun 25 10:02:57 MDT 1998

Failing back the cxo.host2.sbec2 Secondary Backend Controller.

StorageWorks DTSM Notification on Thu Jun 25 10:05:06 MDT 1998

Failback operation on the Secondary Front End Controller completed...

StorageWorks DTSM Notification on Thu Jun 25 10:05:14 MDT 1998

Primary front end controllers being rebooted, this will take about four (4) minutes...

StorageWorks DTSM Notification on Thu Jun 25 10:18:14 MDT 1998

Failback operation complete.

Using the configure Command

Configuring the DTSM agent and the DT system are two operations user will perform. To configure the DTSM agent, enter the following at the dtsm> prompt:

dtsm> configure

A display is returned similar to the following:

WARNING: config.ini does not currently exist on this system.

A new file will be created...

DTSM CLI Commands

```
MonitorInterval> 300
NotificationScript (filename only)> notify.scp
Password> foobar
SWCCPassword> fishtail
```

Use the configure command again if you wish to check the data you just entered for accuracy.

To configure a DT system, enter the following at the dtsm prompt>;

```
configure -d dtSystemname
```

The following is an example script of a DTSM configure:

```
DTSM> configure -d cxo
```

```
Is this host, fwlbal.cxo.dec.com, the primary host
for this new DT system? [Yes or No]> yes
```

WARNING: cxo.ini does not currently exist on this system.

A new file will be created...

```
System Type, [S]tacked or [P]eerToPeer> s
Failure Type, [H]ot or [C]old> c
```

NOTE: HostNames and IP Addresses will be stored to the configuration file just as you typed them! This information will be used for later validation of your configuration so be sure to verify for accuracy before hitting return. Use FULLY QUALIFIED host names, for example: >LITNG.YS0.DEC.COM

```
Primary HostName> fwlbal.cxo.dec.com
Primary Host's IP Address> 16.82.112.207
```

```
Secondary HostName> berry.cxo.dec.com
Secondary Host's IP Address> 16.82.16.160
```

```
Next HostName [return if finished]>
```

Enter the number of PRIMARY Backend Controllers
present on this system, maximum of two allowed> 2

Attempting to connect to SWCC, please wait...

Connection to SWCC established, obtaining controller configurations.

cxo.ini has been successfully created on this system.

IMPORTANT(!): This file MUST be copied to the appropriate directory,
(/opt/dtss/etc), on EACH host identified in this DT System.

DTSM>Using the reset Command

Use the reset command to reset the backend controllers from the SBEC if a failover or failback command failed to complete.

If a failback operation fails and you want to restart it, you must reset the secondary backend controllers. Use the following command:

DTSM host2>**reset -fo -d cxo**

A message is returned similar to the following:

```
-----
Are you sure you want to reset the Secondary Backend Controllers? [Y/N]> y
Please be patient, this operation takes 10+ minutes to complete.
```

SUCCESS: RESET completed successfully.

If a failover operation fails and you want to restart it, you must reset the secondary backend controllers. Use the following command:

DTSM host2>**reset -n -d cxo**

A message is returned similar to the following:

```
-----
Are you sure you want to reset the Secondary Backend Controllers? [Y/N]> y
Please be patient, this operation takes 10+ minutes to complete.
```

SUCCESS: RESET completed successfully.

Using the resynch Command

Loss of a DT mirrorset member requires the resynch command to rebuild the DT mirrorset. As an example, when an SBEC is lost, the following notification message is displayed on the console terminal:

StorageWorks DTSM Notification Wed Jul 01 14:43:13 MDT 1998

On subsystem cxo.host1or2.pfec the following components require attention:

Disk disk50100

Disk disk50200

Disk disk50300

Lun D100 storageset is in a reduced state.

Lun D101 storageset is in a reduced state.

Lun D102 storageset is in a reduced state.

Lun D103 storageset is in a reduced state.

Lun D200 storageset is in a reduced state.

Lun D300 storageset is in a reduced state.

Lun D301 storageset is in a reduced state.

Lun D302 storageset is in a reduced state.

If you execute the following show command, the secondary backend controller is listed as unavailable under the Back End Controller Status section of the display and that the remote mirrorset members are missing from the Mirrorsets section of the display, indicating the failure of the SBECs.

DTSM host1>**show -s -d cxo**

The following is returned:

STATUS FOR SYSTEM: cxo

Back End Controller Status

=====

cxo.host1.pbec1 Normal

cxo.host1.pbec2 Normal

cxo.host2.sbec1 Unavailable

cxo.host2.sbec2 Normal

Mirrorsets

=====

Name: M100

MEMBERSHIP = 4, 3 members present

State: REDUCED

LOCAL DISK10100 (member 0) is NORMAL

LOCAL DISK20100 (member 1) is NORMAL

REMOTE DISK 50100 (member 3) is NORMAL

Name: M200

MEMBERSHIP = 4, 3 members present

State: REDUCED

LOCAL DISK10200 (member 0) is NORMAL

LOCAL DISK20200 (member 1) is NORMAL

REMOTE DISK 50100 (member 3) is NORMAL

Name: M300

MEMBERSHIP = 4, 3 members present

State: REDUCED

LOCAL DISK10300 (member 0) is NORMAL

LOCAL DISK20300 (member 1) is NORMAL

REMOTE DISK 50100 (member 3) is NORMAL

Name: M301

MEMBERSHIP = 4, 3 members present

State: REDUCED

LOCAL DISK10301 (member 0) is NORMAL

LOCAL DISK20301 (member 1) is NORMAL

REMOTE DISK 50100 (member 3) is NORMAL

Name: M302

MEMBERSHIP = 4, 3 members present

State: REDUCED

LOCAL DISK10302 (member 0) is NORMAL

DTSM CLI Commands

```
LOCAL DISK20302 (member 1) is NORMAL
REMOTE DISK 50100 (member 3) is NORMAL
```

```
DTSM host1>
```

Enter the **resynch** command as follows to rebuild the lost mirrorset members.

```
DTSM host1>resynch -n -d cxo -a
```

Enter the **show -s -d cxo** command as shown below.

```
DTSM host1>show -s -d cxo
```

In the resulting display, the SBECs are now shown as Normal under the Back End Controller Status section of the display and the REMOTE mirrorset members are now listed and shown as NORMAL under the Mirrorsets section of the display.

```
STATUS FOR SYSTEM: cxo
```

```
Back End Controller Status
```

```
=====
```

```
cxo.host1.pbec1  Normal
cxo.host1.pbec2  Normal
cxo.host2.sbec1  Normal
cxo.host2.sbec2  Normal
```

```
Mirrorsets
```

```
=====
```

```
Name: M100
```

```
MEMBERSHIP = 4, 4 members present
```

```
State: RECONSTRUCTING
```

```
LOCAL DISK10100 (member 0) is NORMAL
```

```
LOCAL DISK20100 (member 1) is NORMAL
```

```
REMOTE DISK50100 (member 2) is NORMAL
```

```
REMOTE DISK60100 (member 3) is COPYING 74% complete
```

```
Name: M200
```

```
MEMBERSHIP = 4, 4 members present
```

```
State: NORMAL
```

```
LOCAL DISK10200 (member 0) is NORMAL
```

```
LOCAL DISK20200 (member 1) is NORMAL
```

REMOTE DISK50200 (member 2) is NORMAL
 REMOTE DISK60200 (member 3) is NORMAL

Name: M300

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10300 (member 0) is NORMAL
 LOCAL DISK20300 (member 1) is NORMAL
 REMOTE DISK50300 (member 2) is NORMAL
 REMOTE DISK60300 (member 3) is NORMAL

Name: M301

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10301 (member 0) is NORMAL
 LOCAL DISK20301 (member 1) is NORMAL
 REMOTE DISK50301 (member 2) is NORMAL
 REMOTE DISK60301 (member 3) is NORMAL

Name: M302

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10302 (member 0) is NORMAL
 LOCAL DISK20302 (member 1) is NORMAL
 REMOTE DISK50302 (member 2) is NORMAL
 REMOTE DISK60302 (member 3) is NORMAL

DTSM host1>

 There are two notification messages displayed on the console terminal after resynch completes. The first is displayed when all mirrorset members have normalized and is similar to the following:

 StorageWorks DTSM Notification Wed Jul 01 14:18:47 MDT 1998
 All cxo DT System mirrorsets have normalized after
 completion of failback/resynch operation.

DTSM CLI Commands

The second notification message displayed on the console terminal is when all mirrorsets have been set to FAILSAFE error mode and is similar to the following:

```
-----  
StorageWorks DTSM Notification  Wed Jul 01 14:19:32 MDT 1998  
All cxo DT System mirrorset units have been set to failsafe mode after  
completion of failback/resynch operation.  
-----
```

Using the enable Command

The enable command allows you to change the error mode of a device from FAILSAFE to NORMAL. This allows the continuation of data processing on mirror units set to NORMAL in the event that too many mirrorset members are lost. Data processing can still be allowed on NORMAL disks, but the DT mirror unit is no longer considered DT safe.

For this example, a DT mirrorset unit, D301, loses the two remote members. Notification messages are displayed on the console terminal similar to the following:

```
-----  
StorageWorks DTSM Notification  Wed Jul 01 15:04:09 MDT 1998  
On subsystem cxo.host2.sbec2 the following components require attention:  
Disk disk20200
```

```
StorageWorks DTSM Notification  Wed Jul 01 15:04:02 MDT 1998  
On subsystem cxo.host2.sbec1 the following components require attention:  
Disk disk20200
```

```
StorageWorks DTSM Notification  Wed Jul 01 15:14:44 MDT 1998  
On subsystem cxo.host1.pfec the following components require attention:  
Lun D301 storageset is in a reduced state.
```

Enter the HSZ80 controller CLI command **show d301** on the terminal connected to the HSZ80 controller serial line maintenance port as follows:

```
PFECA>
```

A display similar to the following is returned

```
-----  
LUN                Uses  
=====            =====  
D301                M301  
LUN ID: 0000-0000-0000-0000-0001-3283-7456-0847  
Switches:  
RUN                NOWRITE_PROTECT    READ_CACHE
```

```

READAHEAD_CACHE
MAXIMUM_CACHED_TRANSFER_SIZE = 32
ERROR_MODE = FAILSAFE
Access:
  Access path = ALL
State:
  INOPERATIVE
  Unit failsafe locked
  PREFERRED_PATH = THIS_CONTROLLER
Size: NOT YET KNOWN
Geometry (C/H/S): ( 526 / 20 / 169 )

```

Notice that under the State section of the display you see INOPERATIVE and Unit failsafe locked indicating that unit d301 has lost its remote mirrorset members.

To allow continued access to the D301 DT mirrorset unit for data processing, enter the following command at the dtsm> prompt:

```
DTSM host1>enable -n -d cxo -u d301
```

This changes the error mode to NORMAL, allowing data processing to continue although the DT system is no longer DT safe. Re-entering the **show d301** command on the terminal connected to the serial line maintenance port of the HSZ80 controller returns a display similar to the following, showing the error mode set to NORMAL and the mirrorset is listed as ON-LINE to this controller under the State section of the display:

```
PFECA> show d301
```

```

-----
LUN                               Uses
=====                           =====
D301                               M301
LUN ID: 0000-0000-0000-0000-0001-3283-7456-0847
Switches:
  RUN                NOWRITE_PROTECT    READ_CACHE
  READAHEAD_CACHE
  MAXIMUM_CACHED_TRANSFER_SIZE = 32
  ERROR_MODE = NORMAL
Access:
  Access path = ALL
State:

```

DTSM CLI Commands

ON-LINE to this controller

Not reserved

PREFERRED_PATH = THIS_CONTROLLER

Size: 1776472 blocks

Geometry (C/H/S): (526 / 20 / 169)

PFECA>

Entering **show -s -d cxo** as shown below shows status for the DT system cxo. Under the Mirrorsets section of the display, mirrorset unit M301 is shown with the mirrorset in a reduced state, but accessible to the controller, and with the absence of any REMOTE members. Notice how all other mirrorset members are shown with their State as NORMAL and with REMOTE mirrorset members.

DTSM host1>**show -s -d cxo**

STATUS FOR SYSTEM: cxo

Back End Controller Status

=====

cxo.host1.pbec1 Normal

cxo.host1.pbec2 Normal

cxo.host2.sbec1 Normal

cxo.host2.sbec2 Normal

Mirrorsets

=====

Name: M100

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10100 (member 0) is NORMAL

LOCAL DISK20100 (member 1) is NORMAL

REMOTE DISK60100 (member 2) is NORMAL

REMOTE DISK50100 (member 3) is NORMAL

Name: M200

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10200 (member 0) is NORMAL

LOCAL DISK20200 (member 1) is NORMAL
 REMOTE DISK60200 (member 2) is NORMAL
 REMOTE DISK50200 (member 3) is NORMAL

Name: M300

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10300 (member 0) is NORMAL
 LOCAL DISK20300 (member 1) is NORMAL
 REMOTE DISK60300 (member 2) is NORMAL
 REMOTE DISK50300 (member 3) is NORMAL

Name: M301

MEMBERSHIP = 4, 2 members present

State: REDUCED

LOCAL DISK10301 (member 0) is NORMAL
 LOCAL DISK20301 (member 1) is NORMAL

Name: M302

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10302 (member 0) is NORMAL
 LOCAL DISK20302 (member 1) is NORMAL
 REMOTE DISK60302 (member 2) is NORMAL
 REMOTE DISK50302 (member 3) is NORMAL

DTSM host1>

 Once the problem with the mirrorset has been fixed, execute the resynch command to restore the mirrorset as shown below:

DTSM host1>**resynch -n -d cxo -u d301**

When this mirrorset has finished normalizing and has been set to failsafe error mode, the following notification occurs:

 StorageWorks DTSM Notification Wed Jul 01 15:28:30 MDT 1998

All cxo DT System mirrorsets have normalized after completion of failback/resynch operation.

DTSM CLI Commands

Entering a **show** of the DT system shows that M301 mirrorset has all mirrorset members present.

DTSM host1>**show -s -d cxo**

STATUS FOR SYSTEM: cxo

Back End Controller Status

=====

cxo.host1.pbec1 Normal

cxo.host1.pbec2 Normal

cxo.host2.sbec1 Normal

cxo.host2.sbec2 Normal

Mirrorsets

=====

Name: M100

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10100 (member 0) is NORMAL

LOCAL DISK20100 (member 1) is NORMAL

REMOTE DISK60100 (member 2) is NORMAL

REMOTE DISK50100 (member 3) is NORMAL

Name: M200

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10200 (member 0) is NORMAL

LOCAL DISK20200 (member 1) is NORMAL

REMOTE DISK60200 (member 2) is NORMAL

REMOTE DISK50200 (member 3) is NORMAL

Name: M300

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10300 (member 0) is NORMAL

LOCAL DISK20300 (member 1) is NORMAL

REMOTE DISK60300 (member 2) is NORMAL

REMOTE DISK50300 (member 3) is NORMAL

Name: M301

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10301 (member 0) is NORMAL

LOCAL DISK20301 (member 1) is NORMAL

REMOTE DISK50301 (member 2) is NORMAL

REMOTE DISK60301 (member 3) is NORMAL

Name: M302

MEMBERSHIP = 4, 4 members present

State: NORMAL

LOCAL DISK10302 (member 0) is NORMAL

LOCAL DISK20302 (member 1) is NORMAL

REMOTE DISK60302 (member 2) is NORMAL

REMOTE DISK50302 (member 3) is NORMAL

DTSM host1>

 The following notification message is displayed on the console terminal after the successful completion of a resynch command.

 StorageWorks DTSM Notification Wed Jul 01 15:28:36 MDT 1998

All cxo DT System mirrorset units have been set to failsafe mode after completion of failback/resynch operation.

DWZGA SCSI Bus Extender

Introduction

1. For the DT solution, the DWZGA SCSI bus extender provides high-speed connectivity between the primary and secondary sites, allowing SCSI commands and data to pass between the two sites. The DWZGA provides the technology to extend a customer's local SCSI bus up to 15KM to the storage located at the secondary site, enabling customers to maintain copies of critical data off site without requiring the physical movement of storage media. This chapter includes the following subsections:
2. DWZGA Theory of Operation
3. DWZGA Features
4. Front Panel Indicators
5. Rear Panel Indicators

WARNING

To avoid personal injury, de-energize DWZGA units by removing power to the unit before performing installation or maintenance. Never look directly into any fiber-optic connectors or cables.

DWZGA Theory of Operation

The DWZGA SCSI extender converts SCSI commands and data packages into a serial stream of commands and data transmitted via fiber-optic cable. The primary site DWZGA converts the parallel SCSI command packet from the host into serial SCSI commands and sends that serial stream out via single-mode fiber-optic cable to the fiber port of the secondary site's DWZGA. The secondary site DWZGA accepts and unpacks the serial stream and converts it back into the originally transmitted SCSI command format sent from the host. The secondary site DWZGA sends the parallel SCSI command out via its SCSI adapter port on an ultra-wide differential port to the remote storage subsystem. Detailed information about DWZGA SCSI bus extenders and their operation can be found in the *Fiber-Optic UltraSCSI Extender DWZGA User's Guide* (EK-DWZGA-UG.A01).

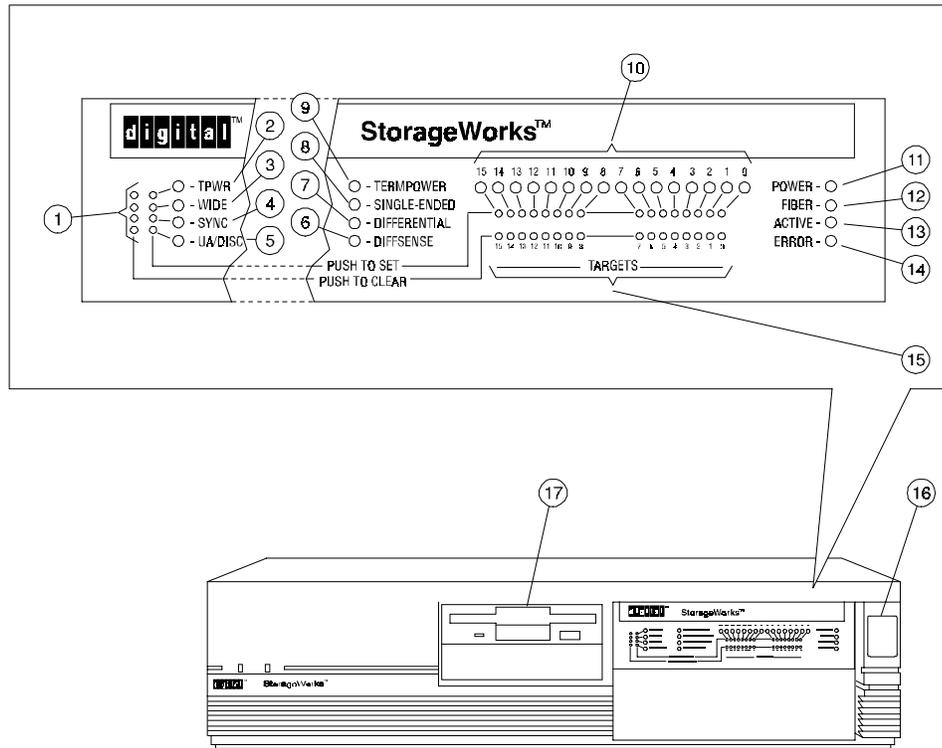
DWZGA Features

For the DT solution, the DWZGA SCSI extender provides the ability to connect primary site operating systems to remote storage sites, satisfying the DT requirement that data be maintained at a secondary site. By using pairs of SCSI extenders, transmission lengths of up to 15 Km are obtained. Each DWZGA contains one ultra-wide SCSI (UWD SCSI) differential bus and one ¼ speed fiber channel fiber-optic port.

Front Panel Indicators

DWZGA front panel indicators consist of multiple push-to-set/push-to-clear rocker-type DIP switches and light emitting diodes (LEDs) that correspond to the positions of the rocker switches. Four LEDs provide parallel SCSI bus status information while four other LEDs provide system and fiber status. The following list explains the DWZGA front panel indicators. Refer to Figure C-1 while reading the descriptions about the front panel indicators.

Figure C-1 DWZGA SCSI Bus Extender Front Panel Indicators



SHR-1002

Each number in the following list corresponds to a callout in the above figure. The following indicators are found on the front panel:

- Four push-to-set and four push-to-clear rocker-type DIP switches located on the left-hand side of the DWZGA front panel that correspond to the LEDs immediately to the right of those DIP switches. (callouts 2, 3, 4, and 5). Also, 16 push-to-set and 16 push-to-clear rocker-type DIP switches located on the right-hand side of the DWZGA front panel that correspond to the 16 TARGET ID LEDs. (callout 10).

2. TPWR LED—LED ON when associated DIP switch is pushed. Relates to LED 9, which is also ON when associated DIP switch is pushed. Indicates that the DWZGA-supplied diode-protected terminator power is enabled.
3. WIDE LED—LED ON when associated DIP switch is pushed. Indicates DWZGA-initiated wide data transfer is enabled (narrow data transfer is always enabled).
4. SYNC LED—LED ON when associated DIP switch is pushed. Indicates DWZGA-initiated synchronous data transfer request is enabled.
5. UA/DISC—LED ON when associated DIP switch is pushed. Indicates DWZGA Unit Attention request is enabled.
6. DIFFSENSE—LED ON indicates that a single-ended device is connected to the differential SCSI bus. This is an error and must be corrected.
7. DIFFERENTIAL—LED ON indicates that the DWZGA senses a differential SCSI bus device.
8. SINGLE-ENDED—LED ON indicates that the DWZGA senses a single-ended SCSI bus device. Default = OFF.
9. TERMPOWER—LED ON indicates that the DWZGA detects SCSI terminator power. Default = ON.
10. TARGET LEDs—LEDs 0-15 correspond directly to the push-to-set and push-to-clear DIP switches below the LEDs. Each LED ON indicates corresponding push-to-set target ID switch is pressed. (See Step. 15). Targets are enabled **only** on the secondary site DWZGA.
11. POWER—LED ON indicates that the DWZGA unit power is ON.
12. FIBER—LED OFF indicates no fiber-optic power detected. This LED ON indicates that connectivity has been established between the local and remote DWZGA.
13. ACTIVE—LED ON indicates that the DWZGA is initiating commands, responding to commands, or transferring commands.
14. ERROR—LED ON indicates that an error has occurred.
15. TARGETS—Sixteen push-to-set and 16 push-to-clear rocker-type DIP switches that, if set, inform the host site initiators attached to the primary site DWZGA of the SCSI device target IDs attached to the secondary site DWZGA. Each DIP switch corresponds to a target ID LED, described in Step 10. If cleared, these switches clear the associated LED and inform the host side initiator that the device with that SCSI ID has been deselected.
16. Power Switch—Pressed to ON (1) connects ac power to DWZGA if rear power switch is pressed to ON (1).
17. Floppy Disk Drive—3.5-inch floppy disk drive used for installation/startup diskette, diagnostic diskette, and dump-to-floppy function.

Number 12 in the previous list describes the FIBER indicator LED located on the front of the DWZGA SCSI bus extender. This LED OFF indicates that no fiber-optic power was detected. This LED ON indicates the state of the local DWZGA's connectivity to the remote DWZGA as follows:

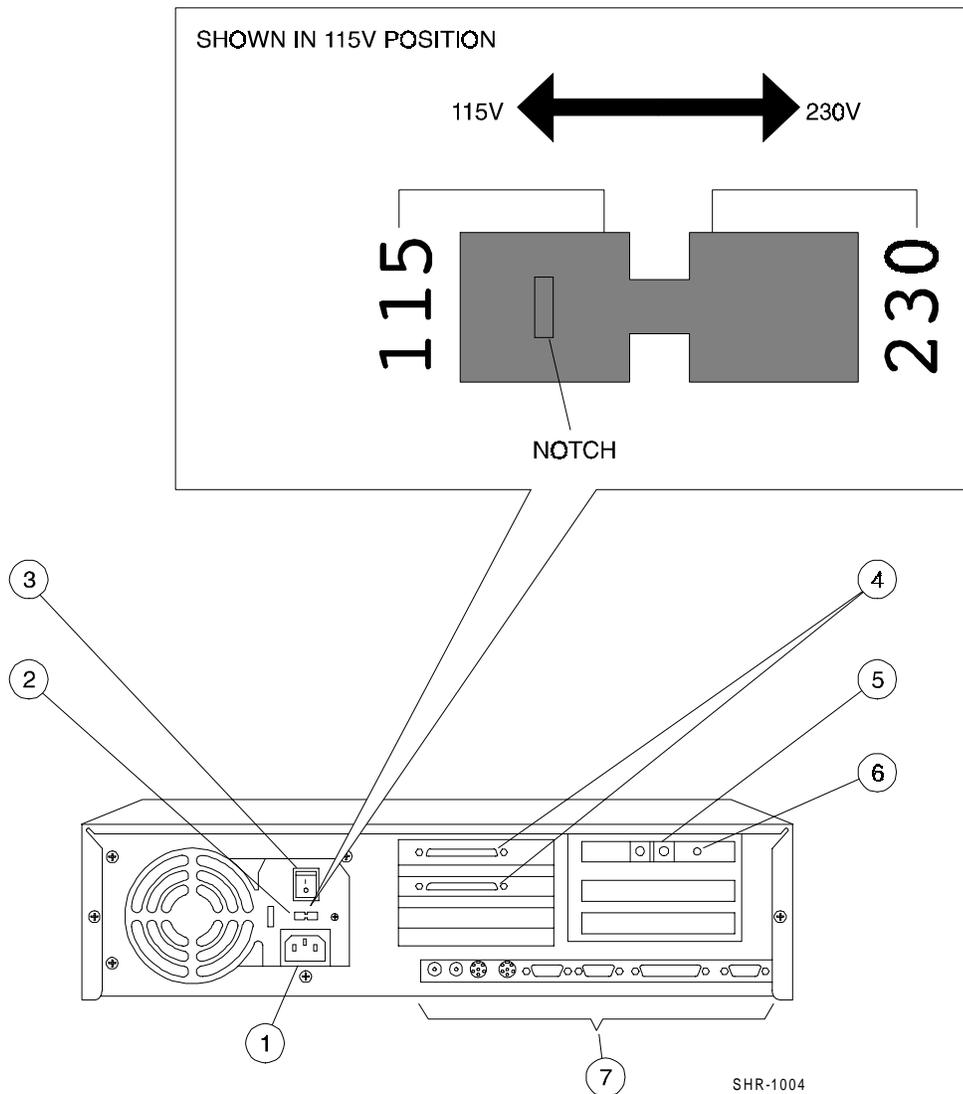
1. LED blinks 1x — Fiber-optic power detected. Waiting for receiver synchronization.
2. LED blinks 2x — Fiber-optic power detected and receiver synchronized. Waiting for fiber interface state change.

3. LED blinks 3x — Other DWZGA reporting itself non-operational.
4. LED blinks 4x — Other DWZGA reporting itself OFF line.
5. LED blinks 5x — Other DWZGA resetting its fiber-optic interface.
6. LED blinks 6x — Waiting for fiber-optic interface reset to complete.
7. LED on solid — Power ON self test complete, connectivity established.

Rear Panel Indicators

Figure C-2 shows the rear of a DWZGA unit. Refer to **Error! Reference source not found.** while reading the following list. The numbers in the list correspond to callouts in the figure.

Figure C-2 DWZGA SCSI Bus Extender Rear Panel Indicators



The following indicators are found on the DWZGA rear panel:

1. ac power inlet—Receptacle that accepts the power cord supplied with each unit to connect to a 100 – 120V ac, 6-amp maximum, or a 200 – 240V ac, 4-amp maximum power source.
2. 115/230 Voltage selector slide switch—Switch is factory-set at 115 position to accept power from a 115V ac source. Moving the switch to 230 position allows the DWZGA to accept power from a 230V ac power source.
3. Power Switch (1/0)—Rocker-type switch that supplies power to the power switch on the front panel when in 1 position. Switch set to 0 position removes power from front panel power switch.
4. SCSI Connectors—Two 68-pin, high-density, SCSI P-type, female SCSI connectors.
5. Fiber Channel Port—Duplex SC connector equipped with a removable rubber plug. Designed to accept laser-based optical data link (ODL) 1300-nanometer wavelength, single-mode cable with 9-micron core diameter. Keying of the fiber-optic connector ensures correct connection.
6. Fiber Optic LED—LED ON indicates fiber-optic module internal to DWZGA is operational. Associated with Fiber LED on front panel. LED OFF (when power is applied to unit) indicates that the fiber-optic module is defective or the fiber link is open.
7. Various rear panel connectors—Eight connectors, from left to right, for audio out, microphone input, keyboard, mouse, comm 1 port, comm 2 port, parallel, and video. The keyboard and video connectors are used with an optional 15 inch VGA monitor and optional PS/2 style keyboard for installation, maintenance and diagnostic purposes. The other connectors are not used.

Note

It is the customer's responsibility to purchase both the optional monitor and keyboard.

Tools Required

Tools required during removal and replacement of the DWZGA SCSI bus extenders are a switch setting tool used to operate the push-to-set and push-to-clear rocker-type DIP switches on the DWZGA front panel, and a small, flat-head screwdriver used to connect and remove SCSI connectors from the rear of the DWZGA.

Removal and Replacement of the DWZGA

Use the following procedure to remove a DWZGA unit once it has been determined that the DWZGA unit is faulty. This procedure assumes all data processing has been terminated.

Caution

Ensure that all backend controllers have been properly shutdown prior to shutting down the frontend controllers.

1. Remove power from the DWZGA unit to be replaced by first pushing the front panel power switch to 0 or OFF, then by pressing the rear panel power switch to OFF.
2. Unplug the ac power cord from the ac power receptacle located on the rear of the DWZGA.

3. Disconnect the fiber cable from the fiber optic ports of the DWZGA.
4. Disconnect the 17-04377-02 SCSI cable from the SCSI input located on the rear of the DWZGA. Remove the SCSI terminator from the other SCSI input located on the rear of the DWZGA.
5. Disconnect all other connections such as the optional keyboard and monitor from their connections located on the rear of the DWZGA.
6. Go to the front of the cabinet and remove the two retaining screws, top and bottom, from each side of the DWZGA bezel. Do not remove the middle screws from each side of the DWZGA bezel.
7. Go to the back of the cabinet and locate the two phillips-head screws on the rear of the DWZGA that secure the DWZGA unit to the DWZGA rack mount hardware. Remove those screws using a small phillips screwdriver and push the DWZGA unit forward approximately two inches.
8. Go to the front of the cabinet and grasp the DWZGA unit in both hands and pull towards you until the DWZGA comes free of the rack mount hardware and free of the cabinet.

WARNING

The DWZGA outer cover is not secured to the DWZGA unit at this point because the two rear retaining screws have been removed. Use caution when removing the DWZGA so that the unit is not dropped.

9. Set the failure DWZGA aside until the replacement DWZGA has been installed. You will need the two rear retaining screws from the replacement DWZGA to secure the cover to the failure DWZGA.

Use the following procedure to install a replacement DWZGA:

1. Unpack the replacement DWZGA
2. Remove the two rear retaining screws from the rear of the replacement DWZGA. Insert the two rear retaining screws into the proper hole location on the failure DWZGA and screw them in order to secure the cover to the failure DWZGA. These two screws are shorter than the two screws used to lock the DWZGA into the cabinet and therefore can not be used to secure the replacement DWZGA into the cabinet.

Caution

The replacement DWZGA now does not have its cover secured to the unit. Use caution when installing the replacement DWZGA.

3. From the front of the cabinet, insert the replacement DWZGA into the rack mount hardware and push the DWZGA in all the way.
4. Go to the rear of the cabinet. Screw the two phillips-head screws previously removed through the holes in the rack mount hardware and into the holes on the rear of the DWZGA, firmly securing the DWZGA into the cabinet.
5. Connect the 17-04377-02 SCSI cable to one of the SCSI input connectors located on the rear of the DWZGA. Terminate the other SCSI input connector with the terminator previously removed.

6. Connect the fiber optic cable to the fiber optic connectors located on the rear of the DWZGA.
7. Set the ac power switch to 230v.
8. Plug the ac power cord into the ac power receptacle located on the rear of the DWZGA.
9. Connect any other connections such as the optional monitor and keyboard to the proper connectors on the rear of the DWZGA.
10. Apply power to the new DWZGA.

WARNING

To avoid personal injury, ensure that the DWZGA units are de-energized by removing power to the unit before performing any installation or maintenance steps. Never look directly into any fiber-optic connectors or cables.

WARNING

To avoid personal injury, ensure that the DWZGA units are de-energized by removing power to the unit before performing any installation or maintenance steps. Never look directly into any fiber-optic connectors or cables.

Secondary Site DWZGA Setup

Use the following procedure to setup the secondary site DWZGA.

1. Ensure that the secondary site DWZGA rear panel and front panel power switches are in the OFF or 0 position.
2. Locate the 115/230 voltage selector switch located on the rear of the secondary site DWZGA. Use a small flat-head screwdriver placed in the notch of the voltage selector switch to move the switch to its 230V position.
3. Plug the ac power cord into the ac receptacle on the rear of the secondary site DWZGA.
4. On the rear of the secondary site DWZGA, connect the optional keyboard to the keyboard port and connect the optional monitor to the monitor port. If you decide not to use the optional keyboard and monitor, DWZGA diagnostic and installation screens will not be visible.
5. Connect the SCSI cable from the secondary site target SCSI devices to either of the SCSI connectors located on the rear of the secondary site DWZGA. Use the supplied 869515-1 Loa-Profile, 68-pin, high-density terminator or the DIGITAL equivalent (H879-AA) to terminate the other SCSI connector located on the rear of the secondary site DWZGA.
6. Insert the DWZGA Installation/Startup floppy and apply power to the secondary site DWZGA by pressing 1 on the DWZGA rear panel power switch (1/0 rocker-type DIP switch on the rear of the secondary site DWZGA) then press the push-button power

switch located on the front panel of the secondary site DWZGA to 1. Verify that the front panel power indicator lights. Allow the secondary site DWZGA to perform its self-test. Upon completion of the self-test, the Switch Display Screen is displayed, showing a representation of the DWZGA front panel switches. Pressing the space bar on the DWZGA keyboard updates this screen. Screens will not be visible to users if the optional monitor and keyboard are not connected to the DWZGA.

7. Ensure all TARGETS LEDs 0—15 are **clear**. Use the switch setting tool to clear the push-to-clear switches if not cleared.
8. Press the associated PUSH TO SET switch to light TPWR, enabling terminator power if not already enabled. Always perform this step.
9. Press the associated PUSH TO SET switch to light WIDE, enabling wide (16-bit) data transfer negotiations. WIDE lit is the default setting.
10. Press the associated PUSH TO SET switch to light SYNC, enabling synchronous data transfer negotiations. SYNC lit is the default setting.
11. Press the associated PUSH TO CLEAR switch to extinguish the UA/DISC LED, disabling DWZGA unit attention.
12. Verify that both TERMPower and DIFFERENTIAL LEDs are lit.
13. Verify that both SINGLE-ENDED and DIFFSENSE are not lit.
14. Remove power to the secondary site DWZGA by pressing the front panel push-button power switch. Verify that the front panel POWER indicator goes off. Press the rear panel power switch to OFF or 0.
15. Leave the Installation/Startup floppy disk in the secondary site DWZGA floppy drive.
16. Insert the Installation/Startup floppy into both the primary and secondary site DWZGA units. Apply power to both DWZGA units by first pressing the rear power switch to ON or 1, and then pressing the front panel power switch to ON or 1.
17. On either DWZGA unit keyboard, press <F2> and observe the monitor screen. The screen reports Operating Software Versions for both DWZGA units. The Operating Software Versions must match.
18. Power off both DWZGA units, by first pressing the front panel power switch and then pressing to 0 the rear panel power switch.
19. Leave the Installation/Startup floppy in both DWZGA units.

Primary Site DWZGA Setup

Follow these steps to validate the primary site DWZGA.

1. Ensure that the primary site DWZGA rear panel and front panel power switches are in the OFF or 0 position.
2. Locate the 115/230 voltage selector switch located on the rear of the primary site DWZGA. Use a small flat-head screwdriver placed in the notch of the voltage selector switch to move the switch to its 230V position.
3. Plug the ac power cord into the ac receptacle on the rear of the primary site DWZGA.
4. On the rear of the primary site DWZGA, connect the optional keyboard to the keyboard port and connect the optional monitor to the monitor port. If you decide not to use the optional keyboard and monitor, DWZGA diagnostic and installation screens will not be visible.

5. Connect the host SCSI cable to either of the SCSI connectors located on the rear of the primary site DWZGA. Use the supplied 869515-1 Lo-Profile, 68-pin, high-density terminator or the DIGITAL equivalent (H879-AA) to terminate the other SCSI connector located on the rear of the primary site DWZGA.
6. Insert the DWZGA Installation/Startup floppy and apply power to the primary site DWZGA by pressing 1 on the DWZGA rear panel power switch (1/0 rocker-type DIP switch on the rear of the primary site DWZGA) then press the push-button power switch located on the front panel of the primary site DWZGA to 1. Verify that the front panel power indicator lights. Allow the primary site DWZGA to perform its self-test. Upon completion of the self-test, the Switch Display Screen is displayed, showing a representation of the DWZGA front panel switches. Pressing the space bar on the DWZGA keyboard updates this screen. Screens will not be visible to users if the optional monitor and keyboard are not connected to the DWZGA.
7. **Clear** all primary site DWZGA TARGET LED switches 0 through 15 by using the switch setting tool to push the push-to-clear switches.
8. Insert the Installation/Startup floppy into the primary site DWZGA's floppy disk drive and apply power to the primary site DWZGA by first pressing the rear panel power switch to 1 and then pressing the front panel power switch to ON or 1.
9. Use the switch setting tool to set the primary site DWZGA push-to-set TARGET LED switches zero (0) through five (5) and switch eight (8).
10. On the primary site DWZGA, press the associated push-to-set switch to light the TPWR LED, enabling TPWR power. Always perform this step.
11. On the primary site DWZGA, push the push-to-clear switch associated with the WIDE LED, turning off that LED and disabling wide (16 bit) as well as narrow (8 bit) transfer negotiations.
12. On the primary site DWZGA, push the push-to-clear switch associated with the SYNC LED, turning off that LED and disabling synchronous data-wide transfers.
13. On the primary site DWZGA, push the push-to-clear switch associated with the UA/DISC LED, turning off this LED and disabling DWZGA unit attention.
14. Verify that both the TERMPower and DIFFERENTIAL LEDs on the primary site DWZGA are lit.
15. Verify that both the SINGLE-ENDED and DIFFSENSE LEDs on the primary site DWZGA are not lit
16. Insert the Installation/Startup floppy into the primary site DWZGA floppy disk drive and reboot with <Ctrl><Alt>.
17. Verify that the front panel power indicator lights. The primary site DWZGA unit now performs its self-test.
18. Leave the Installation/Startup floppy installed in the primary site DWZGA so that the DWZGA unit can recover in the event of a power failure.

Connecting Fiber-Optic Cable Between Sites

Use the following procedure to connect fiber-optic cable between the primary and secondary sites.

1. Remove power to both the primary and secondary site DWZGA units by first pressing the front panel power switch to OFF or 0, and then by pressing the rear panel power switch to OFF or 0.

2. If not already removed, remove the rubber plugs from the fiber-optic ports located on the rear of the DWZGA units located at both the primary and secondary sites.
3. Insert the optical fiber SC connector attached to the end of the fiber-optic cable into the fiber-optic ports of both the primary and secondary site DWZGA units. Align the connector keys to ensure proper polarity.

WARNING

To avoid personal injury, never look directly into any fiber-optic connectors or cables.

4. Apply power to both DWZGA units by first pressing the rear power switch to ON or 1, and then by pressing the front panel power switch to ON or 1.
5. Upon completion of power up and self tests, verify that the Fiber LED located on both DWZGA front panels lights. This verifies connectivity between the primary and secondary site DWZGAs. If the Fiber LED does not light, either the fiber-optic cable polarity is incorrect (check the rear panel fiber connections), the fiber-optic cable is broken, or the DWZGA unit is faulty. The DWZGA monitors attached to each DWZGA should read **FOX Connection Online** on both monitors at this time.

Validating Fiber Connectivity

This section describes how to validate fiber connectivity after all the components have been installed. A simple test of fiber connectivity is to insert the Installation/Startup floppy into the floppy disk drive of both DWZGA units, apply power, and ensure that the Fiber LED on both DWZGA unit front panels lights. The Fiber LED lit on both DWZGA units guarantees fiber connectivity. If the Fiber LED does not light, a quick test is to reverse the polarity of the dual-ended fiber-optic cable at the rear of one DWZGA. If the Fiber LED still is not lit, perform the same step at the rear panel of the other DWZGA. If the Fiber LED is still not lit, the DWZGA unit may be faulty or the fiber-optic cable may be broken.

WARNING

To avoid personal injury, de-energize DWZGA units by removing power before performing installation or maintenance. Never look directly into any fiber-optic connectors or cables.

DWZGA Operator Interface Screens

DWZGA units offer an operator interface with various screens. Screen 1 through Screen 8 are available when connected to the optional keyboard and monitor that enable you to view status and performance information. Screens are selected by pressing the corresponding number keys on the keyboard. Most of the screens provide proprietary information that is unavailable to DIGITAL customers and Field Service Engineers. However, Screen 1 does provide some useful status information as well as the ability to test certain features of the DWZGA. Screen 8 shows you a keyboard menu. This section describes all of the screens available to the user via the monitor/keyboard user interface; the primary focus is on Screen 1 and Screen 8.

Screen 1

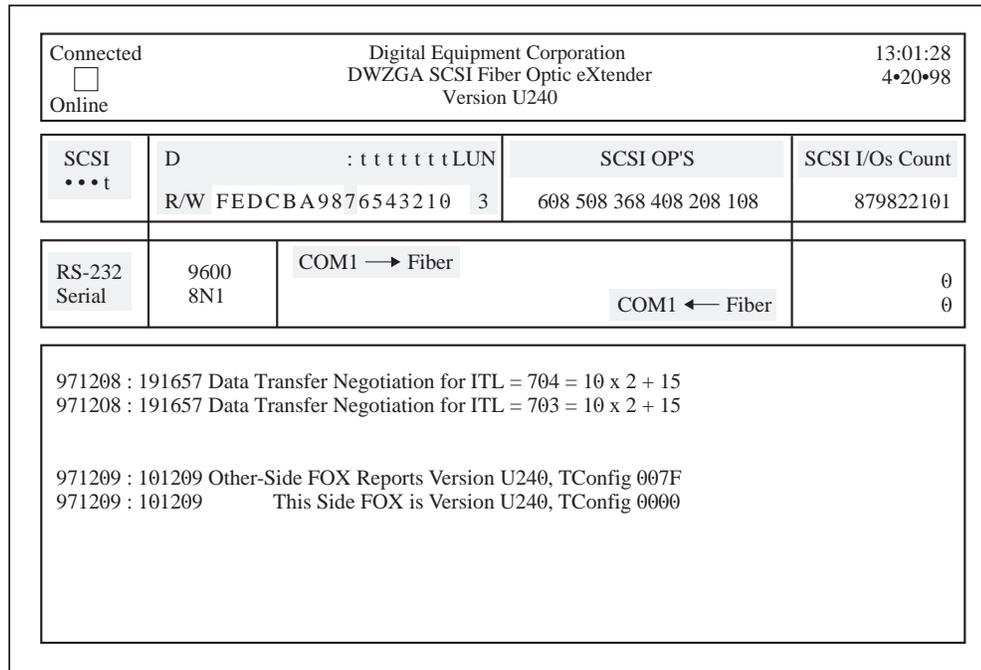
Screen 1 displays the most basic status of the DWZGA extender. Access Screen 1 by pressing <1> on the keyboard. Figure C-3 shows Screen 1 for the remote DWZGA and Figure C-4 shows Screen 1 for the local DWZGA. The text following the figures explains each screen.

Figure C-3 Screen 1 for the Remote DWZGA

Connected <input type="checkbox"/> Online		Digital Equipment Corporation DWZGA SCSI Fiber Optic eXtender Version U240		13:01:28 4•20•98
SCSI .swt	D R/W FEDCBA9876543210	iLUN 3	SCSI OP'S 608 508 368 408 208 108	SCSI I/Os Count 879822101
RS-232 Serial	9600 8N1	COM1 → Fiber	COM1 ← Fiber	0 0
<p>971208 : 191657 Data Transfer Negotiation for ITL = 704 = 70 x 2 + 15 = 703 = 10 x 21 + 15 = 713 = 711 = 721</p> <p>971209 : 101209 Other-Side FOX Reports Version U240, TConfig 007F 971209 : 101209 This Side FOX is Version U240, TConfig 0000</p>				

CXO6250A

Figure C-4 Screen 1 for the Local DWZGA



CX06251A

The screen is divided into four sections. The top of the screen contains header information, including fiber status (**Connected** and **Online**), the firmware Version Number (U240 for this example), and the current time and date. Date and time is set by pressing F1 during boot up of the DWZGA unit. Pressing F1 displays the Set-Up screen. Use the up and down arrows to toggle between the date and time settings and change the date and time as necessary. Save the Set-Up information by pressing F10. A flashing cursor between the header words **Connected** and **Online** indicates the fiber is busy transferring data. Immediately below the header section is a horizontal segment that displays the status of the SCSI bus connected to the DWZGA. The remote DWZGA should have the four characters **.swt** under the word SCSI. These characters equate to the front panel switches, UA/DISC, SYNC, WIDE, and TPWR, respectively. The characters, from left to right, mean the following:

- . = Unit Attention Disabled
- s = Initiated Synchronous Data Transfer Negotiation enabled
- w = Initiated Wide Data Transfer Negotiation enabled
- t = Terminator power measured OK

The local site DWZGA, under the word SCSI, has the four characters **...t**, meaning the following:

- . = Unit Attention Disabled
- . = Initiated Synchronous Data Transfer Negotiation disabled
- . = Initiated Wide Data Transfer Negotiation disabled
- t = Terminator power measured OK

The Activity box resides directly to the right of the SCSI bus indicator. The Activity box for both DWZGA units displays the addresses of the two devices involved in a data transfer, one

device being the initiator and one device being the target. The Logical Unit Number (LUN) of the target device indicates whether the device is an initiator or a target. This section of the screen differs slightly between the remote and local site DWZGA units. For the remote DWZGA, the Activity box has the lower case letter I followed by seven colons, `I:`. The lower case letter I indicates the devices are initiators that have sent a SCSI command. The colons, `:`, indicate that the devices are wide devices. (A period, `.`, would indicate the devices are narrow devices.) For the local DWZGA, the Activity box has a colon, `:`, followed by seven lower case `t`'s, corresponding to the front panel target switches for that address set ON. A lower case `t` that is red in color indicates a target address that has not responded to selection.

The boxes to the right of the Activity box show recent SCSI OPs and counts of SCSI I/Os respectively. SCSI Ops scroll through the display from right to left. The scrolled value is a three digit number, where the first number is the unit number and the second two numbers are the SCSI Operation Code.

The third horizontal segment of Screen 1 contains vendor specific information.

The bottom section of Screen 1 displays status information, stamped with date and time, that scrolls from the bottom of Screen 1 to the top so that the most recent status message is posted at the bottom of the screen. The date and time stamp is formatted as `yymmdd:hhmmss`, where `yy`=year, `mm`=month, `dd`=day, `hh`=hour (using a 24 hour clock), `mm`=minute, and `ss`=second. When status messages scroll off the top of this section of Screen 1, they first scroll to the bottom of Screen 2, then to the top of Screen 2, and then off Screen 2 and are then saved in an extended buffer accessible through Screen 5. If necessary, Screens 1, 2, 3, and 4, plus the extended buffer, can be dumped to a blank DOS formatted floppy disk for further diagnosis. The dump feature is discussed later in this chapter.

Screen 2

Screen 2, as previously described, is used to capture scrolled status messages from Screen 1. Access Screen 2 by pressing `<2>` on the keyboard.

Screen 3

Screen 3 contains cumulative counts of I/O's and bytes transferred and can be cleared at any time by pressing `<Ctl><z>` on the keyboard, even if Screen 3 is not currently displayed. Access Screen 3 by pressing `<3>` on the keyboard. Also on Screen 3 are four sets of time and date; Boot Time, Counter Time, Last Operation Time, and Current Time. Boot Time is the time and date the DWZGA unit was originally booted. Counter Time is the last time and date the counters were zeroed. Last Operation Time is the time and date of the last SCSI operation. The difference between Counter Time and Current Time gives the elapsed time of the counters.

Screen 4

Screen 4 contains information specific to the DWZGA firmware. This information is used by General Signal Networks to look at various firmware related events. Issuing a `SHOW DEVICE` on the host local command console terminal updates this screen's counters to show SCSI Disconnects and SCSI Resets.

Screen 5

Screen 5 is called the Log Functions Screen. Screen 5 allows the user to display the information that was saved in the extended buffer, which is the same information that gets dumped to the floppy. Pressing keyboard number `<5>` displays Screen 5 on the monitor. Use the Screen 5 functions to view the extended log. (Screen 8 is a keyboard menu screen describing the keyboard functions for all screens.)

Screen 6 and Screen 7

Screen 6 and Screen 7 are empty for DIGITAL applications.

Screen 8

Screen 8 displays a master keyboard menu describing the keyboard functions for the DWZGA units optional keyboard and monitor. Access Screen 8 by pressing <8> on the keyboard. Figure C-5 shows Screen 8.

Figure C-5 Screen 8

Digital Equipment Corporation DWZGA Keyboard Menu			
FUNCTION	KEYSTROKE	FUNCTION	KEYSTROKE
Select Screen #1 (Title)	1	Screen 5 (LOG) Functions:	
Select Screen #2 (Messages)	2	Most Recent Msgs	Home
Select Screen #3 (Counts)	3	Oldest Msgs	End
Select Screen #4 (Firmwave)	4	Next Oldest Msgs (page)	PgUp
Select Screen #5 (LOG)	5	Next Newest Msgs (page)	PgDn
Select Screen #6 (Help #1)	6	Next Oldest Msgs (line)	Up Arrow
Select Screen #7 (Help #2)	7	Next Newest Msgs (line)	Dn Arrow
Select Screen #8 (Help #3)	8		
Console Time-Stamp	F1	Change COM1 Baud Rate	CH-B
Simple Fiber Optic Test	F2	Change COM1 Data Format	CH-D
	F3	Change COM1 Parity	CH-P
	F4	Change COM1 Stop Bits	CH-S
	F5		
	F6	Dump Screens to Floppy	CH-F
	F7	Force SCSI Bus Reset	CH-R
	F8		
SCSI Registers DUMP	F8	Reset Screen Counts	CH-Z
Firmware Flags DUMP	F9		

CX06249A

Troubleshooting

This section gives general information on diagnosing and troubleshooting the solution, including the use of the diagnostic floppy provided with each DWZGA.

Extended Target Problems

When experiencing problems related to the extended targets, the DWZGA unit passes the error status and sense information from the target to the host. Comparing host error logs to target sense information could be helpful in the diagnosis of the target.

Using the Diagnostic Floppy at the Secondary Site

The diagnostic floppy provided with the each DWZGA allows you to perform tests at the remote site on target devices. The secondary site DWZGA acts as an initiator, initiating and delivering requests to targets for fulfillment. Tests available are the SI test (loop back test), the ST test (internal loop back test), the SL test (FIFO loop back test), and the SA test, which performs all tests mentioned.

First, insert the Diagnostic floppy into the floppy disk drive located on the front of the secondary site DWZGA and reboot the unit via the keyboard with <Ctrl><Alt>. A static RAM test is performed automatically on boot, followed by a display. The display

shows a representation of the DWZGA front panel switches and target indicators minus the PWR, FIBER, ACTIVE and ERROR LEDs, plus information found on the bottom of the screen on how to access, via keyboard keys, various screens that provide further help about the diagnostics. The <Esc> key removes the display.

Pressing <F1> gives a display showing all available tests. If at any time the display hangs during a test, reboot the test sequence with <Ctrl><Alt>. The following details each available test.

SI Test

The SI test validates that the SCSI bus is working by allowing the remote DWZGA to select targets and perform a SCSI inquiry. The following details the SI test.

1. Press the <F4> key on the keyboard. This allows you to set specific SCSI IDs for the SI test.
2. Follow the directions on the screen to pick an initiator ID and a target ID. For the initiator ID, pick any number that is not in use on the SCSI bus. A 7, 0, or f character is usually a good choice. Press <Enter> when ready.
3. The Field Test Screen is displayed with a FOX> prompt at the bottom of the screen.
4. Enter **SI** at the FOX> prompt followed by <Enter>.
5. If successful, the designated target device flashes briefly and the following information is returned to the screen.

```
FOX>SI
```

```
Device Found, Target ID = 04, Device Type = 00
```

```
Inquiry Bytes (0-7) = 00 00 02 02 5B 00 00 16
```

```
DEC RZ26L DEC442D
```

The returned information informs you that the selected device was found. If the selected device was not found, first check the cable connections. Perform device diagnostics on the storage devices and array controllers second.

ST Test

The ST test, or internal loop back test, measures the ability of the DWZGA unit to assert its data and control lines. This test does not assert any signals on the SCSI bus, but uses special loopback facilities built into the DWZGA unit. The diagnostic floppy must have been inserted and the unit rebooted as described above. The following details the ST test.

1. At the FOX> prompt, enter **ST** followed by <Enter>.
2. Counters at the top of the screen flash, indicating data transfers, and the following is displayed;

```
FOX>
```

```
C770 SCSI Data and Control Test: Begin
```

3. The ST test runs until interrupted by you pressing <Enter>. The screen displays the following after the <Enter> directly under the previous display line.

```
C770SCSI Data and Control Test: Complete
```

SL Test

The SL test, or FIFO test, tests all command path and data path FIFOs. The test performs writes, reads, and comparisons of both the command path data and data path data. Loopback fiber is required. The following details the SL test.

1. At the FOX> prompt, enter **SL** followed by <Enter>.
2. The display responds with the following:

FOX>TAXI/DATA FIFO Loop Test: Begin, Any key to stop

FIFO Loopback Test: Complete 00000001, Loop Count = 0060

The returned information indicates a successful FIFO loopback test.

SA Test

The SA test performs all of the previously mentioned tests. At the FOX> prompt, enter **SA** followed by <Enter>. The display responds with the following:

Run All: Begin

Run All: Complete = 00A01249/00000001, Loop Count = 0064

The above display indicates all tests were run successfully.

Using The Floppy Dump Facility

The floppy dump facility allows a user to dump DWZGA log information to a formatted 3.5-inch 1.44 Mbyte floppy disk. The floppy disk is limited to accepting only one dump from the DWZGA. Successive dumps to the floppy result in over writing the previous dump information, as well as any information previously on the floppy, (with the exception of the file FOX.EXE exe boot code file). To use this feature, insert a floppy that does not contain a FOX.EXE exe code file and press <Ctrl> <f> on the keyboard. The dump takes approximately one minute. The floppy dump facility is not used during normal operation. The floppy dump facility is used by DIGITAL MCS.