Hitachi Data Systems

Hitachi Adaptable Modular Storage 2000 Family Implementation and Support

TCI1835

Book 2 of 2

Courseware Version 2.1

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Essential NAS Platform	HiCard	HiPass	Hi-PER Architecture	Hi-Star
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NanoCopy	Resource Manager	SplitSecond	Thunder 9200	Thunder 9500
Thunder 9585V	Thunder 9580V	Thunder 9570V	Thunder 9530V	Thunder 9520V
Universal Star Network	Universal Storage Platform			

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NOTICE:

Notational conventions: 1KB stands for 1,024 bytes, 1MB for 1,024 kilobytes, 1GB for 1,024 megabytes, and 1TB for 1,024 gigabytes, as is consistent with IEC (International Electrotechnical Commission) standards for prefixes for binary and metric multiples.

HDS Academy 1080

Contact Hitachi Data Systems at www.hds.com.

Product Names mentioned in courseware:

Enterprise Storage Systems

- Hitachi Universal Storage Platform™ V
- Hitachi Universal Storage Platform™ VM
- Hitachi Universal Storage Platform™
- Hitachi Network Storage Controller

Legacy Products:

- Hitachi Lightning 9900™ Series enterprise storage systems
- Hitachi Lightning 9900™ Series enterprise storage systems

Modular Storage Systems

- Hitachi Adaptable Modular Storage system
- Hitachi Adaptable Modular Storage 200
- Hitachi Adaptable Modular Storage 500
- Hitachi Adaptable Modular Storage 1000
- Hitachi Adaptable Modular Storage 200 with iSCSI
- Hitachi Adaptable Modular Storage 200 with NAS Option
- Hitachi Adaptable Modular Storage 500 with iSCSI
- Hitachi Adaptable Modular Storage 500 with NAS Option
- Hitachi Adaptable Modular Storage 1000 with iSCSI
- Hitachi Adaptable Modular Storage 1000 with NAS Option
- Hitachi Adaptable Modular Storage 2000 Family
- Hitachi Adaptable Modular Storage 2100
- Hitachi Adaptable Modular Storage 2300
- Hitachi Adaptable Modular Storage 2500
- Hitachi Workgroup Modular Storage system
- Hitachi Workgroup Modular Storage 100
- Hitachi Workgroup Modular Storage 100 with iSCSI
- Hitachi Workgroup Modular Storage 100 with NAS Option
- Hitachi Simple Modular Storage

Legacy Products:

- Hitachi Thunder 9500™ Series modular storage systems
- Hitachi Thunder 9200V™ entry-level storage

NAS Storage Systems

- Hitachi Essential NAS Platform®
- Hitachi Essential NAS Platform™
- Hitachi High-performance NAS Platform, powered by BlueArc®
- Hitachi NAS Blade for Universal Storage Platform™ and Network Storage Controller

- Hitachi High-performance NAS Platform, powered by BlueArc® 2000 family
  - Hitachi High-Performance NAS Platform 2000
  - Hitachi High-Performance NAS Platform 2100
  - Hitachi High-Performance NAS Platform 2200
- Hitachi High-performance NAS Platform, powered by BlueArc® 3000 family
  - Hitachi High-Performance NAS Platform 3100
  - Hitachi High-Performance NAS Platform 3200

Management Tools

- Hitachi Basic Operating System
- Hitachi Basic Operating System V
- Hitachi Resource Manager™ utility package
  - Module Volume Migration Software
  - LUN Manager/LUN Expansion
  - Network Data Management Protocol (NDMP) agents
  - Logical Unit Size Expansion (LUSE)
  - Cache Partition Manager feature
  - Cache Residency Manager feature
  - Storage Navigator program
  - Storage Navigator Modular program
  - Storage Navigator Modular 2 program
- Hitachi NAS Blade Manager software
- Hitachi NAS Manager Suite of software

Replication Software

Remote Replication:

- Hitachi Universal Replicator software
- Hitachi TrueCopy® Heterogeneous Remote Replication software bundle (for enterprise systems)
- Hitachi TrueCopy® Remote Replication software bundle (for modular systems)
- Hitachi TrueCopy® Synchronous software
- Hitachi TrueCopy® Asynchronous software
- Hitachi TrueCopy® Extended Distance software

Hitachi In-System Replication software bundle:

- Hitachi ShadowImage® Heterogeneous Replication software (for enterprise systems)
- Hitachi ShadowImage® Replication software (for modular systems)
- Hitachi Copy-on-Write Snapshot software

Hitachi Storage Command Software Suite

- Hitachi Chargeback software
- Hitachi Device Manager software

- Hitachi Dynamic Link Manager software
- Hitachi Global Link Manager software
- Hitachi Global Reporter software
- Hitachi Path Provisioning software
- Hitachi Protection Manager software
- Hitachi QoS for File Servers software
- Hitachi QoS for Oracle software
- Hitachi Replication Monitor software
- Hitachi Storage Services Manager software
- Hitachi Tiered Storage Manager software
- Hitachi Tuning Manager software

Other Software

- Hitachi Backup and Recovery software, powered by CommVault®
- Hitachi Backup Services Manager software, powered by APTARE®
- Hitachi Business Continuity Manager software
- Hitachi Command Control Interface (CCI) Software
- Hitachi Dynamic Provisioning software
- Hitachi Storage Resource Management Solutions
- Hitachi Volume Migration software
- Hi-Track® Monitor "call home" service/remote monitoring tool

Other Solutions and Terms

- Hitachi Content Platform
- Hi-Star™ crossbar switch architecture
- Hitachi Universal Star Network™ V

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11. Maintenance and Troubleshooting

Module Objectives

- Upon completion of this module, the learner should be able to:
  - Determine how to troubleshoot common issues
  - Perform detailed troubleshooting using the Maintenance Manual
  - Escalate issues to Hitachi Data Systems Global Support Center (GSC) when necessary

2

Field Replaceable Units (FRUs)

- Hard Disk Drive
- Controller
  - (Cache and Host interface is now combined in the Control Unit)
- Battery
- Power supply or fan
- ENC unit
- Fibre Channel Ports and Host connectors (Fibre SFP in the Control Unit)

3

Maintenance Resources and Tools

- Storage Navigator Modular 2 GUI
  - Maintenance Mode
  - Error Alerts
  - Email Alerts
- SNMP
- Online Tools
- Documentation and Manuals
- Hitachi Data Systems Global Support Call Center
- Hitachi Data Systems Knowledge Base available through Support Web Portal

4

Various tools can be used to perform maintenance.

The Web Tool and Storage Navigator Modular 2 GUI in Maintenance Mode are available. There are also alerts generated by the array. We participate in SNMP support, including online tools and various documents. Finally, Hitachi Data Systems Global Services and Support is available and that includes the Call Center and the Web Portal.

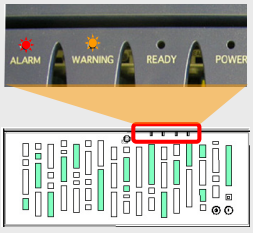
Issues that Warrant Troubleshooting

- A failure notice by email, Storage Navigator Modular 2 or SNMP*

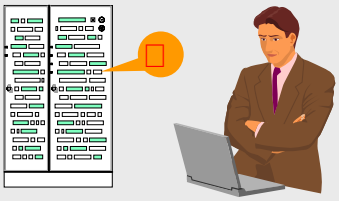
(*) A priced option function of SNMP

- A failure is indicated by the WARNING LED or the ALARM LED

Rack mount model



- Loss of Host Connectivity



5

Hardware Failure Detection

- Summary of Storage Unit Status Messages

icon	Text in screen	Status of each Hardware Component	Summary status of		Required Action
			The selected array	The array's status	
	Normal	Functioning properly			No
	Warning	Array shows trouble with the hardware	Some components of the array	One or more array	Alerts → Detail → Order the parts → Receive & replace parts → Confirm the recovery on Components screen)
	---	Unable to get information from the array (Rebooting, network error, authentication failure)		Status of one or more array is "---"	• Wait and retry • Check network and power switch OR • Troubleshoot with user guide

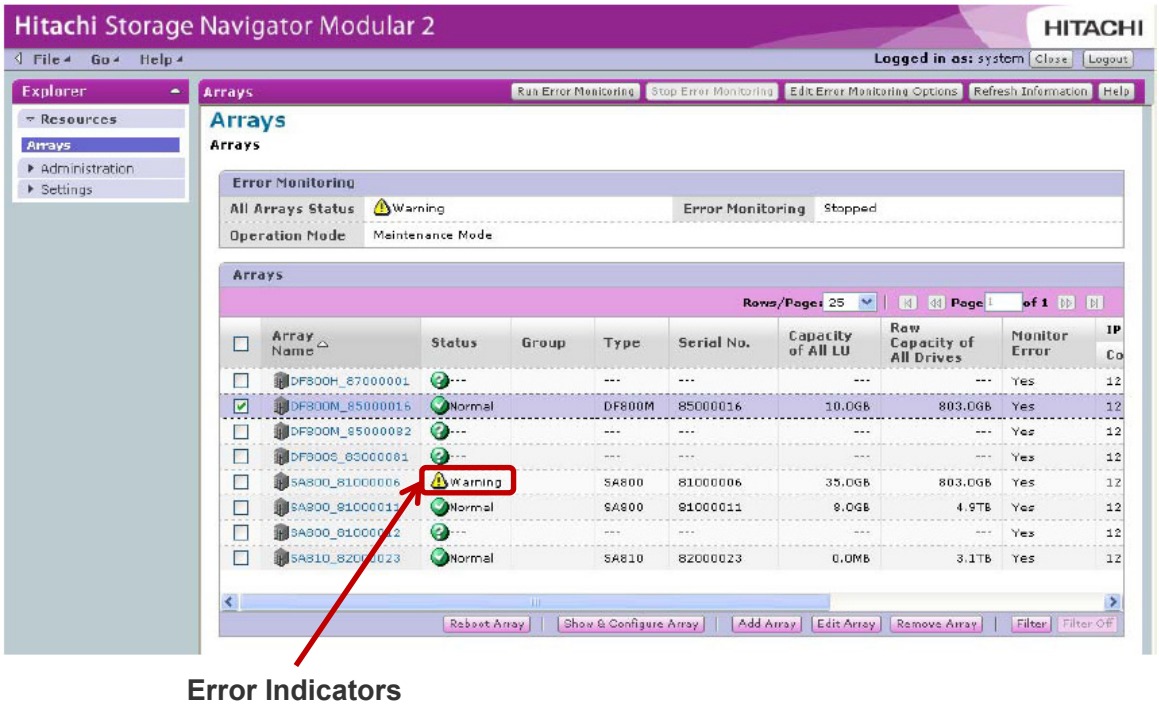
6

This matrix illustrates the types of icons that Storage Navigator Modular 2 uses to display system status. If the array is functioning normally, Storage Navigator Modular 2 returns an icon with a check mark.

In the event of a problem with the array, Storage Navigator Modular 2 returns a yellow exclamation point. If this occurs, the best course of action is to check the **Alerts & Events** option in the **Storage Array** window and determine the cause of the error.

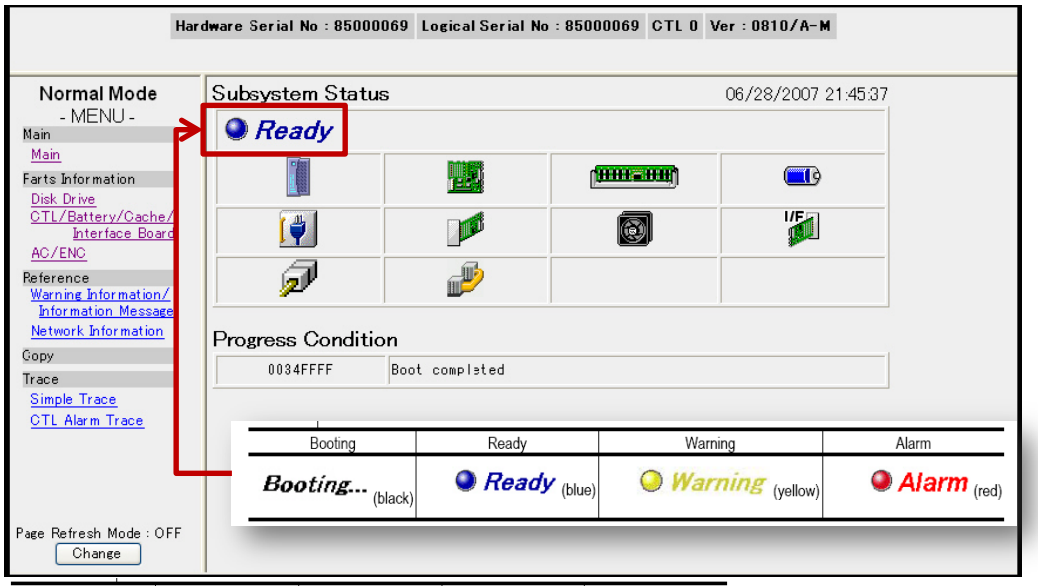
There are some exceptional cases when you lose network connectivity or when you are rebooting and the system cannot retrieve information from the array. In these cases, a question mark icon displays. First, check your network connection between the host and the array. If that does not correct the problem, then consult the user guide.

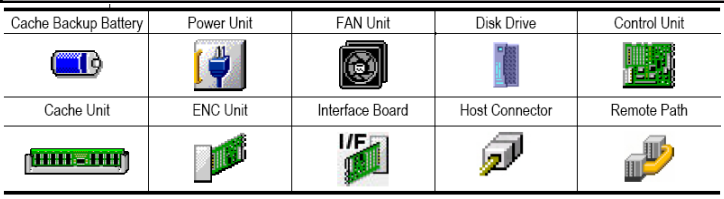
Storage Navigator Modular 2 Status Screen



7

SNM2 Subsystem Status Indicators

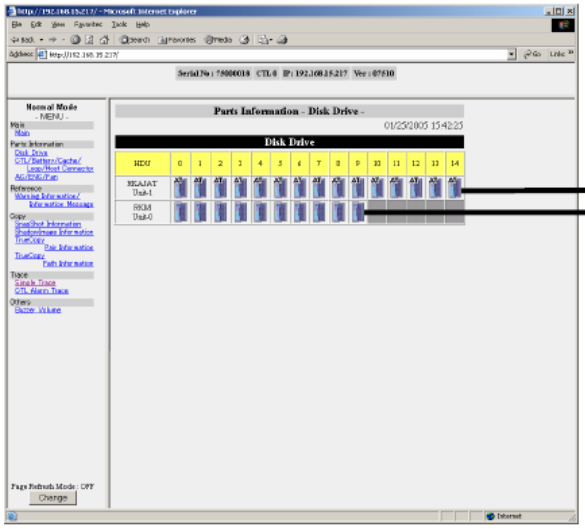




If any part fails, its summary becomes red. If the red part summary is clicked, the state confirmation window of the part appears and the position of the failed part is confirmed more in detail.

8

Disk Status



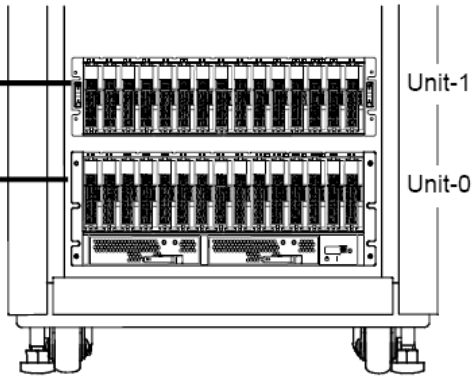
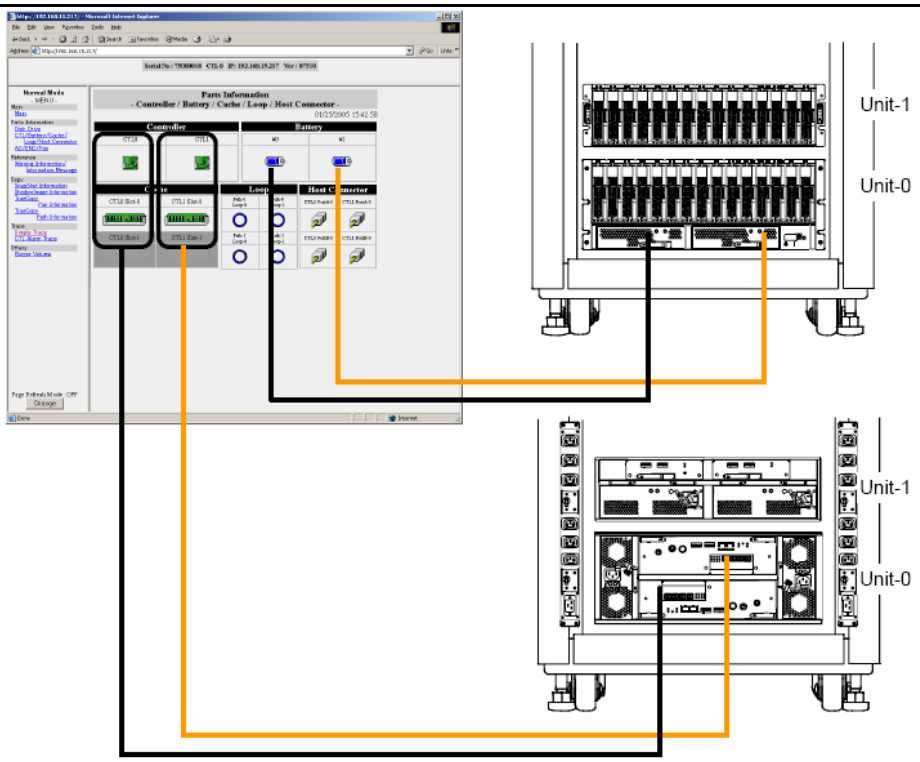


Image	Status
Blue	• Normal
Red	• Fault has occurred to the Disk Drive
Red and Black	• Disk Drive port that the fault occurred is not implementing the Disk Drive
No display	• Disk Drive is not implemented (Except for the status where the Disk Drive that the fault occurred was drawn out), or although a failure occurs in the Disk Drive, the Disk Drive type cannot be determined.

If any part fails, its summary becomes red. If the red part summary is clicked, the state confirmation window of the part appears and the position of the failed part is confirmed more in detail.

9

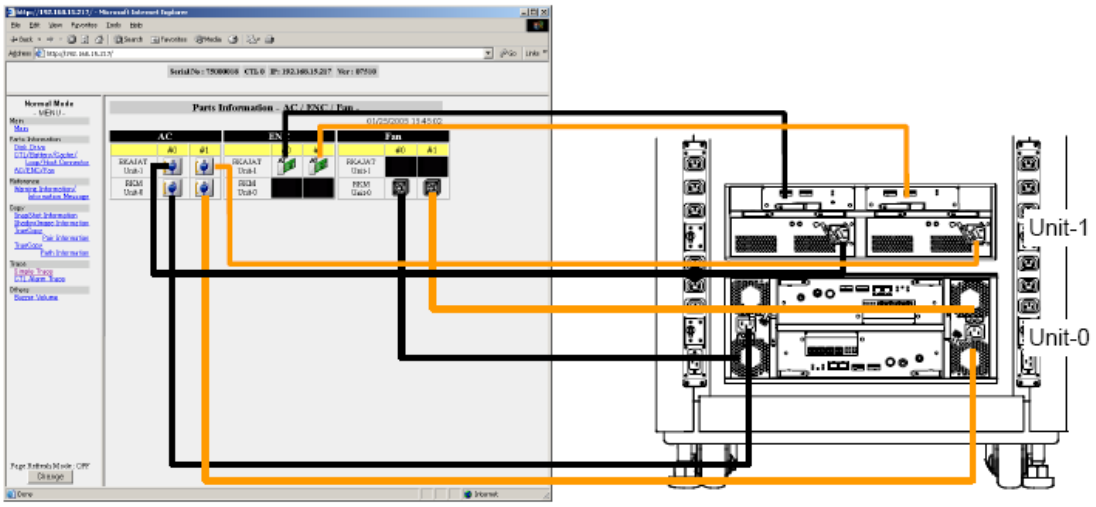
Controller/Battery/Cache/Interface Board/Host Connector Status



If any part fails, its summary becomes red. If the red part summary is clicked, the state confirmation window of the part appears and the position of the failed part is confirmed more in detail.

10

AC, ENC, Fan Status Indicators

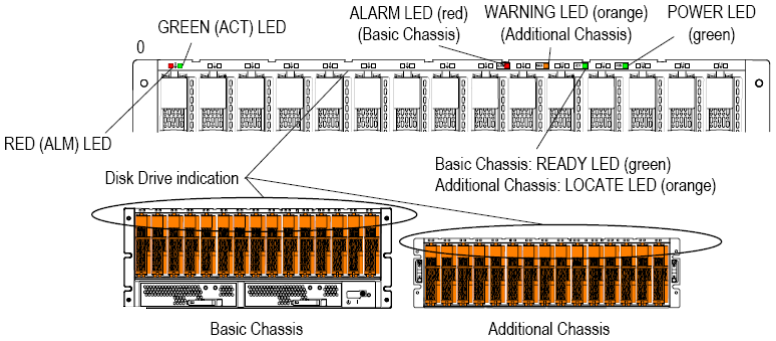


If any part fails, its summary becomes red. If the red part summary is clicked, the state confirmation window of the part appears and the position of the failed part is confirmed more in detail.

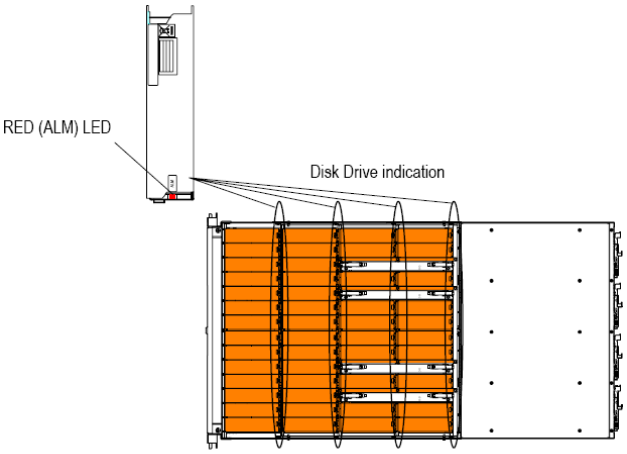
11

Disk LED Status Indicators

1. When the Warning LED (orange) of Basic Chassis is blinking, refer to the LOG Message by WEB connection, and check the backup status to the Spare Disk.
2. Replace the Disk Drive.



RKM/RKS/RKAK

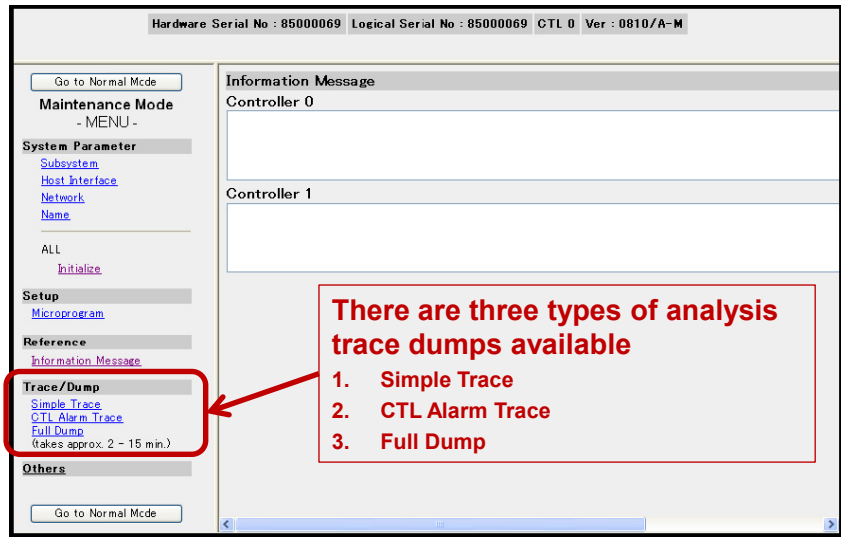


RKAKX

12

Failure Information Collection

- Collect failure information under the following conditions
  - A failure is reported to a work-station server, maintenance client or Web browser.
  - Hitachi Storage Navigator Modular 2 error indicator.
  - The Warning LED (orange) on the front of the Basic Chassis blinked or is on solid.
  - The Alarm LED (red) on the front of the Basic Chassis is on.



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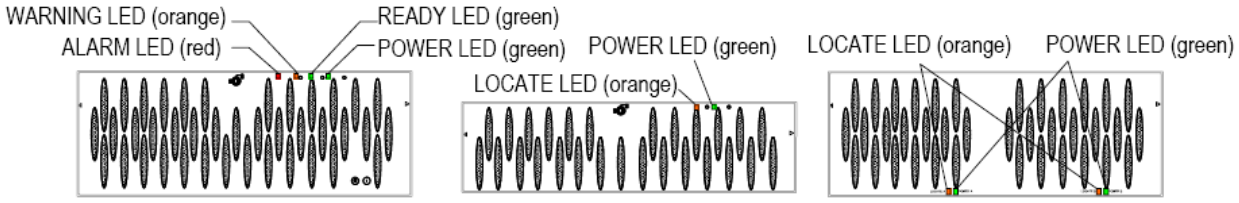
Collection of Trace Data

- Check that the READY LED (green) on the front of the Basic Chassis is not blinking at high speed.
- When the READY LED (green) on the front of the Basic Chassis is blinking at high speed, wait for the maximum of 30 to 50 minutes (or 40 to 60 minutes in case of the RKH) until the READY LED (green) lights up because the automatic download of the ENC firmware is being executed.
- Check that the WARNING LED (orange) on the front of the Basic Chassis (RKM/RKS/RKH) is not blinking at high speed.
- When the WARNING LED (orange) on the front of the Basic Chassis is blinking at high speed, wait for the maximum of 30 to 85 minutes until the WARNING LED (orange) on the front of the Basic Chassis goes out and the READY LED (green) lights up because the update of the flash program or the automatic download of the ENC firmware at the time of turning the power on in the single controller configuration is being executed. There is no problem if it blinks slowly (at intervals of one second).
- Clear the cache of the browser following the procedure shown below so that the old data, which was collected at the preceding time, should not be saved.

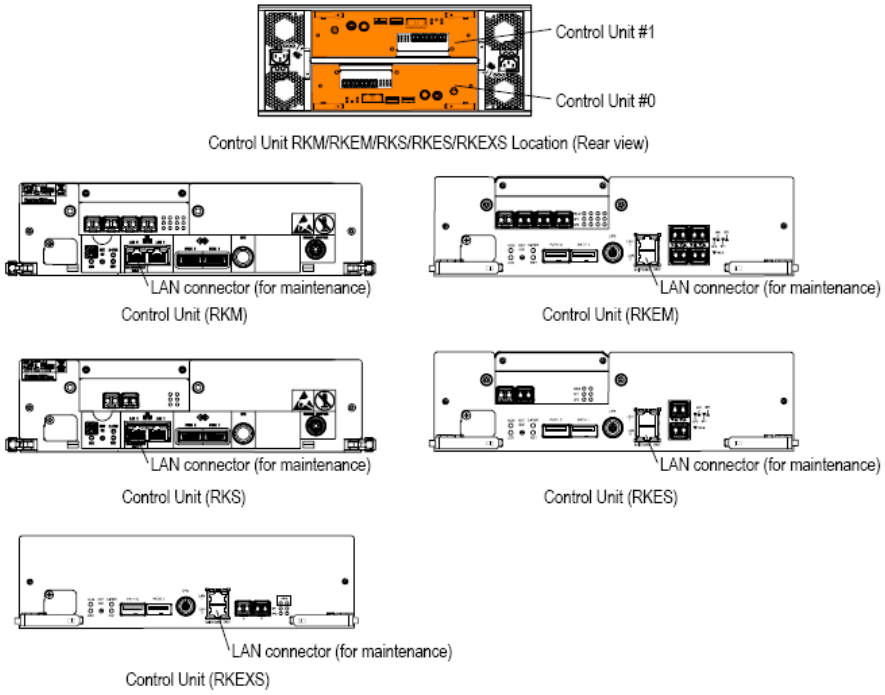


(a) Rackmount model of RKM/RKS/RKH (b) Rackmount model of RKAK (c) Rackmount model of RKAKX

14

Connection for Data Collection

Connect the Device LAN Port for maintenance and the PC terminal with a LAN-cross-cable.

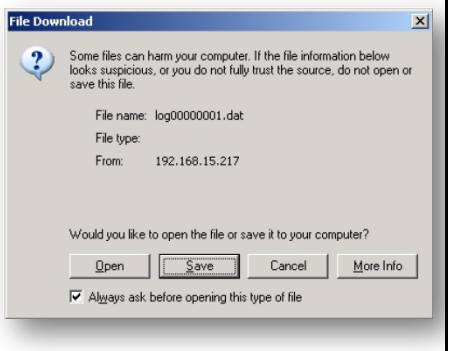


15

Collection of Simple Trace

Simple Trace needs to be collected from both controllers.

- For collecting the simple trace, a maintenance PC requires disk space of no less than 40MB.
  - When the firmware version is **less than 0890/A;**
    - The first file name during the collection from Control Unit #0 - "**smpl_trc0.dat**".
    - The first file name during the collection from Control Unit #1 - "**smpl_trc1.dat**".
  - When the firmware version is **0890/A or more;**
    - The first file name when the collection from Control Unit #0 fits in a file - "**smpl_trc0_0E.dat**"
    - The first file name when the collection from Control Unit #1 fits in a file - "**smpl_trc1_0E.dat**"
    - The first file names when the collection from Control Unit #0 fits in two files - "**smpl_trc0_0S.dat**", "**smpl_trc0_1E.dat**"
    - The first file names when the collection from Control Unit #1 fits in two files - "**smpl_trc1_0S.dat**", "**smpl_trc1_1E.dat**"
    - The first file names when the collection from Control Unit #0 fits in three files - "**smpl_trc0_0S.dat**", "**smpl_trc0_1C.dat**", "**smpl_trc0_2E.dat**"
    - The first file names when the collection from Control Unit #1 fits in three files - "**smpl_trc1_0S.dat**", "**smpl_trc1_1C.dat**", "**smpl_trc1_2E.dat**"

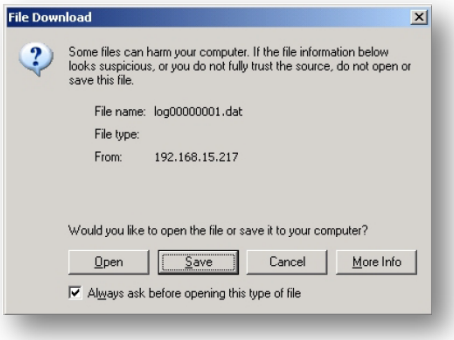


After clicking the Simple Trace link, save file to local hard drive for further analysis.

16

Collection of CTL Alarm Trace

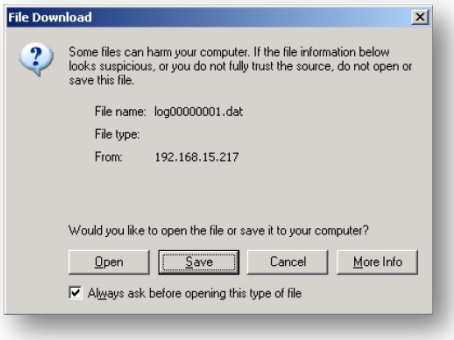
- The controller contains information about the time when the controller is shut down. Use the normal or maintenance mode in a Web browser to download this information from the controller to the browser terminal.
- Through the CTL Alarm Trace collection, detailed information (the CTL Alarm Trace) is collected on the immediately previous Controller blockage stored in the Controller.
- The CTL Alarm Trace is collected in the normal mode or the maintenance mode of the WEB. For connecting to the WEB, a maintenance PC terminal with Browser installed is necessary. For collecting the CTL Alarm Trace, disk space of 520MB per one Control Unit is required.
  - 260MB for temporary data and 260MB for Full Dump data
- After clicking the CTL Alarm Trace link, save file to local hard drive for further analysis.



17

Collection of Full Dump

- The Full Dump is collected in the maintenance mode of the WEB. For connecting to the WEB, a maintenance PC terminal with Browser installed is necessary. For collecting the Full Dump, disk space of 3.6GB per one Control Unit is required.
  - 1.8GB for temporary data and 1.8GB for Full Dump data
- Collect the Full Dump information from each Control Unit.
- After clicking the Full Dump link, save file to local hard drive for further analysis.



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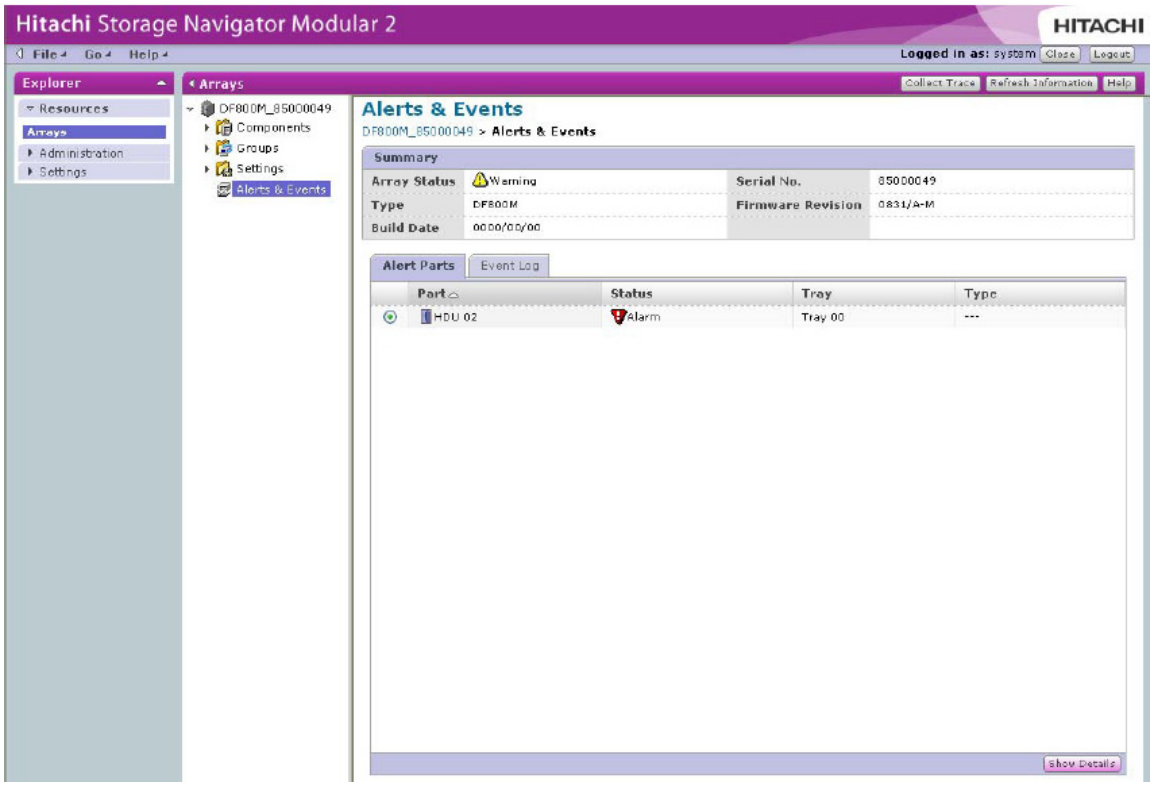
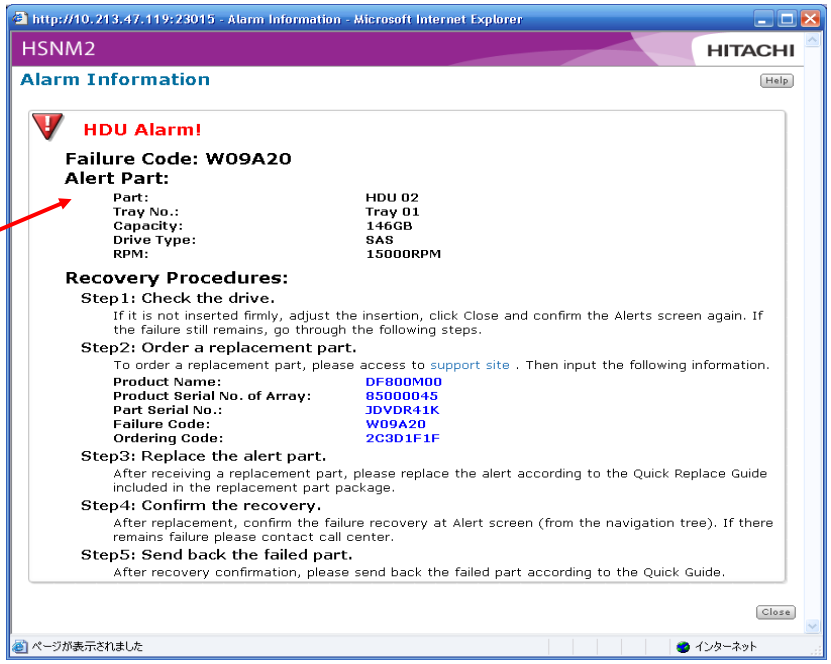
Alerts


Hitachi Storage Navigator Modular 2
HITACHI
File
Go
Help
Logged in as: system
Close
Logout
Explorer
Resources
Arrays
Administration
Settings
Arrays
Collect Trace
Refresh Information
Help
DF800M_85000049
Components
Groups
Settings
Alerts & Events
Alerts & Events
DF800M_85000049 > Alerts & Events
Summary
Array Status
Warning
Serial No.
85000049
Type
DF800M
Firmware Revision
0831/A-M
Build Date
0000/00/00
Alert Parts
Event Log
Part
Status
Tray
Type
HDU 02
Alarm
Tray 00

Show Details

19

- Alerts are messages created by the storage unit to warn the user of a hardware component failure.
- Alarm Types
  - Array
  - **Drive**
- Communications
  - Storage Navigator Modular 2 GUI
  - Email



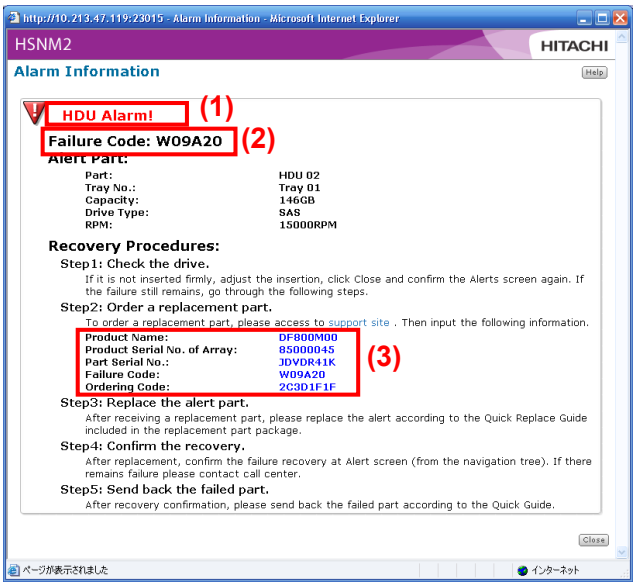
20

Alerts warn the user of a problem with the array. Physically, an HDD can fail or another internal failure can occur that is related to a power supply, fan, or battery. Alerts are set up and sent to a user's email address through Storage Navigator Modular 2.

Sample of Alarm Information

- Sample of Alarm Information on Storage Navigator Modular 2

  HDU failure



(1) Failure Message

(2) Failure Code

Failure Code enables user to specify failure part.

(3) Ordering Information

End user has to input this information at Web portal site.

21

Failure Codes

- Failure code specifies the failing part.

Format of Failure Code: Wabzxy

ab: Kind of Parts (ex: 09 = Drive, 06 = Fan, 07 = PS, 03 = Battery..)

z: Kind of Tray (ex. 1 = Simple Modular Storage, 2 = model 2100, 3 = model 2300, 4 = model 2500, 5 = SA810???, A = expansion unit)

xy: Unique Code

22

Troubleshooting Steps

1. Identify the error.
2. Collection and analysis.
3. Replace hardware components.
4. Confirm successful replacement.

23

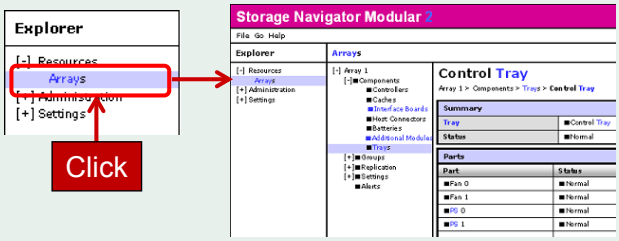
Identify the Error

❶ Start Storage Navigator Modular 2

a. Start the web browser on the computer containing Storage Navigator Modular 2, and enter IP address of maintenance PC: **http://**<*xxx.xxx.x.xx*>**:23015/StorageNavigatorModular/Login** in the address column.

b. Refer to Chapter ○ of the User's Guide for the detail.

Note: When Storage Navigator Modular 2 is starting, click **Arrays** of the **Explorer** menu, and return to the start window.

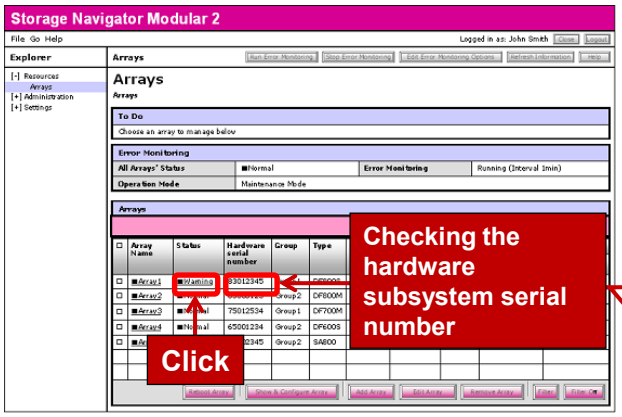


Note: When Storage Navigator Modular 2 does not start, there is possibility of a communication failure with the server, or the server may not be started normally. Refer to Chapter ○ in the Service Guide for actions to be taken.

Note: When the status column of the subsystem concerned is "Normal" or "---", refer to Chapter ○ in the Service Guide.

24

❷ Display the status of the storage system in which the failure occurs.



Email, SNMP

.....
Hardware serial number: 83012345
.....

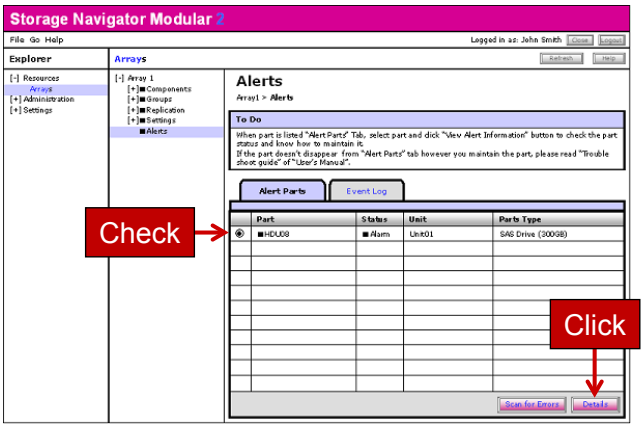
Rear view of the subsystem

The position of the label is shown in the figure.

25

❸ Check the failed parts

- Check that only one failed part is displayed, and then click the **Details** button.



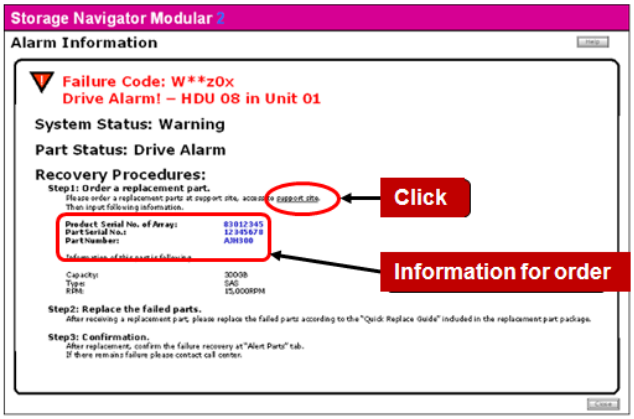
Note: When two or more parts are displayed in this window, refer to the Service Guide.

26

Failed Component Detail Information

❹ Check the details of the failed parts.

- Click the link to the support site, and connect to the support site.



❺ Order the parts to be replaced.

- Enter the necessary information in the support site and order the parts referred to the **Information for order** on the window displayed in ④.

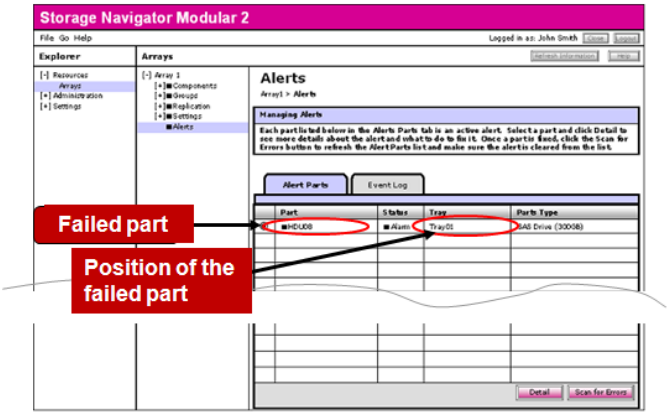
27

Identify the Error

1 Unpack the new parts.
- Keep the box carefully because it is used for sending back failed parts.

2 Check the positions of the failed parts in Storage Navigator Modular 2.
- Check the positions of the failed parts on the failed parts list window.
- (Refer to procedures ① to ③ for checking "when you found failures" for how to display the failed part list window.)

3 Replace the failed parts.
- Refer to the replacement procedure in the guide supplied with the parts. (The replacement procedure of disk drives is also described in the back of the user guide.)



28

Monitoring with SNMP

- The SNMP Agent Support Function notifies a network monitoring personal computer or workstation, in which the SNMP manager program is installed, of failures of the disk array subsystem via the SNMP (Simple Network Management Protocol).
- Further diagnosis can be achieved by reviewing LED indicators and Storage Navigator 2 Alerts and Events detail as previously outlined.

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Typical Troubleshooting Issues for Storage Navigator Modular 2

- Application software fails to install.
- Application software does not run correctly.
- Hardware component fails.

30

Under rare circumstances, you may encounter the following issues while using Storage Navigator Modular 2.

- Storage Navigator Modular 2 installation fails.
- Your browser cannot run Storage Navigator Modular 2.
- A warning message displays in Storage Navigator Modular 2 on the storage array window.

Summary of Fixes for Storage Navigator Modular 2

- Software Installation Failure
  - Check to ensure that hardware settings on installation platform are correct.
- Application Execution Failure
  - Check to ensure that the browser is the correct version.
  - Check to ensure that Microsoft Windows® processes and services are correctly installed and running.

31

In the event Storage Navigator Modular 2 does not install, first verify your hardware settings. Check the Release Notes that are included on your Storage Navigator Modular 2 CD for current information on hardware settings.

If you cannot access Storage Navigator Modular 2 via your browser, make sure you are using port 23015 and that you have included the "slash" at the end of the URL.

If the URL is correct, verify that the browser is supported. Also, confirm that all Microsoft® services and processes are installed and running.

Finally, if you receive an error or a warning message in Storage Navigator Modular 2, navigate to the **Alerts** panel to identify the error.

Application Execution Failure

- Verify Java Runtime Environment
  - http://www.java.com/en/download/installed.jsp
- Verify browser version
  - Open browser window
  - Click **Help → About**
- For current information on application version requirements, please check:
  - Release Notes
  - Storage Navigator Modular 2 User's Guide

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To verify that your Java Runtime Environment is at supported levels, navigate to Java's website and use their online utility for verification.

To verify that your browser is at supported levels, open the browser and on the toolbar, click **Help** and select **About**.

Microsoft Windows Processes for Storage Navigator Modular 2

- To access, press <CTRL+ATL+DEL> and select **Task Manager**.
- Processes are:
  - hcmdssvctl.exe
  - hntr2srv.exe
  - httpsd.exe
  - pdsha.exe
  - pdservice.exe
  - snm2srv.exe
- Locate Microsoft Windows Processes

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Microsoft Windows Services for Storage Navigator Modular 2

- To access

  Start → Programs → Administrative Tools → Services

  – HBase Storage Mgmt Common Service
  – HBase Storage Mgmt Web Service
  – HiRDB
  – Storage Navigator Modular 2 Server
- To stop and start
  – The following command can be run to Start and Stop all Services used by Storage Navigator Modular 2. It is very useful to clear errors or a nonfunctioning condition. It is also required to perform a version upgrade.

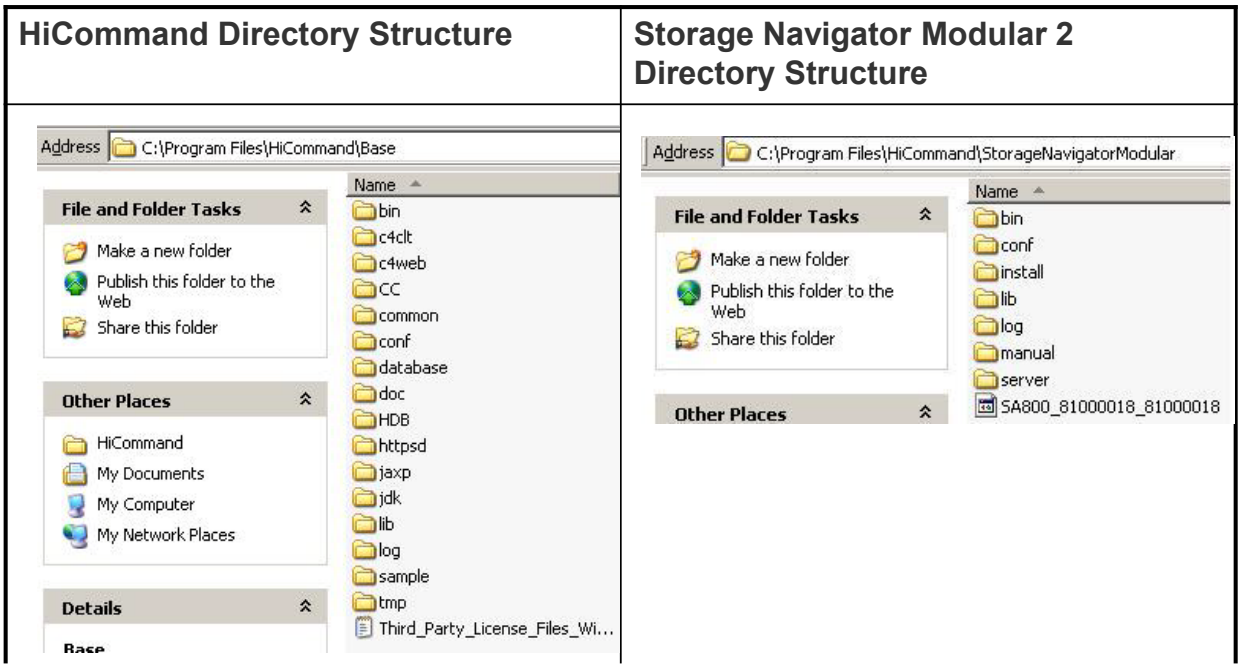
  C:\program files\hicommand\base\bin\hcmdssrv.exe /start or stop
- Locate Microsoft Windows Services
- Navigate to Microsoft Windows Services Profile

34

These services should be running on your PC to successfully execute Storage Navigator Modular 2.

Directory Structure of Storage Navigator Modular 2 Microsoft Windows

- The processes and services reside in the following directories:



Ensure that directory structure exists and matches what you see here. These two directory structures should be built after a successful installation. There are two main directories:

- HiCommand
- StorageNavigatorModular

Note: The HiCommand directory structure is built as part of the Storage Navigator Modular 2 software.

Notify Global Support

- If further support is required through Hitachi Data Systems, please contact the Hitachi Data Systems Global support center.

GEO	Number	Customer Care Center the call will be routed to
EMEA	+44 1753 216060	Sefton Park during Normal business hours. Calls will be diverted to San Diego after hours.
Americas/Asia Pacific	+1 858 621 7130 +1 800 446 0744	San Diego 24/7 Customer Number

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12. Hitachi Storage Navigator Modular 2 Advanced Operations

Module Objectives

- Upon completion of this module, the learner should be able to:
  - Collect a Simple Trace by using Storage Navigator Modular 2
  - Export **Constitute** files for configuration and settings information by using Storage Navigator Modular 2
  - Put SNM2 into **Maintenance Mode**
  - Perform a Microcode/Firmware update by using Storage Navigator Modular 2

2

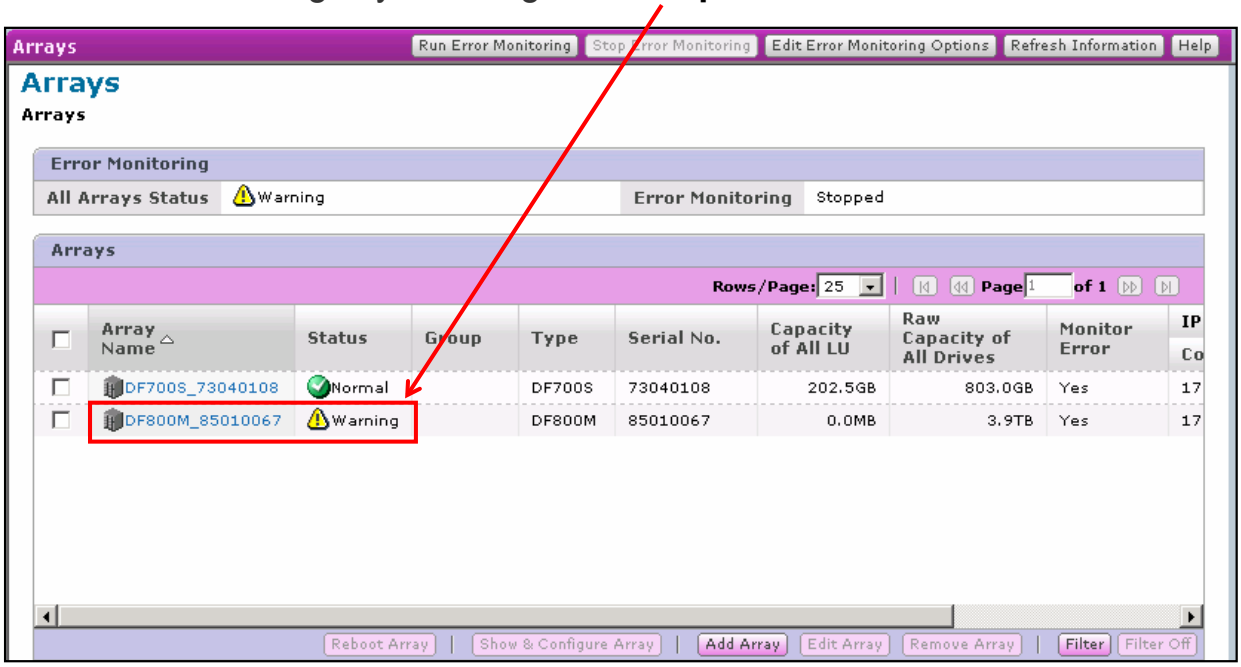
Collect a Simple Trace

- The Simple Trace is used by Hitachi Data Systems support personal to analyze the storage system in case of a problem or for a health check.
- The Simple Trace contains the following information:
  - System settings information
  - System configuration information
  - Detailed message, error logs and statistics
  - System performance information
  - Detailed back end information
  - Detailed front end information

Note: The Simple Trace **does not contain any user data** from disks or Logical Units or captured data from the Host front end.

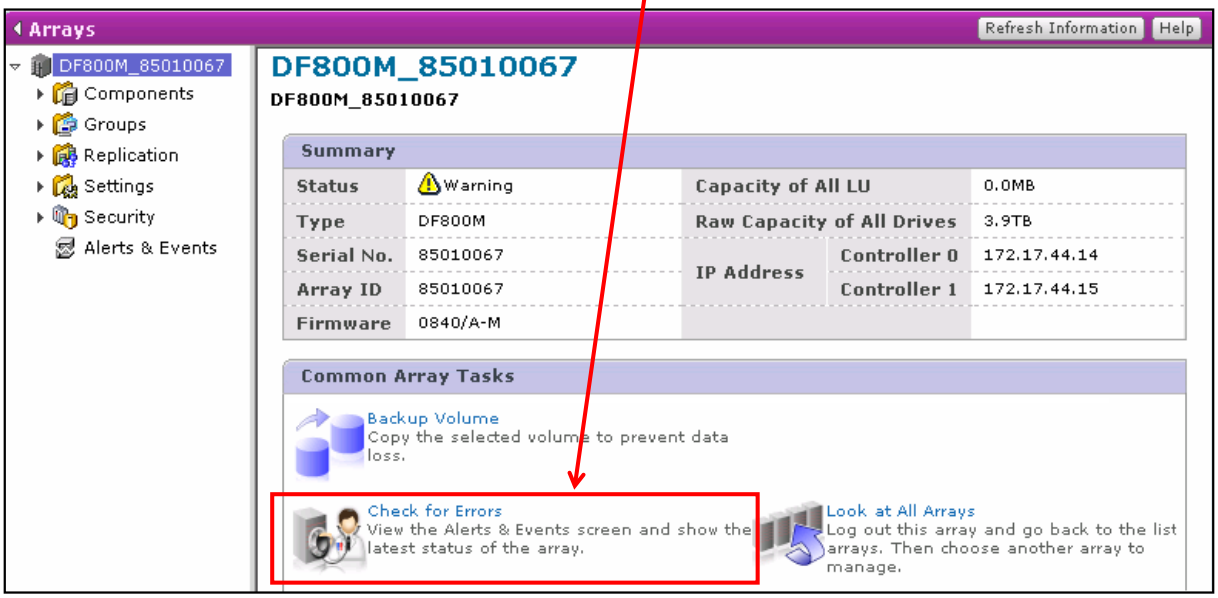
3

1. Select the storage system to gather **Simple Trace** information.



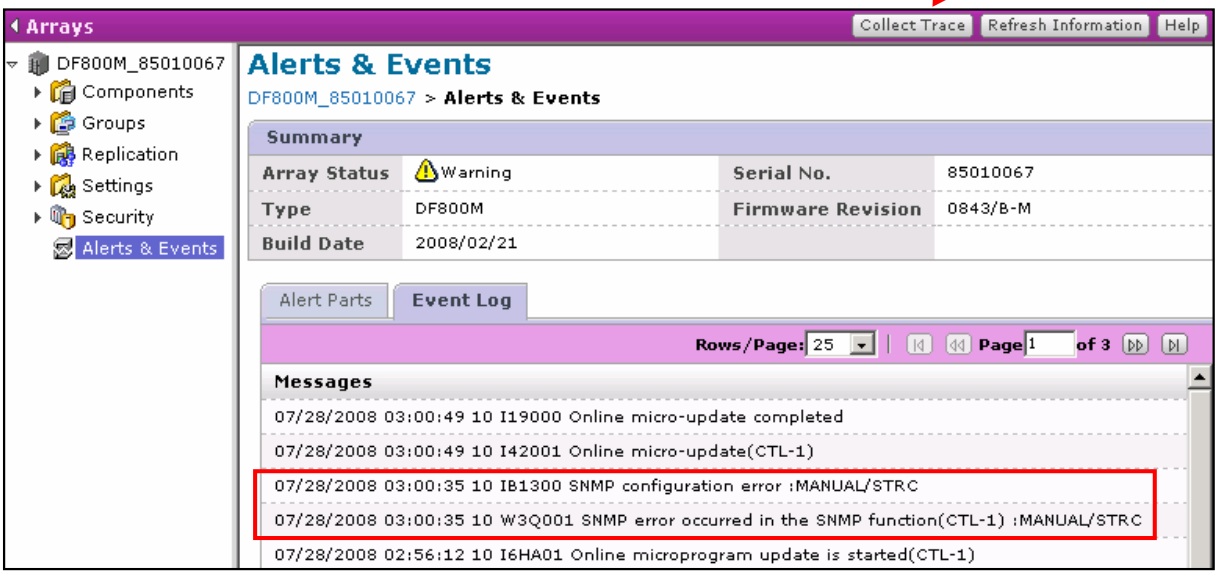
4

2. Click on **Check for Errors**.



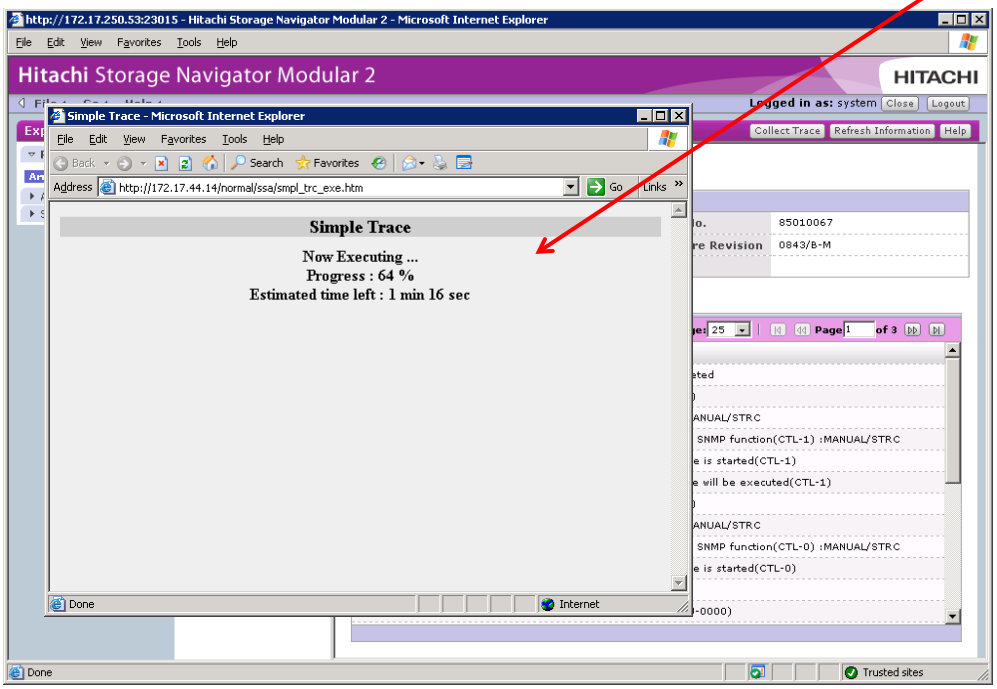
5

3. Click on **Collect Trace** to start the collection process.



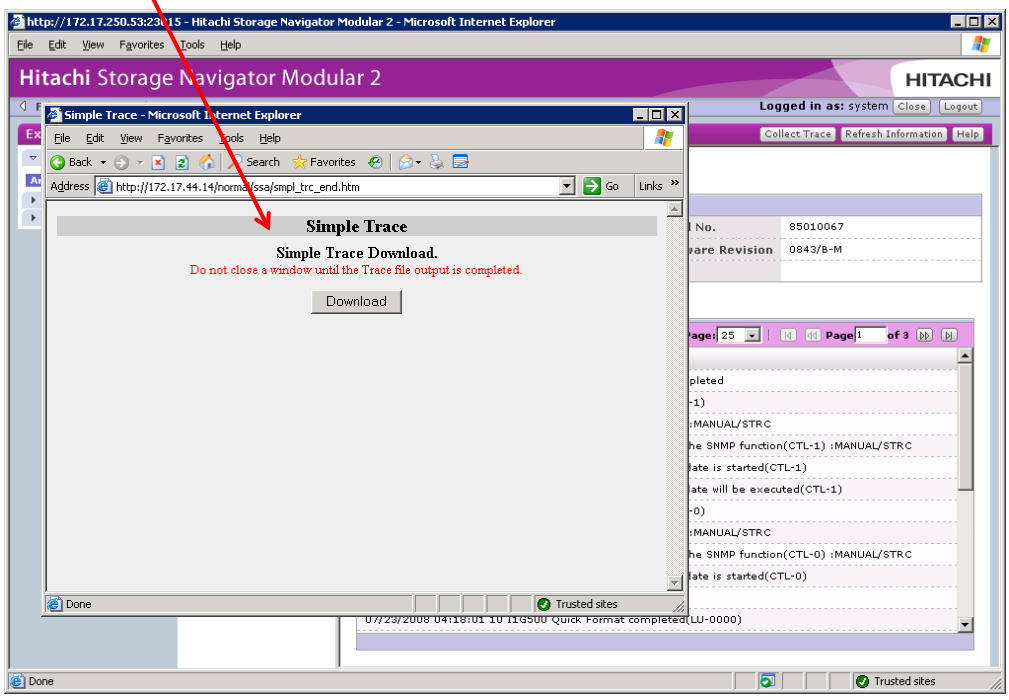
6

- A new window appears. ***Do not close it while executing!***



7

4. Click **Download** to download and save the Simple Trace.



8

Constitute Files

- **Constitute** files contain information as follows:
  - RAID group configuration information
  - LU configuration information
  - Port and Host group configuration information
  - System setting information

9

- The Constitute files can be used to **view** or **set** the configuration or clone an Adaptable Modular Storage 2000 Family system.
- Two Constitute operations can be performed:
  - **Output** – Views the information
  - **Input** – Imports the configuration information from a existing constitute file

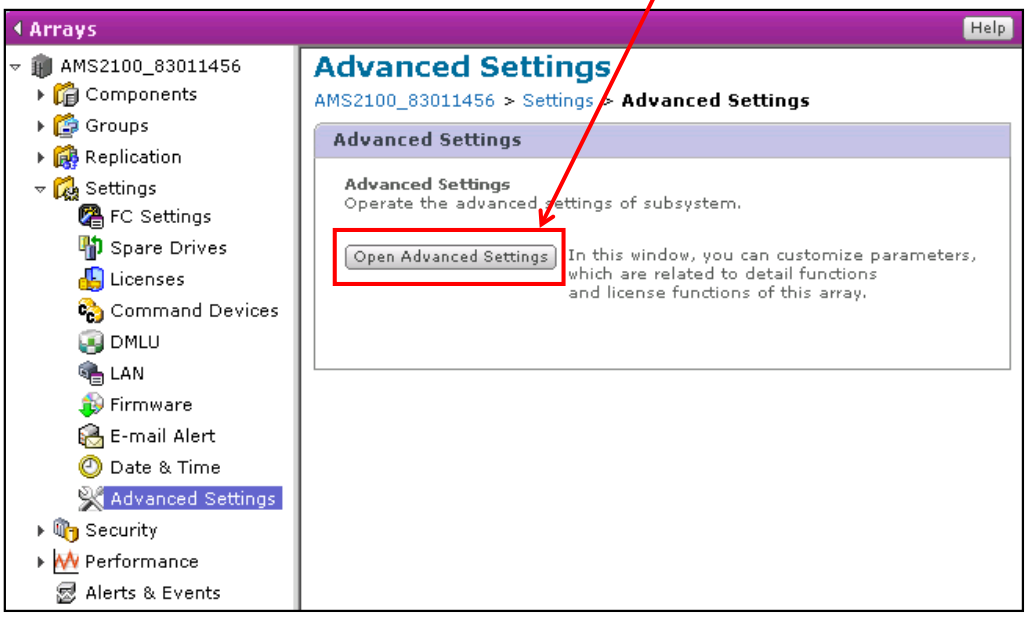
Notes:

- When using **Input** to set **configuration information**, all prior set configuration information is **overwritten**.
- When using **Input** to set **RAID Group** or **Logical Unit** settings, or to clone the storage system, all prior set configuration is **overwritten**, and the data on the affected RAID groups or the Logical Units is **overwritten.**

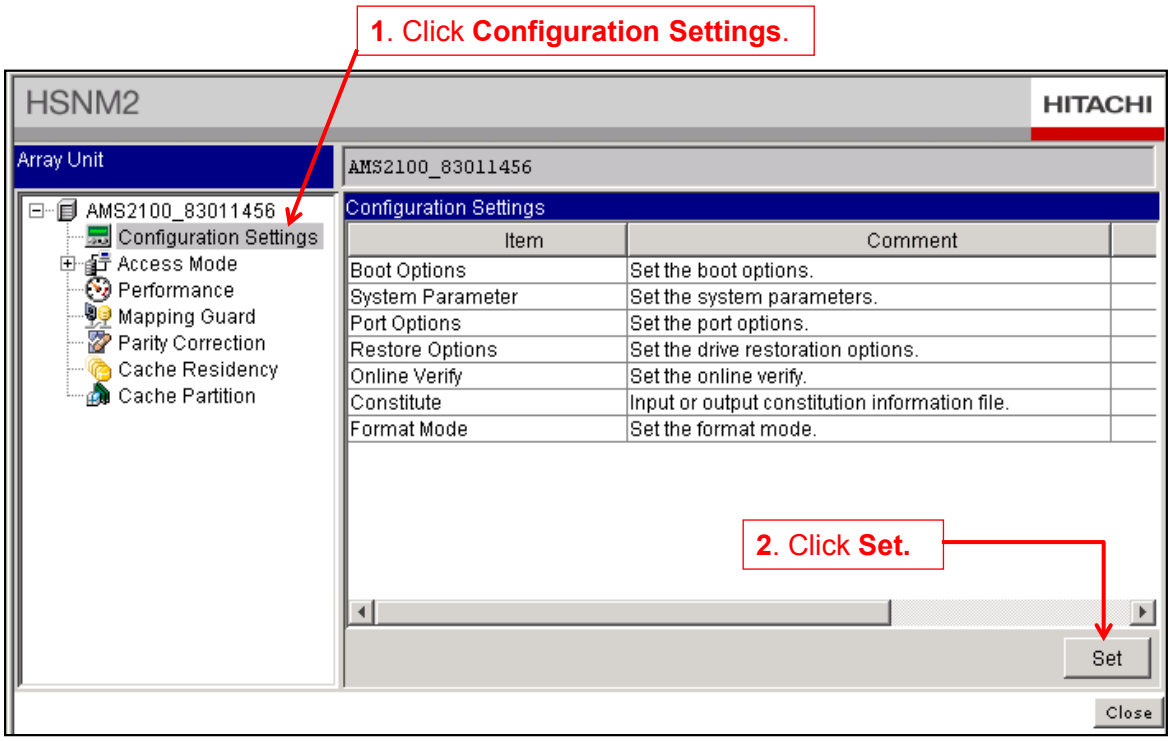
10

Export Constitute Files

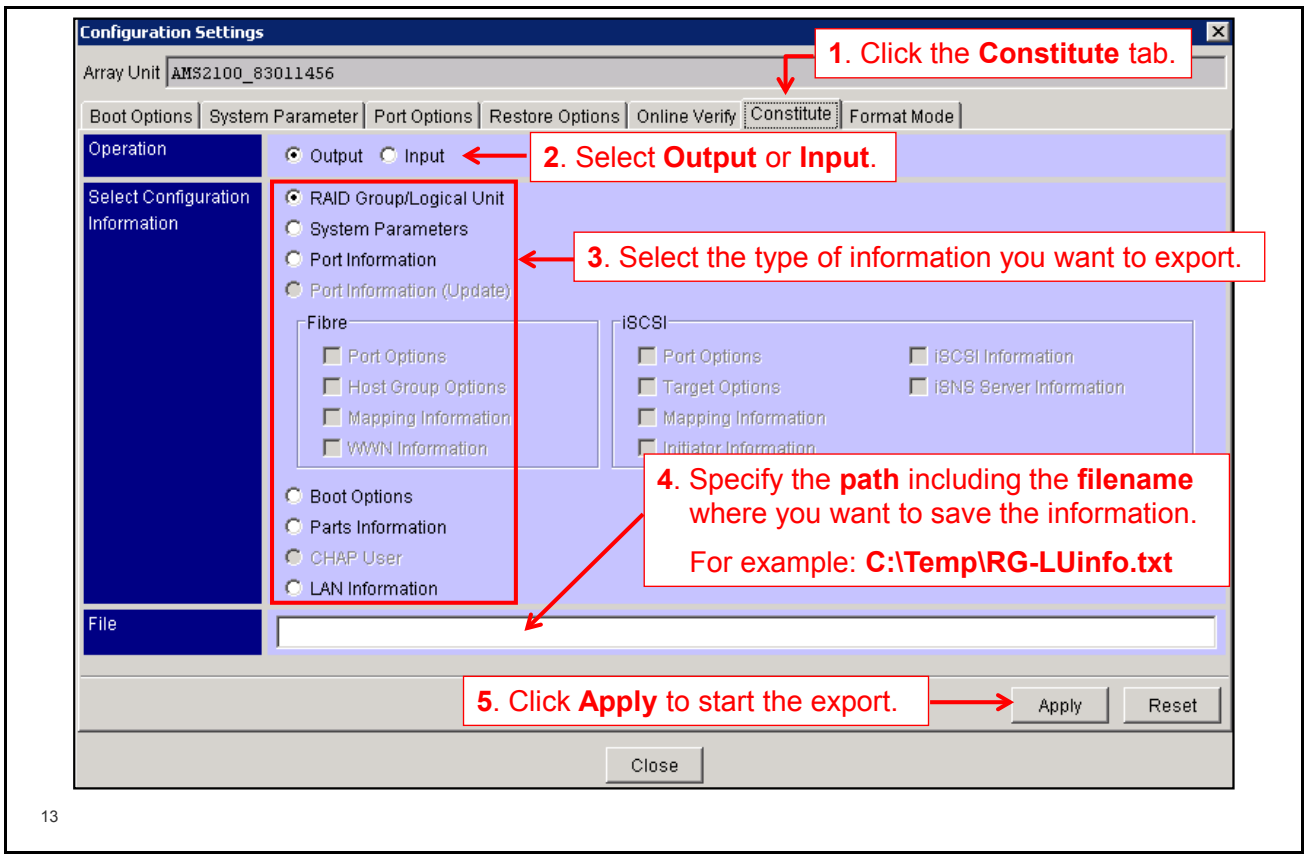
1. Click **Advanced Settings** and then the **Open Advanced Settings** button.

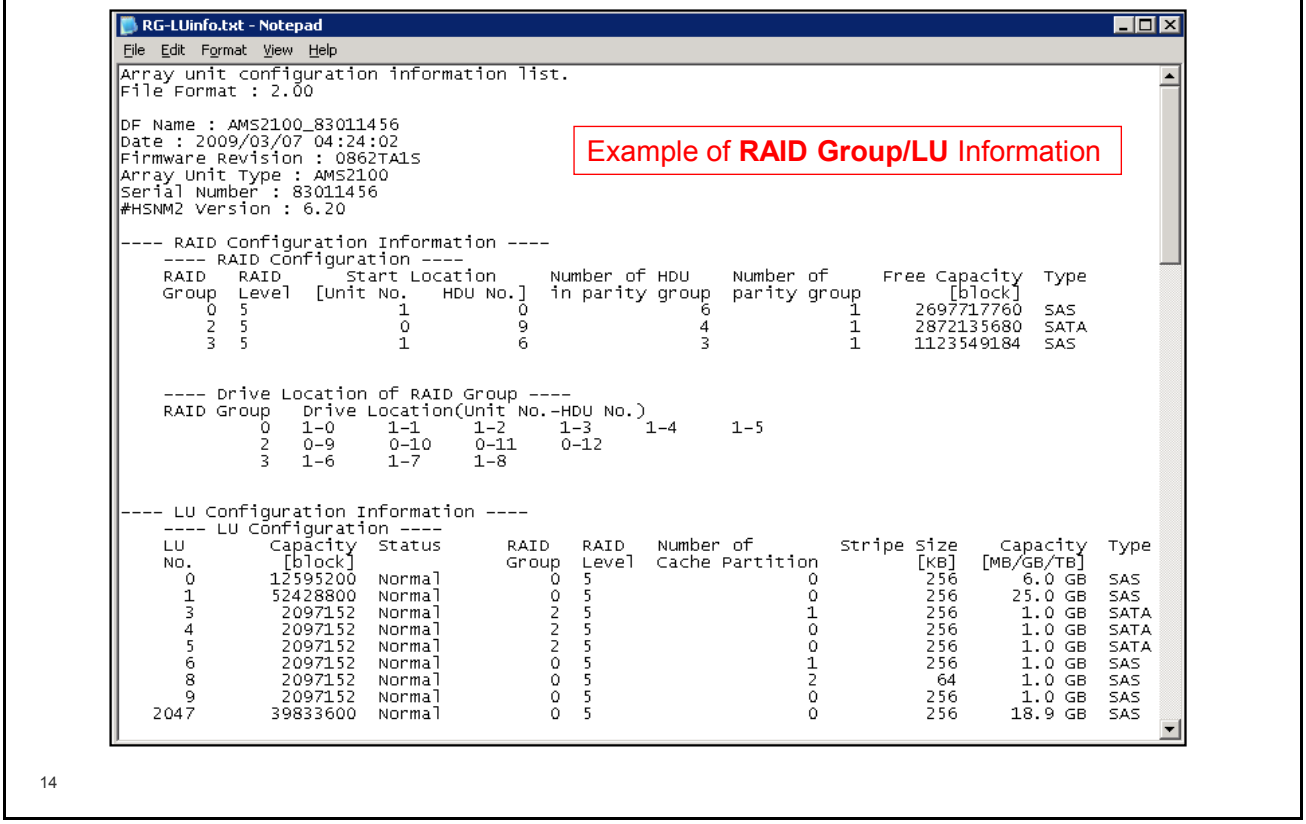


11


1. Click Configuration Settings.
HSNM2
HITACHI
Array Unit
AMS2100_83011456
AMS2100_83011456
Configuration Settings
Access Mode
Performance
Mapping Guard
Parity Correction
Cache Residency
Cache Partition
Configuration Settings
Item
Comment
Boot Options
Set the boot options.
System Parameter
Set the system parameters.
Port Options
Set the port options.
Restore Options
Set the drive restoration options.
Online Verify
Set the online verify.
Constitute
Input or output constitution information file.
Format Mode
Set the format mode.
2. Click Set.
Set
Close

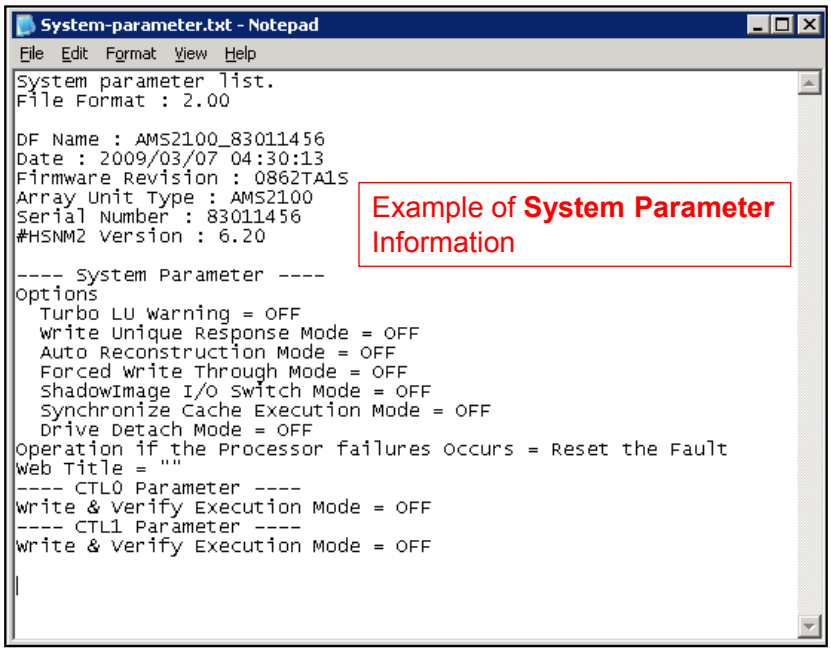
12


Configuration Settings
Array Unit AMS2100_83011456
Boot Options
System Parameter
Port Options
Restore Options
Online Verify
Constitute
Format Mode
1. Click the Constitute tab.
Operation
Output
Input
2. Select Output or Input.
Select Configuration Information
RAID Group/Logical Unit
System Parameters
Port Information
Port Information (Update)
3. Select the type of information you want to export.
Fibre
Port Options
Host Group Options
Mapping Information
WWN Information
iSCSI
Port Options
Target Options
Mapping Information
Initiator Information
iSCSI Information
iSNS Server Information
Boot Options
Parts Information
CHAP User
LAN Information
4. Specify the path including the filename where you want to save the information.
For example: C:\Temp\RG-LUinfo.txt
File
5. Click Apply to start the export.
Apply
Reset
Close
13




```
Array unit configuration information list.
File Format : 2.00

DF Name : AMS2100_83011456
Date : 2009/03/07 04:24:02
Firmware Revision : 0862TA1s
Array Unit Type : AMS2100
Serial Number : 83011456
#HSNM2 Version : 6.20

---- RAID Configuration Information ----
    ---- RAID Configuration ----
    RAID   RAID      Start Location     Number of HDU    Number of     Free Capacity  Type
    Group  Level  [Unit No.   HDU No.]  in parity group  parity group       [block]
        0  5              1          0               6             1     2697717760  SAS
        2  5              0          9               4             1     2872135680  SATA
        3  5              1          6               3             1     1123549184  SAS


    ---- Drive Location of RAID Group ----
    RAID Group   Drive Location(Unit No.-HDU No.)
             0   1-0     1-1     1-2     1-3     1-4     1-5
             2   0-9     0-10    0-11    0-12
             3   1-6     1-7     1-8


---- LU Configuration Information ----
    ---- LU Configuration ----
    LU        Capacity  Status      RAID   RAID   Number of        Stripe Size    Capacity  Type
    No.         [block]             Group  Level  Cache Partition        [KB]  [MB/GB/TB]
      0        12595200  Normal          0  5                    0         256      6.0 GB  SAS
      1        52428800  Normal          0  5                    0         256     25.0 GB  SAS
      3         2097152  Normal          2  5                    1         256      1.0 GB  SATA
      4         2097152  Normal          2  5                    0         256      1.0 GB  SATA
      5         2097152  Normal          2  5                    0         256      1.0 GB  SATA
      6         2097152  Normal          0  5                    1         256      1.0 GB  SAS
      8         2097152  Normal          0  5                    2          64      1.0 GB  SAS
      9         2097152  Normal          0  5                    0         256      1.0 GB  SAS
   2047        39833600  Normal          0  5                    0         256     18.9 GB  SAS
```

Note: If you want to edit this file for cloning another system, use the **Word Pad** edit because Note Pad could inject extra characters.



Example of **System Parameter** Information

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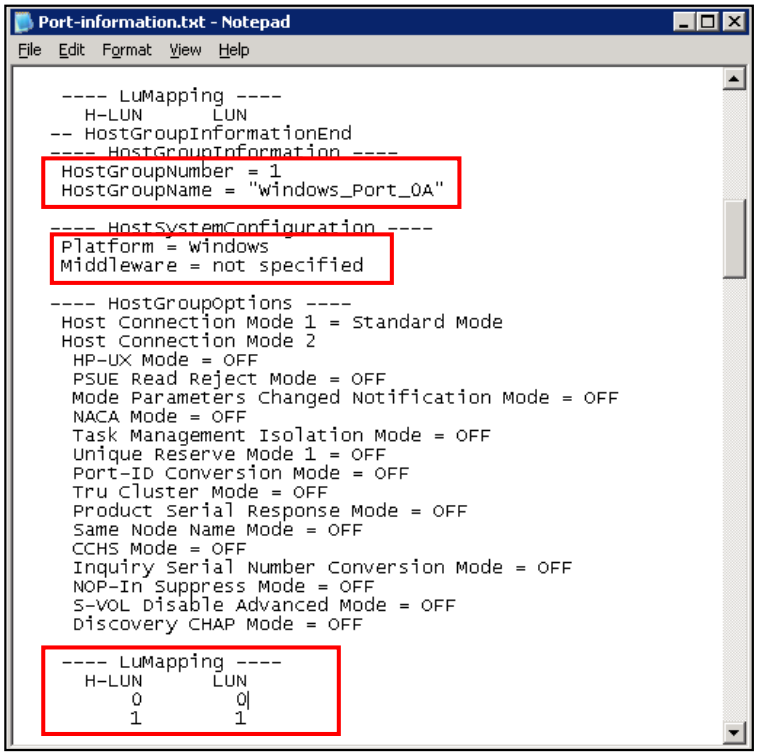
Example of **Port** Information



16

Microcode Functional Update Methods

Function	Interface	Mode	Effect on Host	Path Mgr required	Explanation	Comments
1: Firmware Update (Wizard)	SNM2	Normal	non disruptive	No	fully deploys Active/Active Always use in a production environment	download interval time *cannot* be set to 0
2: Firmware Update (Wizard)	SNM2	SNM2-Maintenance Mode	non disruptive	No	fully deploys Active/Active	download interval time *can* be set to 0
3: Micro Update (old method like in DF700)	SNM2 Advanced Settings	SNM2-Maintenance Mode	non disruptive	Yes	sets FC/IF ports offline	only if required if ECN = Y
4: Micro Initialize or Update	Web GUI	Hardware Maintenance Mode	disruptive	NA	all IF ports are blocked AMS reboot required	mainly for MC initialization. For MC update only if required if ECN = Y

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License Keys that Require a Reboot

Function	Reboot at Key Install	Reboot when Function is used	Reboot at Key De-Install	Comments
COW (Snapshots)	Yes if TCE not installed before No if TCE installed before	N	Yes if TCE not installed before No if TCE installed before	COW install will remove existing CPM partitions. COW de-install will keep existing CPM partitions
Cache Partition Manager	N	Y	N	
Cache Residency	N	Y	N	
TCE (Copy async)	Yes if COW not installed before No if COW installed before	N	Yes if COW not installed before No if COW installed before	TCE and COW share same resources
Hitachi Dynamic Provisioning	Y	N	Y	

18

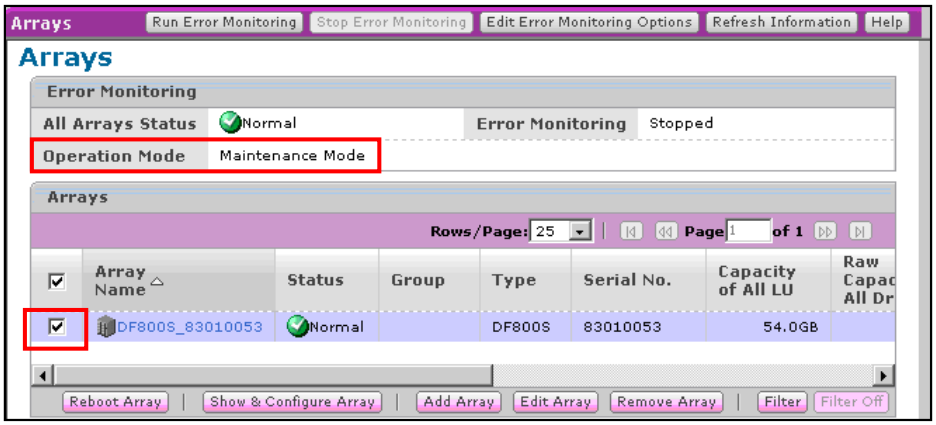
Put SNM2 into Maintenance Mode

To quickly update the microcode, SNM2 is put into **Maintenance Mode.**

1. The maintenance mode file (mode) is pasted into the following folder:

   C:\Program Files\HiCommand\StorageNavigatorModular\conf

2. Launch SNM2 and log in as **system** giving the password **manager.**
3. Check the box to the left of your systems Array Name.
4. Issue the following keyboard keystroke sequence: **Ctrl-Shift-E**

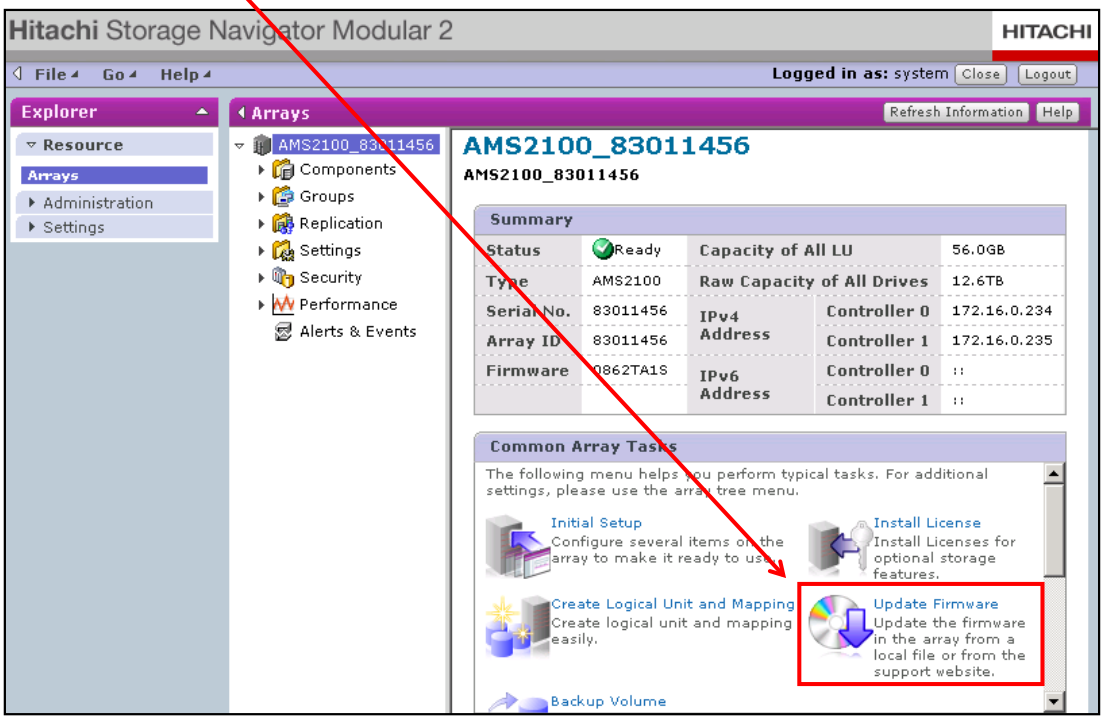


5. Connect to the array.

19

Firmware Update

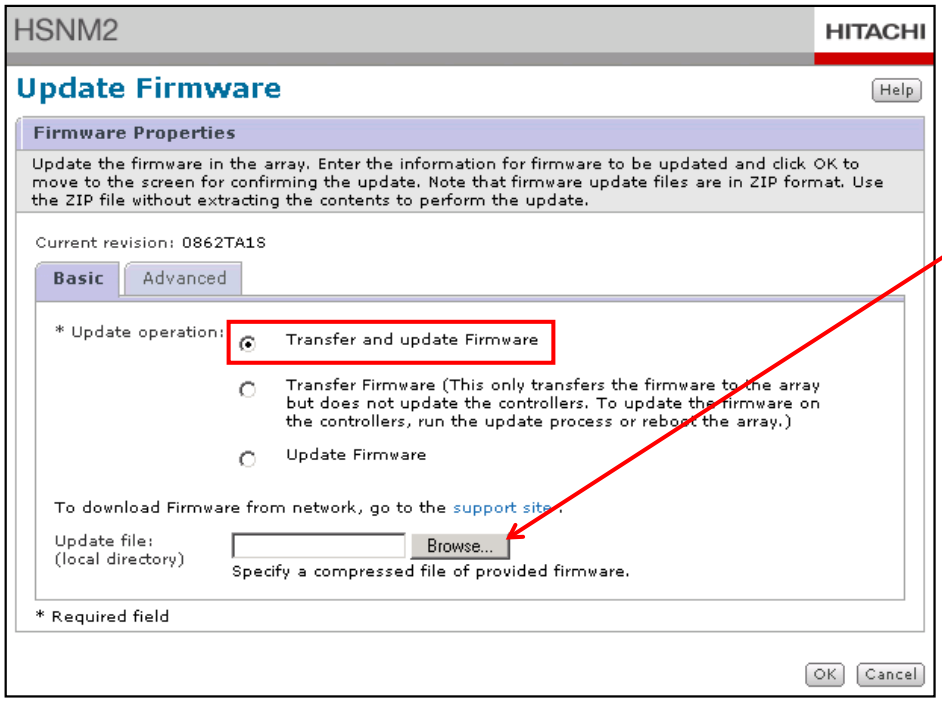
1. Click on **Update Firmware.**



20

Microcode updates can only be performed on an array in *Normal* status mode (no alarm conditions).

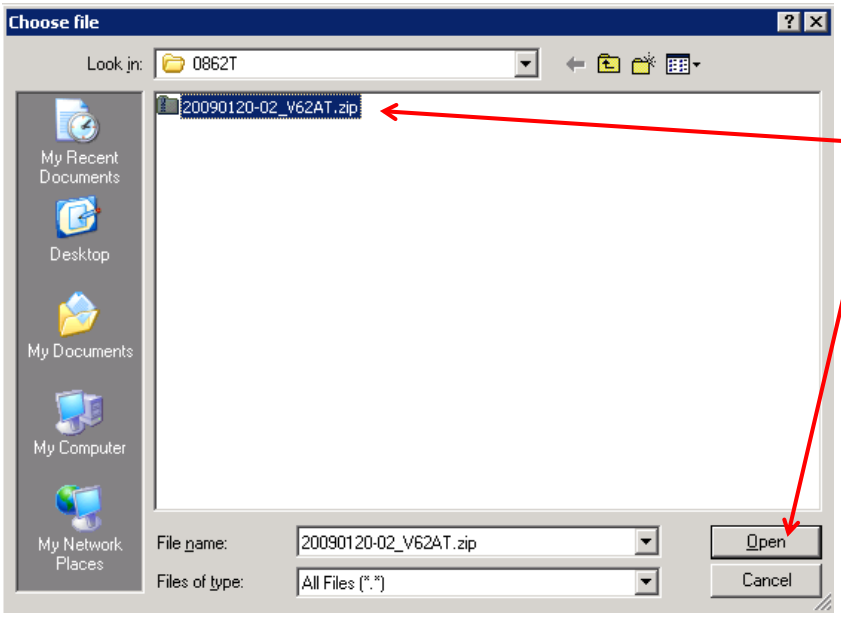
2. Specify the path to the compressed (Zip) file that contains the firmware.



Click on **Browse** (see next slide)

21

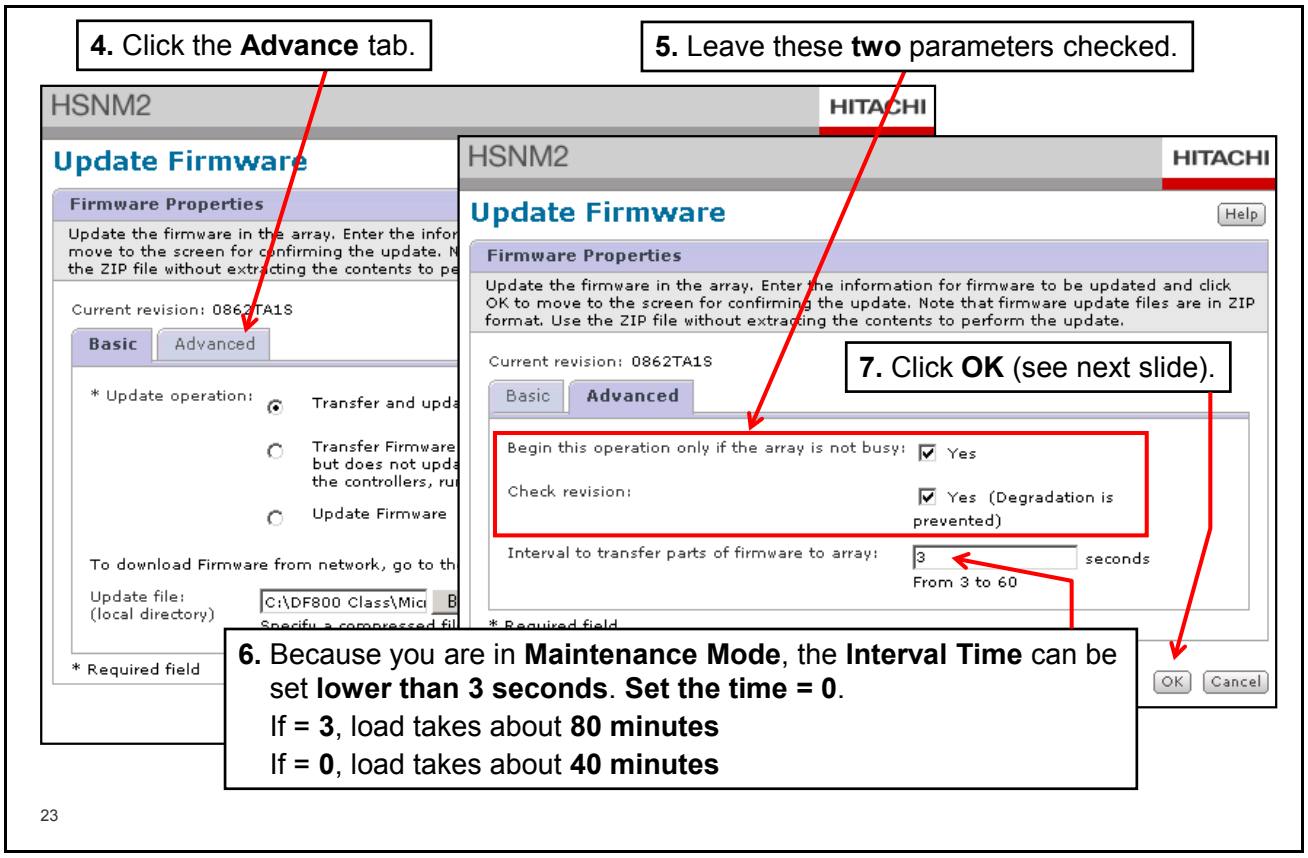
3. Specify the path to the Zip file that contains the firmware.

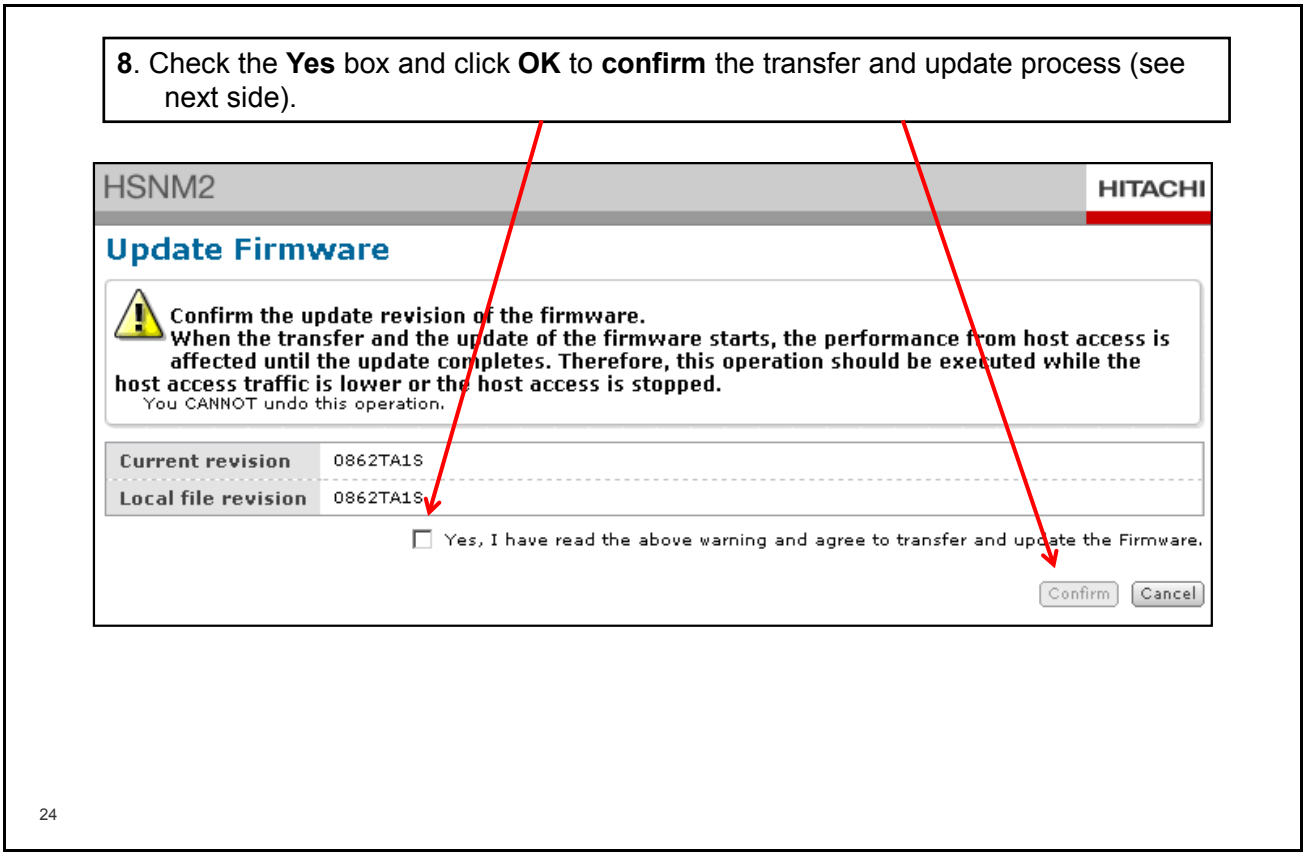


Select the **Zip file** and click **Open.**

22

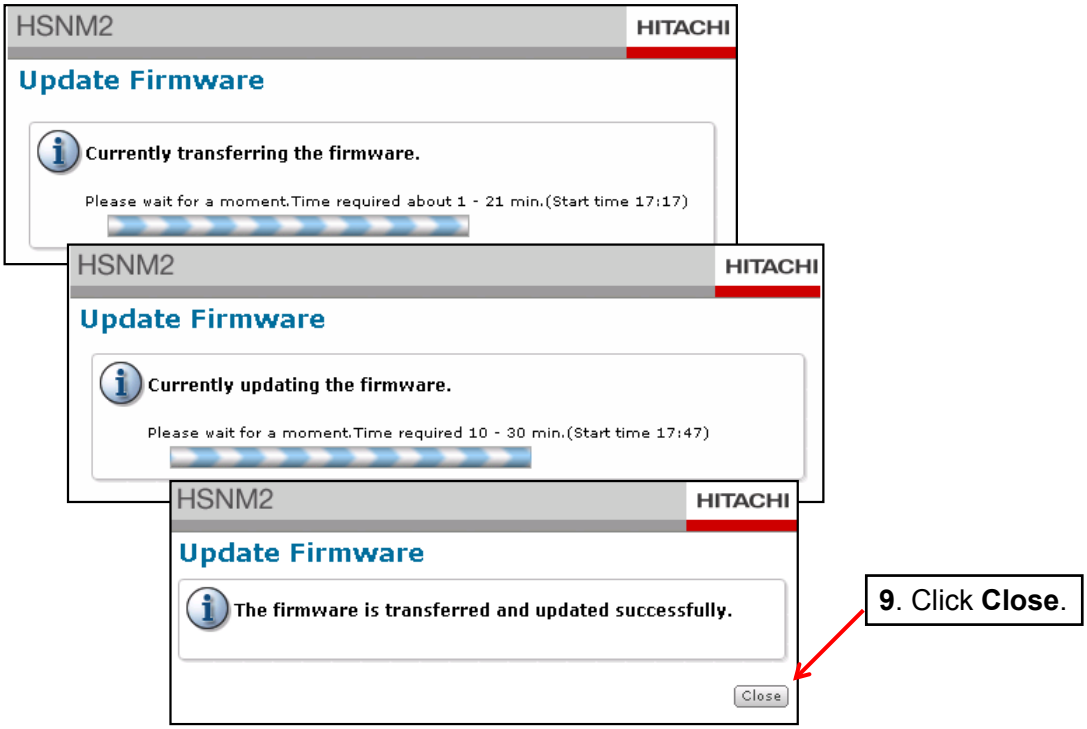
SNM2 requires input of microcode via Zip file only.


4. Click the Advance tab.
5. Leave these two parameters checked.
HSNM2
HITACHI
Update Firmware
Firmware Properties
Update the firmware in the array. Enter the information for firmware to be updated and click OK to move to the screen for confirming the update. Note that firmware update files are in ZIP format. Use the ZIP file without extracting the contents to perform the update.
Current revision: 0862TA1S
Basic
Advanced
Begin this operation only if the array is not busy:
Yes
Check revision:
Yes (Degradation is prevented)
Interval to transfer parts of firmware to array:
3
seconds
From 3 to 60
Help
OK
Cancel
7. Click OK (see next slide).
6. Because you are in Maintenance Mode, the Interval Time can be set lower than 3 seconds. Set the time = 0.
If = 3, load takes about 80 minutes
If = 0, load takes about 40 minutes
23



Note: This is why Maintenance Mode was entered. If SNM2 is in normal mode, then this parameter **cannot be set lower than 3 seconds**. Since SNM2 is in maintenance mode, **the zero (0)** setting will be accepted and the load process will occur **much faster**. This affects front end performance; therefore **avoid using this procedure unless your customer approves its use**.

- Messages during the Firmware Upload and Update process

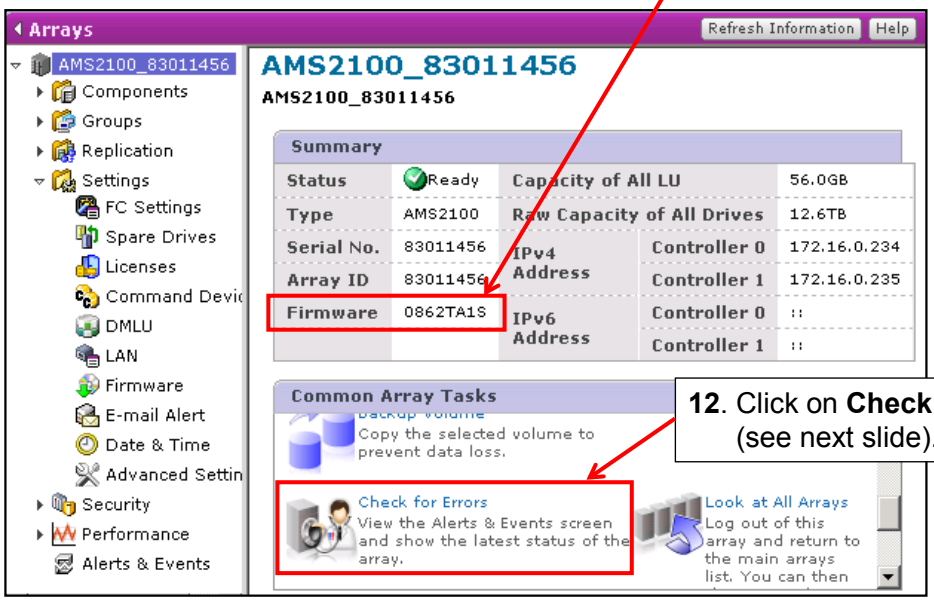


25

- Verify the firmware level and check for errors during the firmware upgrade.

10. In the **Array** panel, click on the **name of your system**.

11. Verify the firmware Level.

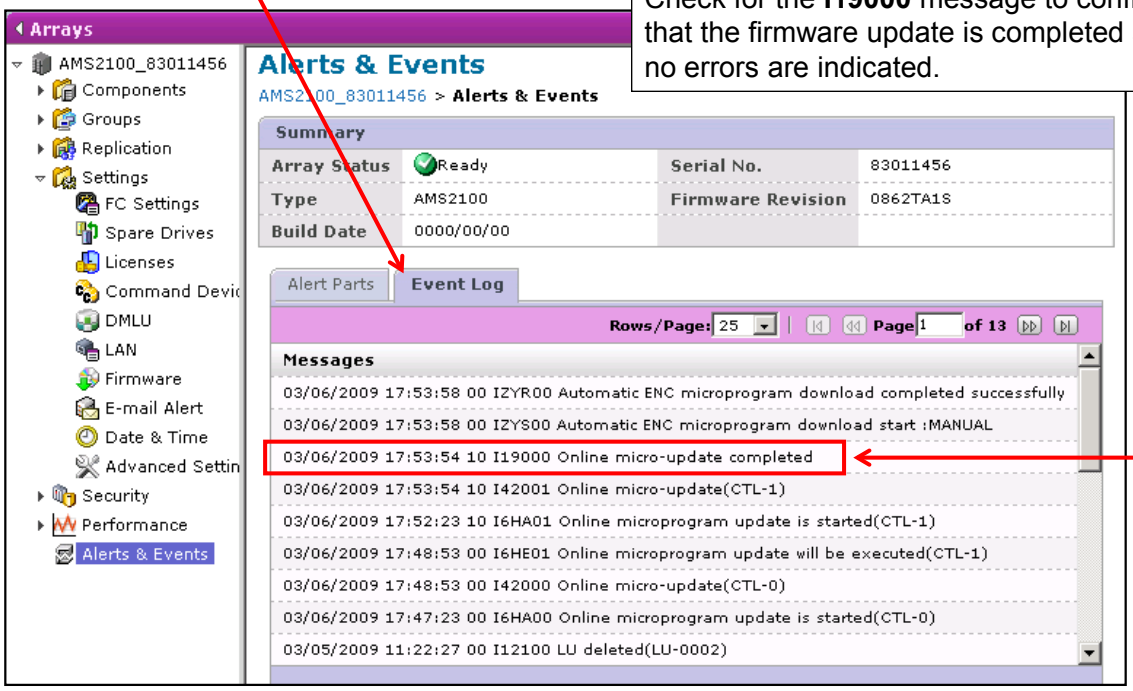


12. Click on **Check for Errors** (see next slide).

26

13. Click the **Event Log** tab.

Check for the **I19000** message to confirm that the firmware update is completed and no errors are indicated.



27

Lab Project 12: SMN2 Advanced Operations

- Timing and Organization
  - Time allotted to complete the project: **60 minutes**
  - The lab project contains two sections:
    - **Section 1** is the lab activity
    - **Section 2** contains the review questions
  - Time allotted to go over the review questions: **10 minutes**
  - The class will be split into lab groups and will perform the lab project on the lab equipment assigned to them by their instructor.

28

Lab Project 12: Objectives

- Upon completion of the lab project, the learner should be able to:
  - Export **Constitute** files for configuration and settings information by using Storage Navigator Modular 2
  - Collect a Simple Trace by using Storage Navigator Modular 2
  - Put SNM2 into **Maintenance Mode**
  - Perform a Microcode/Firmware update by using Storage Navigator Modular 2

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13. SNMP Agent and Hi-Track

Module Objectives

- Upon completion of this module, the learner should be able to:
  - Set up SNMP on Adaptable Modular Storage 2000 Family systems
  - Install Hitachi Hi-Track® Monitor “call home service” / remote monitoring tool and evaluate collected information

2

Capabilities of SNMP Agent

- Sends notification **traps** to your SNMP management server.
- SNMP agent sends error and warning notifications.
- SNMP agent integrates easily into an existing SNMP management server environment, such as HP OpenView or IBM Tivoli, by loading the MIB file into the SNMP management server.
  - The Adaptable Modular Storage 2000 SNMP **MIB file** is on the Storage Navigator Modular 2 CD-ROM which is bundled with the storage system.
- Hi-Track uses SNMP to monitor our Hitachi products for errors

3

- To use the SNMP Agent you must do the following:
  - Check if the SNMP Agent license is installed.
  - Check if the SNMP Agent license is enabled.
  - Load the SNMP MIB file into your SNMP management server.
  - Configure the SNMP Agent settings in Hitachi Storage Navigator Modular 2.

4

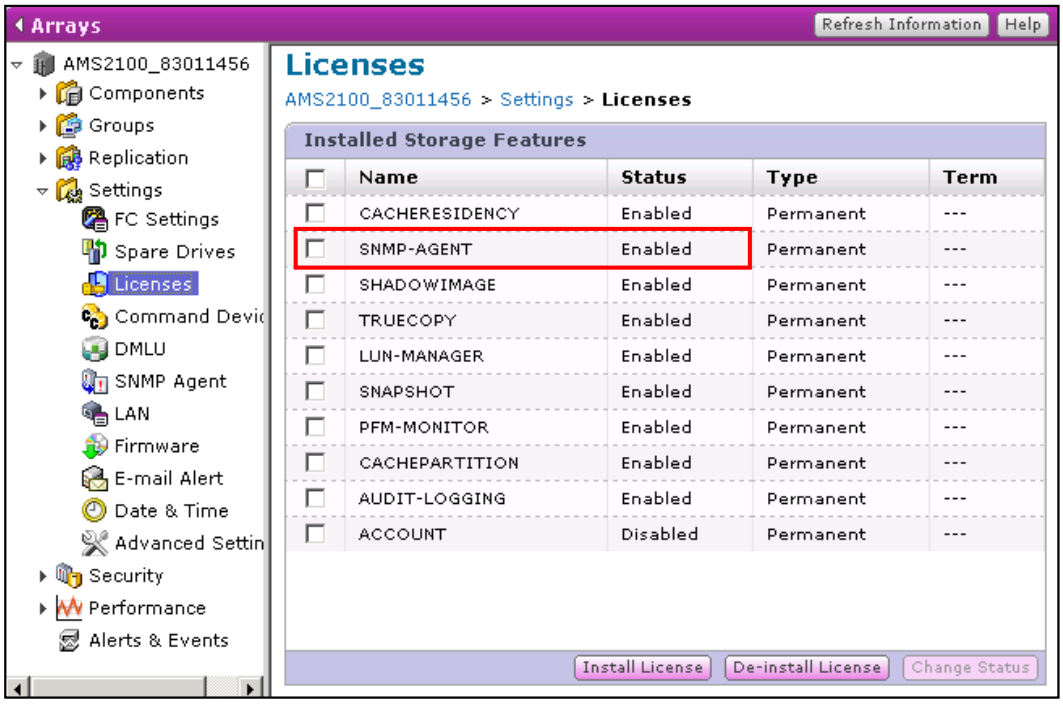
Licensing SNMP

Important:

- If the SNMP Agent license is installed and enabled before the SNMP Agent is configured, you will get a warning from the storage system. This warning disappears after configuring the SNMP Agent.
- Also, installing the license and/or enabling/disabling the function does not cause a reboot of the AMS 2000 storage system.

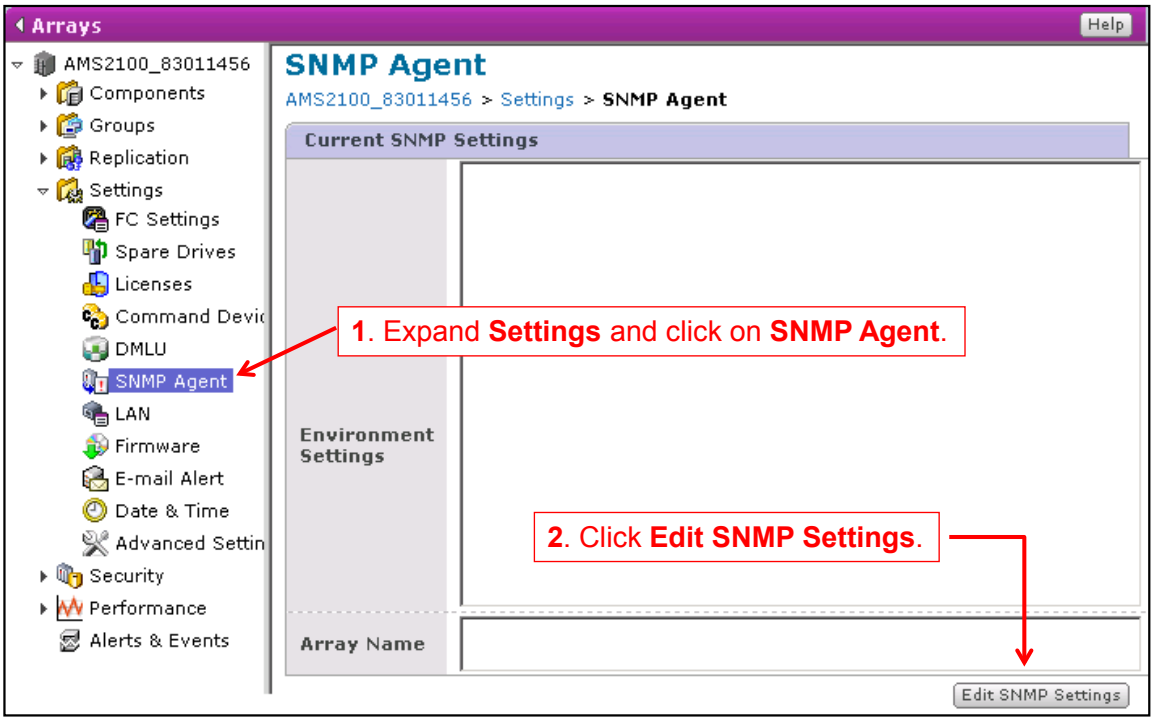
5

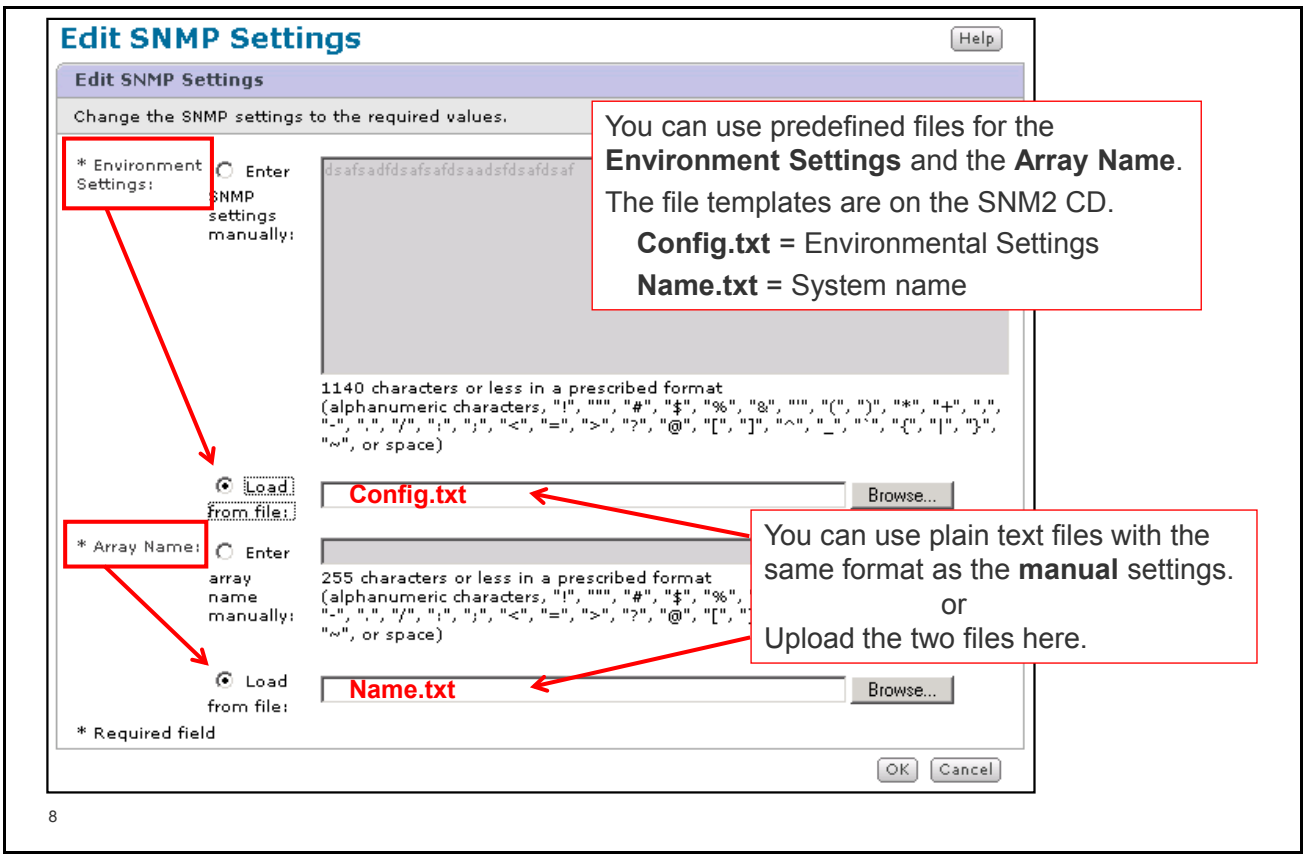
- Check that the SNMP license is installed.



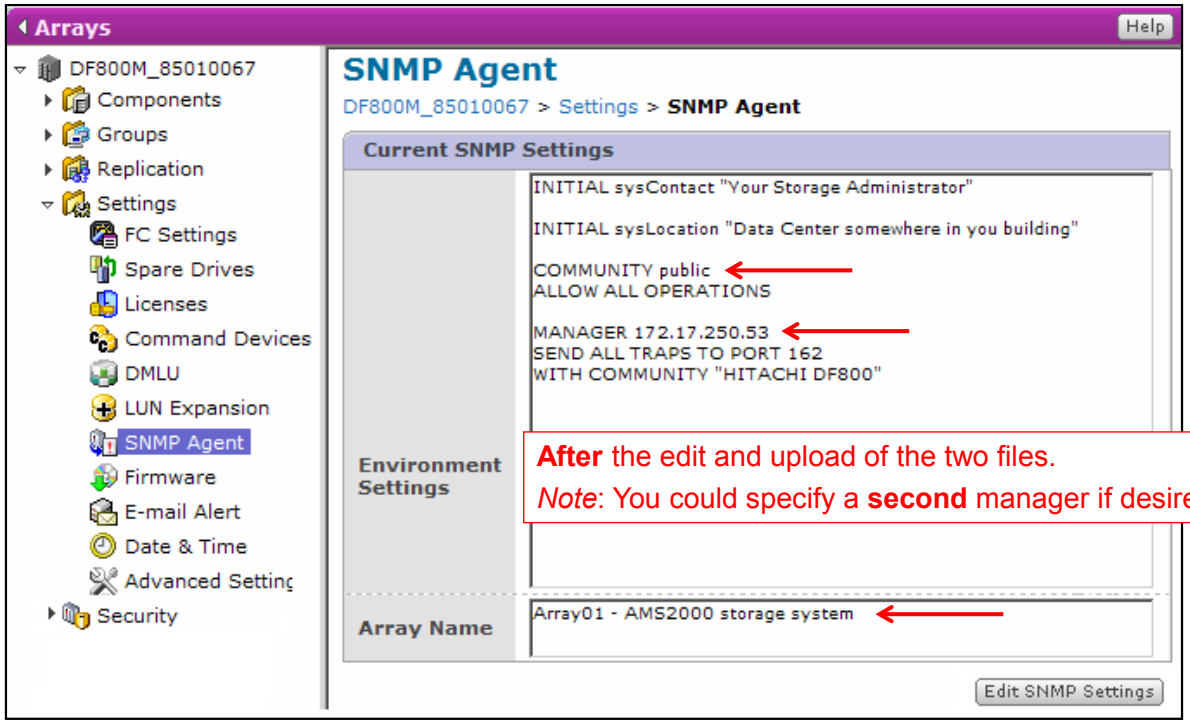
6

Configuring SNMP




Edit SNMP Settings
Help
Edit SNMP Settings
Change the SNMP settings to the required values.
* Environment Settings:
Enter SNMP settings manually:
1140 characters or less in a prescribed format (alphanumeric characters, "!", """, "#", "$", "%", "&", "'", "(", ")", "*", "+", ",", "-", ".", "/", ":", ";", "<", "=", ">", "?", "@", "[", "]", "^", "_", "`", "{", "|", "}", "~", or space)
Load from file:
Config.txt
Browse...
* Array Name:
Enter array name manually:
255 characters or less in a prescribed format (alphanumeric characters, "!", """, "#", "$", "%", "-", ".", "/", ":", ";", "<", "=", ">", "?", "@", "[", "~", or space)
Load from file:
Name.txt
Browse...
* Required field
OK
Cancel
You can use predefined files for the **Environment Settings** and the **Array Name**.
The file templates are on the SNM2 CD.
Config.txt = Environmental Settings
Name.txt = System name
You can use plain text files with the same format as the **manual** settings.
or
Upload the two files here.
8

- Verify the SNMP Agent settings.



9

Hi-Track Monitor: Overview

- The Hi-Track Monitor is a Java application that runs on a customer supplied workstation.
- The application monitors the devices on the customer's LAN that it is configured to monitor and reports the status of the devices to the Hi-Track center by an HTTPS or FTP session through the public internet or through a modem dialup connection with the Hi-Track center.
- The data reflecting the status is sent to the Center if a potential error condition is detected. The status is also sent to the Center daily even if no error condition exists.
- The Hi-Track monitor has a web browser interface that is used to configure the application and to provide a mechanism for displaying the status of each monitored device by the application.
- The Hi-Track Monitor program includes the ability to send email notifications of errors to a user-defined list of email locations.
- The Java JVM used by this application is installed in a subdirectory of the Hi-Track Monitor directory so it is not dependent on any existing JVM that might be on the workstation.

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- Hi-Track provides the remote service and information transport function for HDS products as well as error analysis, case creation, and error/information data browsing functions.
- Hi-Track provides a *watchdog* function of constantly monitoring the supported devices for potential error conditions and transfers relevant data immediately to the Hi-Track Server at HDS where a case opening (notification of the error) will result.
- Hi-Track will transport configuration information to the Hi-Track Server daily. This data typically includes information such as microcode levels, HDD types, board revision levels, and so on.
- A health check process is performed to ensure that Hi-Track has the ability to transport. If Hi-Track does not transport when expected, a case will be opened notifying a support representative that something is wrong.
- Hi-Track automates many of the data acquisition and analysis tasks that would be tedious to impossible for a person to perform manually on a regular basis.
- Hi-Track aggregates the data from all sites into a central location where the data from various sites can be monitored by specialists and analyzed for trends or problematic areas.

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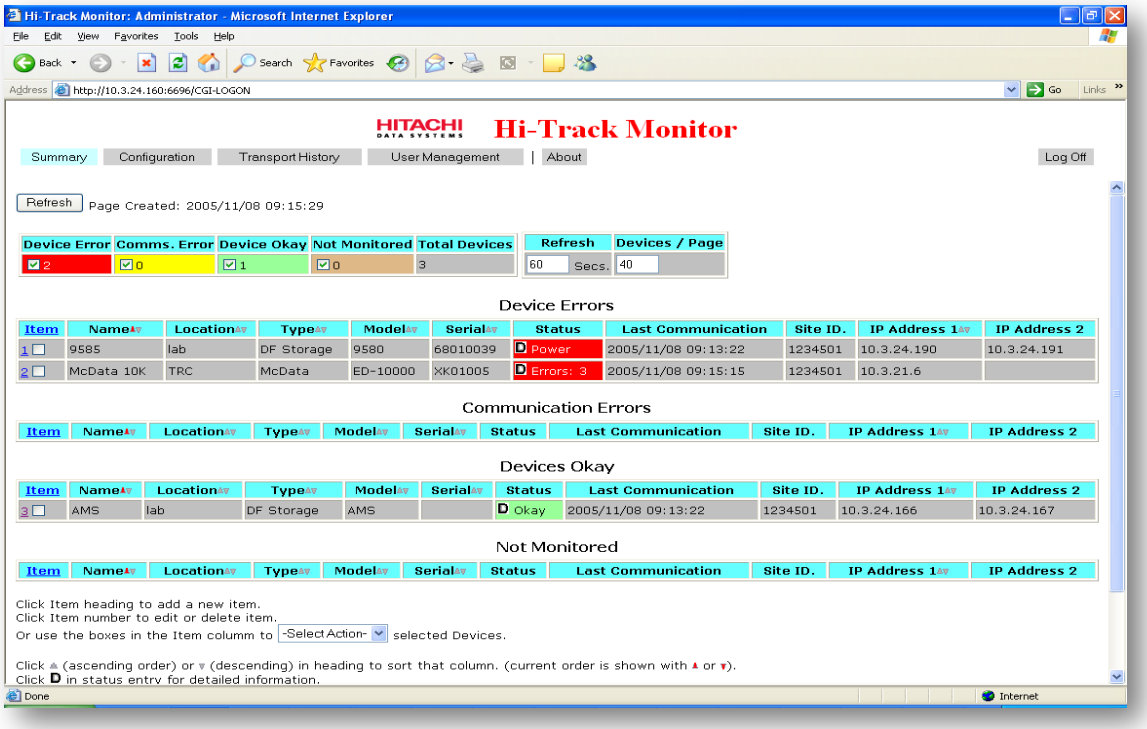
- There are three current Hi-Track agents –
  - Hi-Track SVP Agent for USP V/VM, USP/NSC (Hi-Track B.x/C.x series)
  - Hi-Track SVP Agent for 9900V, 9900, 7700E, 7700 (Hi-Track 8.x/9.x series)
  - **Hi-Track Monitor for AMS**/WMS/SMS, 9500V, 9200, Hitachi Content Archive Platform (HCAP), High Performance NAS (HNAS), Hitachi Essential NAS, Fibre Switches/Directors, Netapp
- Hi-Track Monitor is used for AMS/WMS/SMS, 9500V, 9200, Hitachi Content Archive Platform (HCAP), High Performance NAS (HNAS), Hitachi Essential NAS, Fibre Switches/Directors, Netapp
  - Hi-Track Monitor is a Java application that runs on a customer-supplied Windows or Solaris workstation.
  - Performs Hi-Track functions of error monitoring, configuration data acquisition.
  - Transport to the Hi-Track Center can be through either HTTPS or FTP (SSL or standard) via the public internet or via dialup modem.
  - Can send email alerts to customer (user definable destinations).
  - Has a browser user interface that can be accessed by both field engineers and customers.

12

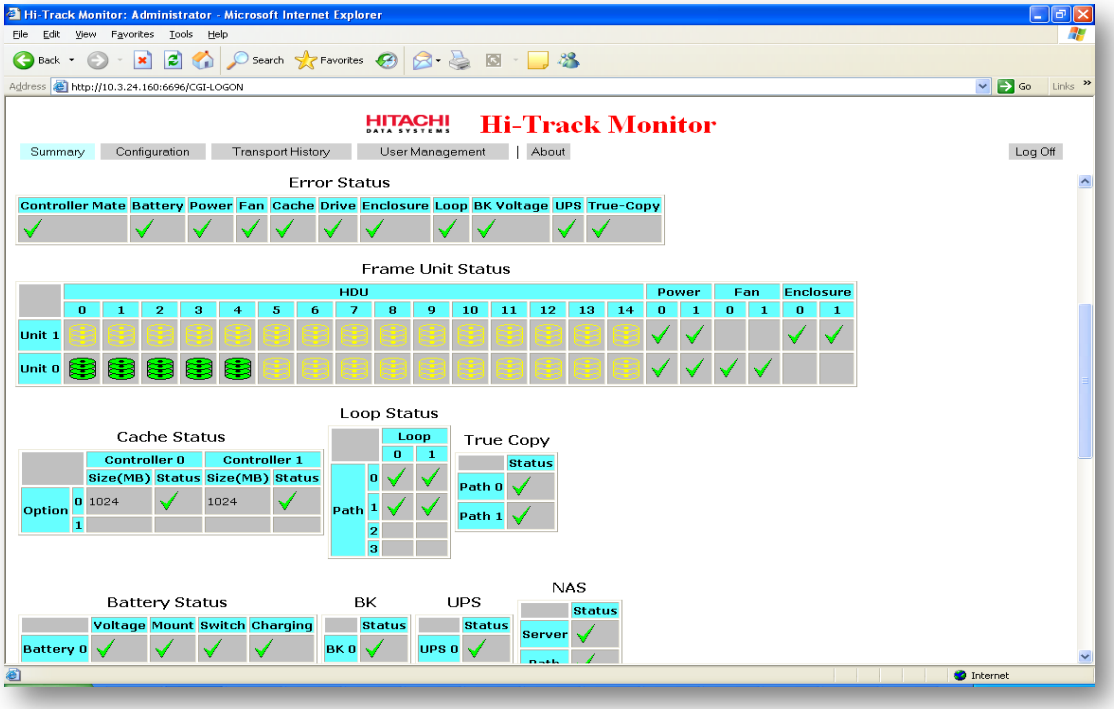
Hi-Track Monitor Summary Screen

- View accumulated tracking data by device and error type



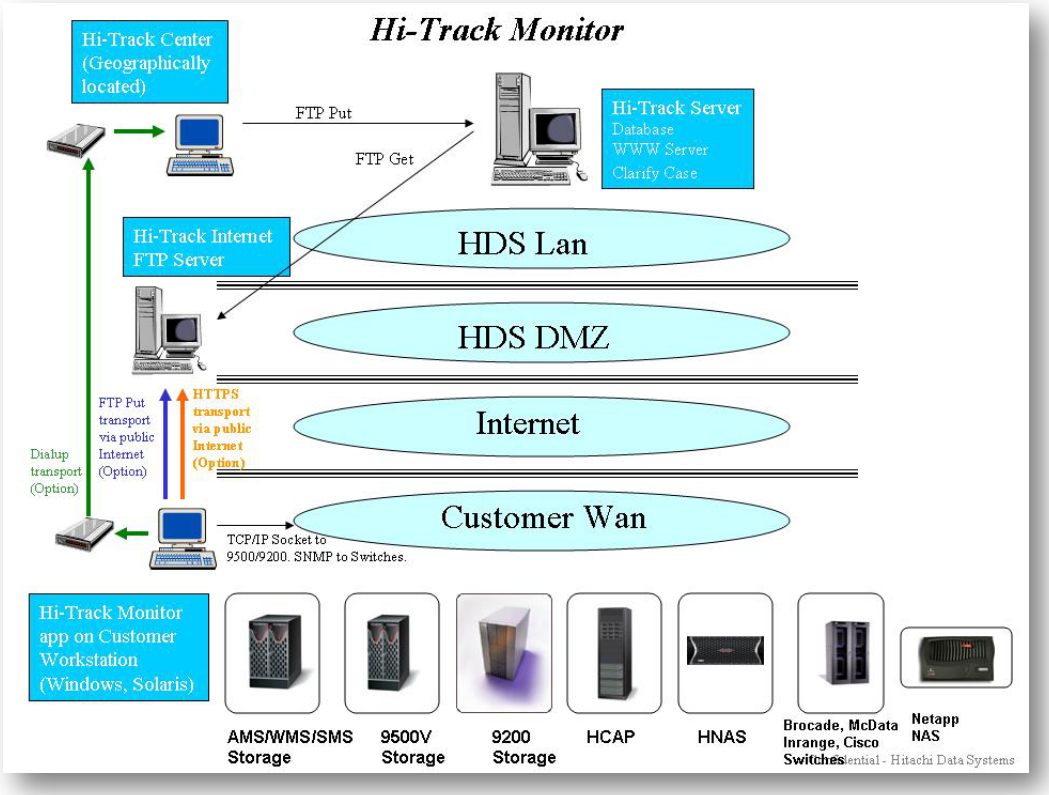
13

- View detailed status of frame features and components



14

Hi-Track Monitor Components



Hi-Track Overview: Security

- Hi-Track cannot and does not access the customer data area of the disk. Only error and configuration information is accessed. This type of data would not normally be considered sensitive data.
- Normal error and configuration transport (dialup, HTTPS, or FTP-SSL) operation of Hi-Track is in an outbound direction originating at the customer site.
- If desired, the remote SVP session capability can be disabled by the customer dynamically by disabling the Remote Enable/Disable switch.
- If desired, auto answer on the modem (if installed) can be disabled which will result in no inbound calls. Incoming calls also can be disabled by the customer through their switchboard assuming it has this functionality.
- The customer can disable the SSL Tunnel connection method by browsing to the application and clicking the **Disable** button.

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- Outbound dialup transports are point to point dialup connections going to a fixed phone number.
- Outbound HTTPS/FTP transports are routed through the customer LAN and firewall allowing the customer to put controls and restrictions on the connection and traffic as well as monitor the usage. The FTP transport can be set to transport the data to the Center in either normal or secure modes. When secure FTP or HTTPS is selected, the data is transported via SSL which provides 128-bit encryption of the data.
- When in a dialup session, Hi-Track uses a proprietary communication protocol that is not compatible with any standard protocol including any terminal emulation, telnet, and so on. Only Hi-Track programs can communicate with Hi-Track running at the customer site. The communication structures are hexadecimal streams and not ASCII, EBCDIC, or any other character-based structures.
- The majority of data transferred by Hi-Track is hex data that is related to maintenance functions and is unintelligible without the knowledge of what each byte and bit means.

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Hi-Track Monitor Installation

- Customer must supply a Windows (Server 2008, Vista, Server 2003, 2000 Professional, XP Professional), Solaris 10, 9, or 8, or Linux 32 bit or 64 bit x86 workstation.
- This workstation needs to run 24/7 in order to properly perform the Hi-Track function.
- There must be TCP/IP LAN connectivity of the monitored device to the Hi-Track monitor workstation.
- If using the HTTPS data transfer mechanism to the Hi-Track Center, there must be connectivity for the HTTPS using the standard HTTPS **port 443**. The customer's firewall must be configured to allow this type of protocol connection through the specified port range by the customer's network administrator if it is not currently enabled. The customer may use an HTTPS proxy if desired. If an HTTPS proxy is used, the customer must supply the parameters to use with their particular proxy server if required.
- If using the FTP data transfer mechanism, there must be FTP Put/Append capability for passive FTP transfers using the standard FTP ports.
- If using the Dialup data transfer mechanism, a modem with a phone line connection installed in the workstation running the Hi-Track Monitor must be provided. *Note:* The following modems have been tested and are approved for use with the Hi-Track Monitor. it is possible that other modems might be used but they have not been tested by the Hi-Track development group.
  - US Robotics Courier V.Everything
  - US Robotics Sportster 56K
  - MultiTech MultiModem
  - Xircom Cardbus Ethernet + Modem 56 PCMCIA Modem
- The workstation needs to include a CD-ROM (for loading the program).
- CD installation media is loaded and simple instructions are followed depending on O/S installed on workstation.
- Installation Guide can be obtained from the Hitachi Data Systems Hi-Track home page. This is also your link to viewing monitored data collected.

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Hi-Track Monitor Configuration

- Access configuration by browser http://IP address
- Present credentials to authenticate (Login administrator/hds)
- User Management Link
  - Hi-Track password change
  - Credentials for AMS2000 access
  - Present SNM2 credentials
  - Set up SSL if required for secure access
- Configuration Link
  - Enter Site ID
  - Enter e-mail notification information
  - FTP: If using FTP, enter FTP credentials and information
  - Dial-up: If using telephone modem, enter dialup information
  - Enter Time zone
- Summary Link
  - The Add Devices information is for gathering all monitored devices.
  - Includes IP details, Site ID and other data already configured from User Management link.

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Hi-Track Monitor Configuration (Optional)

- **Backup Mode –** The Hi-Track Monitor can be configured so that there are two instances of the Hi-Track Monitor running on two different workstations with one acting as a primary and the other as a backup.
- Log file location configuration
- A **Tunnel proxy** can be defined by entries in the configuration file (HitDFmon.config). This is intended to be used by sites that create Hi-Track configurations programmatically. The proxy is defined by entering the following before an FtpHost or HttpsHost definition:
  - *FtpSoHost = proxy IP Address*
  - *FtpSoPort = proxy Port number*
- A **fixed Subject line** for the emails sent by Hi-Track Monitor can be defined in the configuration file, HitDFmon.config:
  - *EmailSubject = subject line text for all emails*

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14. Hardware Replacement Procedures

Module Objectives

- Upon completion of this module, the learner should be able to:
  - Component Based Sparing
  - Put Storage Navigator Modular 2 into Maintenance Mode
  - Replace a hard drive
  - Replace a control unit on the storage system
  - Replace an ENC unit
  - Replace an interface board
  - Replace an SFP Fibre Channel host connector

2

Component Based Sparing

With the addition of the new (**Rev. 2 / 0200)** controllers for AMS2100/2300/2500 we will be switching back to a 'component' based controller spare FRU. This means that the controller will once again be able to be replaced as a separate 'component' as well as the cache and host interface. The **(Rev. 2 / 0200)** controllers will also have new Spare part numbers (see Table below). These new controllers will be phased in beginning in June 2010. This transition process will continue till the end of June at the Geo Distribution centers.

PRODUCTS AFFECTED:

Lines/Models Affected:
AMS2000 - All models

SOFTWARE FIRMWARE/AFFECTED:
SNM2 Ver. 9.03 and above.

MICROCODE AFFECTED:
0890/B and above

DOCUMENTS AFFECTED:
Maintenance Manual Rev. 20

3

- The **(Rev. 1 / 0100)** controller for AMS2100/RKS and AMS2300/RKM will continue to be replaced as a 'composite' FRUs for the controller/cache/IF. With this revision of the controller there is no need to replace the FRU at the lower 'component' level. In the case of the cache or interface error, the composite controller assy. would be ordered and replaced. The only FRU that would be moved over from the failing composite controller part would be the Host Connector (SFPs). The AMS2500/RKHE is the only model that does not include the host interface (FC or iSCSI in the composite FRU, so in the case of the AMS2500 the interface would need to be moved over in addition to the Host connector (SFPs).

- **Please do not tamper with the internal cache or interfaces in the AMS2100/2300 'composite' controllers (Rev.1 / 0100) FRUs** and return them in their entirety.

  Note: FRU = Field Replaceable Unit

4

Part No.		Parts Name	Revision	Model	Specification
3282005	A	Control Unit	Rev. 0100	composite	Control Unit (RKM_FC_2G Cache
3282005	E	Control Unit	Rev. 0100	composite	Control Unit (RKM_FC_4G Cache
3282005	B	Control Unit	Rev. 0100	composite	Control Unit (RKM_iSCSI_2G Cache)
3282005	F	Control Unit	Rev. 0100	composite	Control Unit (RKM_iSCSI_4 Cache)
3282005	C	Control Unit	Rev. 0100	composite	Control Unit (RKS_FC_2G Cache)
3282005	G	Control Unit	Rev. 0100	composite	Control Unit (RKS_FC_4G Cache)
3282005	D	Control Unit	Rev. 0100	composite	Control Unit (RKS_iSCSI_2G Cache)
3282005	H	Control Unit	Rev. 0100	composite	Control Unit (RKS_iSCSI_4G Cache)
3282006	A	Control Unit	Rev. 0100	composite	Control Unit (RKHE_C2GK Cache)
3282006	B	Control Unit	Rev. 0100	composite	Control Unit (RKHE_C4GK Cache)
3282005	J	Control Unit	Rev. 0100	composite	Control Unit (RKM_FC_8G IF_2G Cache)
3282005	K	Control Unit	Rev. 0100	composite	Control Unit (RKM_FC_8G IF_4G Cache)

Part No.		Parts Name	Revision	Model	Specification
3282248	A	Control Unit	Rev. 0200	composite	Control Unit (RKS) rev.2 – FC 2port embedded
3282247	A	Control Unit	Rev. 0200	composite	Control Unit (RKM) rev. 2 – FC 4port embedded
3282249	A	Control Unit	Rev. 0200	composite	Control Unit (RKH) rev. 2
3282246	A	Control Unit	Rev. 0200	composite	Control Unit (RKXS) rev.2 – FC 2port embedded
3282263	A	I/F Assy (8Gbps 2 port)	Rev. 0200	composite	FC Interface 8Gbps – 2 port
3282085	A	I/F Assy (8Gbps 4 port)	Rev. 0200	composite	FC Interface 8Gbps – 4 port
3276278	B	I/F Assy (iSCSI 2 port)	Rev. 0200	composite	iSCSI Interface – 2 port
3276125	B	Cache Memory 2GB	Rev. 0200	composite	Cache Memory 2GB
3276125	J	Cache Memory 4GB	Rev. 0200	composite	Cache Memory 4GB

5

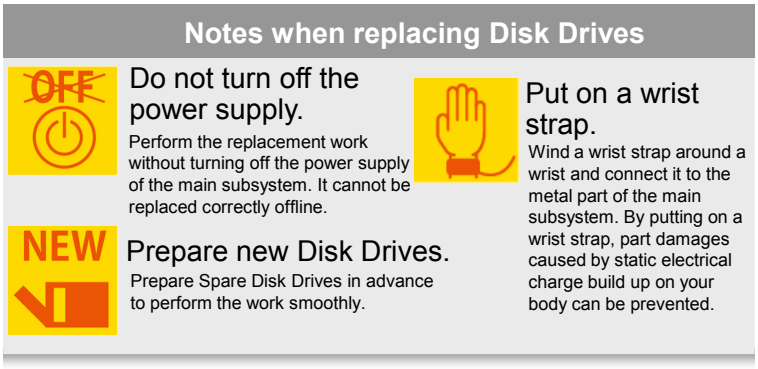
Rev. 2/0200 Controllers New Spare Part Numbers

Note: Controller revision can be checked with SNM2 new H/W Rev. field.

The ***(Rev. 1 / 0100) and (Rev. 2 /0200) controllers are NOT compatible***

6

Replace Disk Drives

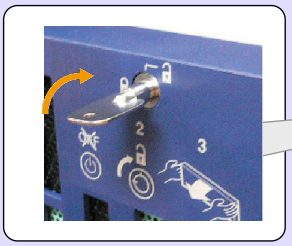


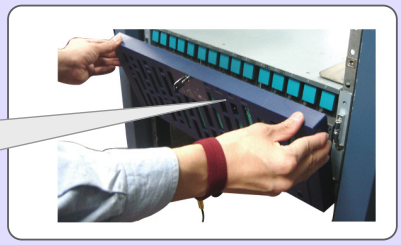
7

Replace Disk Drives (Rack Mounted)

1 Removing the Front Bezel

→Refer to the Service Guide for the detail.





1 Insert the key into the keyhole of the Front Bezel, turn it to the right, and unlock the Front Bezel.

2 Pull it toward you by holding the side where ▸ mark is placed, and remove the Front Bezel.

* If you cannot put your finger in the side of the bezel, pull the key. Be careful not to drop the bezel.

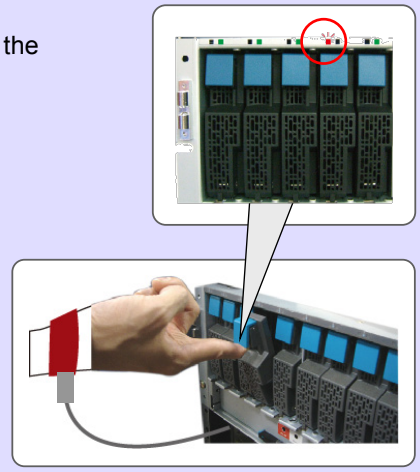
8

Removing Disk Drives

1. Put on a wrist strap directly on your skin, and adjust it so that the metal part lightly touches your skin.
2. Check the place where the ALM (alarm) LED lights on in red, and confirm the position of the failed Disk Drive.

   * Do not pull out anything other than the Disk Drive with the red alarm LED.

3. Pull up the stopper and pull down the lever toward you.



4. Hold the lever, and pull out the Disk Drive.

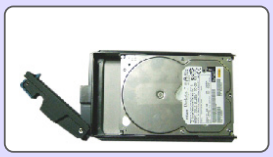
Install it **within 10 minutes** after removing it.

9

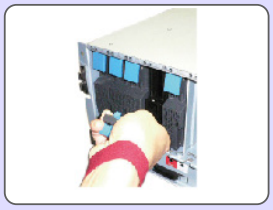
Installing new Disk Drives

Check that **20 seconds or more** elapsed after removing the Disk Drive.

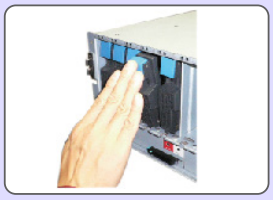
1. Pull up the stopper of the new Disk Drive, and pull the lever down.



2. Hold the lever, and insert it all the way in according to the guide rails.



3. Pull up the lever and lock the Disk Drive.

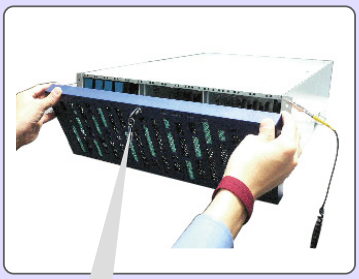


Check that the red ALM (alarm) LED goes out after **two minutes** or so, and the green ACT LED lights up.

10

Attaching the Front Bezel

1. Insert the hooks of the Front Bezel in the holes shown by the arrows.
2. Close the Front Bezel by holding the handle on the side.



3. Turn the key to the left, and lock the Front Bezel.

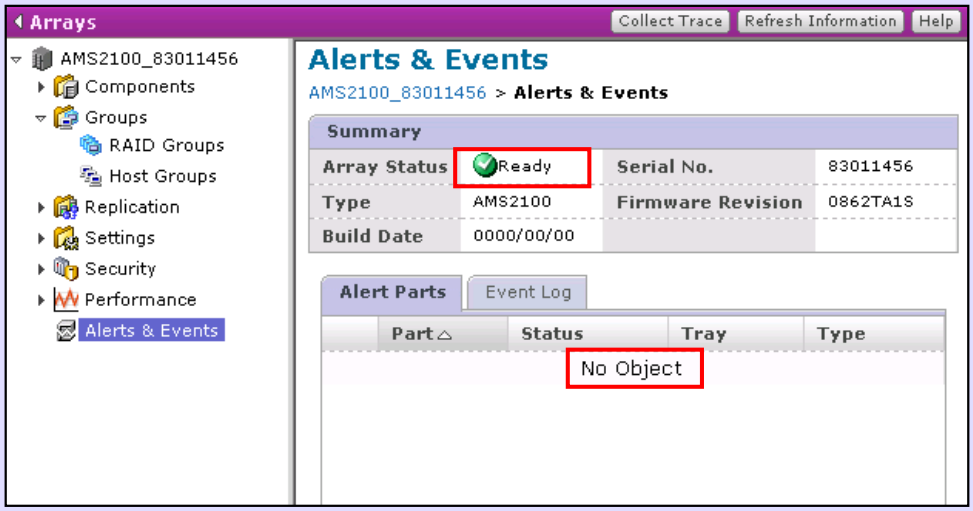
Check that the WARNING LED on the Front Bezel goes out.

11

Confirm Successful Replacement

5 Check the recovery of the failures in Storage Navigator Modular 2.

- Check that **No Object** is displayed in the Alert Parts list.
- Check that the status of the subsystem is **Normal**.

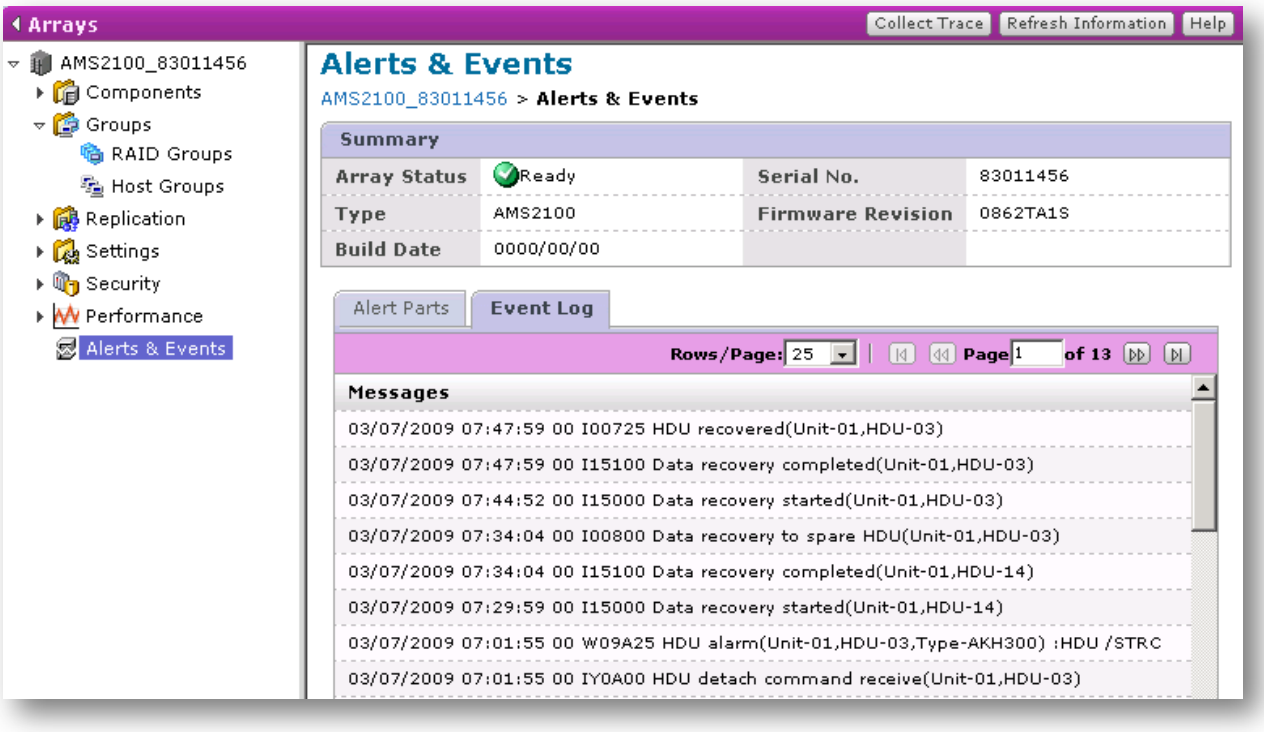


6 Send back the failed parts.

- Put the failed parts in the packing box and send them back.

12

Confirm the Error Log



Controller Replacement

WARNING

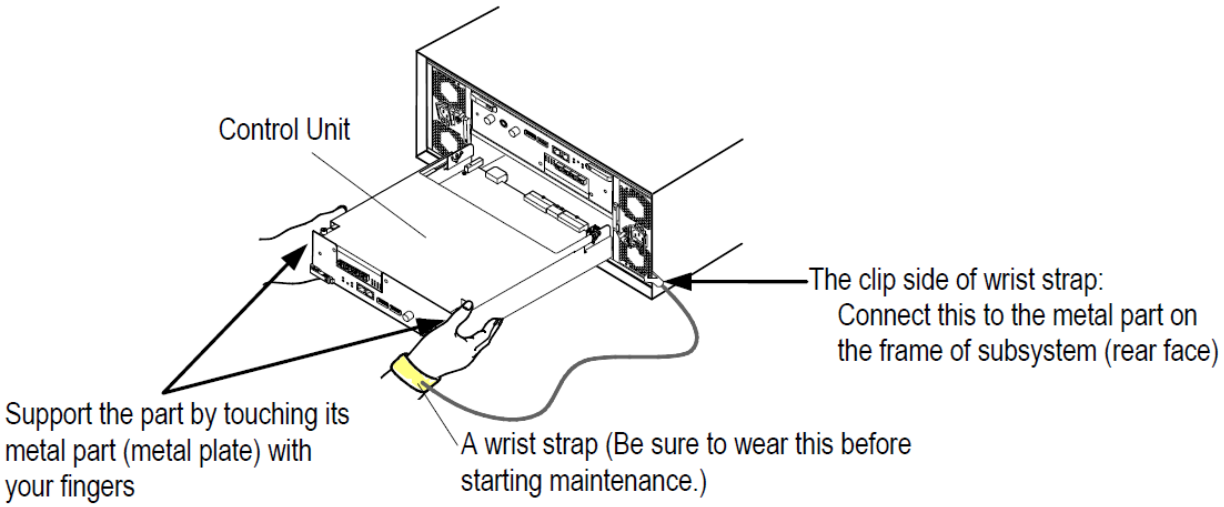
Heat sinks, Integrated Circuit chips (ICs), and many electronic components can become very hot and cause burns.

Handle with care

14

Control Unit Replacement

Before unpacking and replacing maintenance components, be sure to wear a wrist strap and connect to ground the grounding clip in the opposite end of the wrist strap to the chassis frame (metal part).
When you insert a Control Unit into the subsystem, support the Control Unit as touching its metal part with fingers of your hand that wears a wrist strap.



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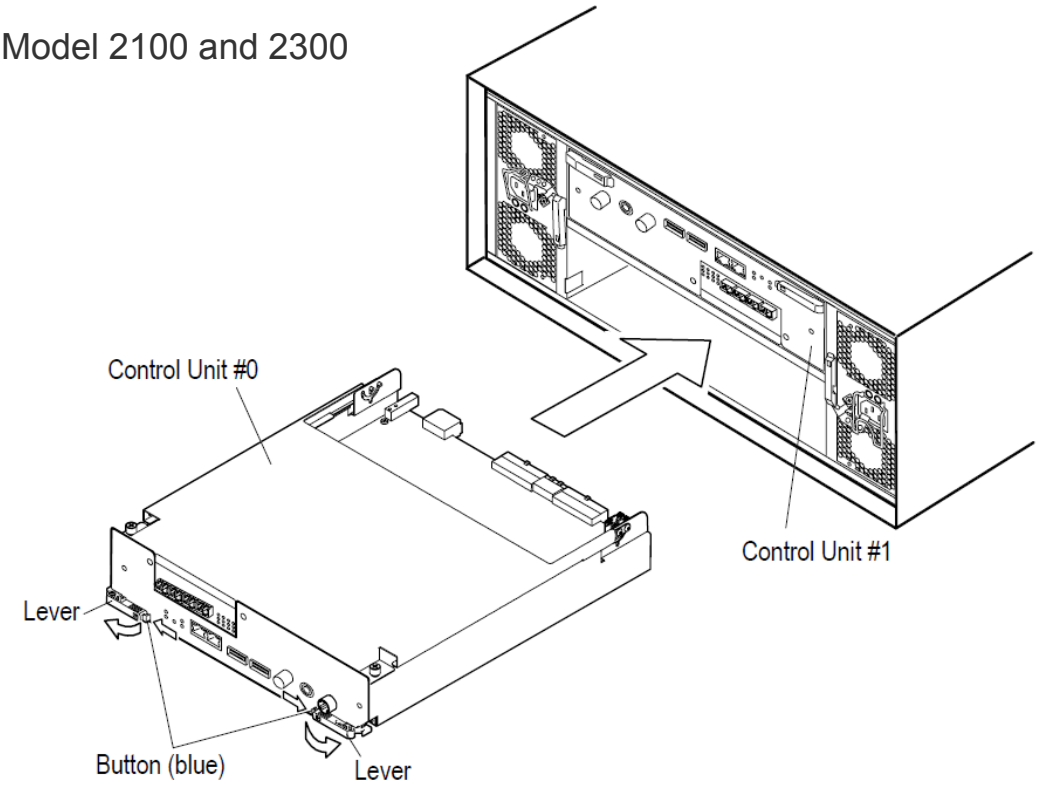
When installing a Control Unit, support its metal part with the hand wearing the wrist strap. This discharges your body's static charge.

- Complete the replacement within **ten minutes**. Otherwise the system may power off due to an abnormal temperature rise.
- Before starting the replacement, review the Control Unit replacement procedure in the appropriate Maintenance Manual of your storage system.
  - The procedure may vary, depending on the system type and Microcode level.

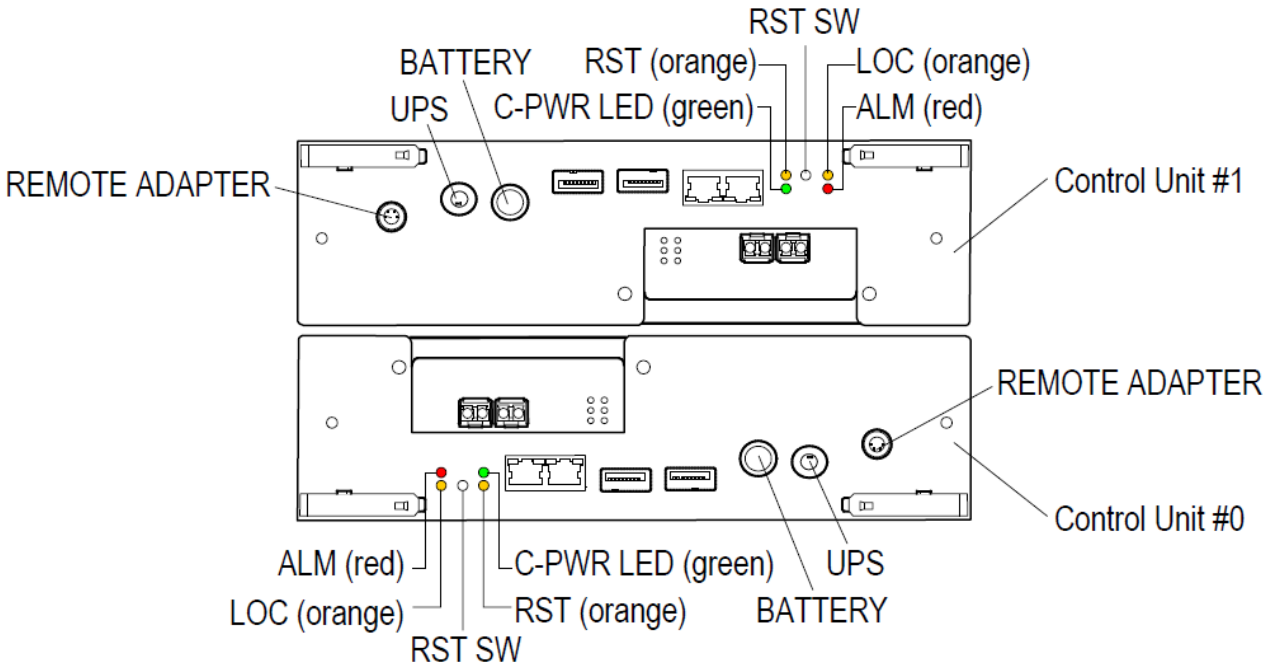
16

- Model 2100 and 2300



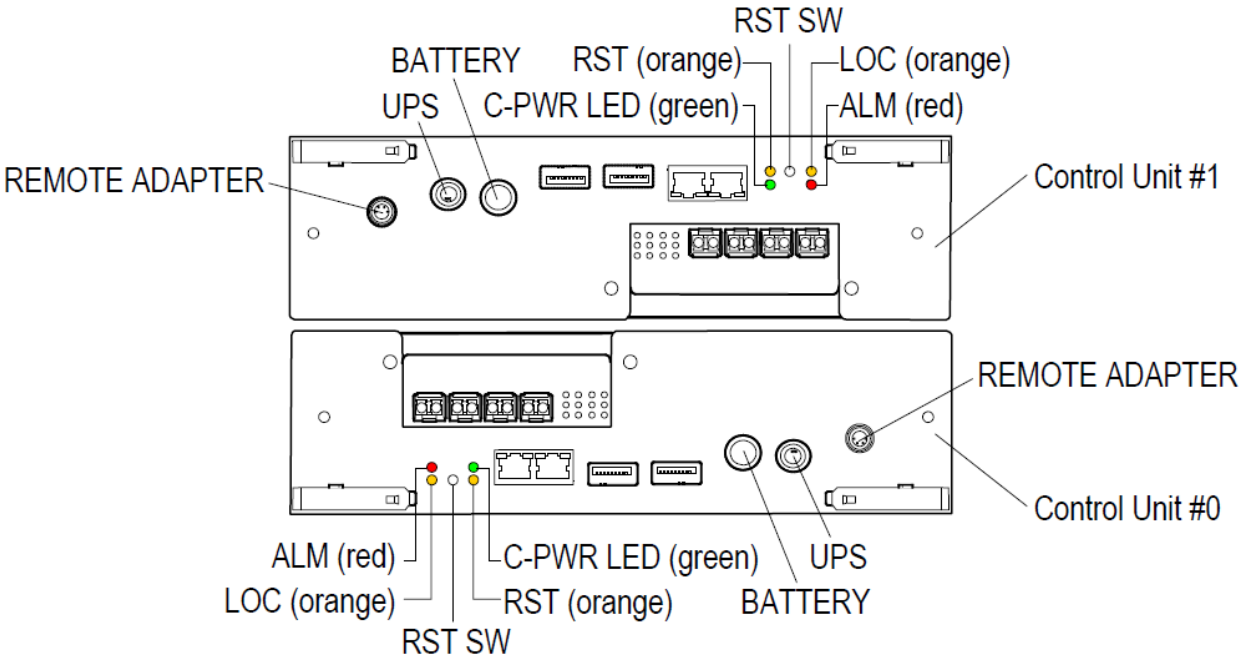
17

- Model 2100 Controller LEDs



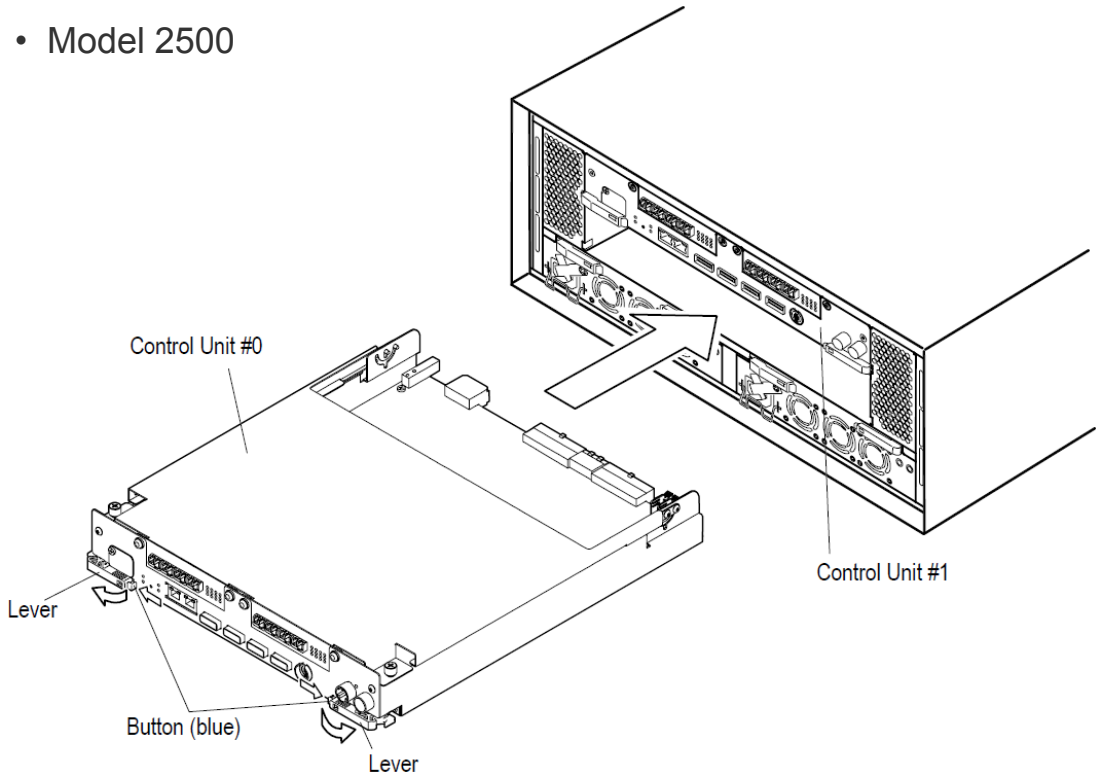
18

- Model 2300 Controller LEDs

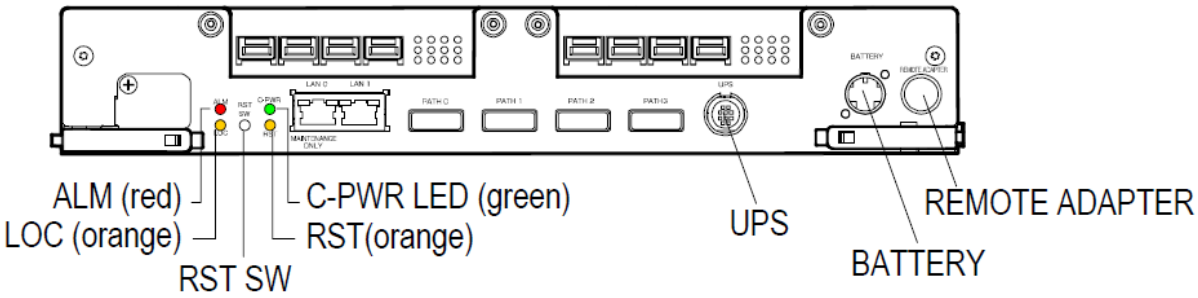


19

- Model 2500



- Model 2500 Controller LEDs



21

CTL1 is not upside down. It is oriented the same as on CTL0.

Note: The procedure assumes the control has failed (red **Alarm** LED **on**).

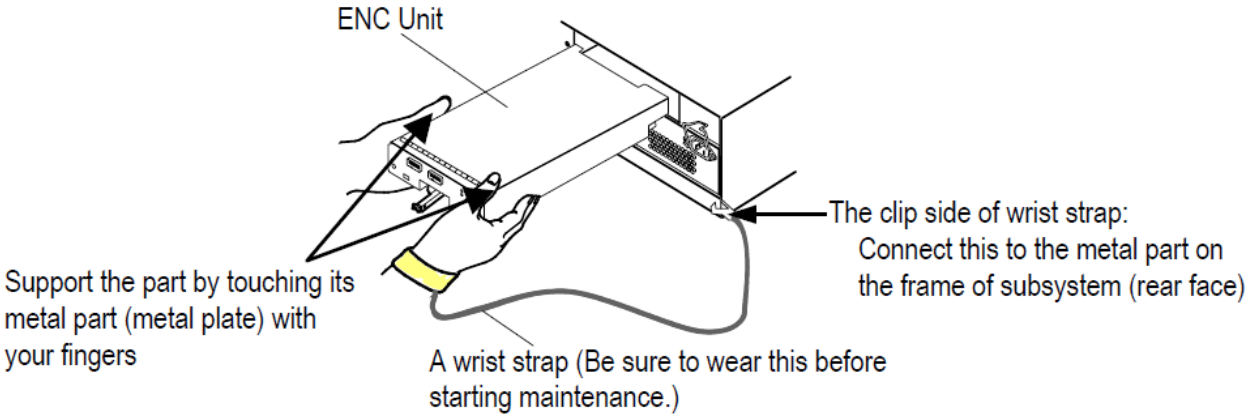
1. Remove the controller by pulling the right and left levers toward you while pressing the blue buttons on each lever.
2. Mark and remove all the cables connected to the Control Unit.
3. Remove the Control Unit by pulling it out toward you.
4. Wait at least 20 seconds before inserting the replacement unit into the RK module, but **do not seat** the controller (leave it out about 2 inches).
5. Connect all the removed cables to the replaced Control Unit.
6. Install (seat) the new Control Unit using the right and left levers, closing the levers completely until the blue buttons click.
7. Make sure that the warning LED on the front of the chassis goes out.
8. Check that the Ready LED is on.
9. Check the information and error messages using the WEB Tool.

Note: If the new Control Unit is inserted without waiting for 20 seconds, it is possible that the Control Unit will not recover normally!

22

ENC Unit Replacement

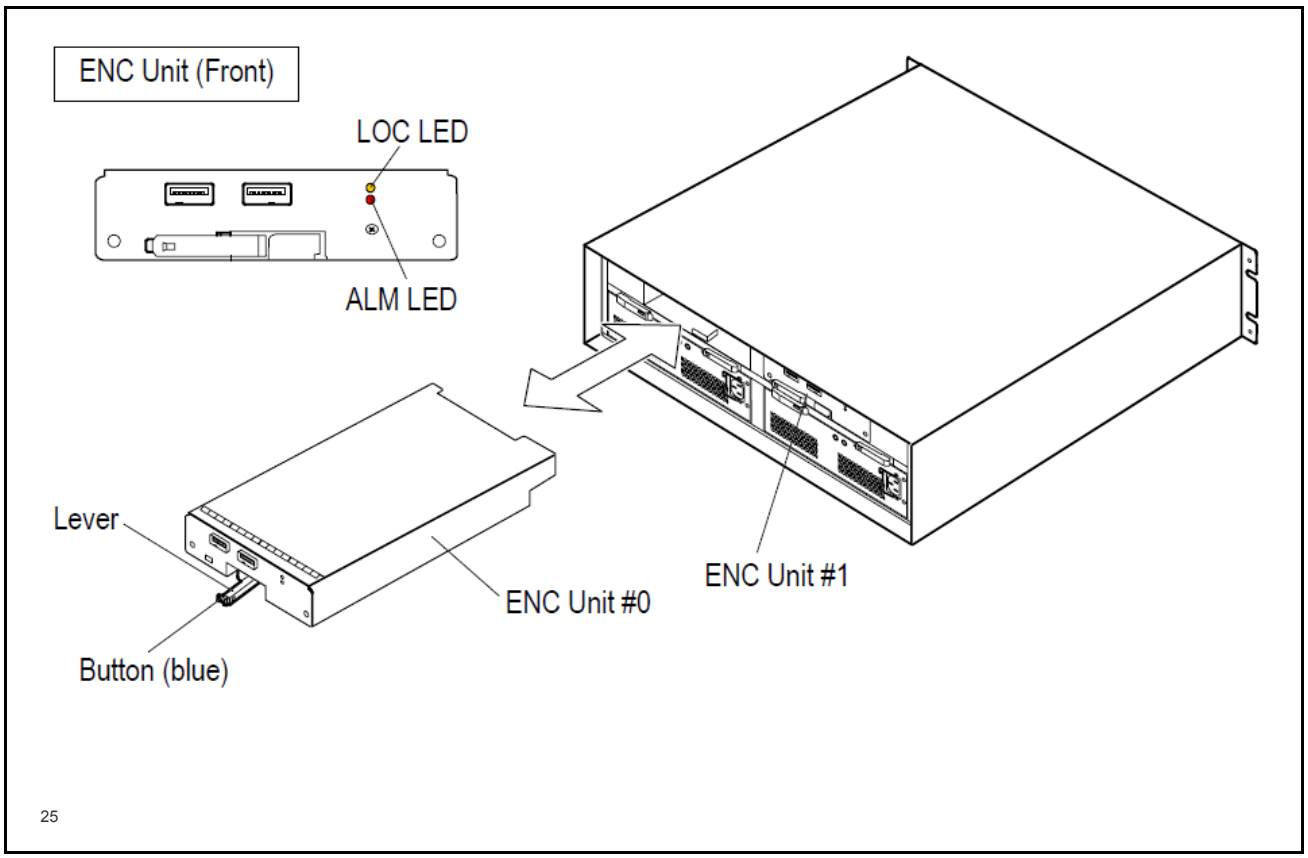
Before unpacking and replacing maintenance components, be sure to wear a wrist strap and connect to ground the grounding clip in the opposite end of the wrist strap to the chassis frame (metal part).
When you insert an ENC Unit into the subsystem, support the ENC Unit as touching its metal part with fingers of your hand that wears a wrist strap.



23

- Complete the replacement within **ten minutes**. Otherwise the system may power off due to an abnormal temperature rise.
- Before starting the replacement, review the ENC Unit replacement procedure in the appropriate Maintenance Manual of your storage system.
  - The procedure may vary, depending on the system type and Microcode level.

24


ENC Unit (Front)
LOC LED
ALM LED
Lever
Button (blue)
ENC Unit #0
ENC Unit #1
25

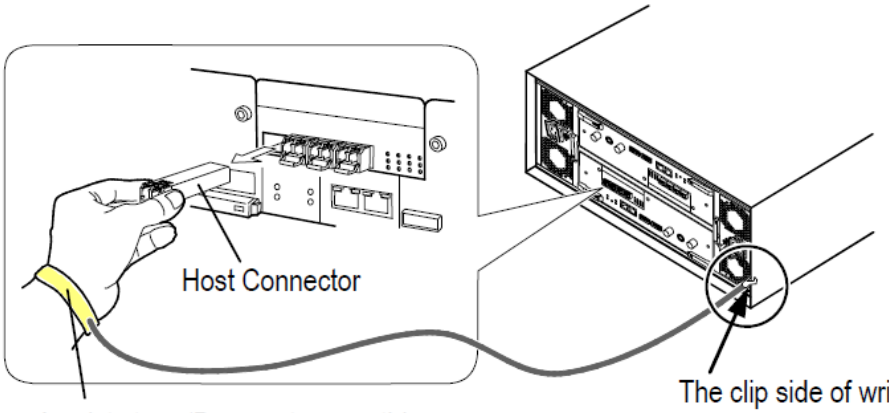
1. Before beginning, collect a **Simple Trace**.
2. Pull the lever toward you while pressing the blue button.
3. Remove the ENC cable connected to the ENC unit to be replaced.
4. Remove the ENC unit by pulling it out toward you.
5. Wait at least 20 seconds, then insert a new ENC unit until its lever is slightly open. Do not insert it completely!
6. Connect the ENC cable to the new ENC unit.
7. Close the lever completely until the blue button clicks.
8. Make sure that the ALM LED on the ENC unit is off.
9. Check that the Ready LED on front of the basic chassis is on and the Alarm LED and the warning LED goes off.
10. Check the information and error messages on the WEB Tool.

Note: If the new ENC unit is inserted without waiting for 20 seconds, it is possible that the ENC unit will not recover normally!

26

FC Host Connector (SFP) Replacement

Before unpacking and replacing maintenance components, be sure to wear a wrist strap and connect to ground the grounding clip in the opposite end of the wrist strap to the chassis frame (metal part).



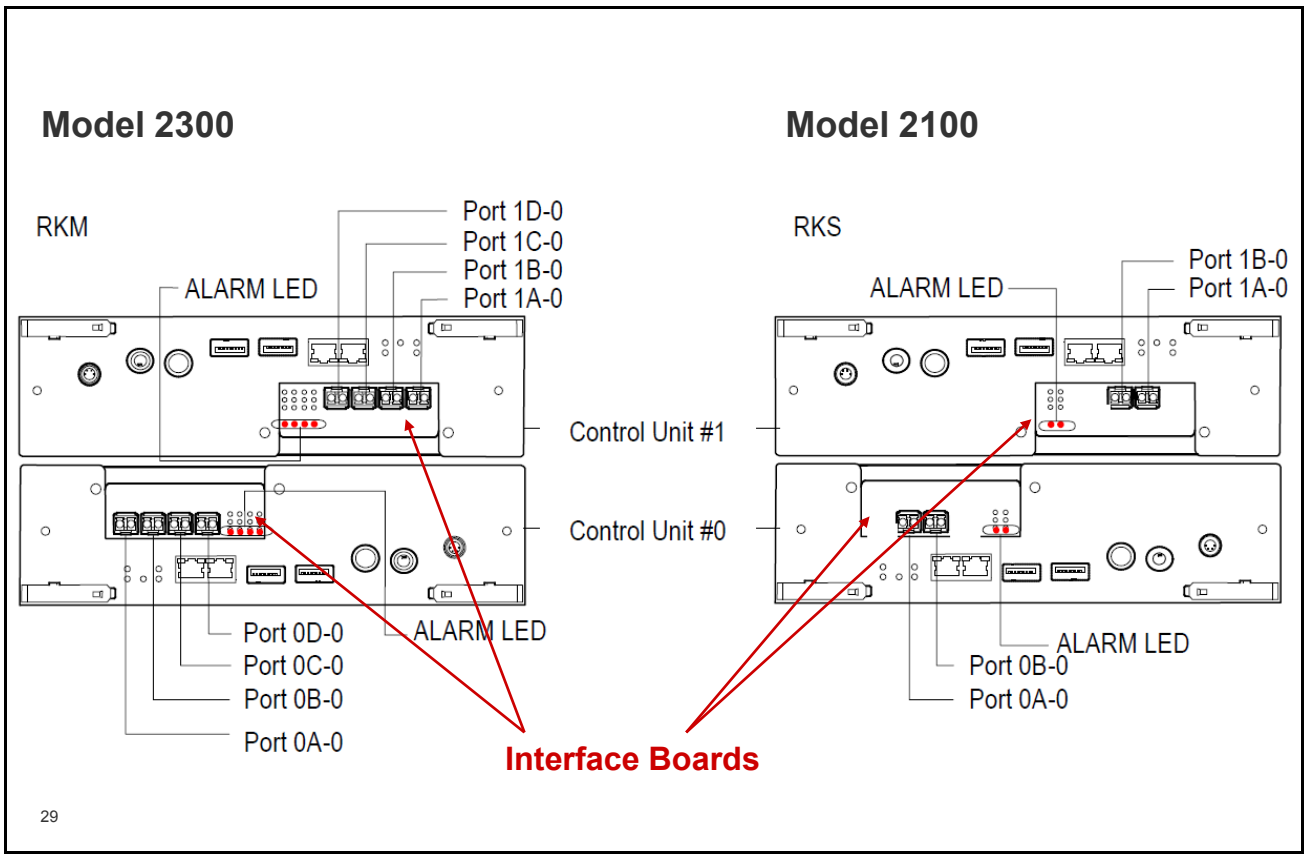
A wrist strap (Be sure to wear this before starting maintenance.)

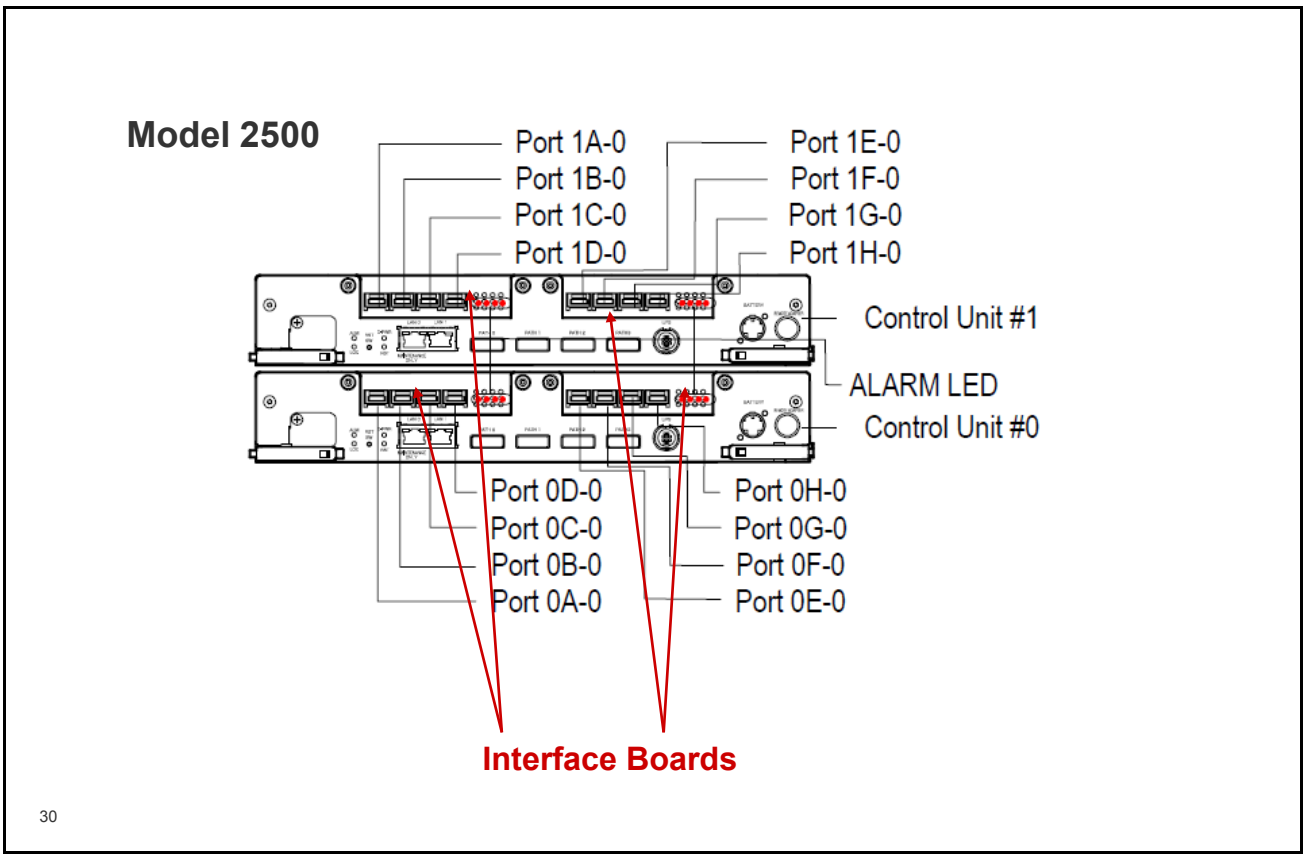
The clip side of wrist strap:
Connect this to the metal part on the frame of subsystem (rear face)

27

- Before starting the replacement, review the Host Connector replacement procedure in the appropriate Maintenance Manual for your storage system.
  - The procedure may vary, depending on the system type and Microcode level.

28


Model 2300
Model 2100
RKM
RKS
ALARM LED
ALARM LED
Port 1D-0
Port 1C-0
Port 1B-0
Port 1A-0
Port 1B-0
Port 1A-0
Control Unit #1
Control Unit #0
Port 0D-0
Port 0C-0
Port 0B-0
Port 0A-0
ALARM LED
ALARM LED
Port 0B-0
Port 0A-0
Interface Boards
29


Model 2500
Port 1A-0
Port 1B-0
Port 1C-0
Port 1D-0
Port 1E-0
Port 1F-0
Port 1G-0
Port 1H-0
Control Unit #1
ALARM LED
Control Unit #0
Port 0D-0
Port 0C-0
Port 0B-0
Port 0A-0
Port 0H-0
Port 0G-0
Port 0F-0
Port 0E-0
Interface Boards
30

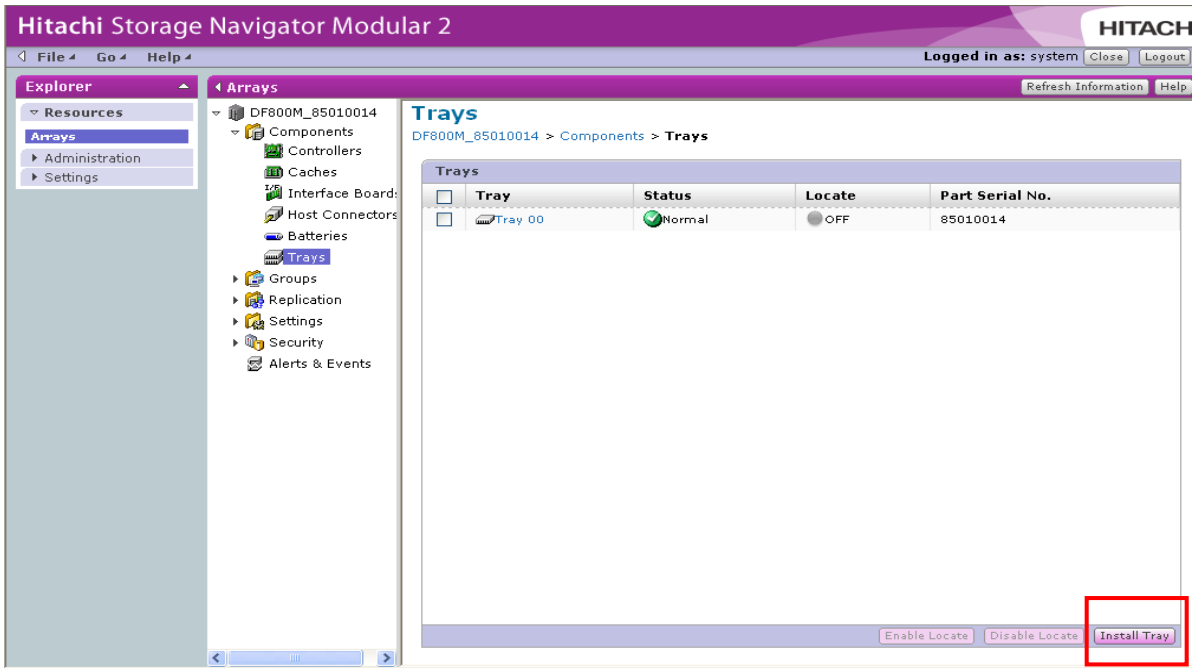
1. Before beginning, collect a **Simple Trace**
2. Remove the FC cables connected to the Control Unit mounting the FC Host Connector to be replaced.
3. Remove the Host Connector. Pull out the Host Connector after raising the lever.
4. Wait at least 20 seconds.
5. Check the insertion direction of the FC Host Connector.
6. Insert the FC Host Connector in the port until it clicks.
7. Connect the FC cables.
8. Check that the port LED does light on.
9. Check the information and error messages on the WEB tool.

Note: If the FC Host Connector is inserted without waiting for 20 seconds, it is possible that the FC Host Connector may not recover normally.

31

Expansion Unit Upgrade

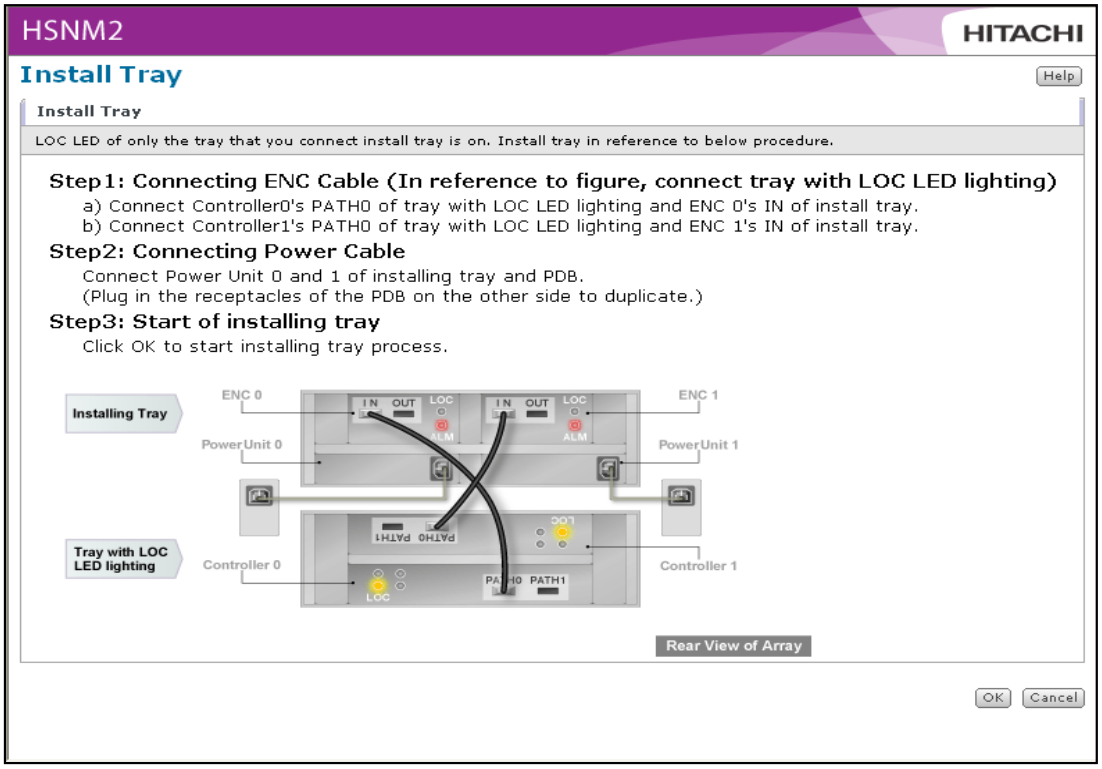
- Use Storage Navigator Modular 2 to **add a tray.**



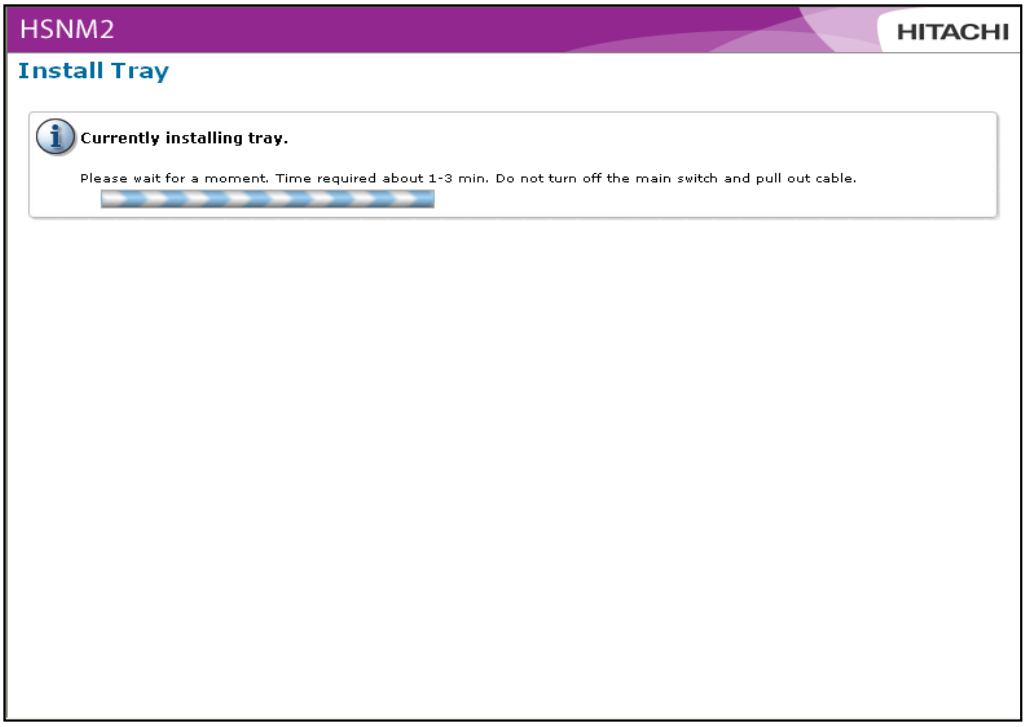
32

The new drive tray power indicator light is off, and it is not represented in this window until performing this procedure.

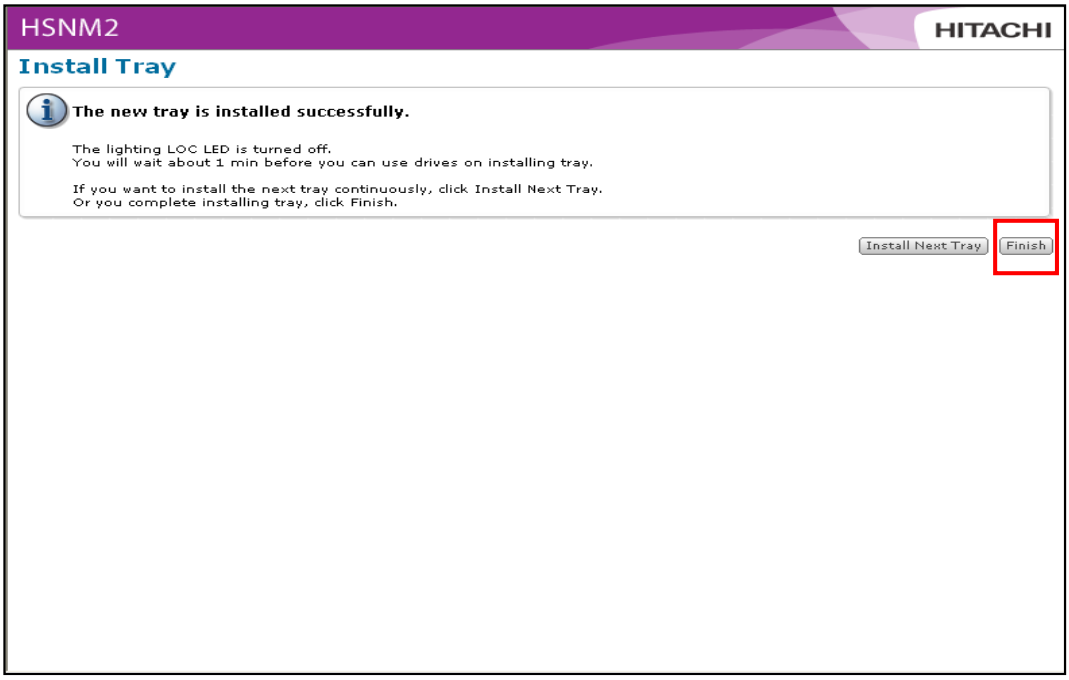
1. Bring up Storage Navigator Modular 2 and connect to the array.
2. Go to Array-Components-Trays screen.
3. Click on **Install tray.** This starts an add tray wizard.


HSNM2
HITACHI
Install Tray
Help
Install Tray
LOC LED of only the tray that you connect install tray is on. Install tray in reference to below procedure.
Step1: Connecting ENC Cable (In reference to figure, connect tray with LOC LED lighting)
a) Connect Controller0's PATH0 of tray with LOC LED lighting and ENC 0's IN of install tray.
b) Connect Controller1's PATH0 of tray with LOC LED lighting and ENC 1's IN of install tray.
Step2: Connecting Power Cable
Connect Power Unit 0 and 1 of installing tray and PDB.
(Plug in the receptacles of the PDB on the other side to duplicate.)
Step3: Start of installing tray
Click OK to start installing tray process.
Installing Tray
Tray with LOC LED lighting
ENC 0
ENC 1
PowerUnit 0
PowerUnit 1
Controller 0
Controller 1
IN
OUT
LOC
ALM
PATH0
PATH1
Rear View of Array
OK
Cancel

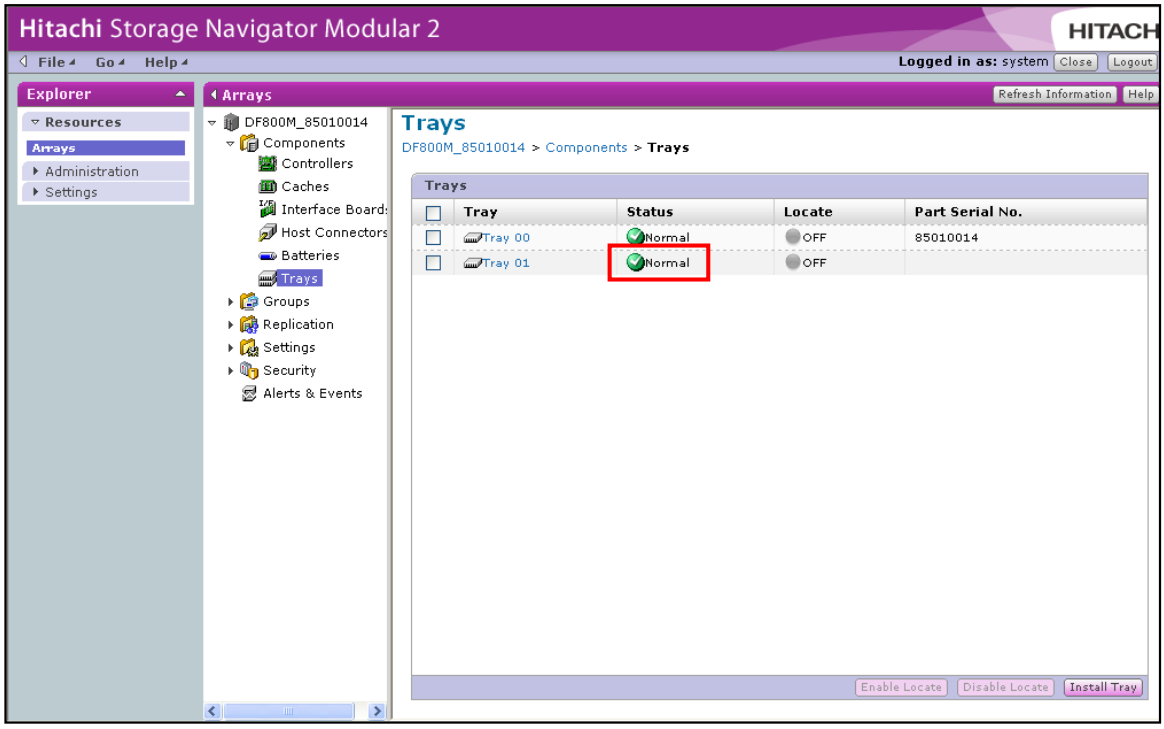
33


HSNM2
HITACHI
Install Tray
Currently installing tray.
Please wait for a moment. Time required about 1-3 min. Do not turn off the main switch and pull out cable.

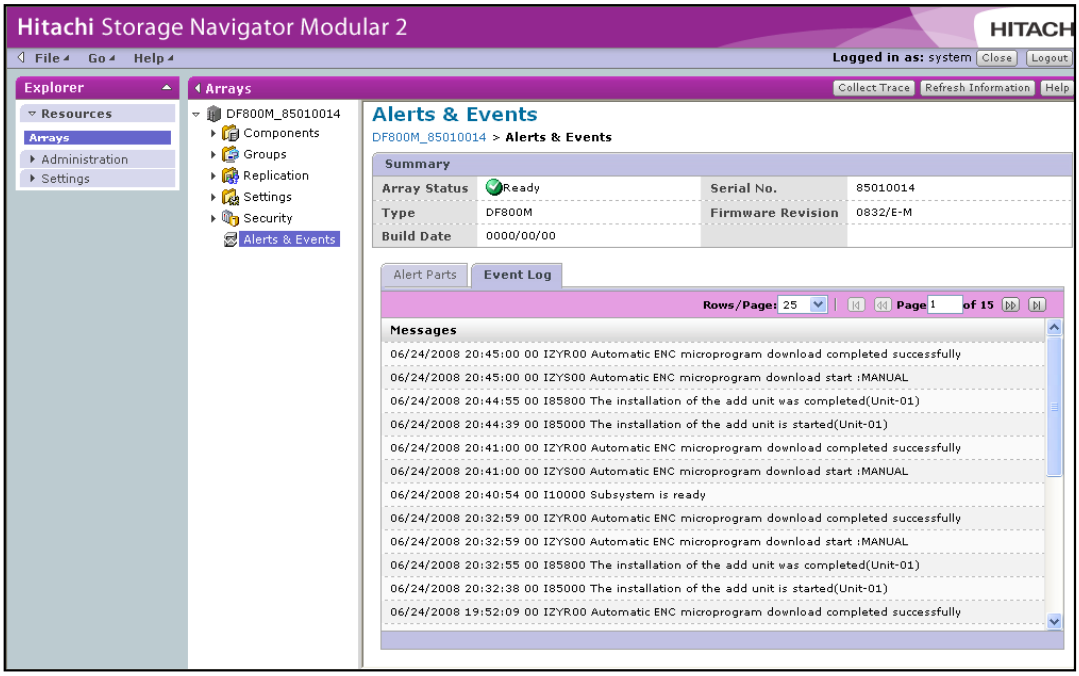
34


HSNM2
HITACHI
Install Tray
The new tray is installed successfully.
The lighting LOC LED is turned off.
You will wait about 1 min before you can use drives on installing tray.
If you want to install the next tray continuously, click Install Next Tray.
Or you complete installing tray, click Finish.
Install Next Tray
Finish

35



This is an automatic refresh of the **Trays** screen that occurs after completing the wizard, showing Normal status.



Confirm that under **Alerts & Events** in the Event log the "Installation completed successfully" message appears.

Lab Project 11: Remove and Add an Expansion Tray

- Timing and Organization
  - Time allotted to complete the project: **60 minutes**
  - Time allotted to go over the review questions: **15 minutes**
  - The class will be split into lab groups.
  - The lab groups will perform the lab project on the lab equipment assigned to them by their instructor.

38

Lab Project 11: Objectives

- Upon completion of the lab project, the learner should be able to:
  - Correctly remove an Expansion Tray from a AMS 2000 (DF800) system
  - Correctly add an Expansion Tray to an operational AMS 2000 (DF800) system without causing any error conditions

39

Lab Project 13: Hardware Replacement

- Timing and Organization
  - Time allotted to complete the project: **90 minutes.**
  - The lab project contains two sections:
    - **Section 1** is the lab activity.
    - **Section 2** contains the review questions.
  - Time allotted to go over the review questions: **10 minutes.**
  - The class will be split into lab groups and will perform the lab project on the lab equipment assigned to them by their instructor.

40

Lab Project 13: Objectives

- Upon completion of the lab project, the learner should be able to:
  - Put SNM2 into Maintenance Mode
  - Replace a Hard Drive
    - While in Maintenance Mode, **detach** a drive from **RAID Group 0.** This **red-lights** the drive (simulates a failure).
    - Collect a Trace dump.
    - Manually cause a **data reconstruction** to the spare drive (happens automatically for a real failure).
    - Perform a dummy replacement (simulates replacing the drive).
  - Replace a Control Unit on a Adaptable Modular Storage 2000
  - Replace an ENC Unit
  - Replace an interface board
  - Replace an SFP Fibre Channel host connector

41

15. Disruptive Microcode Update

Module Objectives

- Upon completion of this module, the learner should be able to:
  - Configure Java to allow the Web Tool to load microcode/firmware to an Adaptable Modular Storage 2000 Family system
  - Update the microcode/firmware and/or initialize the system
- *Notes:*
  - This module describes the 'Initial Setup' that is a destructive process and is normally performed only at the DC Build Centers, or in the rare case that a unit is built from components.
  - A **Warning** is required that this is a destructive process and all Configuration and User data will be destroyed! The Microcode Replacement selection from the Web browser is OK and will update only the microcode.

2

Note: During an initial firmware upload when you initialize the system, all user and configuration data is deleted and lost!

Function of the Web Tool Utility

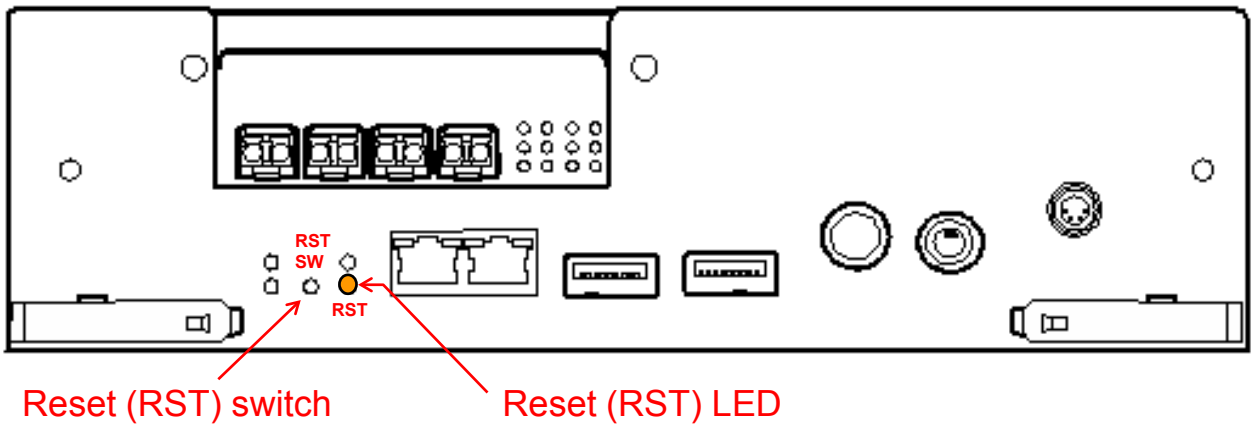
- Provides a convenient browser type interface.
- Communicates with an HTTP server in the modular storage system, and becomes operational after powering on the system.
- Can operate in **normal** or **maintenance** mode.
  - Normal mode is a read-only mode.
  - Maintenance mode allows configuration changes to be made.
- Maintenance mode requires a user ID and password.
- Functionally overlaps with Storage Navigator Modular 2 (SNM2).
- Is required for initial setup, initial IP address, and setting serial number.

Note: When used for loading microcode, a JRE and Java applet is required for Version 1.6.0 or above.

3

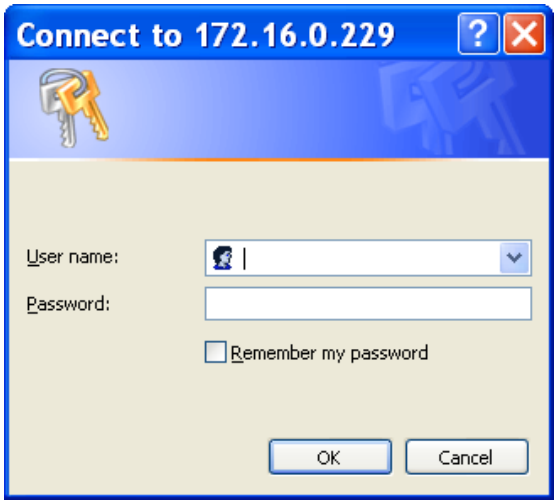
Enter Maintenance Mode

- Maintenance Mode is entered by resetting **both** controllers:
  - Reset Controller 0 **first.**
  - Reset Controller 1 **second** (wait 3–5 seconds after the reset of Controller 0).
    - Remember, Controller 1 is upside down for 2100 and 2300 models.
  - Open a browser and connect to the system (see next slide).



4

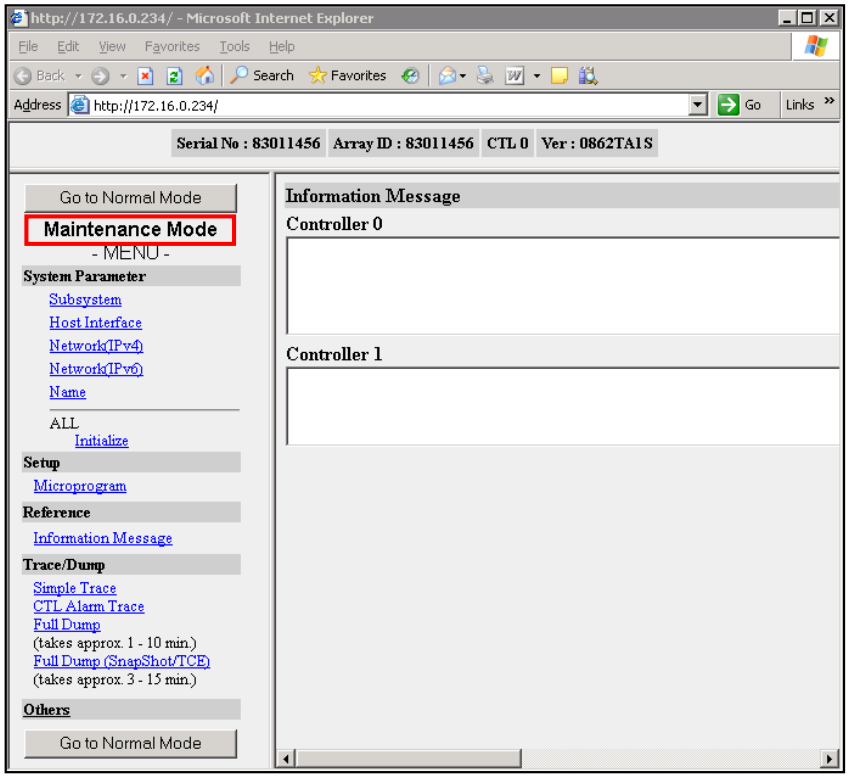
Maintenance Mode User ID and Password



User Name: **maintenance**
Password: **hosyu9500**

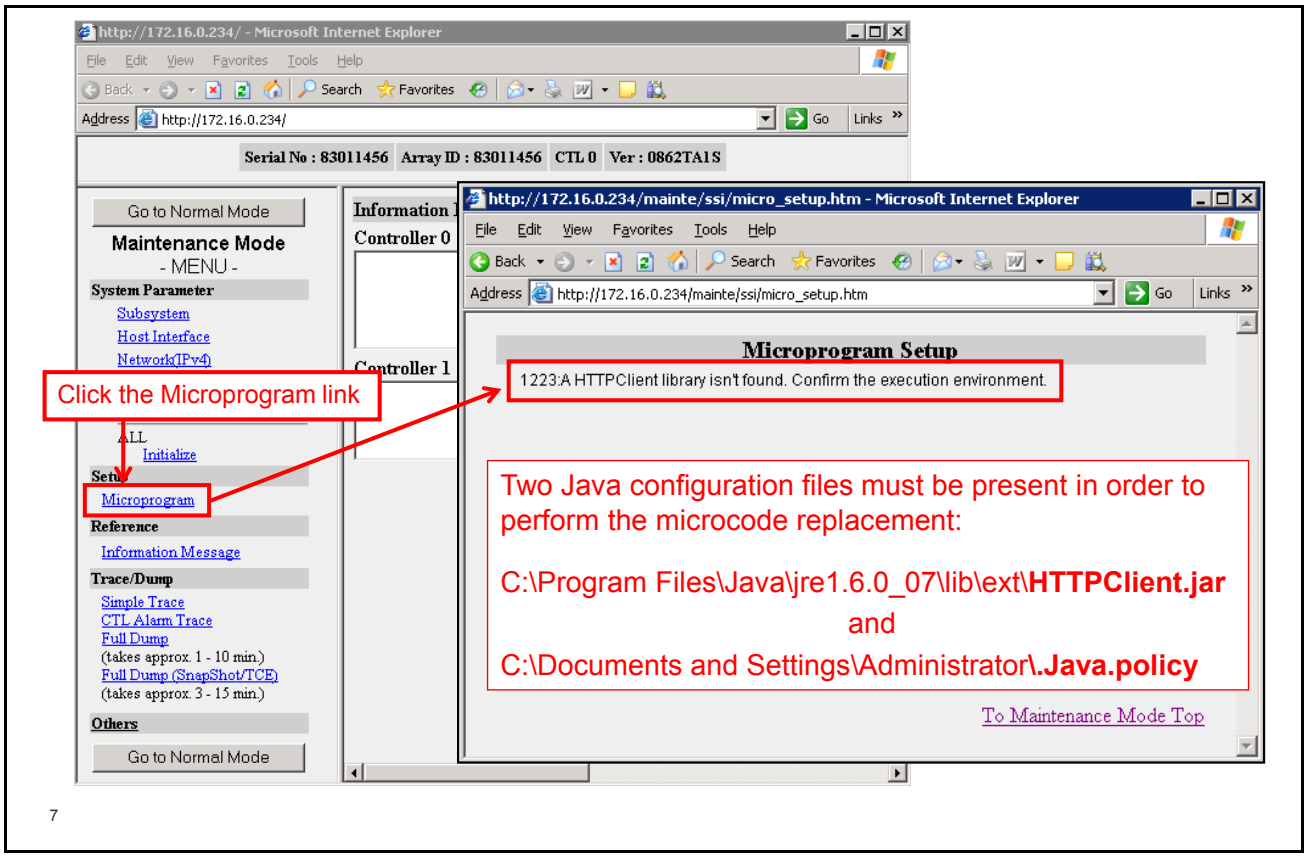
5

Maintenance Mode Initial Window

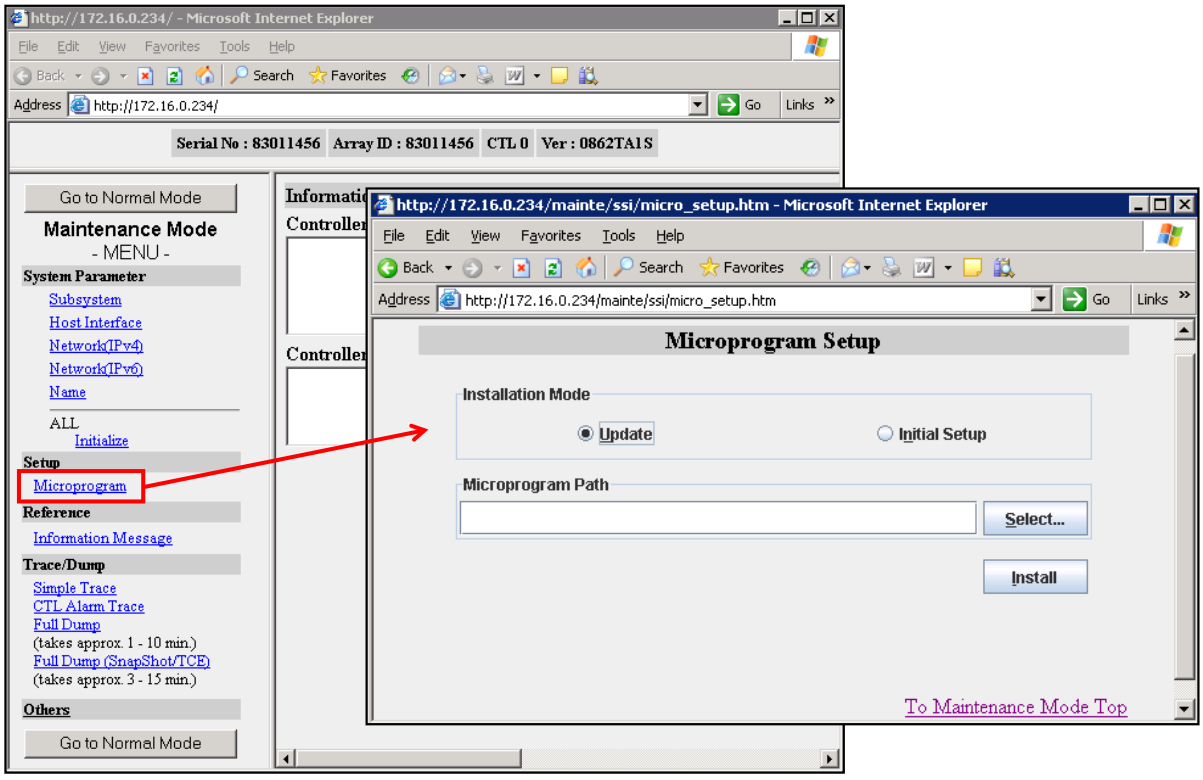


6

Error If JRE Is Not Correctly Configured

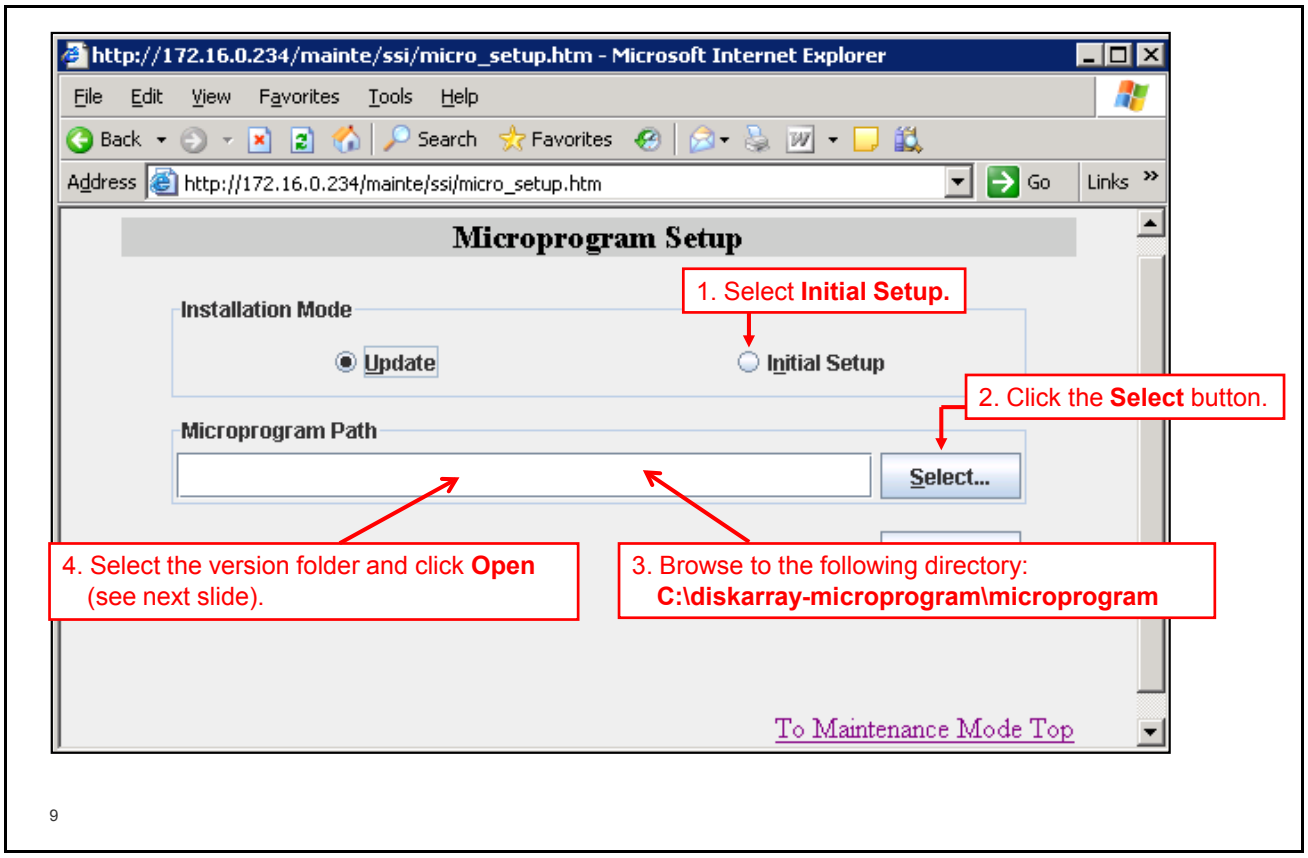


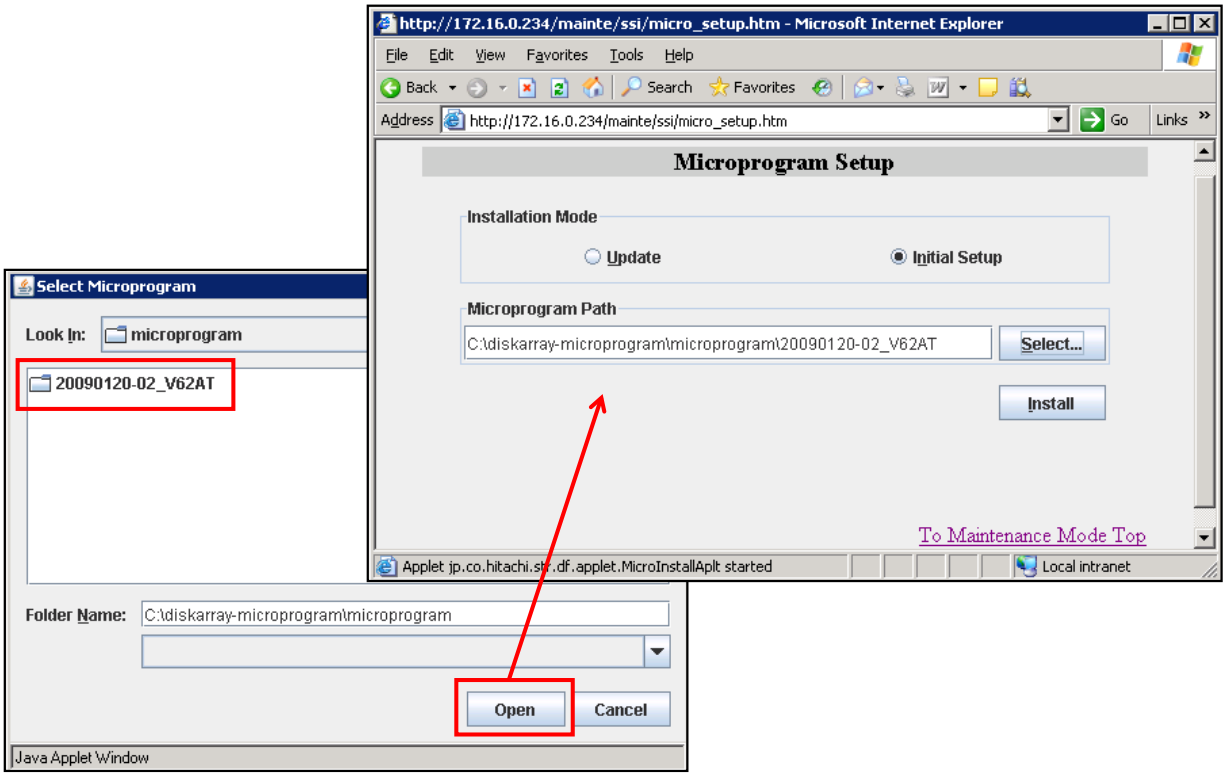
Initial Setup



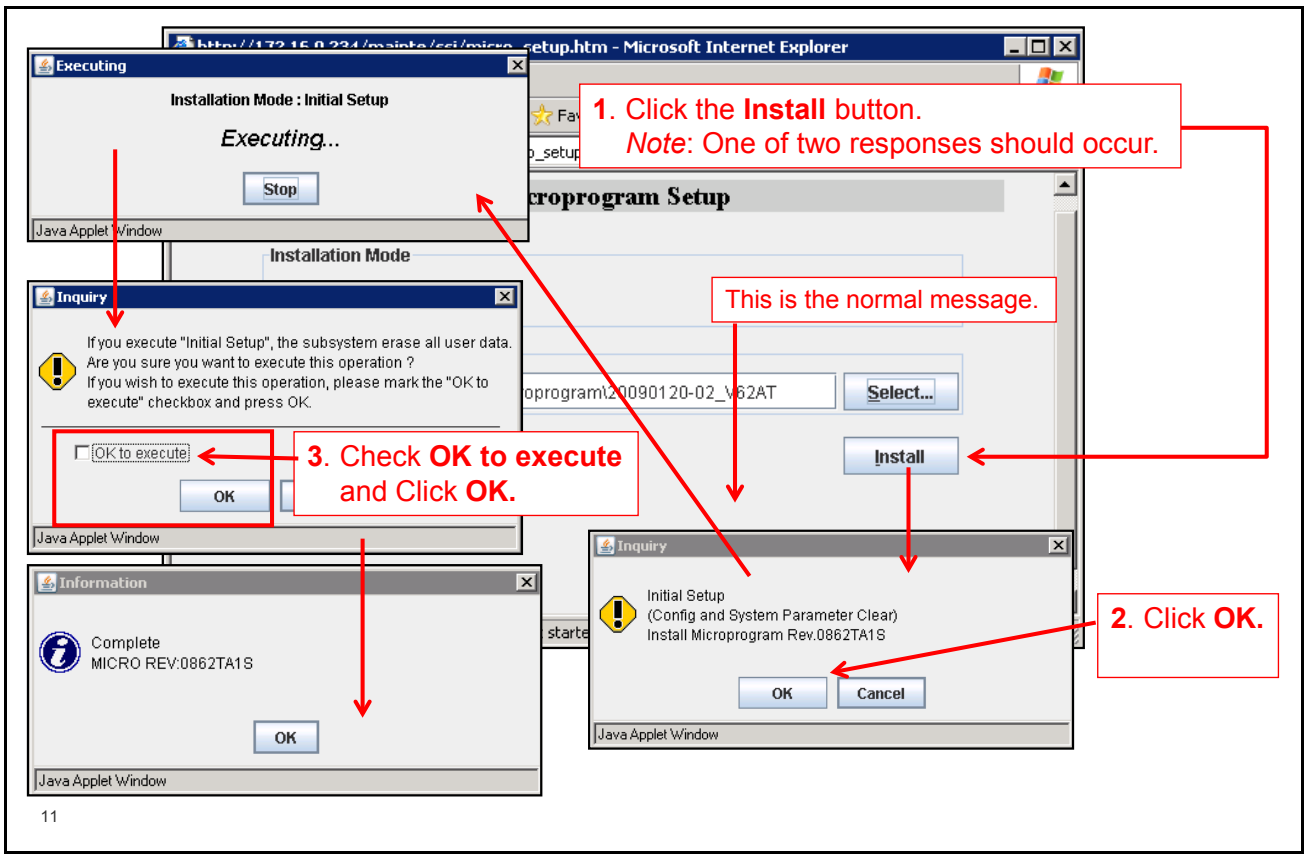
Initial setup clears all parameter and configuration settings and loads initial microcode into the system.

Microcode is loaded on the first **five** drives on the system.

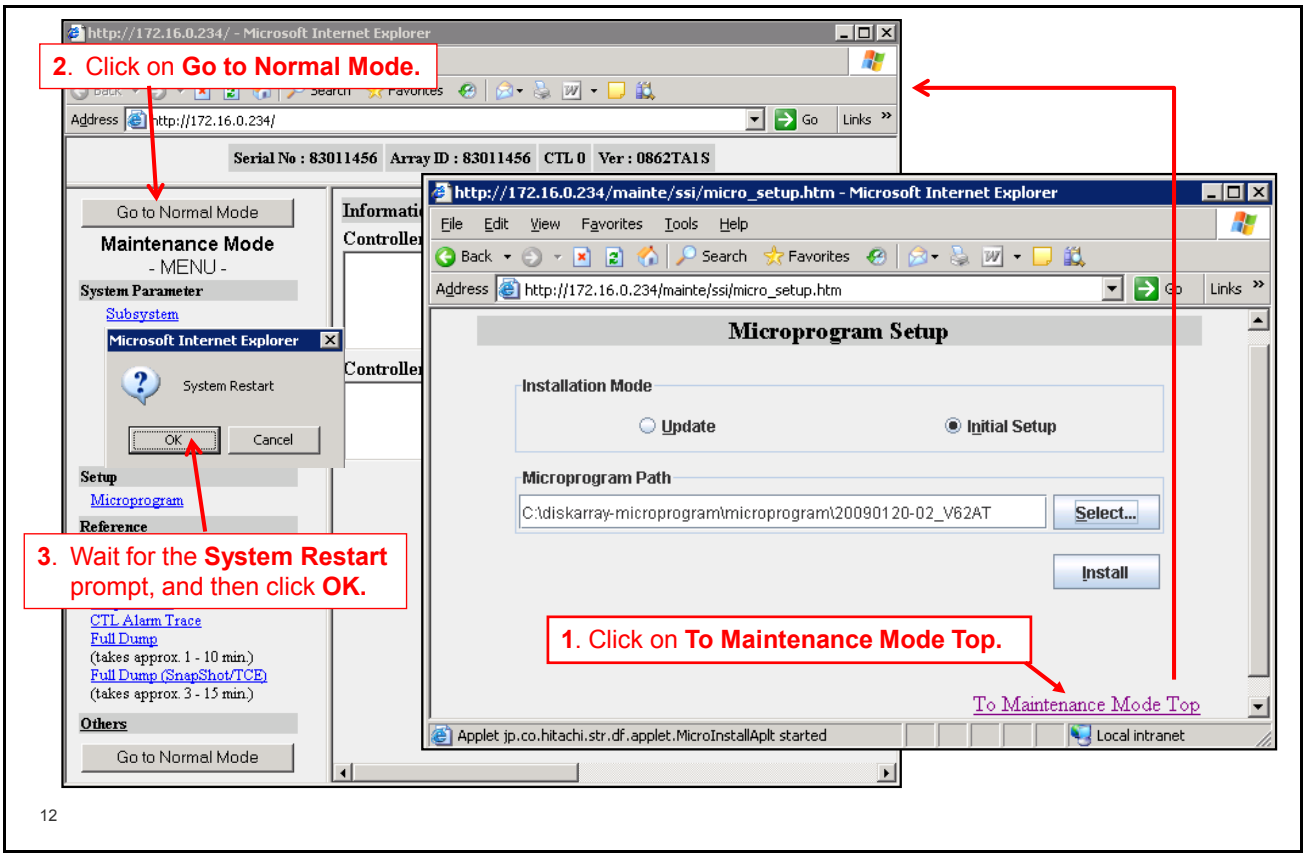

http://172.16.0.234/mainte/ssi/micro_setup.htm - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://172.16.0.234/mainte/ssi/micro_setup.htm
Go Links
Microprogram Setup
1. Select Initial Setup.
Installation Mode
Update
Initial Setup
2. Click the Select button.
Microprogram Path
Select...
4. Select the version folder and click Open (see next slide).
3. Browse to the following directory: C:\diskarray-microprogram\microprogram
To Maintenance Mode Top
9


http://172.16.0.234/mainte/ssi/micro_setup.htm - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://172.16.0.234/mainte/ssi/micro_setup.htm
Go Links
Microprogram Setup
Installation Mode
Update
Initial Setup
Microprogram Path
C:\diskarray-microprogram\microprogram\20090120-02_V62AT
Select...
Install
To Maintenance Mode Top
Applet jp.co.hitachi.ssi.df.applet.MicroInstallAplt started
Local intranet
Select Microprogram
Look In: microprogram
20090120-02_V62AT
Folder Name: C:\diskarray-microprogram\microprogram
Open
Cancel
Java Applet Window

10



At step 1, you may get a message that the initial setup will not be allowed because one of more LUNs is being protected by the **Data Retention** function. If the initial set were allowed, then data that was being protected from deletion would be destroyed.


2. Click on Go to Normal Mode.
http://172.16.0.234/ - Microsoft Internet Explorer
Address http://172.16.0.234/
Serial No : 83011456 Array ID : 83011456 CTL 0 Ver : 0862TA1S
Go to Normal Mode
Maintenance Mode
- MENU -
System Parameter
Subsystem
Microsoft Internet Explorer
System Restart
OK
Cancel
Setup
Microprogram
Reference
CTL Alarm Trace
Full Dump
(takes approx. 1 - 10 min.)
Full Dump (SnapShot/TCE)
(takes approx. 3 - 15 min.)
Others
Go to Normal Mode
3. Wait for the System Restart prompt, and then click OK.
http://172.16.0.234/mainte/ssi/micro_setup.htm - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address http://172.16.0.234/mainte/ssi/micro_setup.htm
Microprogram Setup
Installation Mode
Update
Initial Setup
Microprogram Path
C:\diskarray-microprogram\microprogram\20090120-02_V62AT
Select...
Install
1. Click on To Maintenance Mode Top.
To Maintenance Mode Top
Applet jp.co.hitachi.str.df.applet.MicroInstallAplt started
Local intranet
12

Lab Project 14: Disruptive Microcode Update

- Timing and Organization
  - Time allotted to complete the project: **30 minutes.**
  - The lab project contains two sections:
    - **Section 1** is the lab activity.
    - **Section 2** contains the review questions.
  - Time allotted to go over the review questions: **10 minutes.**
  - The class will be split into lab groups and will perform the lab project on the lab equipment assigned to them by their instructor.

13

Lab Project 14: Objectives

- Upon completion of the lab project, the learner should be able to do the following:
  - Configure Java to allow the Web Tool to load microcode to the Adaptable Modular Storage 2000 array
  - Update the microcode and initialize the system

    Note: The system is at version **0862TA** (lab project 12), you will flash version the same version.
  - Explore some of the other Maintenance Mode functions

14

A. Volume Migration and Replication Specifications

Modular Volume Migration Specifications

No	Item	Adaptable Modular Storage 2000 Family
1	User interface of pair operation	Storage Navigator Modular 2 (GUI, CLI) CCI (RAID Manager)
2	Controller configuration	Dual controllers
3	Maximum number of pairs	Model 2100: 1023 Models 2300 and 2500: 2047 Volume Migration and ShadowImage share number of pairs
4	Maximum number of copy jobs running concurrently in the array	Models 2100 and 2300: two per CTL Model 2500 four per CTL (Dual Core) Volume Migration and ShadowImage share copy jobs

2

No	Item	Adaptable Modular Storage 2000 Family
5	P-VOL: S-VOL	1:1
6	RAID level	RAID 6 , RAID 5, RAID 1, RAID 1+0, RAID 0
7	RAID level of P-VOL to S-VOL	Any to any
8	Drive type for a P-VOL/S-VOL	Any
9	LU size	The size of P-VOL and S-VOL must be the same.
10	Pair operation and format • Migration during format • Format during migration	Not Supported

3

No	Item	Adaptable Modular Storage 2000 Family
11	POOL, DM-LU, Command Device	Cannot be object for LUs used for POOL, DM-LU, Command Device. You must execute LU Migration after releasing LU of POOL, DM-LU, and Command Device.
12	Allocation of P-VOL and S-VOL between RAID groups	The P-VOL and S-VOL can only be allocated in separate RAID groups.
13	External Copy (FC/iSCSI link)	Not supported
14	External Copy (HODM like)	Not supported
15	ShadowImage, TrueCopy, and TrueCopy Extended Distance software	Not supported
16	Hitachi Copy-on-Write Snapshot software Snapshot linkage	Not supported

4

Replication Program Product Specifications

No	Item	Adaptable Modular Storage 2000 Family
1	Maximum number of command devices	128
2	Maximum number of DM-LUs	2 at 10GB each
3	Maximum number of POOLs	64/storage system
4	Maximum number of LUs for POOL	128/storage system
5	Maximum Pool Capacity	Model 2100: 6.2TB Model 2300: 12TB Model 2500: 24TB

5

ShadowImage Replication Specifications

No	Item	Adaptable Modular Storage 2000 Family
1	User interface of pair operation	Storage Navigator Modular 2 (GUI, CLI) CCI (RAID Manager)
2	Controller configuration	Dual controllers
3	Maximum number of pairs	Model 2100: 1023 Models 2300 and 2500: 2047 Volume Migration and ShadowImage share number of pairs.
4	Maximum number of copy jobs running concurrently in the array	Models 2100 and 2300: 4/CTL Model 2500: 8/CTL (4/Core) Volume Migration and ShadowImage share copy jobs

6

No	Item	Adaptable Modular Storage 2000 Family
7	P-VOL: S-VOL	1:8
8	RAID level	RAID 6 , RAID 5, RAID 1, RAID 1+0, RAID 0 P-VOL cannot be RAID 0.
9	RAID level of P-VOL to S-VOL	Any to any
10	RAID Groups that P-VOL and S-VOL resides	It is recommended that P-VOL and S-VOL reside in different RAID Groups.
11	Drive type for a P-VOL/S-VOL	Any
12	Quick Resync/Split	Support planned
13	Split by CTG	Supported

7

No	Item	Adaptable Modular Storage 2000 Family
14	Pair operation and format • Pair operation during format • Format during pair operation	Not supported
15	Combination with another ShadowImage pair • P-VOL of a ShadowImage pair is S-VOL of another ShadowImage pair	Not supported
16	Combination with Copy-on-Write SnapShot pair • P-VOL of a ShadowImage pair is P-VOL of a SnapShot pair • S-VOL of a ShadowImage pair is P-VOL of a SnapShot pair • P-VOL of a ShadowImage pair is V-VOL of a SnapShot pair	Not supported
17	Combination with TrueCopy pair (See TrueCopy section)	Supported (including Swap-resync)
18	Combination with TrueCopy Extended Distance pair (See TrueCopy Extended section)	Not supported

8

Copy-on-Write Snapshot Specifications

No	Item	Adaptable Modular Storage 2000 Family
1	User interface of pair operation	Storage Navigator Modular 2 (GUI,CLI) CCI (RAID Manager)
2	Controller configuration	Dual controllers
3	Maximum number of pairs	Model 2100: 1022 Models 2300 and 2500: 2046
4	P-VOL: V-VOL	1:32
5	RAID level	RAID 6 , RAID 5, RAID 1, RAID 1+0
6	RAID level of P-VOL to V-VOL	Any to any
7	RAID Group	It is recommended that P-VOL and POOL reside in different RAID Groups.
8	Drive type for a P-VOL/V-VOL	Any
9	V-VOL definition	Do not have to specify P-VOL
10	Split by CTG	Supported

9

No	Item	Adaptable Modular Storage 2000 Family
11	SNMP Trap	• PSUE • POOL threshold over • POOL over
12	Pair operation and format • Pair operation during format • Format during pair operation	Not supported
13	Combination with ShadowImage pair (See ShadowImage section)	Not supported
14	Combination with another SnapShot pair • V-VOL of a Snapshot pair is P-VOL of another SnapShot pair	Not supported
15	Combination with TrueCopy pair (See TrueCopy section)	Supported (including Swap-resync)
16	Combination with TrueCopy Extended pair (See TrueCopy Extended section)	Supported

10

TrueCopy Synchronous Specifications

No	Item	Adaptable Modular Storage 2000 Family
1	User interface of Pair Operation	Storage Navigator Modular 2 (GUI, CLI) CCI (RAID Manager)
2	Controller configuration	Dual controllers
3	Maximum number of pairs	Model 2100: **2046** Models 2300 and 2500: **4094**
4	Local system: Remote system	1:1
5	P-VOL: S-VOL	1:1
6	RAID level	RAID 6, RAID 5, RAID 1, RAID 1+0
7	RAID level of P-VOL to S-VOL	Any to any
8	Drive type for a P-VOL/S-VOL	Any
9	LU size	The size of P-VOL and S-VOL must be the same.

11

No	Item	Adaptable Modular Storage 2000 Family
10	Fibre Channel link	Supported
11	iSCSI link	Supported
12	Remote Path Bandwidth	At least 1.5Mbps per path
13	2000 Family storage to previous AMS modular storage system TrueCopy software	Supported
14	2000 Family storage to Universal Storage Platform TrueCopy software	Not supported
15	Maximum number of CTGs	256 per storage system
16	Swap Takeover	Supported
17	SNMP Trap	- PSUE - Path blockade
18	Pair operation and format • Pair operation during format • Format during pair operation	Not supported

12

Cross-generation functions revert to previous Adaptable Modular Storage specifications.

No	Item	Adaptable Modular Storage 2000 Family
19	Combination with ShadowImage pair • P-VOL of a ShadowImage pair is P-VOL of a TrueCopy pair • P-VOL of a ShadowImage pair is S-VOL of a TrueCopy pair • S-VOL of a ShadowImage pair is P-VOL of a TrueCopy pair	Supported (including Swap-resync)
20	Combination with SnapShot pair • P-VOL of a SnapShot pair is P-VOL of a TrueCopy pair • P-VOL of a SnapShot pair is S-VOL of a TrueCopy pair • V-VOL of a SnapShot pair is P-VOL of a TrueCopy pair	Supported (including Swap-resync)
21	Concurrent use with TrueCopy Extended	Not supported

13

TrueCopy Extended Distance Specifications

No	Item	Adaptable Modular Storage 2000 Family
1	User interface of Pair Operation	Storage Navigator Modular 2 (GUI,CLI) CCI (RAID Manager)
2	Controller configuration	Dual controllers
3	Maximum number of pairs	Model 2100: **1024** Models 2300 and 2500: **2046**
6	Local system: Remote system	1:1
7	P-VOL: S-VOL	1:1
8	RAID level	RAID 6 , RAID 5, RAID 1, RAID 1+0
9	RAID level of P-VOL to S-VOL	Any to any
10	Drive type for a P-VOL/S-VOL	Any
11	LU size	The size of P-VOL and S-VOL must be the same.
12	FC link	Supported
13	iSCSI link	Supported
14	Remote Path Bandwidth	At least 1.5Mbps per path

14

No	Item	Adaptable Modular Storage 2000 Family
15	Inflow limitation for TrueCopy Extended Distance	Unlimited
16	2000 Family storage to previous modular storage (AMS500 and AMS1000) TrueCopy Extended Distance	Supported
17	2000 Family storage to Universal Storage Platform TrueCopy Extended Distance	Not supported
18	Maximum number of CTGs	16 per storage system
19	Swap Resync	Supported
20	SNMP Trap	• PSUE • POOL threshold over • POOL over • cycle time over • path blockade
21	Indication about cycle information	Local site and Remote site: • Time for determined data • Actual last cycle time

15

Cross-generation functions revert to Adaptable Modular Storage 500 and 1000 specifications.

No	Item	Adaptable Modular Storage 2000 Family
22	Pair operation and format • Pair operation during format • Format during pair operation	Not supported
23	Combination with ShadowImage pair • P-VOL of a ShadowImage pair is P-VOL of a TrueCopy Extended Distance pair • P-VOL of a ShadowImage pair is S-VOL of a TrueCopy Extended Distance pair • S-VOL of a ShadowImage pair is P-VOL of a TrueCopy Extended Distance pair	Not supported
24	Combination with SnapShot pair • P-VOL of a SnapShot pair is P-VOL of a TrueCopy Extended Distance pair • P-VOL of a SnapShot pair is S-VOL of a TrueCopy Extended Distance pair	Supported
25	Concurrent use with TrueCopy	Not supported
26	Installation	Reboot is required after installation

16

Cache Partition Manager Specifications

No	Item	Adaptable Modular Storage 2000 Family
1	Support configuration (Model and Cache combination)	Model 2100: 4GB, /CTL Model 2300: 8GB /CTL Model 2500: 16GB /CTL
2	Number of partitions	Model 2100: 16 Model 2300: 32 Model 2500: 32
3	Minimum partition size	Models 2100 and 2300: 200MB Model 2500: 400MB
4	Segment Size	Selectable for each partitioned cache(4, 8, 16 (Default) 64, 256, and 512KB)
5	Mirror Cache OFF	Not supported
6	Stripe Size	Selectable for each LU (16, 64 (Default) 256, 512KB)
7	Installation	With reboot is required
8	Config change	With reboot is required

17

B. RKAKX Dense Tray Installation

Module Sections

1. Dense tray specifications
2. Genie Lift assembly and step ladder
3. RKAKX unpacking
4. 47U rack assembly stabilizer
5. RKAKX unit preparation and placement
6. RKAKX cable routing brackets
7. RKAKX cable installation

2

Dense Tray Specifications

Specifications: High-density Expansion Unit

Models	2100	2300	2500
RAID Levels	RAID 1, 1+0, 5, 6		
Max # of RAID Groups	50	75	100
Max # of Spare Drives	15	30	30
Max # of LUs	2048	4096	4096
Max LU size	60TB		
Supported Drives	**S-ATA** 1TB and 2TB **SAS-15** 450GB and 600GB		
Upgrades	Model 2100 to 2300, and 2300 to 2500 model via Controller, Data In Place Remote Mirroring interoperable with previous Adaptable Modular Storage (DF700)		
Dense Expansion Unit Disk Trays - RKAKX (Optional based on capacity)	Min. 4 – max. 48 HDD/Tray Max. 120 Drives total	Min. 4 – max. 48 HDD/Tray Max. 240 Drives total	Min. 4 – max. 48 HDD/Tray Max. 480 Drives total
Maximum Capacity	120TB	240TB	480TB

4

- The DF800-RKAKX High Capacity Expansion Unit 4U drive tray for the MS2000 allows the installation of a highly dense SATA drive solution in a small footprint. The RKAKX is designed as (2) logical RKAK, A/B sides with (4) ENC, power supplies, and (4~48) SATA disk drives, or (4~38) SAS disk drives. The RKAKX uses slide rail kits in order to accommodate maintenance access from the top for the disk drives and from the rear for the power supplies.

- The HDS/Rittal Standard or Solutions 19 in. (1050mm) Rack can mount an AMS2500 (DF800-RKHE2/RKEH) plus up to (9) RKAKX for a total capacity of (432) drives in one rack. Additional racks can be added for up to (480) drives maximum. The AMS2100 and AMS2300 can also support the Dense unit but at smaller maximum.

- The HDS/Rittal AMS 47U Rack (1050mm) can mount an AMS2500 (DF800-RKHE2/RKEH) plus up to (10) RKAKX for a total capacity of (480) drives in one rack.

- When installing SAS 15K HDDs into the RKAKX drive tray, HDDs cannot be installed in slots A19~A23 or B19~B23; these slots are logically blocked in microcode. This is due to the power requirement of the SAS drives, which is higher than the SATA drives.

5

AMS2500 (RKHE2)	RKAK (15)	RKAKX	SAS Drives (38 per RKAKX)	SATA Drives (48 per RKAKX)
	0	10	380	480
	2	9		462
	6	8	394	474
	8	7		456
	12	6		468
	14	5		450
	16	4		432
	20	3		444
	24	2		456
	28	1		468
	32	0		480
AMS2300 (RKM)			**SAS Drives (38 per RKAKX)**	**SATA Drives (48 per RKAKX)**
	0	4	167	192
	1	4	182	222
	3	4	212 - Rev 0200 CTL	
	5	3	204	234
	7	2		216
	11	1		228
	15	0		240
AMS2100 (RKS)			**SAS Drives (38 per RKAKX)**	**SATA Drives (48 per RKAKX)**
	0	3	129	159
	3	2	136	156
	5	1		138
	7	0		120

6

Specifications: High-density Expansion Unit (Intermix)

Unit	Expansion Units 15 Disk Drives	High-density Expansion Units 48 disk Drives	Total Number of Disk Drives
AMS 2500	0	10	480 [1]
	1	9	447
	2	9	462
	3	8	429
	4	8	444
	5	8	459
	6	8	474 [2]
	7	7	441
	8	7	456
	9	6	423
	10	6	438
	11	6	453
	12	6	468
	13	5	435
AMS 2500	14	5	450
	15	4	417
	16	4	432
	17	3	399
	18	3	414
	19	3	429
	20	3	444
	21	2	411
	22	2	426
	23	2	441
	24	2	456
	25	1	423
	26	1	438
	27	1	453
	28	1	468
	29	0	435
	30	0	450
	31	0	465
	32	0	480 [3]

1. **Maximum number of disk drives using only high-density expansion units.**
2. **Maximum number of disk drives using intermix of expansion units and high density expansion units.**
3. **Maximum number of disk drives using only expansion units.**

7

Expansion unit intermix:
You can set up a complex system by using the maximum of 480 disk drives by connecting a mixture of expansion units and high-density expansion units to the AMS 2500 base unit.

Base Unit			Expansion Unit				
	Disk Drives		Type	Units		Disk Drives	
	Min	Max		Min	Max	Min	Max
AMS 2500	0	0	Expansion Unit (RKAK)	1	32	1st unit: 4 All other units: 2	15 per unit
			High-density Expansion Unit (RKAKX)	1	10	2 in each section of the unit [1]	48 per unit

Unit	Expansion Units 15 Disk Drives	High-density Expansion Units 48 disk Drives	Total Number of Disk Drives	Total Number of SAS Disk Drives
AMS 2500	0	10	480 [1]	380
	2	9	462	372
	6	8	474 [2]	394
	8	7	456	386
	12	6	468	408
AMS 2500	14	5	450	400
	16	4	432	392
	20	3	444	414
	24	2	456	436
	28	1	468	458
	32	0	480 [3]	480

1. **Maximum number of disk drives using only high-density expansion units.**
2. **Maximum number of disk drives using intermix of expansion units and high-density expansion units.**
3. **Maximum number of disk drives using only expansion units.**

Specifications: Dense and Regular Expansion (Intermix)

Model 2100

Expansion Units	Dense Units	Total HDDs
0	2	111(*)
0	1	63
1	1	78
2	1	93
3	1	108
4	0	75
5	0	90
6	0	105
7	0	120

Model 2300

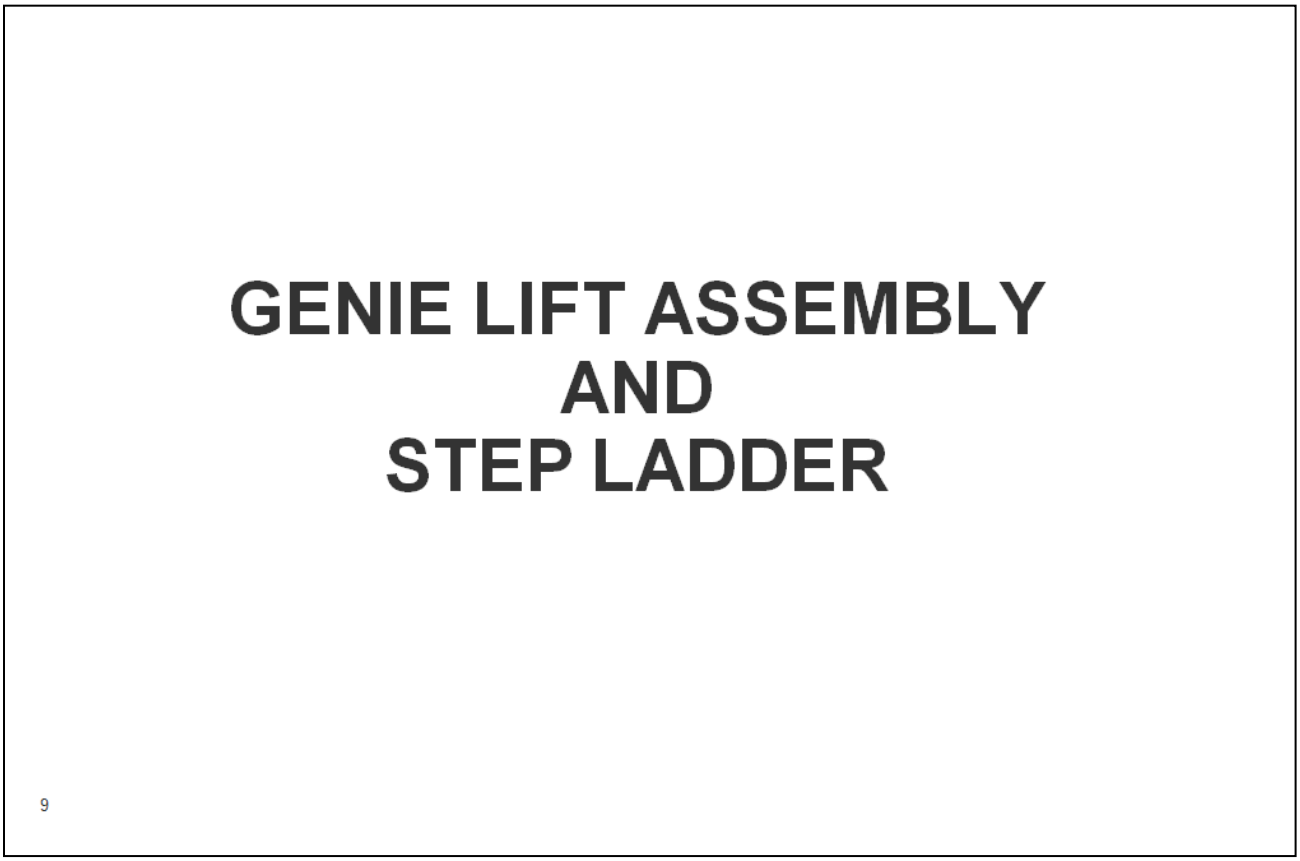
Expansion Units	Dense Units	Total HDDs
0	4	207
1	4	222
2	3	189
3	3	204
4	3	219
5	3	234
6	2	201
7	2	216
8	1	183
9	1	198
10	1	213
11	1	228
12	0	195
13	0	210
14	0	225
15	0	240

Model 2500

Expansion Units	Dense Units	Total HDDs
0	10	480
1	9	447
2	9	462
3	8	429
4	8	444
5	8	459
6	8	474
7	7	441
8	7	456
9	6	423
10	6	438
11	6	453
12	6	468
13	5	435
14	5	450
15	4	417
16	4	432
17	3	399
18	3	414
19	3	429
20	3	444
21	2	411
22	2	426
23	2	441
24	2	456
25	1	423
26	1	438
27	1	453
28	1	468
29	0	435
30	0	450
31	0	465

8

Genie Lift Assembly and Step Ladder



Installation Rules / Tools

- The maximum number of DF800-RKAKX units that can be shipped in a Rack is (4), you may need to install up to (5) additional RKAKX at the customer site, (6) for the 47U tall rack. Due to the extremely heavy weight, no attempt should be made to move the rack with more than (4) RKAKX installed.
- All Dense Expansion Trays must be placed at the lowest point in the rack to maintain a low center of gravity.
- The Genie lift (GL-8) w/GL-LP platform or (compatible lift device) is required to install the DF800-RKAKX. This can be ordered from HDS Logistics if unavailable from the customer site. Please order the following part number well in advance of the installation and allow five days for delivery.
  - IP2000-1.x – Single step-ladder
  - IP2000-2.x – (GL-8 - Lift only)
  - IP2500-2.x – (This includes GL-8 lift and (2) step ladders (see below).

Note: The GL-8 can be raised to 8 ft 3 in. and the load rating is 400 lbs.

Note: In the case of installation in the UK and Europe, a Transport/Logistic company will provide the physical installation of the High Capacity Expansion units into the rack.

10

Two men and a lift are required for installation of RKAKX (including Empty unit).

Installation of the Rack provided Anti-Tip Plate (front) and (sides) is Mandatory prior to attempting to mount or Service the Dense RKAKX drive trays.

Please remove the disk drives and power supplies prior to installation when mounting into the Rack. This will reduce the weight of the drive tray significantly. DF800-RKAKX empty weight is 35 kg. / 77 lbs.

WARNING – NO MORE than (1) RKAKX should ever be extended on rails within the rack during installation or Service to avoid risk of tipping.

Small step ladder is required for Service of (5) units or more or when units are mounted at 26U or higher. The ladder is needed to service the drive trays as maintenance access is from the top and rear. This ladder can be ordered from HDS Logistics. Please order: (IP-2000-1.x) Stapleton Step-Ladder #39968 – Qnty. (1).

Please ensure IDC/EDC has removed all plastic cut-outs at the top of the rack to insure proper airflow for heat dissipation.

Ensure the Rack casters are lined up straight (front to rear).

Lower both front and rear Rack Leveler feet to the floor prior to installing the Anti-tip Plate both front and sides.

Note: *Standard Crescent wrench / spanner is required to lower the leveler feet.*

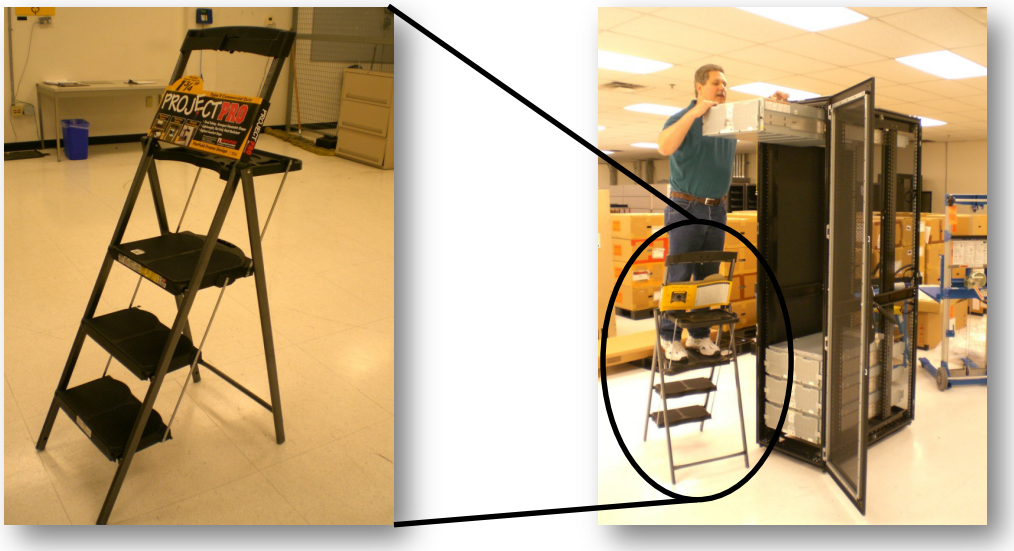
When you receive the Rack from IDC/EDC, please mount the RKAKX drive trays according to the “Serial Form sheet.” This sheet can be found on top of individual RKAKX in the shipping carton and also mounted on the rear rack door. This is the same as current process with the RKAK drive tray.

When Servicing the Power Supplies or ENC expanders at the rear of the rack, the Cable Routing arms must be un-cabled and pulled back from the rail mounting. Please plan for a significant amount of time when servicing the rack from the rear and possible additional plastic tie wraps to complete this re-cabling task. Plan for at least 30min. to re-cable a single RKAKX drive tray.

If this is an Upgrade installation into an existing rack, the RKAKX trays must be installed as far toward the bottom of the rack as possible to keep the center of gravity low.

11

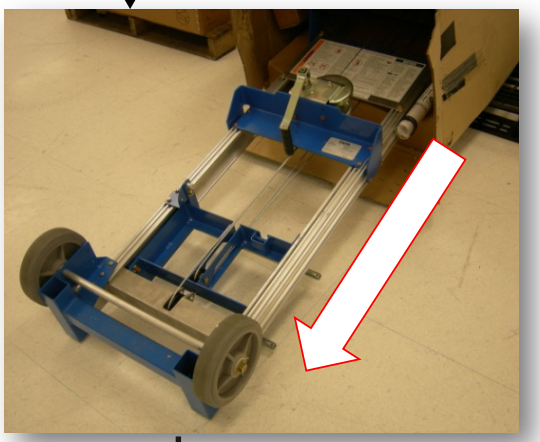
The image below is a dramatization only to show the physical height of a top loaded RKAKX Dense Tray. Trays should *always* be installed from bottom to top in order to keep a low center of gravity balance.



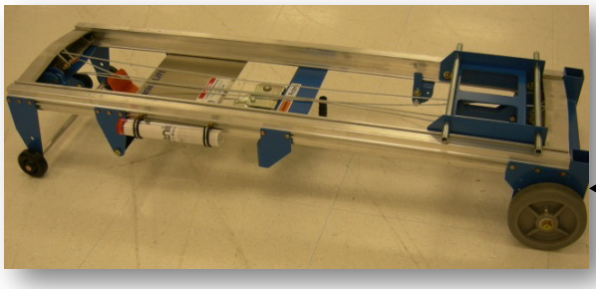
12

Genie Lift: Unpack the Lift

Open the end of the box



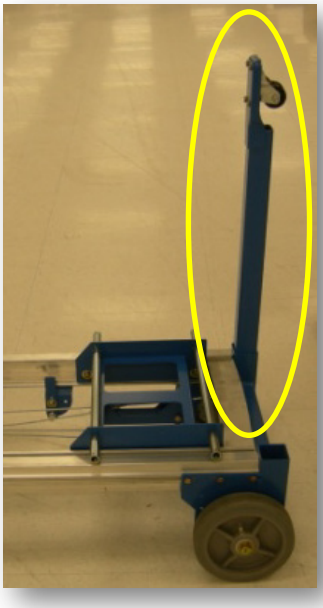
Slide the lift out of the box



Lay the lift horizontally for next steps

13

Genie Lift Preparation: Attach Supporting Feet

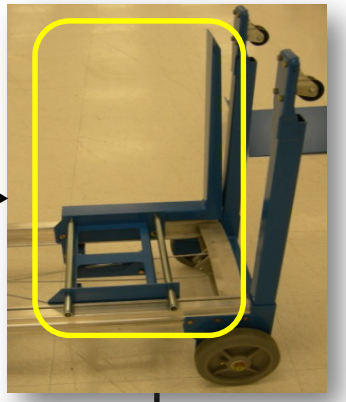


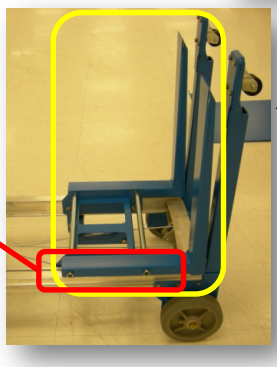
Fit the supporting feet with wheels into the two slots in the bottom frame of the lift assembly

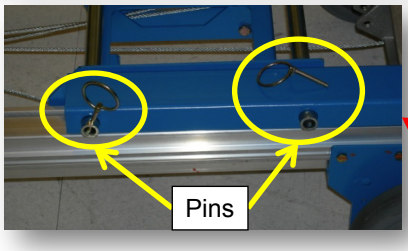
14

Genie Lift Preparation: Attach Lift Forks

Slide the lift forks that support the heavy metal tray over the ends of the two support tubes







Insert a retaining pin in the end of each supporting tube

15

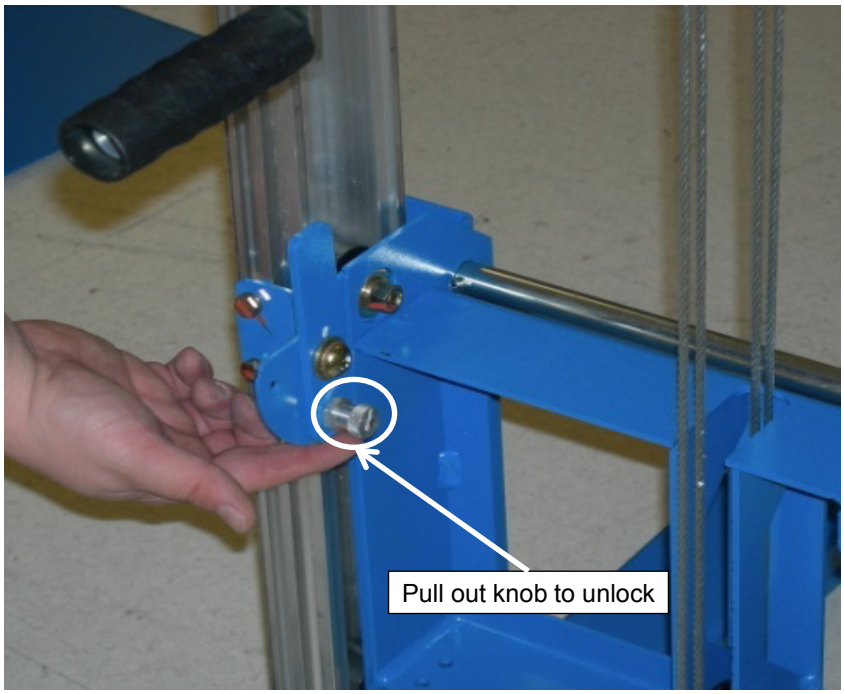
Genie Lift Preparation: Attach Load Platform

- Follow the instructions on the label on the load platform to attach it.
  1. Lay the load platform on the two load forks.
  2. Lift the platform and push it until the back edge is under the lower fork mounting tube.
  3. Rotate the platform down until it locks in place.

16

Genie Lift Preparation: Unlock the Lift

Unlock the lift by pulling out the locking knob.

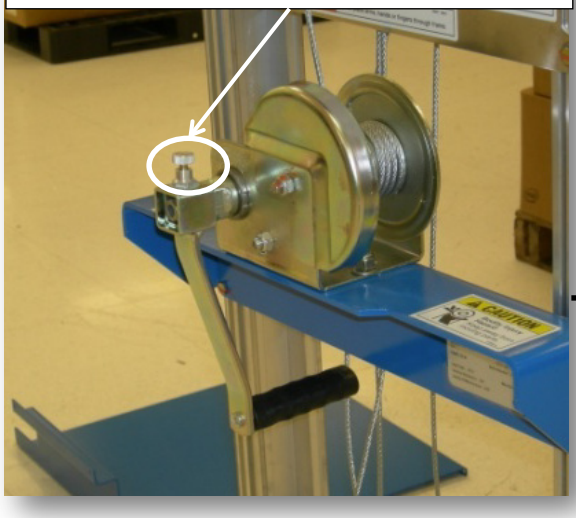


17

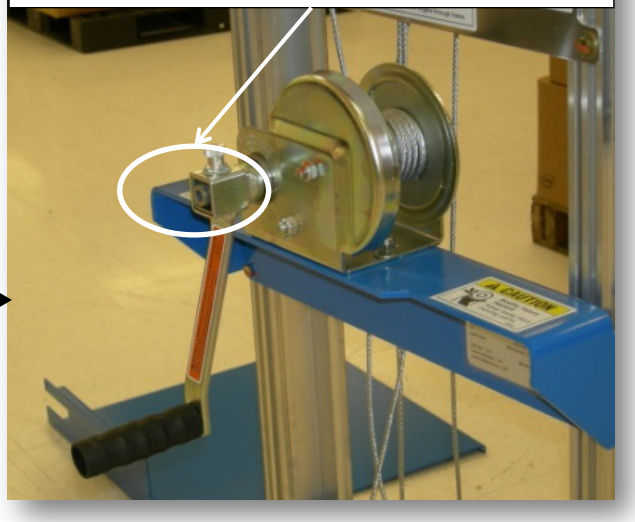
Genie Lift Preparation: Configure Lift Handle

- Follow the three steps shown below to configure the lift handle.

1. Pull out knob to unlock handle arm.
2. Remove the handle arm and turn it around so the handle faces outward.



3. Reattach the handle arm with the handle facing outward.



18

RKAKX Unpacking

- The carton on a wooden pallet includes both the actual RKAKX tray plus another box that stores all related hardware. Unpack in three steps.

1. Leave the RKAKX unit on the pallet and lift up the carton from one side to prevent any vacuum from impeding removal.

20

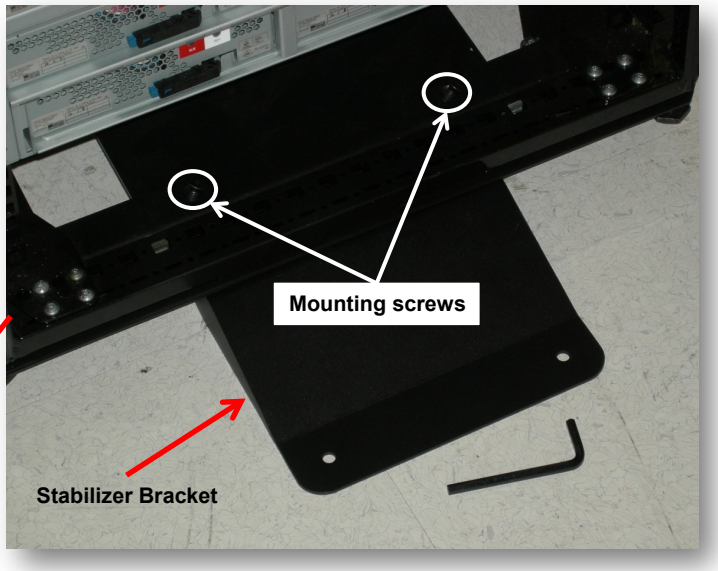
- Complete the unpacking process.
  2. Remove the parts box (yellow arrow) from the top of the carton.
  3. Lay out all parts in an area where you can inventory them and have them handy as you proceed with the rest of the installation steps.

21

47U Rack Assembly Preparation

47U Rack Assembly: Stabilizer Preparation

This full size view of the 47U rack shows the physical location of the stabilizer foot.



The stabilizer mounts with two screws at the front of the rack. To install the stabilizer just swing the bracket under the frame and it aligns with the screw holes.

Note: The 47U rack is much taller than the previous versions and requires a stable step stool to install cables in the upper half.

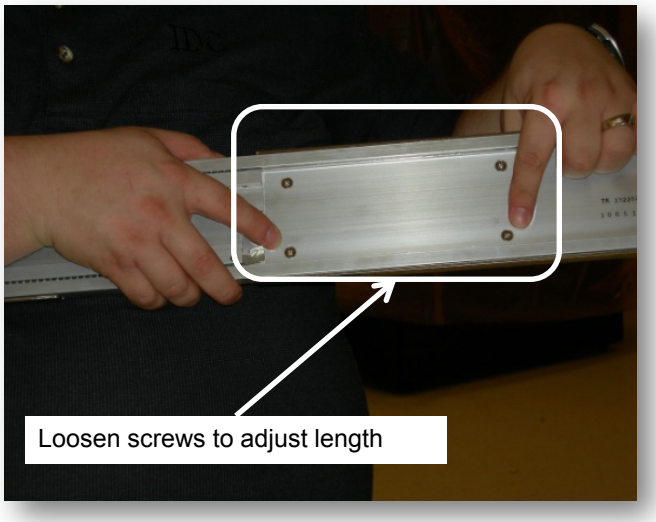
23

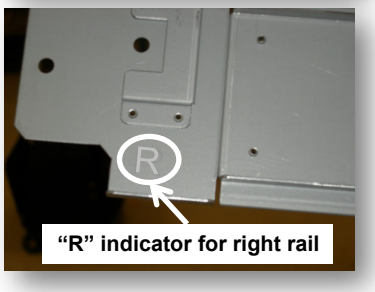
RKAKX Preparation and Placement

RKAKX: Install Slide Brackets

- You must first install the side slide brackets to mount the RKAKX tray.
  1. Note the four screws in the center of the bracket .
  2. Slightly loosen the screws to allow the bracket to be expanded for accurate fit to the rack rails.
  3. Retighten the screws when the brackets are in place.

  Note: The brackets are labeled “L” for left and “R” for right side locations.





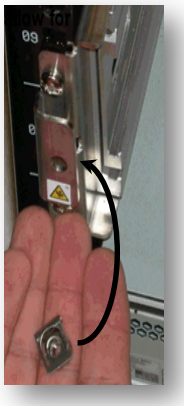
25

RKAKX: Attach the Rails

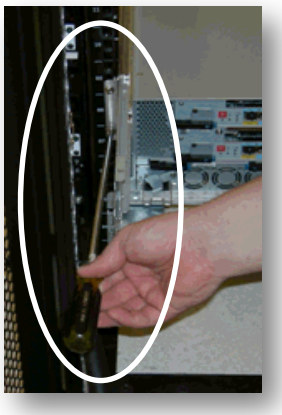
- Four rack nuts are used on the rack tracks for mounting the RKAKX rails.
- Also, on the front of each rail an additional slide-in nut allows for securing the tray when it is in place.
- When installing rails, use a long screw driver in the rear because this access has the rail extended.

Rail nuts

Third nut slides in to lock the tray in place



Rear of rail access requires long screwdriver



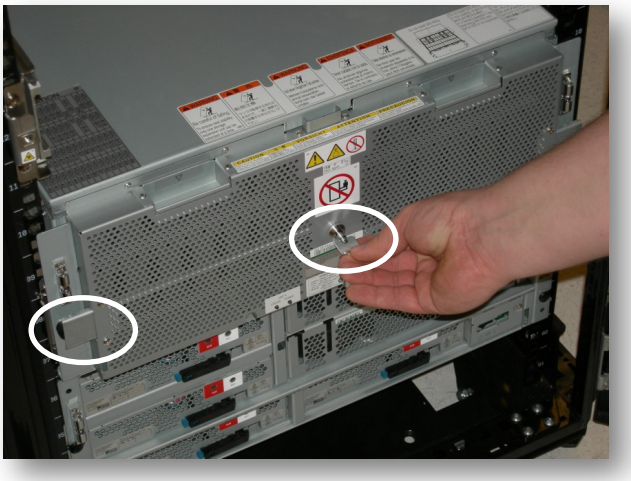
Tighten these four screws on each rail when the rail is in place

26

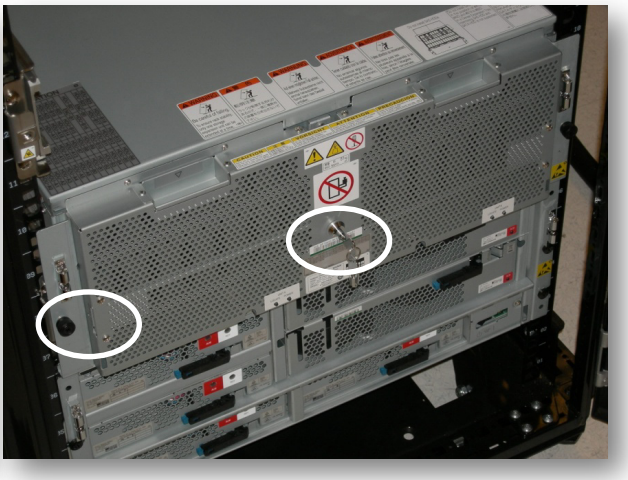
RKAKX: Fail Safe Lock

- The front of the RKAKX has a key lock that acts as a fail safe to prevent the tray from being released by unauthorized personnel.
- When the key is turned, it extends two horizontal lock arms that cover the tray locking screws.
- This key must be turned to access the screws when installing or removing the tray assembly.

Locked



Unlocked



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RKAKX: Tray Releases

- When the tray is placed in the rails, there are two releases on the sides of the tray: a rear release and a front release.
- Depressing the rear release allows for the tray to be pushed back into the rack.
- Depressing the front release allows the tray to be pulled forward for maintenance or removal.

Rear release

Front release

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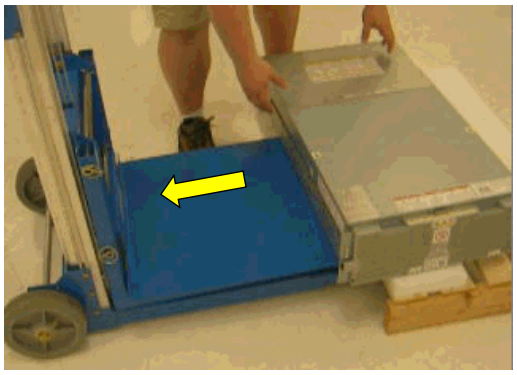
RKAKX: Mounting with Genie Lift

- When the rails are installed in the rack, use the Genie Lift to bring the RKAKX tray in place.
- The Genie Lift crank handle lifts by turning clockwise.
- To lower the lift, turn the crank handle about ¼ turn counter-clockwise to unlock the safety latch; then continue turning the handle to lower the lift.

Crank handle for lifting

To load the RKAKX tray onto the Genie Lift, slide the tray off the pallet and onto Genie Lift at right angles to the long side of the tray.



29

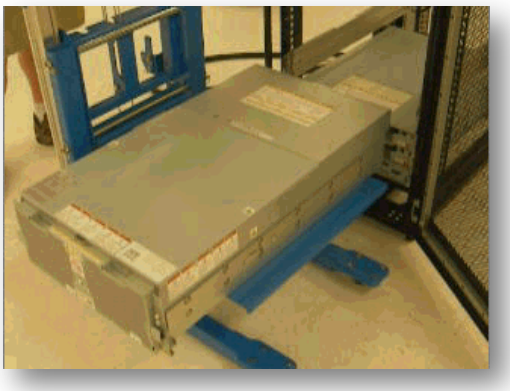
RKAKX: Install in the 47U Rack Assembly

WARNING – Make sure the rack stabilizer is installed before installing the RKAKX.

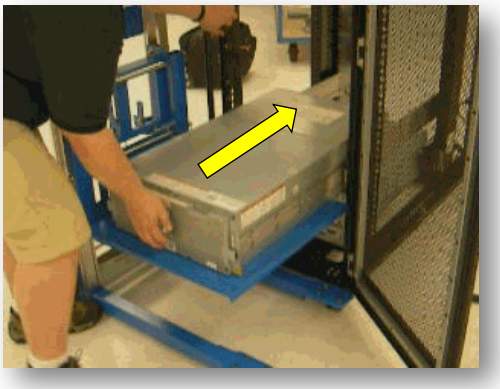
Installation

- The RKAKX tray rails are beveled to aid in sliding the tray easily into the rack mounted rails.
- Raise the tray slightly above the bottom of the rack rails with Genie Lift before sliding the tray rearward into the rack.
- When the tray is seated in the rails, push the tray until a snapping sound is heard.
  - This is the indicator that the rails matched and are locked securely to prevent the tray being pulled forward and falling.

Raise Genie Lift to the height of the rack mounted rails



Slide tray rearward into rails



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Cable Routing Brackets

RKAKX: Install Cable Routing Brackets

- The first step for mounting the swing arm assemblies is to install the primary bracket to which the swing connects.
- There is a left and a right bracket.
- These brackets simply slide in place and are held stationary with a spring tension button that snaps to fit.

- When the left and right primary brackets are in place, connect the left and right pivotal brackets to them.
- These swing arms also connect in place with a spring tension button.

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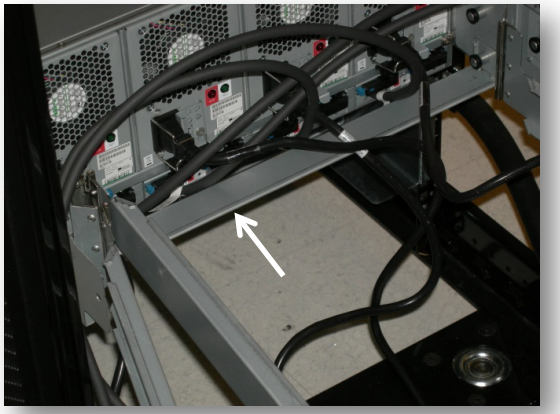
- Directly beneath the mounting brackets, insert a stress relief panel by snapping it in place with spring tension buttons.



- In the far rear of the swing brackets, install the final bracket cover by snapping it in place with spring tension buttons on each swing arm.

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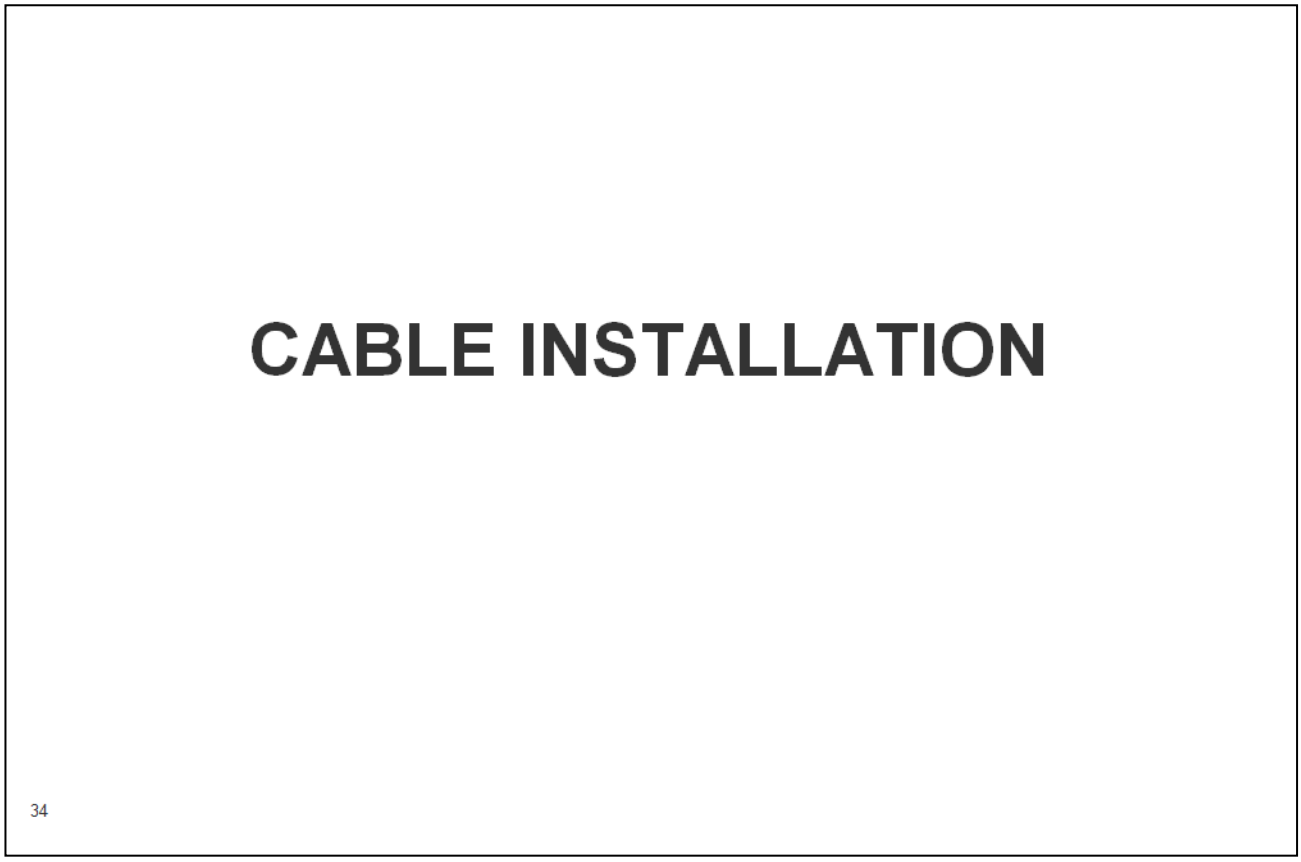
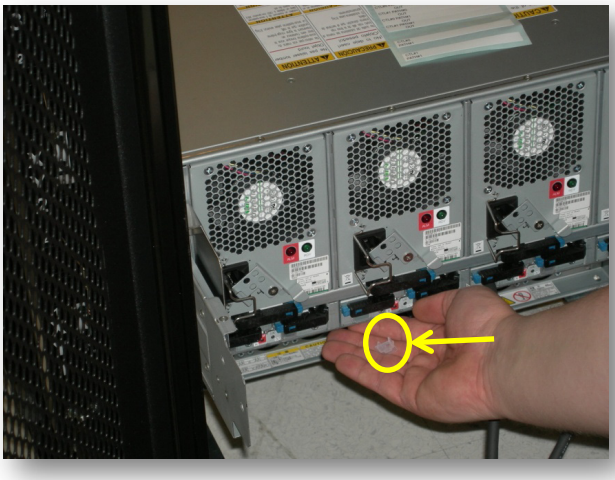
Cable Installation

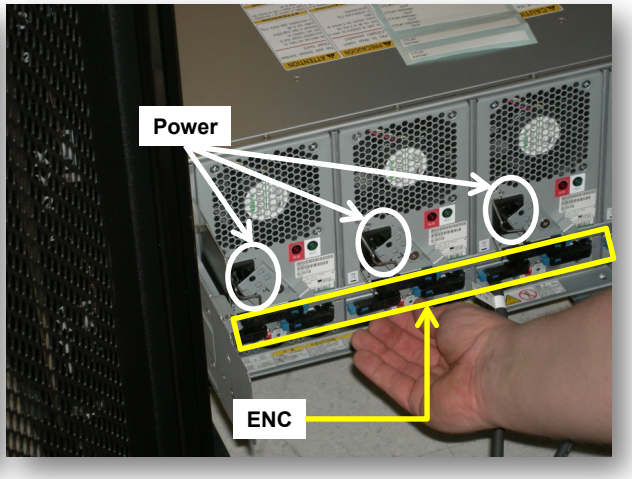


Install the RKAKX ENC/Power Cables

Remove the clear plastic cover



Pull ENC assembly from bottom of tray



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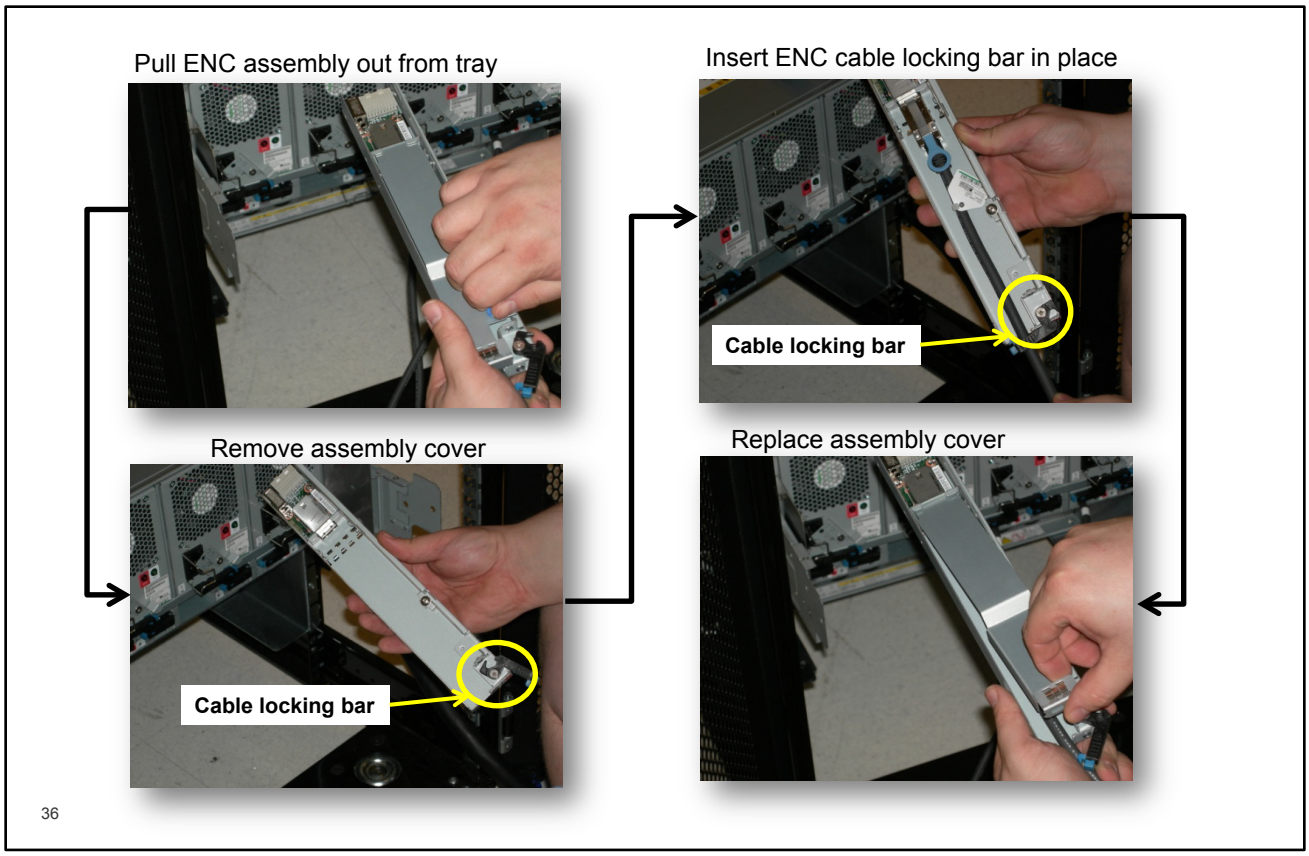
Pull ENC assembly out from tray
Insert ENC cable locking bar in place
Cable locking bar
Remove assembly cover
Cable locking bar
Replace assembly cover
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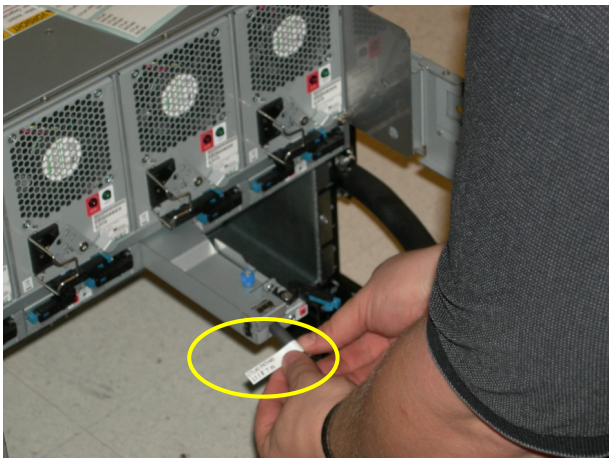
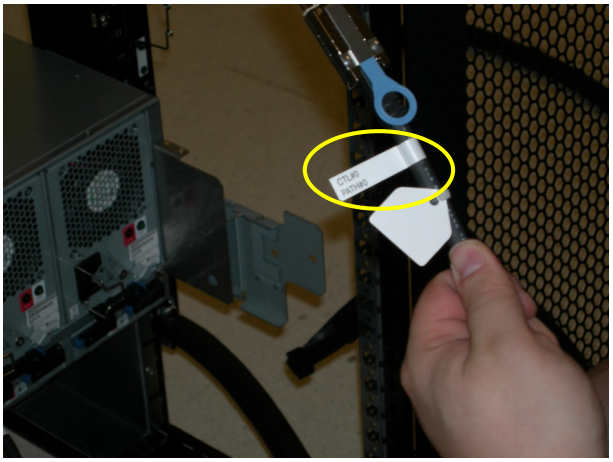
- Label each cable with identical tags on both ends as each cable is installed.
- Labeling tags come with the kit.





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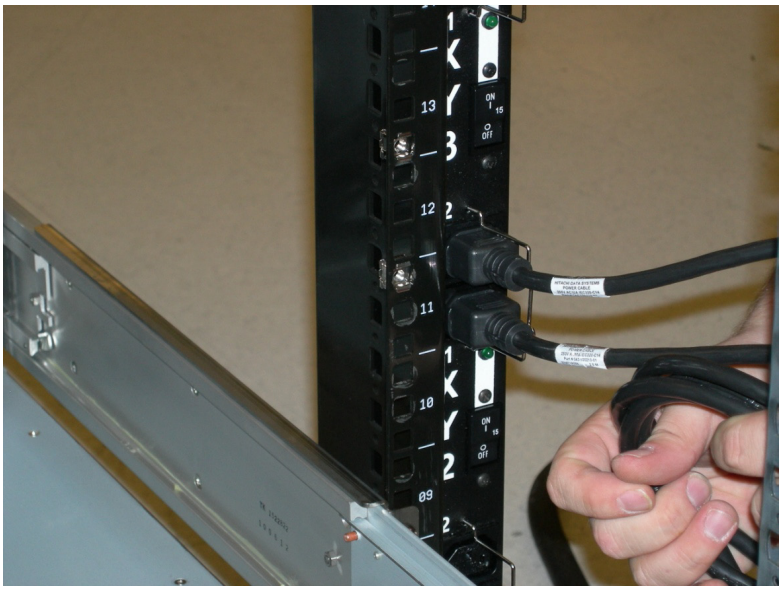
- Route power cables to appropriate power distribution units for separation between power sources.
- Routing depends on source and configuration as outlined during the preparation stage of installation.



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Routing Channels for Power Cables

- Follow a similar routing plan for power cables as with ENC cables.

Power and ENC cables are routing to opposite end of tray to corresponding brackets. Place the larger ENC cables at the bottom of the channel.

Place Velcro straps around outside of the cables and the brackets to secure the cables to brackets.

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Glossary

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

—A—

ACC— Action Code. A SIM System Information Message. Will produce an ACC which takes an engineer to the correct fix procedures in the ACC directory in the MM (Maintenance Manual)

ACE (Access Control Entry) — Stores access rights for a single user or group within the Windows security model

ACL (Access Control List)— stores a set of ACEs, so describes the complete set of access rights for a file system object within the Microsoft Windows security model

ACP (Array Control Processor) — Microprocessor mounted on the disk adapter circuit board (DKA) that controls the drives in a specific disk array. Considered part of the back-end, it controls data transfer between cache and the hard drives.

ACP PAIR — Physical disk access control logic. Each ACP consists of two DKA PCBs. To provide 8 loop paths to the real HDDs

Actuator (arm) — read/write heads are attached to a single head actuator, or actuator arm, that moves the heads around the platters

AD — Active Directory

ADC — Accelerated Data Copy

ADP —Adapter

ADS — Active Directory Service

Address— A location of data, usually in main memory or on a disk. A name or token that identifies a network component. In local area networks (LANs), for example, every node has a unique address

AIX — IBM UNIX

AL (Arbitrated Loop) — A network in which nodes contend to send data and only one node at a time is able to send data.

AL-PA — Arbitrated Loop Physical Address

AMS —Adaptable Modular Storage

APID — An ID to identify a command device.

APF (Authorized Program Facility) — In z/OS and OS/390 environments, a facility that permits the identification of programs that are authorized to use restricted functions.

Application Management —The processes that manage the capacity and performance of applications

ARB — Arbitration or “request”

Array Domain—all functions, paths, and disk drives controlled by a single ACP pair. An array domain can contain a variety of LVI and/or LU configurations.

ARRAY UNIT - A group of Hard Disk Drives in one RAID structure. Same as Parity Group

ASIC — Application specific integrated circuit

ASSY — Assembly

Asymmetric virtualization — See Out-of-band virtualization.

Asynchronous— An I/O operation whose initiator does not await its completion before proceeding with other work. Asynchronous I/O operations enable an initiator to have multiple concurrent I/O operations in progress.

ATA — Short for ***A**dvanced **T**echnology **A**ttachment,* a disk drive implementation that integrates the controller on the disk drive itself, also known as IDE (Integrated Drive Electronics) Advanced Technology Attachment is a standard designed to connect hard and removable disk drives

Authentication — The process of identifying an individual, usually based on a username and password.

Availability — Consistent direct access to information over time

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—B—

B4 — A group of 4 HDU boxes that are used to contain 128 HDDs

Backend— In client/server applications, the client part of the program is often called the front-end and the server part is called the back-end. Backup image—Data saved during an archive operation. It includes all the associated files, directories, and catalog information of the backup operation.

BATCTR — Battery Control PCB

BED — Back End Director. Controls the paths to the HDDs

Bind Mode — One of two modes available when using FlashAccess™, in which the FlashAccess™ extents hold read data for specific extents on volumes (see Priority Mode).

BST — Binary Search Tree

BTU— British Thermal Unit

Business Continuity Plan — Describes how an organization will resume partially- or completely interrupted critical functions within a predetermined time after a disruption or a disaster. Sometimes also called a Disaster Recovery Plan.

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—C—

CA — Continuous Access software (see HORC)

Cache — Cache Memory**.** Intermediate buffer between the channels and drives. It has a maximum of 64 GB (32 GB x 2 areas) of capacity. It is available and controlled as two areas of cache (cache A and cache B). It is fully battery-backed (48 hours) .

Cache hit rate — When data is found in the cache, it is called a cache hit, and the effectiveness of a cache is judged by its hit rate.

Cache partitioning — Storage management software that allows the virtual partitioning of cache and allocation of it to different applications

CAD — Computer-Aided Design

Capacity — Capacity is the amount of data that a drive can store after formatting. Most data storage companies, including HDS, calculate capacity based on the assumption that 1 megabyte = 1000 kilobytes and 1 gigabyte=1,000 megabytes.

CAPEX - capital expenditure **-** is the cost of developing or providing non-consumable parts for the product or system. For example, the purchase of a photocopier is the CAPEX, and the annual paper and toner cost is the OPEX. (See OPEX).

CAS — Column address strobe is a signal sent to a dynamic random access memory (DRAM) that tells it that an associated address is a column address. CAS- column address strobe sent by the processor to a DRAM circuit to activate a column address.

CCI — Command Control Interface

CE — Customer Engineer

Centralized management —Storage data management, capacity management, access security management, and path management functions accomplished by software.

CentOS— **C**ommunity **Ent**erprise **O**perating **S**ystem

CFW— Cache Fast Write

CHA (Channel Adapter) — Provides the channel interface control functions and internal cache data transfer functions. It is used to convert

the data format between CKD and FBA. The CHA contains an internal processor and 128 bytes of edit buffer memory.

CH — Channel

CHA — Channel Adapter

CHAP — Challenge-Handshake Authentication Protocol

CHF — Channel Fibre

CHIP (Client-Host Interface Processor) — Microprocessors on the CHA boards that process the channel commands from the hosts and manage host access to cache.

CHK— Check

CHN — **CH**annel adapter **N**AS

CHP — Channel Processor or Channel Path

CHPID — Channel Path Identifier

CH S— Channel SCSI

CHSN — Cache memory Hierarchical Star Network

CHT—Channel tachyon, a Fibre Channel protocol controller

CIFS protocol — common internet file system is a platform-independent file sharing system. A network file system access protocol primarily used by Windows clients to communicate file access requests to Windows servers.

CIM — Common Information ModelCKD (Count-key Data) — A format for encoding data on hard disk drives; typically used in the mainframe environment.

CKPT — Check Point

CL — See Cluster

CLI — Command Line Interface

CLPR (**C**ache **L**ogical **P**a**R**tition) — Cache can be divided into multiple virtual cache memories to lessen I/O contention.

Cluster — A collection of computers that are interconnected (typically at high-speeds) for the purpose of improving reliability, availability, serviceability and/or performance (via load balancing). Often, clustered computers have access to a common pool of storage, and run special software to coordinate the component computers' activities.

CM (Cache Memory Module) — Cache Memory**.** Intermediate buffer between the channels and drives. It has a maximum of 64 GB (32 GB x 2 areas) of capacity. It is available and controlled as two areas of cache (cache A and cache B). It is fully battery-backed (48 hours)

CM PATH (Cache Memory Access Path) — Access Path from the processors of CHA, DKA PCB to Cache Memory.

CMD — Command

CMG — Cache Memory Group

CNAME — Canonical NAME

CPM (Cache Partition Manager) — Allows for partitioning of the cache and assigns a partition to a LU; this enables tuning of the system's performance.

CNS— Clustered Name Space

Concatenation — A logical joining of two series of data. Usually represented by the symbol "|". In data communications, two or more data are often concatenated to provide a unique name or reference (e.g., S_ID | X_ID). Volume managers concatenate disk address spaces to present a single larger address spaces.

Connectivity technology — a program or device's ability to link with other programs and devices. Connectivity technology allows programs on a given computer to run routines or access objects on another remote computer

Controller — A device that controls the transfer of data from a computer to a peripheral device (including a storage system) and vice versa.

Controller-based Virtualization — Driven by the physical controller at the hardware microcode level versus at the application software layer and integrates into the infrastructure to allow virtualization across heterogeneous storage and third party products

Corporate governance — Organizational compliance with government-mandated regulations

COW — Copy On Write Snapshot

CPS — Cache Port Slave

CPU — Central Processor Unit

CRM — Customer Relationship Management

CruiseControl — Now called Hitachi Volume Migration software

CSV — Comma Separated Value

CSW (Cache Switch PCB) — The cache switch (CSW) connects the channel adapter or disk adapter to the cache. Each of them is connected to the cache by the Cache Memory Hierarchical Star Net (C-HSN)

method. Each cluster is provided with the two CSWs, and each CSW can connect four caches. The CSW switches any of the cache paths to which the channel adapter or disk adapter is to be connected through arbitration.

CU (Control Unit) — The hexadecimal number to which 256 LDEVs may be assigned

CUDG —Control Unit DiaGnostics. Internal system tests.

CV — Custom Volume

CVS (Customizable Volume Size) — software used to create custom volume sizes. Marketed under the name Virtual LVI (VLVI) and Virtual LUN (VLUN)

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—D—

DAD (Device Address Domain) — Indicates a site of the same device number automation support function. If several hosts on the same site have the same device number system, they have the same name.

DACL — Discretionary ACL - the part of a security descriptor that stores access rights for users and groups.

DAMP (Disk Array Management Program) — Renamed to Storage Navigator Modular (SNM)

DAS — Direct Attached Storage

DASD—Direct Access Storage Device

Data Blocks — A fixed-size unit of data that is transferred together. For example, the X-modem protocol transfers blocks of 128 bytes. In general, the larger the block size, the faster the data transfer rate.

Data Integrity —Assurance that information will be protected from modification and corruption.

Data Lifecycle Management — An approach to information and storage management. The policies, processes, practices, services and tools used to align the business value of data with the most appropriate and cost-effective storage infrastructure from the time data is created through its final disposition. Data is aligned with business requirements through management policies and service levels associated with performance, availability, recoverability, cost and what ever parameters the organization defines as critical to its operations.

Data Migration— The process of moving data from one storage device to another. In this context, data migration is the same as Hierarchical Storage Management (HSM).

Data Pool— A volume containing differential data only.

Data Striping — Disk array data mapping technique in which fixed-length sequences of virtual disk data addresses are mapped to sequences of member disk addresses in a regular rotating pattern.

Data Transfer Rate (DTR) — The speed at which data can be transferred. Measured in kilobytes per second for a CD-ROM drive, in bits per second for a modem, and in megabytes per second for a hard drive. Also, often called simply *data rate*.

DCR (Dynamic Cache Residency) — see FlashAccess™

DE— Data Exchange Software

Device Management — Processes that configure and manage storage systems

DDL — Database Definition Language

DDNS —Dynamic DNS

DFS — Microsoft Distributed File System

DFW —DASD Fast Write

DIMM—Dual In-line Memory Module

Direct Attached Storage — Storage that is directly attached to the application or file server. No other device on the network can access the stored data

Director class switches — larger switches often used as the core of large switched fabrics

Disaster Recovery Plan (DRP) — A plan that describes how an organization will deal with potential disasters. It may include the precautions taken to either maintain or quickly resume mission-critical functions. Sometimes also referred to as a *Business Continuity Plan*.

Disk Administrator — An administrative tool that displays the actual LU storage configuration

Disk Array — A linked group of one or more physical independent hard disk drives generally used to replace larger, single disk drive systems. The most common disk arrays are in daisy chain configuration or implement RAID (Redundant Array of Independent Disks) technology. A disk array may contain several disk drive trays, and is structured to improve speed and increase protection against loss of data. Disk arrays organize their data storage into Logical Units

(LUs), which appear as linear block paces to their clients. A small disk array, with a few disks, might support up to 8 LUs; a large one, with hundreds of disk drives, can support thousands.

DKA (Disk Adapter) — Also called an array control processor (ACP); it provides the control functions for data transfer between drives and cache. The DKA contains DRR (Data Recover and Reconstruct), a parity generator circuit. It supports four fibre channel paths and offers 32 KB of buffer for each fibre channel path.

DKC (Disk Controller Unit) — In a multi-frame configuration, the frame that contains the front end (control and memory components).

DKCMN — Disk Controller Monitor. Monitors temperature and power status throughout the machine

DKF (fibre disk adapter) — Another term for a DKA.DKU (Disk Unit) — In a multi-frame configuration, a frame that contains hard disk units (HDUs).

DLIBs — Distribution Libraries

DLM —Data Lifecycle Management

DMA— Direct Memory Access

DM-LU (Differential Management Logical Unit) — DM-LU is used for saving management information of the copy functions in the cache

DMP — Disk Master Program

DNS — Domain Name System

Domain — A number of related storage array groups. An “ACP Domain” or “Array Domain” means all of the array-groups controlled by the same pair of DKA boards.
OR
— The HDDs managed by one ACP PAIR (also called BED)

DR — Disaster Recovery

DRR (Data Recover and Reconstruct) —Data Parity Generator chip on DKA

DRV — Dynamic Reallocation Volume

DSB — Dynamic Super Block

DSP — Disk Slave Program

DTA —Data adapter and path to cache-switches

DW — Duplex Write

DWL — Duplex Write Line

Dynamic Link Manager — HDS software that ensures that no single path becomes overworked while others remain underused. Dynamic Link Manager does this by providing automatic load balancing, path failover, and recovery capabilities in case of a path failure.

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—E—

ECC — Error Checking & Correction

ECC.DDR SDRAM — **E**rror **C**orrection **C**ode **D**ouble **D**ata **R**ate **S**ynchronous **D**ynamic **RA**m **M**emory

ECN — Engineering Change Notice

E-COPY — Serverless or LAN free backup

ENC — Stands for **EN**closure **C**ontroller, the units that connect the controllers in the DF700 with the Fibre Channel disks. They also allow for online extending a system by adding RKAs

ECM— Extended Control Memory

EOF — End Of Field

EPO — Emergency Power Off

ENC — Enclosure

EREP — Error REporting and Printing

ERP — Enterprise Resource Management

ESA — Enterprise Systems Architecture

ESC — Error Source Code

ESCD — ESCON Director

ESCON (Enterprise Systems Connection) — An input/output (I/O) interface for mainframe computer connections to storage devices developed by IBM.

Ethernet — A local area network (LAN) architecture that supports clients and servers and uses twisted pair cables for connectivity.

EVS — Enterprise Virtual Server

ExSA — Extended Serial Adapter

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—F—

Fabric — The hardware that connects workstations and servers to storage devices in a SAN is referred to as a "fabric." The SAN fabric enables any-server-to-any-storage device connectivity through the use of Fibre Channel switching technology.

Failback — The restoration of a failed system share of a load to a replacement component.

For example, when a failed controller in a redundant configuration is replaced, the devices that were originally controlled by the failed controller are usually failed back to the replacement controller to restore the I/O balance, and to restore failure tolerance. Similarly, when a defective fan or power supply is replaced, its load, previously borne by a redundant component, can be failed back to the replacement part.

Failed over — A mode of operation for failure tolerant systems in which a component has failed and its function has been assumed by a redundant component. A system that protects against single failures operating in failed over mode is not failure tolerant, since failure of the redundant component may render the system unable to function. Some systems (e.g., clusters) are able to tolerate more than one failure; these remain failure tolerant until no redundant component is available to protect against further failures.

Failover — A backup operation that automatically switches to a standby database server or network if the primary system fails, or is temporarily shut down for servicing. Failover is an important fault tolerance function of mission-critical systems that rely on constant accessibility. Failover automatically and transparently to the user redirects requests from the failed or down system to the backup system that mimics the operations of the primary system.

Failure tolerance — The ability of a system to continue to perform its function or at a reduced performance level, when one or more of its components has failed. Failure tolerance in disk subsystems is often achieved by including redundant instances of components whose failure would make the system inoperable, coupled with facilities that allow the redundant components to assume the function of failed ones.

FAIS — Fabric Application Interface Standard

FAL — File Access Library

FAT — File Allocation Table

Fault Tolerat — Describes a computer system or component designed so that, in the event of a component failure, a backup component or procedure can immediately take its place with no loss of service. Fault tolerance can be provided with software, embedded in hardware, or provided by some hybrid combination.

FBA — Fixed-block Architecture. Physical disk sector mapping.

FBA/CKD Conversion — The process of converting open-system data in FBA format to mainframe data in CKD format.

FBA — Fixed Block Architecture

FBUS — Fast I/O Bus

FC — Fibre Channel is a technology for transmitting data between computer devices; a set of standards for a serial I/O bus capable of transferring data between two ports

FC-0 — Lowest layer on fibre channel transport, it represents the physical media.

FC-1 — This layer contains the 8b/10b encoding scheme.

FC-2 — This layer handles framing and protocol, frame format, sequence/exchange management and ordered set usage.

FC-3 — This layer contains common services used by multiple N_Ports in a node.

FC-4 — This layer handles standards and profiles for mapping upper level protocols like SCSI an IP onto the Fibre Channel Protocol.

FCA — Fibre Adapter. Fibre interface card. Controls transmission of fibre packets.

FC-AL — Fibre Channel Arbitrated Loop. A serial data transfer architecture developed by a consortium of computer and mass storage device manufacturers and now being standardized by ANSI. FC-AL was designed for new mass storage devices and other peripheral devices that require very high bandwidth. Using optical fiber to connect devices, FC-AL supports full-duplex data transfer rates of 100MBps. FC-AL is compatible with SCSI for high-performance storage systems.

FC-P2P — Fibre Channel Point-to-Point

FC-SW — Fibre Channel Switched

FCC — Federal Communications Commission

FC — Fibre Channel or Field-Change (microcode update)

FCIP –**F**ibre **C**hannel over **IP**, a network storage technology that combines the features of Fibre Channel and the Internet Protocol (IP) to connect distributed SANs over large distances. FCIP is considered *a tunneling protocol*, as it makes a transparent point-to-point connection between geographically separated SANs over IP networks. FCIP relies on TCP/IP services to establish connectivity between remote SANs over LANs, MANs, or WANs.

An advantage of FCIP is that it can use TCP/IP as the transport while keeping Fibre Channel fabric services intact.

FCP — Fibre Channel Protocol

FC RKAJ (Fibre Channel Rack Additional) — Acronym referring to an additional rack unit(s) that houses additional hard drives exceeding the capacity of the core RK unit of the Thunder 9500V/9200 subsystem.

FCU— File Conversion Utility

FD — Floppy Disk

FDR— Fast Dump/Restore

FE — Field Engineer

FED — Channel Front End Directors

Fibre Channel — A serial data transfer architecture developed by a consortium of computer and mass storage device manufacturers and now being standardized by ANSI. The most prominent Fibre Channel standard is Fibre Channel Arbitrated Loop (FC-AL).

FICON (Fiber Connectivity) — A high-speed input/output (I/O) interface for mainframe computer connections to storage devices. As part of IBM's S/390 server, FICON channels increase I/O capacity through the combination of a new architecture and faster physical link rates to make them up to eight times as efficient as ESCON (Enterprise System Connection), IBM's previous fiber optic channel standard.

Flash ACC — Flash access. Placing an entire LUN into cache

FlashAccess — HDS software used to maintain certain types of data in cache to ensure quicker access to that data.

FLGFAN — Front Logic Box Fan Assembly.

FLOGIC Box — Front Logic Box.

FM (Flash Memory) — Each microprocessor has FM. FM is non-volatile memory which contains microcode.

FOP — Fibre Optic Processor or fibre open

FPC — Failure Parts Code or Fibre Channel Protocol Chip

FPGA — Field Programmable Gate Array

Frames — An ordered vector of words that is the basic unit of data transmission in a Fibre Channel network.

Front-end — In client/server applications, the client part of the program is often called the front end and the server part is called the back end.

FS — File System

FSA — File System Module-A

FSB — File System Module-B

FSM — File System Module

FSW (Fibre Channel Interface Switch PCB) — A board that provides the physical interface (cable connectors) between the ACP ports and the disks housed in a given disk drive.

FTP (File Transfer Protocol) — A client-server protocol which allows a user on one computer to transfer files to and from another computer over a TCP/IP network

FWD — Fast Write Differential

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—G—

GARD — General Available Restricted Distribution

GB — Gigabyte

GBIC — Gigabit Interface Converter

GID — Group Identifier

GID — **G**roup **Id**entifier within the Unix security model

GigE — Giga Bit Ethernet

GLM — Gigabyte Link Module

Global Cache — Cache memory is used on demand by multiple applications, use changes dynamically as required for READ performance between hosts/applications/LUs.

Graph-Track™ — HDS software used to monitor the performance of the Hitachi storage subsystems. Graph-Track™ provides graphical displays, which give information on device usage and system performance.

GUI — Graphical User Interface

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—H—

H1F — Essentially the Floor Mounted disk rack (also called Desk Side) equivalent of the RK. (See also: RK, RKA, and H2F).

H2F — Essentially the Floor Mounted disk rack (also called Desk Side) add-on equivalent similar to the RKA. There is a limitation of only one H2F that can be added to the core RK Floor Mounted unit. (See also: RK, RKA, and H1F).

HLU (Host Logical Unit) — A LU that the Operating System and the HDLM recognizes. Each HLU includes the devices that comprise the storage LU

H-LUN — Host Logical Unit Number (See LUN)

HA — High Availability

HBA — Host Bus Adapter—An HBA is an I/O adapter that sits between the host computer's bus and the Fibre Channel loop and manages the transfer of information between the two channels. In order to minimize the impact on host processor performance, the host bus adapter performs many low-level interface functions automatically or with minimal processor involvement.

HDD (Hard Disk Drive) — A spindle of hard disks that make up a hard drive, which is a unit of physical storage within a subsystem.

HD — Hard Disk

HDev (Hidden devices) — Hitachi Tuning Manager Main Console may not display some drive letters in its resource tree, and information such as performance and capacity is not available for such invisible drives. This problem occurs if there is a physical drive with lower PhysicalDrive number assigned that is in “damaged (SCSI Inquiry data cannot be obtained)” or “hidden by HDLM” status.

HDS — Hitachi Data Systems

HDU (Hard Disk Unit) — A number of hard drives (HDDs) grouped together within a subsystem.

HDLM — Hitachi Dynamic Link Manager software

Head — See read/write head

Heterogeneous — The characteristic of containing dissimilar elements. A common use of this word in information technology is to describe a product as able to contain or be part of a *heterogeneous network,"* consisting of different manufacturers' products that can interoperate. Heterogeneous networks are made possible by standards-conforming hardware and software interfaces used in common by different products, thus allowing them to communicate with each other. The Internet itself is an example of a heterogeneous network.

HiRDB — Hitachi Relational Database

HIS — High Speed Interconnect

HiStar — Multiple point-to-point data paths to cache

Hi Track System — Automatic fault reporting system.

HIHSM — Hitachi Internal Hierarchy Storage Management

HMDE — Hitachi Multiplatform Data Exchange

HMRC F — Hitachi Multiple Raid Coupling Feature

HMRS — Hitachi Multiplatform Resource Sharing

HODM — Hitachi Online Data Migration

Homogeneous — Of the same or similar kind

HOMRCF — Hitachi Open Multiple Raid Coupling Feature; Shadow Image, marketing name for HOMRCF

HORC — Hitachi Open Remote Copy — See TrueCopy

HORCM — Hitachi Open Raid Configuration Manager

Host — Also called a server. A Host is basically a central computer that processes end-user applications or requests.

Host LU — See HLU

Host Storage Domains—Allows host pooling at the LUN level and the priority access feature lets administrator set service levels for applications

HP — Hewlett-Packard Company

HPC — High Performance Computing

HRC — Hitachi Remote Copy — See TrueCopy

HSG — Host Security Group

HSM — Hierarchical Storage Management

HSSDC — High Speed Serial Data Connector

HTTP — Hyper Text Transfer Protocol

HTTPS — Hyper Text Transfer Protocol Secure

Hub — A common connection point for devices in a network. Hubs are commonly used to connect segments of a LAN. A hub contains multiple ports. When a packet arrives at one port, it is copied to the other ports so that all segments of the LAN can see all packets. A switching hub actually reads the destination address of each packet and then forwards the packet to the correct port.

HXRC — Hitachi Extended Remote Copy

Hub — Device to which nodes on a multi-point bus or loop are physically connected

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IBR — Incremental Block-level Replication

IBR —Intelligent Block Replication

ID — Identifier

IDR — Incremental Data Replication

iFCP — Short for the ***I**nternet **F**ibre **C**hannel **P**rotocol*, iFCP allows an organization to extend Fibre Channel storage networks over the Internet by using TCP/IP. TCP is responsible for managing congestion control as well as error detection and recovery services. iFCP allows an organization to create an IP SAN fabric that minimizes the Fibre Channel fabric component and maximizes use of the company's TCP/IP infrastructure.

In-band virtualization — Refers to the location of the storage network path, between the application host servers in the storage systems. Provides both control and data along the same connection path. Also called symmetric virtualization.

Interface —The physical and logical arrangement supporting the attachment of any device to a connector or to another device.

Internal bus — Another name for an internal data bus. Also, an expansion bus is often referred to as an internal bus.

Internal data bus — A bus that operates only within the internal circuitry of the CPU, communicating among the internal caches of memory that are part of the CPU chip's design. This bus is typically rather quick and is independent of the rest of the computer's operations.

IID — Stands for Initiator ID. This is used to identify LU whether it is NAS System LU or User LU. If it is 0, that means NAS System LU and if it is 1, then the LU is User LU.

IIS — Internet Information Server

I/O — Input/Output — The term I/O (pronounced "eye-oh") is used to describe any program, operation or device that transfers data to or from a computer and to or from a peripheral device.

IML — Initial Microprogram Load

IP — Internet Protocol

IPL — Initial Program Load

IPSEC — IP security

iSCSI (Internet SCSI) — Pronounced eye skuzzy. Short for Internet SCSI, an IP-based standard for linking data storage devices over a network and transferring data by carrying SCSI commands over IP networks. iSCSI supports a Gigabit Ethernet interface at the physical layer, which allows systems supporting iSCSI interfaces to connect directly to standard Gigabit Ethernet switches and/or IP routers. When an operating system receives a request it generates the SCSI command and then sends an IP packet over an Ethernet connection. At the receiving end, the SCSI commands are separated from the request, and the SCSI commands and data are sent to the SCSI controller and then to the SCSI storage device. iSCSI will also return a response to the request using the same protocol. iSCSI is important to SAN technology because it enables a SAN to be deployed in a LAN, WAN or MAN.

iSER — iSCSI Extensions for RDMA

ISL — Inter-Switch Link

iSNS — Internet Storage Name Service

ISPF — Interactive System Productivity Facility

ISC — Initial shipping condition

ISOE — iSCSI Offload Engine

ISP — Internet service provider

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—J—

Java (and Java applications). — Java is a widely accepted, open systems programming language. Hitachi's enterprise software products are all accessed using Java applications. This enables storage administrators to access the Hitachi enterprise software products from any PC or workstation that runs a supported thin-client internet browser application and that has TCP/IP network access to the computer on which the software product runs.

Java VM — Java Virtual Machine

JCL — Job Control Language

JBOD — Just a Bunch of Disks

JRE —Java Runtime Environment

JMP —Jumper. Option setting method

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—K—

kVA— Kilovolt Ampere

kW — Kilowatt

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—L—

LACP — Link Aggregation Control Protocol

LAG — Link Aggregation Groups

LAN— Local Area Network

LBA (logical block address) — A 28-bit value that maps to a specific cylinder-head-sector address on the disk.

LC (Lucent connector) — Fibre Channel connector that is smaller than a simplex connector (SC)

LCDG—Link Processor Control Diagnostics

LCM— Link Control Module

LCP (Link Control Processor) — Controls the optical links. LCP is located in the LCM.

LCU — Logical Control Unit

LD — Logical Device

LDAP — Lightweight Directory Access Protocol

LDEV (Logical Device) — A set of physical disk partitions (all or portions of one or more disks) that are combined so that the subsystem sees and treats them as a single area of data storage; also called a volume. An LDEV has a specific and unique address within a subsystem. LDEVs become LUNs to an open-systems host.

LDKC — Logical Disk Controller
Manual.

LDM — Logical Disk Manager

LED — Light Emitting Diode

LM — Local Memory

LMODs — Load Modules

LNKLST — Link List

Load balancing — Distributing processing and communications activity evenly across a computer network so that no single device is overwhelmed. Load balancing is especially important for networks where it's difficult to predict the number of requests that will be issued to a server. If one server starts to be swamped, requests are forwarded to another server with more capacity. Load balancing can also refer to the communications channels themselves.

LOC — Locations section of the Maintenance

Logical DKC (LDKC) — An internal architecture extension to the Control Unit addressing scheme that allows more LDEVs to be identified within one Hitachi enterprise storage system. The LDKC is supported only on Universal Storage Platform V/VM class storage systems. As of March 2008, only one LDKC is supported, LDKC 00. Refer to product documentation as Hitachi has announced their intent to expand this capacity in the future.

LPAR — Logical Partition

LRU — Least Recently Used

LU — Logical Unit; Mapping number of an LDEV

LUN (Logical Unit Number) — One or more LDEVs. Used only for open systems. LVI (logical volume image) identifies a similar concept in the mainframe environment.

LUN Manager — HDS software used to map Logical Units (LUNs) to subsystem ports.

LUSE (Logical Unit Size Expansion) — Feature used to create virtual LUs that are up to 36 times larger than the standard OPEN-x LUs.

LVDS — Low Voltage Differential Signal

LVM — Logical Volume Manager

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—M—

MAC — Media Access Control (MAC address = a unique identifier attached to most forms of networking equipment.

MIB — Management information base

MMC — Microsoft Management Console

MPIO — multipath I/O

Mapping — Conversion between two data addressing spaces. For example, mapping refers to the conversion between physical disk block addresses and the block addresses of the virtual disks presented to operating environments by control software.

Mb — Megabits

MB — Megabytes

MBUS — Multi-CPU Bus

MC — Multi Cabinet

MCU — Main Disk Control Unit; the local CU of a remote copy pair.

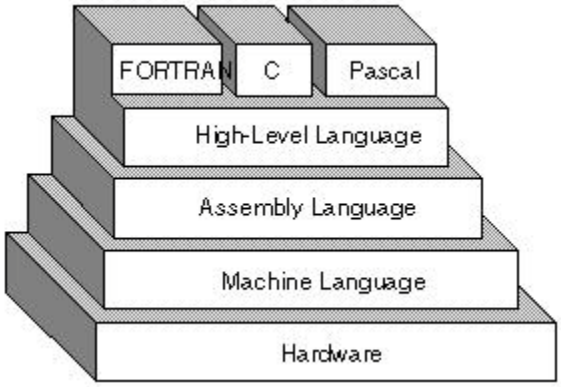
Metadata — In database management systems, data files are the files that store the database

information, whereas other files, such as index files and data dictionaries, store administrative information, known as metadata.

MFC — Main Failure Code

MIB — Management Information Base, a database of objects that can be monitored by a network management system. Both SNMP and RMON use standardized MIB formats that allow any SNMP and RMON tools to monitor any device defined by a MIB.

Microcode — The lowest-level instructions that directly control a microprocessor. A single machine-language instruction typically translates into several microcode instructions.



Microprogram — See Microcode

Mirror Cache OFF — Increases cache efficiency over cache data redundancy.

MM — Maintenance manual.

MPA — Micro-processor adapter

MP — Microprocessor

MPU— Microprocessor Unit

Mode— The state or setting of a program or device. The term mode implies a choice -- that you can change the setting and put the system in a different mode.

MSCS — Microsoft Cluster Server

MS/SG — Microsoft Service Guard

MTS — Multi-Tiered Storage

MVS — Multiple Virtual Storage

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—N—

NAS (Network Attached Storage) — A disk array connected to a controller that gives access to a LAN Transport. It handles data at the file level.

NAT — Network Address Translation

NAT — Network Address Translation

NDMP — Network Data Management Protocol, is a protocol meant to transport data between NAS devices

NetBIOS — Network Basic Input/Output System

Network — A computer system that allows sharing of resources, such as files and peripheral hardware devices

NFS protocol — Network File System is a protocol which allows a computer to access files over a network as easily as if they were on its local disks.

NIM — Network Interface Module

NIS — Network Information Service (YP)

Node — An addressable entity connected to an I/O bus or network. Used primarily to refer to computers, storage devices, and storage subsystems. The component of a node that connects to the bus or network is a port.

Node name — A Name_Identifier associated with a node.

NTP — Network Time Protocol

NVS — Non Volatile Storage

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—O—

OEM — Original Equipment Manufacturer

OFC — Open Fibre Control

OID — Object identifier

OLTP — On-Line Transaction Processing

ONODE — Object node

OPEX – Operational Expenditure – An operating expense, operating expenditure, operational expense, operational expenditure or OPEX is an on-going cost for running a product, business, or system. Its counterpart is a capital expenditure (CAPEX).

Out-of-band virtualization — Refers to systems where the controller is located outside of the SAN data path. Separates control and data on different connection paths. Also called asymmetric virtualization.

ORM— Online Read Margin

OS — Operating System

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—P—

Parity — A technique of checking whether data has been lost or written over when it's moved from one place in storage to another or when it's transmitted between computers

Parity Group — Also called an array group, is a group of hard disk drives (HDDs) that form the basic unit of storage in a subsystem. All HDDs in a parity group must have the same physical capacity.

Partitioned cache memory — Separate workloads in a 'storage consolidated' system by dividing cache into individually managed multiple partitions. Then customize the partition to match the I/O characteristics of assigned LUs

PAT — Port Address Translation

PATA — Parallel ATA

Path — Also referred to as a transmission channel, the path between two nodes of a network that a data communication follows. The term can refer to the physical cabling that connects the nodes on a network, the signal that is communicated over the pathway or a sub-channel in a carrier frequency.

Path failover — See Failover

PAV — Parallel Access Volumes

PAWS — Protect Against Wrapped Sequences

PBC — Port By-pass Circuit

PCB — Printed Circuit Board

PCI — Power Control Interface

PCI CON (Power Control Interface Connector Board)

Performance — speed of access or the delivery of information

PD — Product Detail

PDEV— Physical Device

PDM — Primary Data Migrator

PDM — Policy based Data Migration

PGR — Persistent Group Reserve

PK — Package (see PCB)

PI — Product Interval

PIR — Performance Information Report

PiT — Point-in-Time

PL — Platter (Motherboard/Backplane) - the circular disk on which the magnetic data is stored.

Port — In TCP/IP and UDP networks, an endpoint to a logical connection. The port number identifies what type of port it is. For example, port 80 is used for HTTP traffic.

P-P — Point to Point; also P2P

Priority Mode— Also PRIO mode, is one of the modes of FlashAccess™ in which the FlashAccess™ extents hold read and write data for specific extents on volumes (see Bind Mode).

Provisioning — The process of allocating storage resources and assigning storage capacity for an application, usually in the form of server disk drive space, in order to optimize the performance of a storage area network (SAN). Traditionally, this has been done by the SAN administrator, and it can be a tedious process.

In recent years, automated storage provisioning, also called auto-provisioning, programs have become available. These programs can reduce the time required for the storage provisioning process, and can free the administrator from the often distasteful task of performing this chore manually

Protocol — A convention or standard that enables the communication between two computing endpoints. In its simplest form, a protocol can be defined as the rules governing the syntax, semantics, and synchronization of communication. Protocols may be implemented by hardware, software, or a combination of the two. At the lowest level, a protocol defines the behavior of a hardware connection.

PS — Power Supply

PSA — Partition Storage Administrator

PSSC — Perl SiliconServer Control

PSU — Power Supply Unit

PTR — Pointer

P-VOL — Primary Volume

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—Q—

QD — Quorum Device

QoS — Quality of Service —In the field of computer networking, the traffic engineering term quality of service (QoS), refers to resource reservation control mechanisms rather than the achieved service quality. Quality of service is the ability to provide different priority to different applications, users, or data flows, or to guarantee a certain level of performance to a data flow.

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—R—

R/W — Read/Write

RAID (Redundant Array of Independent Disks, or Redundant Array of Inexpensive Disks) — A group of disks that look like a single volume to the server. RAID improves performance by pulling a single stripe of data from multiple disks, and improves fault-tolerance either through mirroring or parity checking and it is a component of a customer's SLA.

RAID-0 — Striped array with no parity

RAID-1 — Mirrored array & duplexing

RAID-3 — Striped array with typically non-rotating parity, optimized for long, single-threaded transfers

RAID-4 — Striped array with typically non-rotating parity, optimized for short, multi-threaded transfers

RAID-5 — Striped array with typically rotating parity, optimized for short, multithreaded transfers

RAID-6 — Similar to RAID-5, but with dual rotating parity physical disks, tolerating two physical disk failures

RAM — Random Access Memory

RAM DISK — A LUN held entirely in the cache area.

Read/Write Head — Read and write data to the platters, typically there is one head per platter side, and each head is attached to a single actuator shaft

Redundant — Describes computer or network system components, such as fans, hard disk drives, servers, operating systems, switches, and telecommunication links that are installed to back up primary resources in case they fail. A well-known example of a redundant system is the redundant array of independent disks (RAID). Redundancy contributes to the *fault tolerance* of a system.

Reliability —level of assurance that data will not be lost or degraded over time

Resource Manager — Hitachi Resource Manager™ utility package is a software suite that rolls into one package the following four pieces of software:

- Hitachi Graph-Track™ performance monitor feature
- Virtual Logical Volume Image (VLMI) Manager (optimizes capacity utilization),
- Hitachi Cache Residency Manager feature (formerly FlashAccess) (uses cache to speed data reads and writes),
- LUN Manager (reconfiguration of LUNS, or logical unit numbers).

RCHA — RAID Channel Adapter

RC — Reference Code or Remote Control

RCP — Remote Control Processor

RCU — Remote Disk Control Unit

RDMA — Remote Direct Memory Access

Redundancy — Backing up a component to help ensure high availability.

Reliability — An attribute of any commuter component (software, hardware, or a network) that consistently performs according to its specifications.

RID — **R**elative **Id**entifier that uniquely identifies a user or group within a Microsoft Windows domain

RISC — Reduced Instruction Set Computer

RK (Rack) — Acronym referring to the main "Rack" unit, which houses the core operational hardware components of the Thunder 9500V/9200 subsystem. (See also: RKA, H1F, and H2F)

RKA (Rack Additional) — Acronym referring to "Rack Additional", namely additional rack unit(s) which house additional hard drives exceeding the capacity of the core RK unit of the Thunder 9500V/9200 subsystem. (See also: RK, RKA, H1F, and H2F).

RKAJAT — Rack Additional SATA disk tray

RLGFAN — Rear Logic Box Fan Assembly

RLOGIC BOX — Rear Logic Box

RMI (Remote Method Invocation) — A way that a programmer, using the Java programming language and development environment, can write object-oriented programming in which objects on different computers can interact in a distributed network. RMI is the Java version of what is generally known as a RPC

(remote procedure call), but with the ability to pass one or more objects along with the request.

RoHS — Restriction of Hazardous Substances (in Electrical and Electronic Equipment)

ROI — Return on Investment

ROM — Read-only memory

Round robin mode — A load balancing technique in which balances power is placed in the DNS server instead of a strictly dedicated machine as other load techniques do. Round robin works on a rotating basis in that one server IP address is handed out, then moves to the back of the list; the next server IP address is handed out, and then it moves to the end of the list; and so on, depending on the number of servers being used. This works in a looping fashion. Round robin DNS is usually used for balancing the load of geographically distributed Web servers.

Router — a computer networking device that forwards data packets toward their destinations, through a process known as routing.

RPO (Recovery Point Option) — point in time that recovered data should match.

RPSFAN — Rear Power Supply Fan Assembly

RS CON — RS232C/RS422 Interface Connector

RSD — Raid Storage Division

R-SIM—Remote Service Information Message

RTO (Recovery Time Option) — length of time that can be tolerated between a disaster and recovery of data.

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—S—

SA — Storage Administrator

SAA — Share Access Authentication - the process of restricting a user's rights to a file system object by combining the security descriptors from both the file system object itself and the share to which the user is connected

SACK — **S**equential **Ack**nowledge

SACL — System ACL - the part of a security descriptor that stores system auditing information

SAN (Storage Area Network) — A network linking computing devices to disk or tape arrays and other devices over Fibre Channel. It handles data at the block level.

SANtinel — HDS software that provides LUN security. SANtinel protects data from unauthorized access in SAN environments. It restricts server access by implementing boundaries around predefined zones and is used to map hosts in a host group to the appropriate LUNs.

SARD — System Assurance Registration Document

SAS — SAN Attached Storage, storage elements that connect directly to a storage area network and provide data access services to computer systems.

SAS — (Serial Attached SCSI) disk drive configurations for Hitachi Simple Modular Storage 100 systems

SATA — (Serial ATA) —Serial Advanced Technology Attachment is a new standard for connecting hard drives into computer systems. SATA is based on serial signaling technology, unlike current IDE (Integrated Drive Electronics) hard drives that use parallel signaling.

SC (simplex connector) — Fibre Channel connector that is larger than a Lucent connector (LC).

SC — Single Cabinet

SCM — Supply Chain Management

SCP — Secure Copy

SCSI — Small Computer Systems Interface. A parallel bus architecture and a protocol for transmitting large data blocks up to a distance of 15-25 meters.

Sector - a sub-division of a track of a magnetic disk that stores a fixed amount of data.

Selectable segment size — can be set per partition

Selectable Stripe Size — Increases performance by customizing the disk access size.

Serial Transmission — The transmission of data bits in sequential order over a single line.

Server — A central computer that processes end-user applications or requests, also called a host.

Service-level agreement (SLA**) -** A contract between a network service provider and a customer that specifies, usually in measurable terms, what services the network service provider will furnish. Many Internet service providers (ISP)s provide their customers with an SLA. More recently,

IT departments in major enterprises have adopted the idea of writing a service level agreement so that services for their customers (users in other departments within the enterprise) can be measured, justified, and perhaps compared with those of outsourcing network providers.

Some metrics that SLAs may specify include:

- What percentage of the time services will be available
- The number of users that can be served simultaneously
- Specific performance benchmarks to which actual performance will be periodically compared
- The schedule for notification in advance of network changes that may affect users
- Help desk response time for various classes of problems
- Dial-in access availability
- Usage statistics that will be provided.

Service-Level Objective (SLO) - Individual performance metrics are called service-level objectives (SLOs). Although there is no hard and fast rule governing how many SLOs may be included in each SLA, it only makes sense to measure what matters.

Each SLO corresponds to a single performance characteristic relevant to the delivery of an overall service. Some examples of SLOs would include: system availability, help desk incident resolution time, and application response time.

SES — SCSI Enclosure Services

SENC — Is the SATA (Serial ATA) version of the ENC. ENCs and SENCs are complete microprocessor systems on their own and they occasionally require a firmware upgrade.

SFP — Small Form-Factor Pluggable module Host connector — A specification for a new generation of optical modular transceivers. The devices are designed for use with small form factor (SFF) connectors, and offer high speed and physical compactness. They are hot-swappable.

ShadowImage® — HDS software used to duplicate large amounts of data within a subsystem without affecting the service and performance levels or timing out. ShadowImage replicates data with high speed and reduces backup time.

SHSN — Shared memory Hierarchical Star Network

SI — Hitachi ShadowImage® Replication software

SIM RC — Service (or system) Information Message Reference Code

SID — Security Identifier - user or group identifier within the Microsoft Windows security model

SIMM — Single In-line Memory Module

SIM — Storage Interface Module

SIM — Service Information Message; a message reporting an error; contains fix guidance information

SIz — Hitachi ShadowImage® Replication Software

SLA —Service Level Agreement

SLPR (**S**torage administrator **L**ogical **P**a**R**tition) — Storage can be divided among various users to reduce conflicts with usage.

SM (Shared Memory Module) — Stores the shared information about the subsystem and the cache control information (director names). This type of information is used for the exclusive control of the subsystem. Like CACHE, shared memory is controlled as two areas of memory and fully non-volatile (sustained for approximately 7 days).

SM PATH (Shared Memory Access Path) — Access Path from the processors of CHA, DKA PCB to Shared Memory.

SMB/CIFS — Server Message Block Protocol / Common Internet File System

SMC — Shared Memory Control

SM — Shared Memory

SMI-S — Storage Management Initiative Specification

SMP/E (System Modification Program/Extended) — An IBM licensed program used to install software and software changes on z/OS systems.

SMS — Hitachi Simple Modular Storage

SMTP — Simple Mail Transfer Protocol

SMU — System Management Unit

Snapshot Image — A logical duplicated volume (V-VOL) of the primary volume. It is an internal volume intended for restoration

SNIA — Storage Networking Industry Association, an association of producers and consumers of storage networking products, whose goal is to further storage networking technology and applications.

SNMP (Simple Network Management Protocol) — A TCP/IP protocol that was designed for

management of networks over TCP/IP, using agents and stations.

SOAP (simple object access protocol) — A way for a program running in one kind of operating system (such as Windows 2000) to communicate with a program in the same or another kind of an operating system (such as Linux) by using the World Wide Web's Hypertext Transfer Protocol (HTTP) and its Extensible Markup Language (XML) as the mechanisms for information exchange.

Socket — In UNIX and some other operating systems, a software object that connects an application to a network protocol. In UNIX, for example, a program can send and receive TCP/IP messages by opening a socket and reading and writing data to and from the socket. This simplifies program development because the programmer need only worry about manipulating the socket and can rely on the operating system to actually transport messages across the network correctly. Note that a socket in this sense is completely soft - it's a software object, not a physical component.

SPAN — Span is a section between two intermediate supports. See Storage pool

Spare — An object reserved for the purpose of substitution for a like object in case of that object's failure.

SPC — SCSI Protocol Controller

SpecSFS — Standard Performance Evaluation Corporation Shared File system

SSB — Sense Byte

SSC — SiliconServer Control

SSH — Secure Shell

SSID — Subsystem Identifier

SSL — Secure Sockets Layer

SSVP — Sub Service Processor; interfaces the SVP to the DKC

Sticky Bit — Extended Unix mode bit that prevents objects from being deleted from a directory by anyone other than the object's owner, the directory's owner or the root user

STR — Storage and Retrieval Systems

Storage pooling — The ability to consolidate and manage storage resources across storage system enclosures where the consolidation of many appears as a single view.

Striping — A RAID technique for writing a file to multiple disks on a block-by-block basis, with or without parity.

Subsystem — Hardware and/or software that performs a specific function within a larger system.

SVC — Supervisor Call Interruption

S-VOL — Secondary Volume

SVP (Service Processor) — A laptop computer mounted on the control frame (DKC) and used for monitoring, maintenance and administration of the subsystem

Symmetric virtualization — See In-band virtualization.

Synchronous— Operations which have a fixed time relationship to each other. Most commonly used to denote I/O operations which occur in time sequence, i.e., a successor operation does not occur until its predecessor is complete.

Switch— A fabric device providing full bandwidth per port and high-speed routing of data via link-level addressing.

Software — Switch

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—T—

T.S.C. (Technical Support Center) — A chip developed by HP, and used in various devices. This chip has FC-0 through FC-2 on one chip.

TCA — TrueCopy Asynchronous

TCO — Total Cost of Ownership

TCP/IP — Transmission Control Protocol over Internet Protocol

TCP/UDP — User Datagram Protocol is one of the core protocols of the Internet protocol suite. Using UDP, programs on networked computers can send short messages known as datagrams to one another.

TCS — TrueCopy Synchronous

TCz — Hitachi TrueCopy® Remote Replication software

TDCONV (Trace Dump CONVerter) — Is a software program that is used to convert traces taken on the system into readable text. This information is loaded into a special spreadsheet that allows for further investigation of the data. More in-depth failure analysis.

TGTLIBs— Target Libraries

Target — The system component that receives a SCSI I/O command, an open device that operates at the request of the initiator

THF — Front Thermostat

Thin Provisioning — Thin Provisioning allows space to be easily allocated to servers, on a just-enough and just-in-time basis.

Throughput — The amount of data transferred from one place to another or processed in a specified amount of time. Data transfer rates for disk drives and networks are measured in terms of throughput. Typically, throughputs are measured in kbps, Mbps and Gbps.

THR — Rear Thermostat

TID — Target ID

Tiered storage —A storage strategy that matches data classification to storage metrics. Tiered storage is the assignment of different categories of data to different types of storage media in order to reduce total storage cost. Categories may be based on levels of protection needed, performance requirements, frequency of use, and other considerations. Since assigning data to particular media may be an ongoing and complex activity, some vendors provide software for automatically managing the process based on a company-defined policy.

Tiered Storage Promotion — Moving data between tiers of storage as their availability requirements change

TISC — The Hitachi Data Systems internal Technical Information Service Centre from which microcode, user guides, ECNs, etc. can be downloaded.

TLS — Tape Library System

TLS — Transport Layer Security

TMP — Temporary

TOC — Table Of Contents

TOD — Time Of Day

TOE — TCP Offload Engine

Topology — The shape of a network or how it is laid out. Topologies are either physical or logical.

TPF — Transaction Processing Facility

Transfer Rate — See Data Transfer Rate

Track — Circular segment of a hard disk or other storage media

Trap — A program interrupt, usually an interrupt caused by some exceptional situation in the user program. In most cases, the Operating System performs some action, and then returns control to the program.

TRC — Technical Resource Center

TrueCopy — HDS software that replicates data between subsystems. These systems can be located within a data center or at geographically separated data centers. The 9900V adds the capability of using TrueCopy to make copies in two different locations simultaneously.

TSC — Technical Support Center

TSO/E — Time Sharing Option/Extended

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—U—

UFA — UNIX File Attributes

UID — **U**ser **Id**entifier

UID — **U**ser **Id**entifier within the UNIX security model

UPS — Uninterruptible Power Supply — A power supply that includes a battery to maintain power in the event of a power outage.

URz — Hitachi Universal Replicator software

USP — Universal Storage Platform™

USP V — Universal Storage Platform™ V

USP VM — Universal Storage Platform™ VM

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—V—

VCS — Veritas Cluster System

VHDL — VHSIC (Very-High-Speed Integrated Circuit) Hardware Description Language

VHSIC — Very-High-Speed Integrated Circuit

VI — Virtual Interface, a research prototype that is undergoing active development, and the details of the implementation may change considerably. It is an application interface that gives user-level processes direct but protected access to network interface cards. This allows applications to bypass IP processing overheads (copying data, computing checksums, etc.) and system call overheads while still preventing one process from accidentally or maliciously tampering with or reading data being used by another.

VirtLUN —VLL. Customized volume; size chosen by user

Virtualization —The amalgamation of multiple network storage devices into what appears to be a **single** storage unit. Storage virtualization is often used in a SAN, and makes tasks such as archiving, back up, and recovery easier and faster. Storage virtualization is usually implemented via software applications.

VLL — Virtual Logical Volume Image/Logical Unit Number

VLVI — Virtual Logic Volume Image, marketing name for CVS (custom volume size)

VOLID — Volume ID

Volume — A fixed amount of storage on a disk or tape. The term volume is often used as a synonym for the storage medium itself, but it is possible for a single disk to contain more than one volume or for a volume to span more than one disk.

VTOC — Volume Table of Contents

V-VOL — Virtual volume

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—W—

WAN —Wide Area Network

WDIR — Working Directory

WDIR — Directory Name Object

WDS — Working Data Set

WFILE — Working File

WFILE — File Object

WFS — Working File Set

WINS — Windows Internet Naming Service

WMS — Hitachi Workgroup Modular Storage system

WTREE — Working Tree

WTREE — Directory Tree Object

WWN (World Wide Name) — A unique identifier for an open-system host. It consists of a 64-bit physical address (the IEEE 48-bit format with a 12-bit extension and a 4-bit prefix). The WWN is essential for defining the Hitachi Volume Security software (formerly SANtinel) parameters because it determines whether the open-system host is to be allowed or denied access to a specified LU or a group of LUs.

WWN — World Wide Name — A unique identifier for an open systems host. It consists of a 64-bit physical address (the IEEE 48-bit format with a 12-bit extension and a 4-bit prefix). The WWN is essential for defining the SANtinel parameters because it determines whether the open systems host is to be allowed or denied access to a specified LU or a group of LUs.

WWNN — World Wide Node Name — A globally unique 64-bit identifier assigned to each Fibre Channel node process.

WWPN (World Wide Port Name) — A globally unique 64-bit identifier assigned to each Fibre Channel port. Fibre Channel ports' WWPN are permitted to use any of several naming authorities. Fibre Channel specifies a Network Address Authority (NAA) to distinguish between the various name registration authorities that may be used to identify the WWPN.

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—X—

XAUI — "X"=10, AUI = Attachment Unit Interface

XFI — Standard interface for connecting 10 Gig Ethernet MAC device to XFP interface

XFP — "X" = 10 Gigabit Small Form Factor Pluggable

XRC — Extended Remote Copy

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—Y—

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—Z—

Zone — A collection of Fibre Channel Ports that are permitted to communicate with each other via the fabric

Zoning — A method of subdividing a storage area network into disjoint zones, or subsets of nodes on the network. Storage area network nodes outside a zone are invisible to nodes within the zone. Moreover, with switched SANs, traffic within each zone may be physically isolated from traffic outside the zone.

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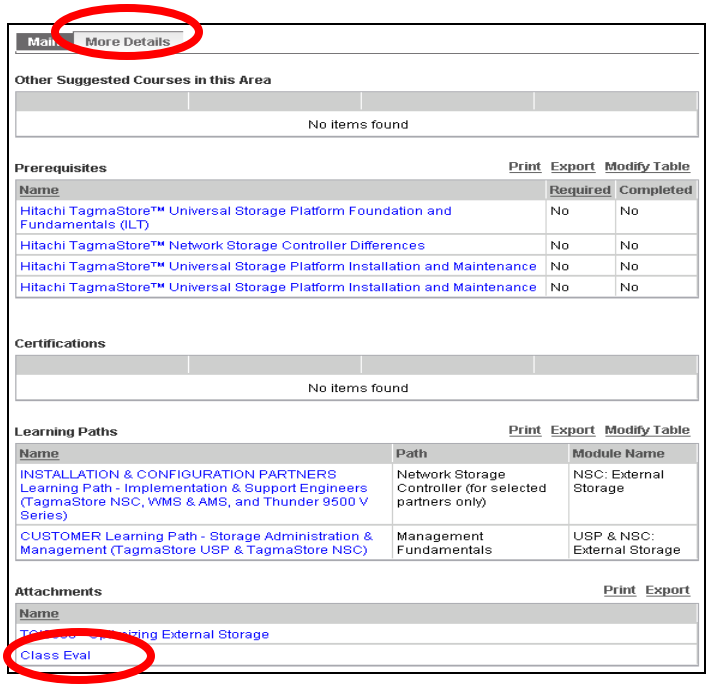

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