IBM PC Servers

S96H-9840-01

IBM SSA RAID Cluster Adapter

Hardware Maintenance Manual Supplement

October 1997

Use this supplement with the IBM PC Servers Hardware Maintenance Manual

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Second Edition (October 1997)

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About This Supplement

This book is intended for service representatives who service PC servers that use the IBM SSA RAID Cluster Adapter for PC Servers.

How This Book Is Organized

"Introducing the SSA RAID Cluster Adapter for PC Servers, SSA, and RAID" on page 1 describes the adapter, what is provided with it, and the environments in which it works.

"Service Request Numbers (SRNs)" on page 13 provides a table of service request numbers (SRNs) that are related to the adapter.

"SSA Maintenance Analysis Procedures (MAPs)" on page 23 provides maintenance analysis procedures (MAPs) for the adapter.

"Removing and Replacing FRUs" on page 29 describes how to exchange disk drives, and how to exchange DRAMs on the adapter.

"Using the SSA Service Aids and Other Service Tools" on page 37 describes the SSA service aids.

"Using the SSA Configurator Functions" on page 49 describes the functions of the array utility programs that are supplied with the adapter.

Important

This manual is intended for trained servicers who are familiar with IBM PC Server products.

Before servicing an IBM product, be sure to review "Safety Information" in your manual.

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Related Publications

Other manuals that you might find useful are:

- *IBM SSA RAID Cluster Adapter for PC Servers: Installation and User's Guide*, S96H-9839
- *IBM SSA RAID Cluster Adapter for PC Servers: Technical Reference*, SA33-3275

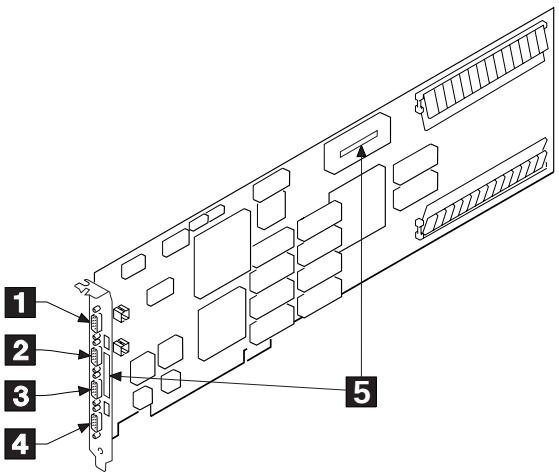
For more information, contact IBM or your IBM Authorized Dealer.

Introducing the SSA RAID Cluster Adapter for PC Servers, SSA, and RAID

The IBM SSA RAID Cluster Adapter for PC Servers is a Peripheral Component Interconnect (PCI) bus-master adapter that is used as the interface between systems that are using PCI architecture, and devices that are using Serial Storage Architecture (SSA). The adapter provides redundant array of independent disk (RAID) functions at RAID level 1. It can be configured in a cluster of two SSA RAID Cluster Adapters, where one SSA RAID Cluster Adapter is present in each of two PC Servers. (See "Clustering" on page 9 for more details.)

The adapter provides four SSA ports for the attachment of storage devices such as hard disk drives. Each port operates at 20MB/s full-duplex, and uses point-to-point copper cables that can be up to 25 meters long. SSA uses SCSI-2 commands, queuing model, status, and sense bytes; it is an industry-standard interface.

1 SSA Loop B Port 2
2 SSA Loop B Port 1
3 SSA Loop A Port 2
4 SSA Loop A Port 1
5 Serial number labels



The adapter card has two pairs of SSA connectors, one pair (port 1 and port 2) for each SSA loop. Next to each pair of connectors is a light that functions as follows:

- The light is on continuously when power is turned on to the adapter and both ports for that loop are operational; that is, the devices connected next to the adapter in the loop have power turned on, are connected correctly to the adapter, and are operational.

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- The light flashes continuously if one of the ports is not operational. Such a condition occurs if the cable to that port is not connected correctly, or if the device that is connected next to the adapter in the loop is not operational.
- The light is off if both ports are not operational.

Next to the SSA connectors and on one of the modules are labels on which is printed the 15-character SSA unique ID of the adapter.

A maximum of three adapters can be present in one system unit, if those adapters are all on the same bus.

CAUTION:
A lithium battery can cause fire, explosion, or a severe burn. Do not recharge, disassemble, heat above 100°C (212°F), solder directly to the cell, incinerate, or expose cell contents to water. Keep away from children. Replace only with the part number specified with your system. Use of another battery might present a risk of fire or explosion.

The battery connector is polarized; do not try to reverse the polarity.

Dispose of the battery according to local regulations.

A module on the SSA RAID Cluster Adapter contains a lithium battery.

Operating System

The SSA RAID Cluster Adapter, its microcode, and the software that is supplied with it allow the attachment of SSA devices to servers that are running Microsoft Windows NT 4.0 Server or Microsoft Windows NT 4.0 Server/Enterprise Edition which includes Microsoft Cluster Server.

Microsoft Cluster Server handles failover between clustered adapters. The maximum number of arrays you can define is lower if you are using Microsoft Cluster Server; “Rules for SSA Loops” on page 6 gives details of this.

Serial Storage Architecture (SSA)

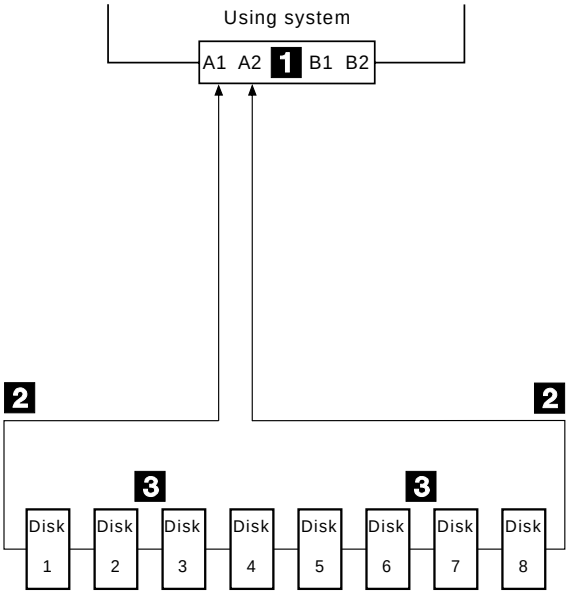
Serial Storage Architecture (SSA) is an industry-standard interface that provides high-performance fault-tolerant attachment of I/O storage devices. In SSA subsystems, transmissions to several destinations are multiplexed; the effective bandwidth is further increased by spatial reuse of the individual links. Commands are forwarded automatically from device to device along a loop until the target device is reached. Multiple commands can be travelling around the loop simultaneously. SSA retains the SCSI-2 commands, queuing model, and status and sense bytes.

SSA Loops, Links, and Data Paths

In the simplest SSA configuration, SSA devices are connected through two or more SSA links to an SSA adapter that is located in the system unit. The devices, SSA links, and SSA adapter are configured in loops. Each loop provides a data path that starts at one connector of the SSA adapter and passes through a link (SSA cable) to the devices. The loop continues through the devices, then returns through another link to a second connector on the SSA adapter.

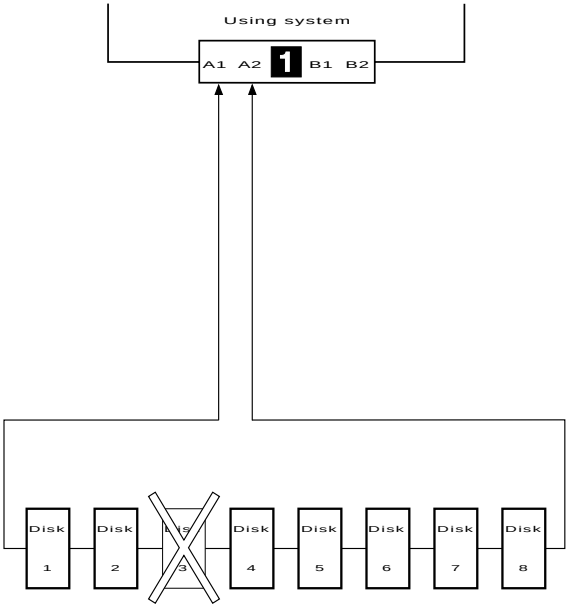
All devices that are attached to an SSA adapter card 1 are connected through SSA links 2 . The SSA links are configured as loops. Data and commands to a particular device pass through all other devices on the link between the adapter and the target device.

Data can travel in either direction round a loop. The adapter can, therefore, get access to the devices 3 (disk drives in this example) through two data paths. The system cannot detect which data path is being used.



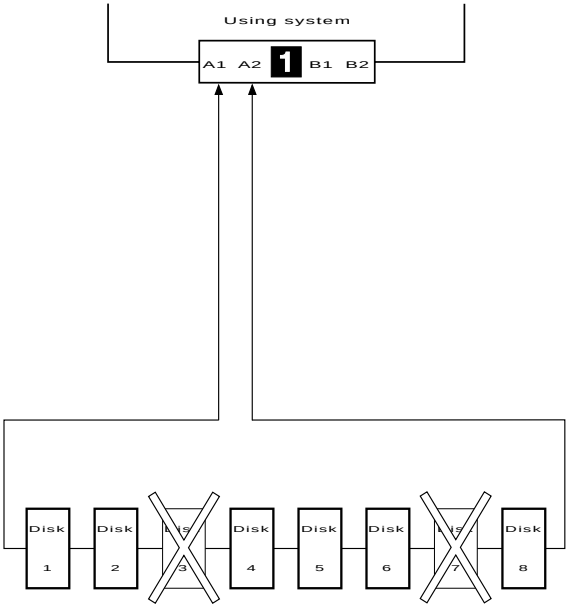
If a disk drive fails, or is turned off, the loop is broken, and one of the data paths to a particular disk drive is no longer available. The disk drives on the remains of the loop continue to work, but an error is reported to the system.

In the diagram, disk drive number 3 has failed. Disk drives 1 and 2 can communicate with the system only through connector A1 of the SSA adapter. Disk drives 4 through 8 can communicate only through connector A2 of the SSA adapter.



If two or more disk drives are turned off, fail, or are removed from the loop, some disk drives might become isolated from the SSA adapter.

In the diagram, disk drives 3 and 7 have been removed. Disk drives 1 and 2 can communicate with the system only through connector A1 of the SSA adapter. Disk drive number 8 can communicate with the system only through connector A2 of the SSA adapter. Disk drives 4, 5, and 6 are isolated from the SSA adapter.



Rules for SSA Loops

For SSA loops that include the SSA RAID Cluster Adapter, the following rules apply:

- Each SSA loop must be connected to valid pair of connectors on the adapter (that is, either connectors A1 and A2, or connectors B1 and B2).
- A maximum of two SSA loops can be connected to an SSA RAID Cluster Adapter.
- A maximum of two SSA RAID Cluster Adapters can be connected in a particular SSA loop.
- If two adapters are present in a particular SSA loop, both adapters must be SSA RAID Cluster Adapters.
- In a configuration that consists of two adapters and two SSA loops, both adapters must be SSA RAID Cluster Adapters, and both adapters must be connected to both SSA loops.
- In a configuration that consists of two SSA RAID Cluster Adapters and only one SSA loop, the spare pair of SSA connectors on each adapter must be

either not used, or connected to the spare connectors of the other adapter.

- Neither of the two servers in an SSA cluster can share disk drives with a third server.
- One system must be designated system A; the other must be designated system B.
- If multiple SSA RAID Cluster Adapters are installed in two systems that are sharing disk drives, the priority of the adapters in each loop must be the same for each system. For example, the first adapter in one system must be connected to the first adapter in the other system. (The adapters in a particular system are usually in slot-number sequence.)
- A maximum of 48 devices can be connected in a particular SSA loop.
- Under Microsoft Cluster Server, for a pair of servers, the total number of non-RAID disks and RAID-1 arrays can be up to 22. If no disk drives are configured as non-RAID disks, up to 44 disk drives can be configured as members of RAID-1 arrays, in addition to any disks that are configured as hot spares.
- Without Microsoft Cluster Server, for a pair of servers, up to 96 RAID-1 arrays can be configured; that is, up to 32 arrays on each of three pairs of adapters.
- Member disks of an array can be on different loops.
- The maximum permitted length for an external cable that connects two SSA nodes (for example, disk drives) is 25 meters (82 feet). If fiber optic cables and fibre-optic extenders are used, the link between two SSA nodes can be up to 2.4 km (7874 ft).

RAID Functions

Redundant Array of Independent Disks (RAID) technology provides immediate availability and recovery of data.

RAID technology stores data across groups of disk drives that are known as *arrays*. Subject to the level of RAID that you are using, this method of data storage provides the data redundancy that is needed for a secure system, and can allow faster retrieval of data through multiple channel access. Also, if a disk drive fails, it can normally be exchanged without interruption of normal system operation.

The arrays can provide data redundancy that ensures that no data is lost if one disk drive in the array fails. The method that is used to write data to an array is related to the level of RAID that is being used. Arrays are contained in array subsystems. Configurations can consist of one or more arrays.

The SSA RAID Cluster Adapter provides RAID 1 facilities, and allows access to SSA disk drives that are not configured as members of an array.

RAID Level 1

RAID level 1 is also known as mirroring or dual copy. It provides redundancy with better performance than a single disk, but requires real disk capacity of two times the data size.

A RAID 1 array has two disk drive members. If the members have different capacities, the resulting RAID 1 array has the capacity of the smaller member. Each data block of the array is written on each of the two members.

If one member fails, operations continue, to the good member. Performance is degraded for read operations, and improved for write operations, so a mixed workload might not show any change in overall performance. When a member returns or it is replaced (either manually or automatically by the hot-spare mechanism), a rebuilding operation occurs. This rebuilding operation is performed concurrently with any activity to the array.

Hot Spare Disk Drives

A hot-spare disk drive is a disk drive that is defined for automatic use if a disk drive in an array fails. The hot-spare disk drive must have a storage capacity that is greater than, or equal to, that of the smallest member of an array. You can define as many hot spare disk drives as you want. RAID 1 arrays can use hot-spare disk drives.

| If a disk drive in an array fails, after an interval, the adapter automatically uses a hot spare disk drive instead of the failed disk drive. The adapter rebuilds the data that

was on the failed disk drive, and writes that rebuilt data onto the hot-spare disk drive.

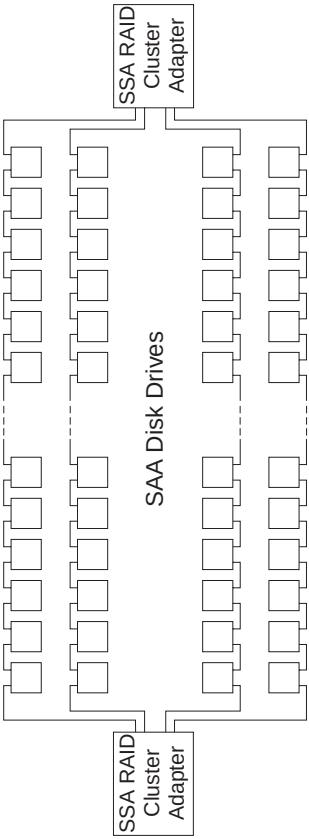
Clustering

Two SSA RAID Cluster Adapters can be connected in one or two SSA loops that contain SSA disk drives. One SSA RAID Adapter is present in each of two PC Servers. Such an arrangement is called a cluster.

The two adapters of a cluster can provide support for up to 96 SSA disk drives (a maximum of 48 per loop). The disk drives can be configured as:

- Disk drives that are members of up to 32 RAID-1 arrays
- Hot spare disk drives for the arrays
- Disk drives that are not in arrays

The diagram shows an example configuration that has two loops.



How a Cluster Works

A cluster has two adapters, a primary adapter and a non-primary adapter. The primary adapter is the adapter that controls the RAID arrays.

When the cluster is first configured and the systems turned on, the adapter that has the higher SSA Unique ID is automatically defined to be the primary adapter. The SSA configuration provides an option that allows the user to define the other adapter to be the primary adapter, if required. All commands to the arrays, including commands from the non-primary adapter, are always routed to the primary adapter for processing. The performance of I/O operations to RAID 1 arrays is:

- Highest when the server that contains the primary adapter starts all the I/O operations.
- Lowest when the server that contains the non-primary adapter starts all the I/O operations.

All the arrays are reported to both systems. The system software determines which server communicates with which array.

Each adapter checks periodically that it can still communicate with its system. If it cannot communicate, it stops operating. The other adapter detects that the first adapter has stopped operating, and reconfigures the SSA network.

If the non-primary adapter detects that it has lost access to the other adapter across the SSA loop, the non-primary adapter becomes the primary adapter. Commands that were sent to the original primary adapter after access was lost are sent again, but this time, they are sent to the new primary adapter. This action is called *failover*.

If write operations are in progress to an array (or have occurred within the previous 20 seconds) when failover occurs, the array is rebuilt after the new primary adapter has taken control.

| If an array has one of its members missing (that is, the
| array is in the exposed or degraded state) when a failover
| occurs, the status of the array becomes offline and an
| error is logged. Manual intervention is needed to resolve
| this error.

| After a failover has occurred and a new adapter has been
| installed in place of the faulty one, the new adapter might
| have an SSA Unique ID that is higher than that of the
| remaining (currently primary) adapter. Under that
| condition, the new adapter becomes the primary adapter.
| This action is called *failback*.

Disk Drives That Are Not in Arrays

Disk drives that are connected to an SSA RAID Cluster Adapter do not need to be members of an array. The SSA RAID Cluster Adapter handles such disk drives in the same way as a non-RAID adapter does. It transfers data directly between the disk drives and the system unit, and uses no RAID functions.

Access Modes

Note: Access modes have meaning only in SSA loops that contain multiple adapters.

Disk drives that are not members of an array can be in any one of the following access modes, which are selectable from the SSA Configurator and Service Aids Utility (see “Changing the Access Mode” on page 55). The access modes for the disk drives of both systems in the cluster can be changed through the adapter of either system. The adapter is selected from the SSA Adapter List of the SSA Configurator and Service Aids Utility. In the following definitions, the term “this adapter” means the adapter that has been selected from the SSA Adapter List.

Public System access is available to this resource through ***both*** adapters in the loop.

Local System access is available to this resource only through ***this*** adapter.

Private System access is ***not*** available to this resource through this adapter.

No Access System access is not available to this resource through ***either*** adapter in the loop.

Arrays are in Public mode. Their mode cannot be changed.

Public mode is the default mode.

If a system is to be booted from an SSA disk, the access mode of the boot disk must be local when viewed through the adapter that is installed in that system.

Disk Numbers

A disk number is assigned to a disk drive, or to an array, when the SSA configurator attaches that disk drive, or array, to the system. (That is, the disk drive, or array, becomes a system resource.)

The number that is assigned is related to the position in the System Resource List at which the resource (disk drive or array) is attached. The SSA configurator provides an option that allows the user to change the disk number to another number, if required. Valid numbers are 1 through 255.

Disk numbers are similar to the SCSI ID settings on SCSI disk drives. The system software uses the disk numbers to map the disk drives to a logical bus, target, and LUN.

The logical bus number to which a system resource is mapped is:

```
Disk number divided by 32
```

where 32 is the number of targets on each bus.
| Therefore, a disk number that is lower than 32 is mapped
| to logical bus 0.

The target address is the remainder that results from dividing the disk number by 32.

For example:

Disk Number	Mapping
2	Logical Bus 0 Target 2
32	Logical Bus 1 Target 0
37	Logical Bus 1 Target 5
65	Logical Bus 2 Target 1

| The device is always mapped to LUN 0.

| Microsoft Cluster Server requires that the boot device be
| on a different logical bus from any shared disks.

Service Request Numbers (SRNs)

Service request numbers (SRNs) are generated by the system error-log analysis, system configuration code, diagnostics, and customer problem-determination procedures. SRNs help you to identify the cause of a problem, the failing field-replaceable units (FRUs), and the service actions that might be needed to solve the problem.

The SRN Table

The table in this section lists the SRNs and describes the actions you should do. The table columns are:

SRN	The service reference number.
FRU list	The FRU or FRUs that might be causing the problem, and how likely it is (by percentage) that the FRU is causing the problem.
Problem	A description of the problem and the action you must take.

Abbreviations used in the table are:

DMA	Direct memory access
FRU	Field-replaceable unit
PAA	P = Adapter port number AA = SSA address (see also "Finding the Device When No Service Aids Are Available" on page 46)
PCI	Peripheral Component Interconnect
POST	Power-On Self-Test

Using the SRN Table

Important: You should have been sent here from either diagnostics or a START MAP. Do not start problem determination from the SRN table; always go to the START MAP for the unit in which the device is installed.

1. Locate the SRN in the table. ***If you cannot find the SRN***, refer to the documentation for the subsystem or device. If you still cannot find the SRN, you have a problem with the diagnostics, the microcode, or the documentation. Call your support center for assistance.
2. Read carefully the "Action" you must do for the problem. *Do not exchange adapters unless you are instructed to do so*.
3. Normally exchange only one adapter at a time. Always use instructions provided with the system unit when exchanging adapters. After each adapter is exchanged, go to "MAP 2410: SSA Repair Verification" on page 2410-1 to verify the repair.

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SRN	FRU List	Problem
20PAA	**Device (45%)** (“Exchanging Disk Drives” on page 29). **SSA adapter card (45%)** **External SSA cables (6%)** **Internal SSA connections (4%)** (unit *Hardware Maintenance Manual*).	Description: An open SSA link has been detected. Action: Run the Disk service aid to isolate the failure (see “Using the SSA Service Aids and Other Service Tools” on page 37). If the SSA service aids are not available, go to the service information for the unit in which the device is installed.
21PAA to 29PAA	**Device (45%)** (“Exchanging Disk Drives” on page 29). **SSA adapter card (45%)** **External SSA cables (6%)** **Internal SSA connections (4%)** (unit *Hardware Maintenance Manual*).	Description: An SSA ‘Threshold exceeded’ link error has been detected. Action: Go to “MAP 2010: START” on page 2010-1.
2A002	**Device (50%)** (“Exchanging Disk Drives” on page 29). **SSA adapter card (50%)**	Description: Async code 02 has been received. Probably, a software error has occurred. Action: Go to “Software and Microcode Errors” on page 21 before exchanging any FRUs.
2A003	**Device (50%)** (“Exchanging Disk Drives” on page 29). **SSA adapter card (50%)**	Description: Async code 03 has been received. Probably, a software error has occurred. Action: Go to “Software and Microcode Errors” on page 21 before exchanging any FRUs.
2A004	**Device (50%)** (“Exchanging Disk Drives” on page 29). **SSA adapter card (50%)**	Description: Async code 04 has been received. Probably, a software error has occurred. Action: Go to “Software and Microcode Errors” on page 21 before exchanging any FRUs.
2FFFF	**None**	Description: An async code that is not valid has been received. Action: Go to “Software and Microcode Errors” on page 21.
40000	**SSA adapter card (100%)**	Description: The SSA adapter card has failed. Action: Exchange the FRU for a new FRU.
40004	**4 MB DRAM module 0 (100%)** (“Exchanging DRAMs on the SSA RAID Cluster Adapter” on page 35).	Description: A 4 MB DRAM in adapter card module 0 has failed. Action: Exchange the FRU for a new FRU.
40008	**8 MB DRAM module 0 (100%)** (“Exchanging DRAMs on the SSA RAID Cluster Adapter” on page 35).	Description: An 8 MB DRAM in adapter card module 0 has failed. Action: Exchange the FRU for a new FRU.

SRN	FRU List	Problem
40016	**16 MB DRAM module 0 (100%)** (“Exchanging DRAMs on the SSA RAID Cluster Adapter” on page 35).	Description: A 16 MB DRAM in adapter card module 0 has failed. Action: Exchange the FRU for a new FRU.
40032	**32 MB DRAM module 0 (100%)** (“Exchanging DRAMs on the SSA RAID Cluster Adapter” on page 35).	Description: A 32 MB DRAM in adapter card module 0 has failed. Action: Exchange the FRU for a new FRU.
40064	**64 MB DRAM module 0 (100%)** (“Exchanging DRAMs on the SSA RAID Cluster Adapter” on page 35).	Description: A 64 MB DRAM in adapter card module 0 has failed. Action: Exchange the FRU for a new FRU.
40128	**128 MB DRAM module 0 (100%)** (“Exchanging DRAMs on the SSA RAID Cluster Adapter” on page 35).	Description: A 128 MB DRAM in adapter card module 0 has failed. Action: Exchange the FRU for a new FRU.
41004	**4 MB DRAM module 1 (100%)** (“Exchanging DRAMs on the SSA RAID Cluster Adapter” on page 35).	Description: A 4 MB DRAM in adapter card module 1 has failed. Action: Exchange the FRU for a new FRU.
41008	**8 MB DRAM module 1 (100%)** (“Exchanging DRAMs on the SSA RAID Cluster Adapter” on page 35).	Description: An 8 MB DRAM in adapter card module 1 has failed. Action: Exchange the FRU for a new FRU.
41016	**16 MB DRAM module 1 (100%)** (“Exchanging DRAMs on the SSA RAID Cluster Adapter” on page 35).	Description: A 16 MB DRAM in adapter card module 1 has failed. Action: Exchange the FRU for a new FRU.
41032	**32 MB DRAM module 1 (100%)** (“Exchanging DRAMs on the SSA RAID Cluster Adapter” on page 35).	Description: A 32 MB DRAM in adapter card module 1 has failed. Action: Exchange the FRU for a new FRU.
41064	**64 MB DRAM module 1 (100%)** (“Exchanging DRAMs on the SSA RAID Cluster Adapter” on page 35).	Description: A 64 MB DRAM in adapter card module 1 has failed. Action: Exchange the FRU for a new FRU.

SRN	FRU List	Problem
41128	**128 MB DRAM module 1 (100%)** ("Exchanging DRAMs on the SSA RAID Cluster Adapter" on page 35).	Description: A 128 MB DRAM in adapter card module 1 has failed. Action: Exchange the FRU for a new FRU.
42000	**SSA adapter card (50%)** **DRAM modules (50%)** ("Exchanging DRAMs on the SSA RAID Cluster Adapter" on page 35).	Description: The SSA adapter has detected that both DRAM modules are failing. Action: 1. Check whether both DRAM modules are correctly installed on the adapter card. Make any necessary corrections. 2. If this problem has occurred immediately after an upgrade to the adapter card, check whether the correct type of DRAM modules have been installed. Make any necessary corrections. 3. If the problem remains, exchange the adapter card FRU for a new one. *Do not exchange any DRAM modules yet.* 4. Install the DRAM modules from the original adapter card onto the new adapter card, then install the new adapter card. 5. If the problem remains, exchange the DRAM modules for new modules. 6. Install the new DRAM modules onto the original adapter card. Reinstall the original adapter card.
42500	**Write cache card on the SSA adapter card (100%)**	Description: The SSA adapter has detected a failure in the write cache. Action: Exchange the FRU for a new FRU.
43PAA	**Device (90%)** ("Exchanging Disk Drives" on page 29). **SSA adapter card (10%)**	Description: An SSA device on the link is preventing the completion of the loop configuration. Action: Go to "MAP 2010: START" on page 2010-1.

SRN	FRU List	Problem
44PAA	**Device (100%)** ("Exchanging Disk Drives" on page 29).	Description: An SSA device has a 'Failed' status. Action: If the SSA service aids are available, run the Disk service aid (see "Using the SSA Service Aids and Other Service Tools" on page 37) to find the failing device. If no device is listed as Rejected, use the PAA part of the SRN to determine which device is failing. Before you exchange the failing device, run nonconcurrent diagnostics to that device to determine the cause of the problem. If the SSA service aids are not available, note the value of PAA in this SRN, and go to "Finding the Physical Location of a Device" on page 46. Exchange the failing FRU for a new FRU.
45PAA	**Device (40%)** ("Exchanging Disk Drives" on page 29). **SSA Adapter card (40%)** **SSA cables, or other SSA connections in the device enclosure (20%)**. (unit *Hardware Maintenance Manual*).	Description: The SSA adapter has detected an open SSA loop. Action: If the SSA service aids are available, run the Disk service aid (see "Using the SSA Service Aids and Other Service Tools" on page 37) to determine which part of the loop is failing. If the SSA service aids are not available, note the value of PAA in this SRN, and go to "Finding the Physical Location of a Device" on page 46.
47000	**None**	Description: An attempt has been made to store in the SSA adapter the details of more than 32 arrays. Action: Go to "MAP 2010: START" on page 2010-1.
47500	**None**	Description: Part of the array data might have been lost. Action: Go to "MAP 2010: START" on page 2010-1.
48000	**None**	Description: The SSA adapter has detected a link configuration that is not valid. Action: See "SSA Loop Configurations that Are Not Valid" on page 22.

SRN	FRU List	Problem
49000	**None**	Description: An array is in the Degraded state because a disk drive is not available to the array, and a write command has been sent to that array. Action: A disk drive might not be available for one of the following reasons: • The disk drive has failed. • The disk drive has been removed from the subsystem. • An SSA link has failed. • A power failure has occurred. Go to "MAP 2010: START" on page 2010-1.
49100	**None**	Description: An array is in the Exposed state because a disk drive is not available to the array. Action: A disk drive can become not available for several reasons: • The disk drive has failed. • The disk drive has been removed from the subsystem. • An SSA link has failed. • A power failure has occurred. Go to "MAP 2010: START" on page 2010-1.
49500	**None**	Description: No hot spare disk drives are available for an array that is configured for hot spare disk drives. Action: Go to "MAP 2010: START" on page 2010-1.
4C000	**None**	Description: A configuration that is not valid has been detected. Some disk drives do not have failover protection. Action: Go to "SSA Loop Configurations that Are Not Valid" on page 22.
4C200	**None**	Description: A configuration that is not valid has been detected. Corresponding SSA adapters are not wired together. Action: Go to "SSA Loop Configurations that Are Not Valid" on page 22.
4C400	**None**	Description: A configuration that is not valid has been detected. One system must be configured as A and the other as B. Action: Go to "SSA Loop Configurations that Are Not Valid" on page 22.
4C600	**None**	Description: Failover has occurred. This SSA adapter is now controlling the arrays. Action: Run the Disk service aid, and check the SSA configuration for correct connections and for correct SSA adapter operation.

SRN	FRU List	Problem
4C800	**None**	Description: Only one member of a RAID 1 array is present, and its owning adapter serial number does not match that of this adapter. Action: Do one of the following actions: • Install the other member of the array onto this SSA adapter. • Remove the array member from this SSA adapter. • If you want to continue to use the one member on this SSA loop, go to "Modifying Attributes of Resources" on page 80, and set the Split Resolution field to the member number of the array member that you want to use.
4E000	**Device (100%)** ("Exchanging Disk Drives" on page 29).	Description: Data scrubbing has reconstructed a data block and reassigned the affected blocks. Action: If this SRN occurs three times in 24 hours, exchange the FRU for a new FRU.
4F000	**None**	Description: The SSA adapter has detected duplicate disk attachment numbers. Action: The disk drive that has the duplicate attachment number has been designated as a new resource. Reattach the disk drive in the required position (see "Attaching a Resource to the System" on page 63).
4F100	**None**	Description: Both members of a RAID 1 array are indicating that they have been updated while the other member was not available. The array name is reported. (A corresponding SRN 4F101 is also logged.) Action: If you want to continue to use this array, you must specify one of the members as the member that contains good data, and update the data of the other member to match it. To do this, go to "Modifying Attributes of Resources" on page 80, and set the Split Resolution field to the member number of the array member that you want to use.

SRN	FRU List	Problem
4F101	**None**	Description: Both members of a RAID 1 array are indicating that they have been updated while the other member was not available. The UID/array name of the member that was not available is reported. (A corresponding SRN 4F100 is also logged.) Action: If you want to continue to use this array, you must specify one of the members as the member that contains good data, and update the data of the other member to match it. To do this, go to “Modifying Attributes of Resources” on page 80, and set the Split Resolution field to the member number of the array member that you want to use.
4F200	**None**	Description: A member of a RAID 1 array has been rejected. The array name is reported. Action: Delete this SRN.
4F201	**None**	Description: A member of a RAID 1 array has been rejected. The member UID is reported. Action: Delete this SRN.
50000	**SSA adapter card (100%)**	Description: The SSA adapter failed to respond to the device driver. Action: Exchange the FRU for a new FRU.
50001	**SSA adapter card (100%)**	Description: A data parity error has occurred. Action: Exchange the FRU for a new FRU.
50002	**SSA adapter card (100%)**	Description: An SSA adapter DMA error has occurred. Action: Exchange the FRU for a new FRU.
50004	**SSA adapter card (100%)**	Description: An adapter error has been detected. Action: Exchange the FRU for a new FRU.
50005	**SSA adapter card (100%)**	Description: A software error has occurred. Action: Go to “Software and Microcode Errors” on page 21 before exchanging the FRU.
50006	**SSA adapter card (100%)**	Description: An adapter error has been detected. Action: Exchange the FRU for a new FRU.
50007	**SSA adapter card (100%)**	Description: An adapter error has been detected. Action: Exchange the FRU for a new FRU.
50008	**SSA adapter card (100%)**	Description: Unable to read or write the PCI registers. Action: Exchange the FRU for a new FRU.

SRN	FRU List	Problem
50010	**SSA adapter card (100%)**	Description: An SSA adapter or device drive protocol error has occurred. Action: Go to “Software and Microcode Errors” on page 21 before exchanging the FRU.
50012	**SSA adapter card (100%)**	Description: The SSA adapter microcode has hung. Action: Run nonconcurrent diagnostics to the SSA adapter. If the diagnostics fail, exchange the FRU for a new FRU. If the diagnostics do not fail, go to “Software and Microcode Errors” on page 21 before exchanging the FRU.
D4000	**SSA adapter card (100%)**	Description: The diagnostics cannot configure the SSA adapter. Action: Exchange the FRU for a new FRU.
D4100	**SSA adapter card (100%)**	Description: The diagnostics cannot open the SSA adapter. Action: Exchange the FRU for a new FRU.
D4300	**SSA adapter card (100%)**	Description: The diagnostics have detected an SSA adapter POST failure. Action: Exchange the FRU for a new FRU.
DFFFF	**SSA adapter card (100%)**	Description: A command or parameter that has been sent or received is not valid. This problem is caused either by the SSA adapter, or by an error in the microcode. Action: Go to “Software and Microcode Errors” on page 21 before exchanging the FRU.

Software and Microcode Errors

Some SRNs indicate that a problem might have been caused by a software error or by a microcode error. If you have one of these SRNs, do the following actions:

1. Make a note of the contents of the error log for the device that has the problem.
2. Go to the system service aids and select **Display Vital Product Data** to display the VPD of the failing system. Make a note of the VPD for all the SSA adapters and disk drives.
3. Report the problem to your support center. The center can tell you whether you have a known problem, and can, if necessary, provide you with a correction for the software or microcode.

SSA Loop Configurations that Are Not Valid

The SRNs that send you to this section indicate an SSA loop or configuration that is not valid. The description for your particular SRN might provide additional information. “Rules for SSA Loops” on page 6 shows how many devices and adapters can be contained in an SSA loop.

If the SRN occurred when you, or the customer, turned on the system:

1. Turn off the system.
2. Review the configuration that you are trying to make, and determine why that configuration is not valid.
3. Correct your configuration by reconfiguring the SSA cables or by removing the excess devices or adapters from the loop.
4. Turn on the system.

If the SRN occurred because additional devices or adapters were added to a working SSA loop:

1. Remove the additional devices or adapters that are causing the problem, and put the loop back into its original, working configuration.

   Note: *It is important that you do these actions*, because they enable the configuration code to reset itself from the effects of the error.
2. Review the configuration that you are trying to make, and determine why that configuration is not valid.
3. Correct your configuration by reconfiguring the SSA cables or by removing the excess devices or adapters from the loop.

SSA Maintenance Analysis Procedures (MAPs)

The maintenance analysis procedures (MAPs) describe how to analyze a failure that has occurred in an SSA loop.

How to Use the MAPs

Attention: Unless the system unit needs to be turned off for some other reason, *do not turn off the system when servicing an SSA loop*. Unit power cables and external SSA cables that connect the devices to the system can be disconnected while that system is running.

- To isolate the FRUs, do the actions and answer the questions given in the MAPs.
- When instructed to exchange two or more FRUs in sequence:
  1. Exchange the first FRU in the list for a new one.
  2. Verify that the problem is solved. For some problems, verification means running the diagnostic programs.
  3. If the problem remains:
     a. Reinstall the original FRU.
     b. Exchange the next FRU in the list for a new one.
  4. Repeat steps 2 and 3 until either the problem is solved, or all the related FRUs have been exchanged.
  5. Do the next action indicated by the MAP.

Attention: Disk drives are fragile. Handle them with care, and keep them well away from strong magnetic fields.

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MAP 2010: START

This MAP is the entry point to the MAPs for the SSA RAID Cluster Adapter. If you are not familiar with these MAPs, read "How to Use the MAPs" on page 23 first.

You might have been sent here because:

- The system problem determination procedures sent you here.
- Action from an SRN list sent you here.
- A problem occurred during the installation of a disk subsystem or a disk drive.
- Another MAP sent you here.
- A customer observed a problem that was not detected by the system problem determination procedures.

Attention: Unless the system unit needs to be turned off for some other reason, *do not turn off the system when servicing the SSA loop*. Unit power cables and external SSA cables that connect the devices to the system can be disconnected while that system is running.

001

HAVE YOU BEEN SENT HERE FROM THE SRN LIST IN THIS BOOK?

Yes **No**

002

Go to Step 004.

003

Go to Step 007 on page 2010-2.

004

(From step 002)

DO YOU HAVE AN SRN?

Yes **No**

005

- Start the SSA Configurator and Service Aids Utility (see "Starting the SSA Configurator Functions" on page 51).
- From the Main menu, select **SSA Adapter List**.
- Select the adapter from the SSA Adapter List.
- Select **Run Concurrent Diagnostics**.

If an SRN is produced, go to "Service Request Numbers (SRNs)" on page 13.
(Step **005** continues)

005 (continued)

If no SRN is produced, go to "MAP 2410: SSA Repair Verification" on page 2410-1.

006

Go to "Service Request Numbers (SRNs)" on page 13.

007

(From step 003)

IS THE SRN 45PAA?

Yes **No**

008

Go to Step 010.

009

Go to "MAP 2320: SSA Link" on page 2320-1.

010

(From step 008)

IS THE SRN IN THE RANGE 21000 THROUGH 29FFF?

Yes **No**

011

Go to Step 013.

012

Go to "MAP 2323: SSA Intermittent Link Error" on page 2323-1.

013

(From step 011)

IS THE SRN 47000, 49000, 49100, OR 49500?

Yes **No**

014

You are in the wrong book. Go to the correct service information for your problem.

015

Go to "MAP 2324: SSA RAID" on page 2324-1.

MAP 2320: SSA Link

This MAP helps you to isolate FRUs that are causing an SSA loop problem between a device and the SSA RAID Cluster Adapter, or between two devices. If you are not familiar with SSA loops, read the section "SSA Loops, Links, and Data Paths" on page 3 before using this MAP. "SSA Loops, Links, and Data Paths" explains SSA links, strings, and loops.

Attention: Unless the system unit needs to be turned off for some other reason, *do not turn off the system when servicing the SSA loop*. Unit power cables and external SSA cables that connect the devices to the system can be disconnected while that system is running.

001

ARE THE SSA SERVICE AIDS AVAILABLE?

Yes **No**

002

Go to Step 004.

003

Go to Step 007 on page 2320-2.

004

(From step 002)

ARE ANY LINK STATUS (READY) LIGHTS FLASHING ON THIS SSA LOOP?

Yes **No**

005

– Note the PAA (that is, the last three digits) of the SRN.

Go to "Finding the Physical Location of a Device" on page 46.

006

Go to "SSA Link Errors" on page 25.

007

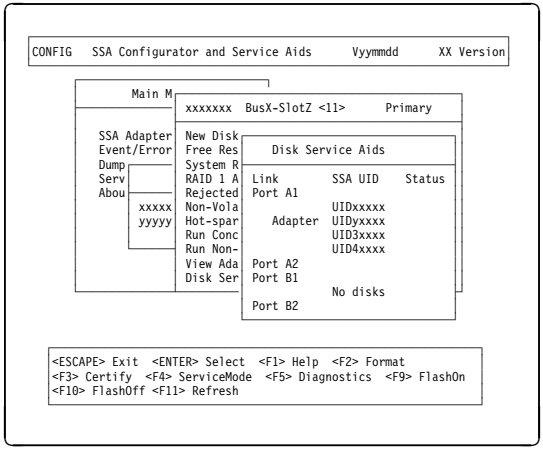
(From step 003)

– Start the SSA Configurator and Service Aids Utility (see "Starting the SSA Configurator Functions" on page 51).

– From the Main menu, select **SSA Adapter List**.

– Select the required adapter from the SSA Adapter List.

– Select **Disk Service Aids** from the Adapter menu. The Disk Service Aids window is displayed:



ARE ANY DISK DRIVES LISTED FOR THE SELECTED SSA CLUSTER ADAPTER?

Yes **No**

008

– One of the following conditions exists. Take the action described.

- No physical disks are connected to this SSA RAID Cluster Adapter:
  1. Ensure that the external SSA cables are correctly connected to the units in which the devices are installed and to the SSA RAID Cluster Adapter.
  2. Go to "MAP 2410: SSA Repair Verification" on page 2410-1 to verify the repair.
- All the disk drives are turned off:

  Go to the START MAP for the unit in which the SSA devices are installed.
- The SSA RAID Cluster Adapter is failing:

(Step **008** continues)

008 (continued)

1. Exchange the SSA RAID Cluster Adapter for a new one.
2. Go to “MAP 2410: SSA Repair Verification” on page 2410-1 to verify the repair.

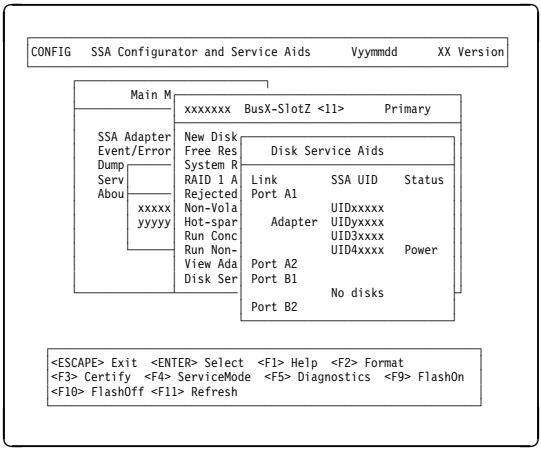
009

Go to Step 010.

010

(From step 009)

– Observe the Status column on the screen. If the status of any disk drive is ‘Power’, that disk drive has detected a loss of redundant power or cooling. In the example shown here, the third disk drive has detected such a loss.



DO ONE OR MORE DISK DRIVES HAVE A ‘POWER’ STATUS?

Yes **No**

011

Go to Step 013 on page 2320-4.

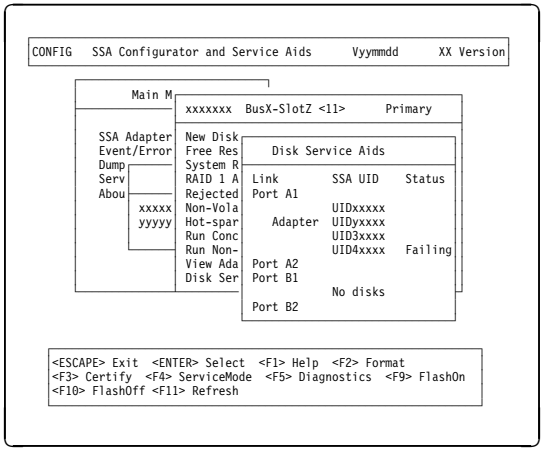
012

Go to the START MAP for the unit in which the disk drive is installed.

013

(From step 011)

– Observe the Status column on the screen. If the status of any disk drive is 'Failed', that disk drive is failing. In the example shown here, the third disk drive is failing.



IS ONE OF THE DISK DRIVES FAILING?

Yes **No**

014

Go to Step 016 on page 2320-5.

015

– Use the Identify function (as instructed on the screen) to find the failing disk drive. See "Finding the Physical Location of a Device" on page 46 if you need more information about finding the disk drive.

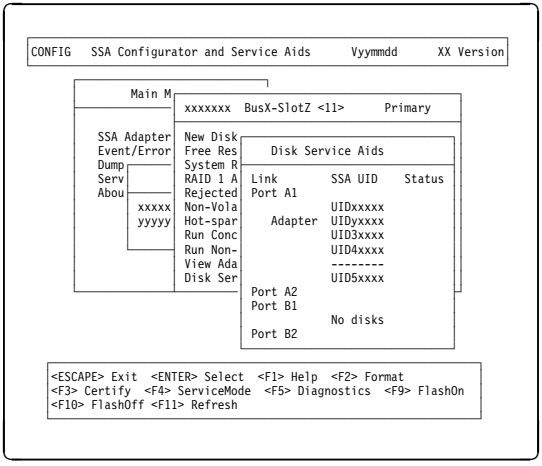
– Exchange the disk drive for a new one (see "Exchanging Disk Drives" on page 29).

Go to "MAP 2410: SSA Repair Verification" on page 2410-1 to verify the repair.

016

(From step 014)

– Observe the list of disk drives on the screen. A dashed line (-----) shows that a link in one of the loops is broken. If two dashed lines are displayed, two links are broken, one in each loop. In the example shown here, a break has occurred between the third and the fourth disk drive.



IS A LINK BROKEN BETWEEN TWO DISK DRIVES?

Yes **No**

017

No trouble found.

018

– Use the Identify function (as instructed on the screen) to find the devices (disk drives or adapters) that are on each side of the broken link. See “Finding the Physical Location of a Device” on page 46 if you need more information about finding the disk drive.

Go to “SSA Link Errors” on page 25. The information that is provided there can help you solve the problem. If necessary, refer to the service information for the unit that contains the device.

MAP 2323: SSA Intermittent Link Error

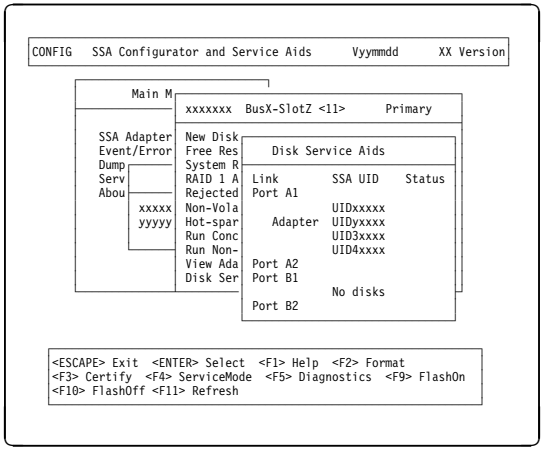
This MAP helps you to isolate FRUs that are causing an intermittent SSA link problem. You are here because you have an SRN from the series 21000 through 29000.

If you are not familiar with the SSA link, read the section “SSA Loops, Links, and Data Paths” on page 3 before using this MAP. “SSA Loops, Links, and Data Paths” explains SSA links, strings, and loops.

Attention: Unless the system unit needs to be turned off for some other reason, *do not turn off the system when servicing an SSA loop*. Power cables and external SSA cables can be disconnected while that system is running.

001

– Start the SSA Configurator and Service Aids Utility (see "Starting the SSA Configurator Functions" on page 51).
– From the Main menu, select **SSA Adapter List**.
– Select the required adapter from the SSA Adapter List.
– Select **Disk Service Aids** from the Adapter menu.



Note: On the Disk Service Aids screen, each adapter port is identified by the number of its related connector on the adapter card:

- Adapter port 0 is identified as A1
- Adapter port 1 is identified as A2
- Adapter port 2 is identified as B1
- Adapter port 3 is identified as B2.

SRNs 21000 through 29000 include the adapter port number (0–3).

Go to Step 002.

002

(From step 001)

– Observe the SRN that sent you to this MAP. It is in the series 21PAA through 29PAA (where P is the number of the adapter port, and AA is the SSA address of the device).

Note the value of PAA in the SRN. For example:

If the SRN is 24002, PAA = 002.
If the SRN is 24104, PAA = 104.

– Observe the screen, and identify the physical device that is represented by PAA in the SRN.

(Step **002** continues)

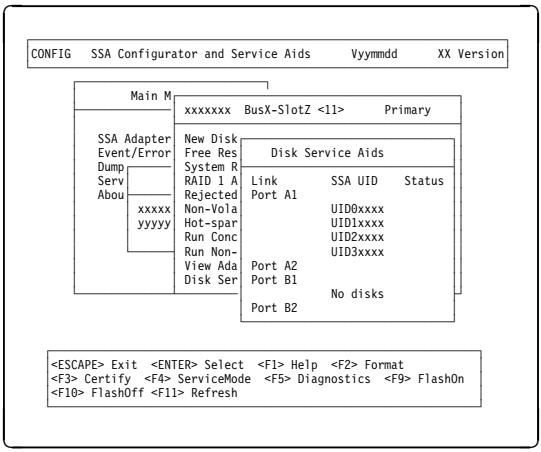
002 (continued)

Note: If the SSA address (AA) in the SRN is higher than the highest SSA address that is displayed for the adapter port (P), that address is the address of the SSA RAID Cluster Adapter.

Read through the following examples if you need help in identifying the device, then go to Step 003 on page 2323-4. Otherwise, go directly to Step 003 on page 2323-4.

Example 1

If the SRN is 24002, the device is connected to adapter port 0 (shown as A1 on the screen), and has an SSA address of 02. In the example screen, that device is the third disk drive (counting from 0).



Example 2

If the SRN is 24104, the device (in theory) is connected to adapter port 1 (shown as A2 on the screen). The device, however, has an SSA address of 04. That address is one more than the number of devices shown (counting from 0) and is, therefore, the SSA RAID Cluster Adapter.

003

(From step 002)

The problem is in the SSA link between the device that you identified in Step 002 on page 2323-2 and the device that is on the same adapter port (P), but whose SSA address has a value of 1 less than AA (AA – 1).

For example, in Step 002 on page 2323-2, SRN 24002 identified pdisk3. The SSA address of the third disk drive is 02; the address (AA – 1) of the other device on the link is, therefore, 01. SSA address 01 is the address of the second disk drive. SRN 24002 indicates, therefore, that link errors have been detected between the second and third disk drives.

Similarly, SRN 24104 identified the SSA RAID Cluster Adapter. The SSA address of the adapter is 04. The address of the other device is, therefore, 03. SSA address 03 is the address of the first disk drive. SRN 24104 indicates, therefore, that link errors have been detected between adapter port A2 and the first disk drive.

– Exchange, in the sequence shown, the following FRUs for new FRUs. Ensure that for *each* FRU exchange, you go to "MAP 2410: SSA Repair Verification" on page 2410-1 to verify the repair.

  1. One of the two devices that are identified by the SRN (see "Exchanging Disk Drives" on page 29).
  2. The other of the two devices.
  3. The internal SSA connections of the unit or units in which the devices are installed.
  4. The external SSA cable.

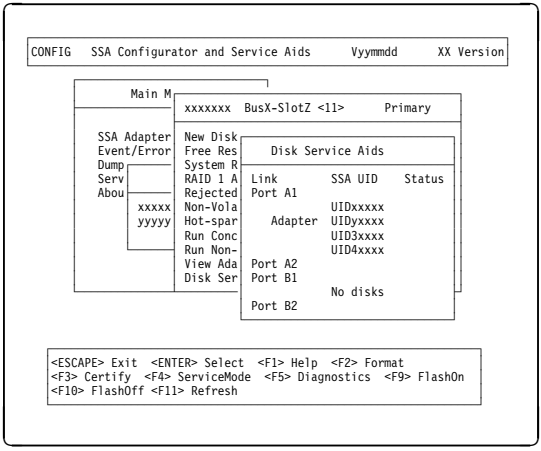
MAP 2324: SSA RAID

This MAP helps you to solve problems that have occurred in SSA RAID arrays.

Attention: Unless the system unit needs to be turned off for some other reason, *do not turn off the system when servicing an SSA link or a unit in which SSA devices are installed*. Unit power cables and external SSA cables that connect devices to the system can be disconnected while that system is running.

Before starting this MAP, ensure that all the disk drives are working correctly:

1. Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).
2. From the Main menu, select **SSA Adapter List**.
3. Select the required adapter from the SSA Adapter List.
4. Select **Disk Service Aids** from the Adapter menu.



5. Select **Run Concurrent Diagnostics** to identify any disk drive problems that have occurred.
6. Check the Status column to find any power problems, SSA link problems, and SSA disk drives that have a Failed status.
7. Correct all those problems before you start this procedure.

Attention: Some of the steps in this MAP need you to change the configuration of the array, or to change the use of an SSA disk drive. Do not do those steps unless you have the user’s permission.

001

(From steps 009 and 040)

You have been sent to this step either from another step in this MAP, or because you have one of the following Service Request Numbers (SRNs):

47000, 49000, 49100, 49500

DO YOU HAVE SRN 49500?

Yes **No**

002

– Run concurrent diagnostics to the SSA RAID Cluster Adapters.

Go to Step 004.

003

No hot spare disk drives are available. Go to Step 029 on page 2324-7.

004

(From step 002)

DID THE DIAGNOSTICS GIVE YOU SRN 47000, 49000, or 49100?

Yes **No**

005

Go to Step 007.

006

Go to Step 010 on page 2324-3.

007

(From step 005)

DID THE DIAGNOSTICS GIVE YOU ANY OTHER SRN?

Yes **No**

008

Go to Step 032 on page 2324-9.

009

– Solve the problems that caused the SRN.

Return to Step 001.

010

(From step 006)

– Find your SRN in the following table, then do the appropriate actions.

Note: If you still do not have any of these SRNs, you are in the wrong MAP.

SRN	Cause	Action
47000	You have more than the maximum number of arrays allowed.	Go to Step 011.
49000	An array is in the Degraded state.	Go to Step 012.
49100	An array is in the Exposed state.	Go to Step 022 on page 2324-6.

011

(From step 010)

An attempt has been made to create a new array, but the adapter already has the maximum number of arrays defined.

– Start the SSA Configurator and Service Aids Utility (see "Starting the SSA Configurator Functions" on page 51).

Go to "Listing or Deleting Records of Old Arrays in the NVRAM" on page 94, and delete any array names that are no longer used (dormant).

012

(From step 010)

An array is in the Degraded state if one member disk drive of the array is missing, and a write command has been sent to that array. When an array is in the Degraded state, its data is not protected.

– Start the SSA Configurator and Service Aids Utility (see "Starting the SSA Configurator Functions" on page 51).

– From the Main menu, select **SSA Adapter List**.

– Select the adapter from the SSA Adapter List.

– Select **Rejected Disks**.

ARE ANY DISK DRIVES LISTED?

Yes **No**

013

A disk drive has not been detected by the adapter. (Step **013** continues)

013 (continued)

Go to Step 016.

014

– Run nonconcurrent diagnostics to all the disk drives that are listed as rejected.
– Run the Certify service aid (see “Certify Disk Service Aid” on page 44) to all the disk drives that are listed as rejected.

If problems occur on any disk drive, go to Step 015. Otherwise, continue with this procedure.

– Do the actions described in “Adding a Disk Drive to an Array” on page 85.
– Referring to the displayed instructions, select a disk from the list of array candidate disk drives, and add that disk drive to the array that is in the Degraded state. The array changes its state to the Good state, and parity is rebuilt.

015

(From step 014)

– Exchange the disk drive for a new one (see “Exchanging Disk Drives” on page 29).

Go to Step 047 on page 2324-12 to add the disk drives to the group of disk drives that are available for use by the RAID manager.

Note: A disk drive that is listed as rejected is not necessarily failing. For example, the array might have rejected the disk drive because a power problem, or an SSA link problem, caused that drive to become temporarily unavailable. Under such conditions, the disk drive can be reused.

016

(From step 013)

DOES THE DISK SERVICE AID INDICATE AN OPEN LOOP?

Yes **No**

017

Go to Step 019 on page 2324-5.

018

Go to “MAP 2320: SSA Link” on page 2320-1.

019

(From steps 017 and 027)

DOES ANY SSA DISK DRIVE HAVE ITS CHECK LIGHT ON?

Yes **No**

020

The disk drive might have been removed from the subsystem.

- Reinstall the removed drive, or select a new disk drive for addition to the array.
- Do the actions described in "Adding a Disk Drive to an Array" on page 85.
- Referring to the displayed instructions, select a disk from the list of array candidate disk drives, and add that disk drive to the array that is in the Degraded state.

The array changes its state to the Good state, and parity is rebuilt.

021

- Exchange the failed disk drive for a new one (see "Exchanging Disk Drives" on page 29).

Go to Step 047 on page 2324-12.

022

(From step 010)

An array is in the Exposed state when one member disk drive of the array is not available. When an array is in the Exposed state, its data is not protected. A command line parameter is available to prevent write operations to an array that is in the Exposed state. See “Array States” on page 50 for more information.

– Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).
– From the Main menu, select **SSA Adapter List**.
– Select the adapter from the SSA Adapter List.
– Select **Rejected Disks**.

ARE ANY DISK DRIVES LISTED?

Yes **No**

023

A disk drive has not been detected by the adapter. Go to Step 026 on page 2324-7.

024

– Run nonconcurrent diagnostics to all the disk drives that are listed as rejected.
– Run the Certify service aid (see “Certify Disk Service Aid” on page 44) to all the disk drives that are listed as rejected.

If problems occur on any disk drive, go to Step 025. Otherwise, continue with this procedure.

– Do the actions described in “Adding a Disk Drive to an Array” on page 85.
– Referring to the displayed instructions, select a disk from the list of array candidate disk drives, and add that disk drive to the array that is in the Exposed state.

The array changes its state from the Exposed state, and parity is rebuilt.

025

(From step 024)

– Exchange the disk drive for a new drive (see “Exchanging Disk Drives” on page 29).

Go to Step 047 on page 2324-12 to add the disk drives to the group of disk drives that are available for use by the RAID manager.

Note: A disk drive that is listed as rejected is not necessarily defective. For example, the array might have rejected the disk drive because a power

problem, or an SSA link problem, caused that drive to become temporarily unavailable. Under such conditions, the disk drive can be reused.

026

(From step 023)

DOES THE DISK SERVICE AID INDICATE AN OPEN LOOP?

Yes **No**

027

Go to Step 019 on page 2324-5.

028

Go to "MAP 2320: SSA Link" on page 2320-1.

029

(From step 003)

No spare disk drives are available for an array that is configured for hot spare disk drives.

- If the subsystem contains disk drives that have failed, repair those disk drives, or exchange them for new disk drives (see "Exchanging Disk Drives" on page 29).
- Start the SSA Configurator and Service Aids Utility (see "Starting the SSA Configurator Functions" on page 51).
- From the Main menu, select **SSA Adapter List**.
- From the SSA Adapter List, select the adapter against which SRN 49500 was logged.
- Select **Spare Disk**. No spare disk drives are listed.
- Using the Insert function, try to make a spare disk drive. (Use the default block size.)

ARE ANY CANDIDATE DISK DRIVES LISTED?

Yes **No**

030

- Review with the customer the requirement for hot spare disk drives. If the customer wants hot spare disk drives, one or more disk drives must have their use changed to **Hot Spare Disk**.

If the customer does not want hot spare disk drives:

- Go to "Modifying Attributes of Resources" on page 80.
- Change the **Enable Use of Hot Spares** attribute to **No**.

031

– Go to “Creating an Array or a Hot Spare Disk Drive” on page 58, and create a hot spare disk drive from one of the listed candidate disk drives.

You have solved the problem.

Note: Because this problem has occurred, an error log is generated when the system runs the health check program. To verify that the availability of hot spare disk drives has solved the problem:

1. Run concurrent diagnostics to the adapter.
2. Verify that error code 049500 is ***not*** returned.

RAID Checkout

You are now starting the RAID checkout procedure

032

(From MAP 2410 step 006 on page 2410-2)
(From step 008)

– Start the SSA Configurator and Service Aids Utility (see "Starting the SSA Configurator Functions" on page 51).
– From the Main menu, select **SSA Adapter List**.
– Select the adapter from the SSA Adapter List.
– Select **Rejected Disks**.

ARE ANY DISK DRIVES LISTED?

Yes **No**

033

Go to Step 038 on page 2324-10.

034

– Run nonconcurrent diagnostics to all the disk drives that are listed as rejected.
– Run the Certify service aid (see "Certify Disk Service Aid" on page 44) to all the rejected disk drives.

Go to Step 035 on page 2324-10.

035

(From step 034)

IS ANY DISK DRIVE FAILING?

Yes **No**

036

Go to Step 038.

Note: A disk drive that is listed as rejected is not necessarily failing. For example, the array might have rejected the disk drive because a power problem, or an SSA link problem, caused that drive to become temporarily unavailable. Under such conditions, the disk drive can be reused.

037

– Exchange the failing disk drive for a new one (see "Exchanging Disk Drives" on page 29).

Go to Step 047 on page 2324-12 to add the disk drive to the group of disk drives that are available for use by the RAID manager.

038

(From steps 033 and 036)

– Start the SSA Configurator and Service Aids Utility (see "Starting the SSA Configurator Functions" on page 51).

– From the Main menu, select **SSA Adapter List**.

– Select the adapter from the SSA Adapter List.

– Select each array type in turn.

ARE ANY ARRAYS LISTED WITH A STATUS OTHER THAN GOOD OR REBUILDING?

Yes **No**

039

Go to Step 041 on page 2324-11.

040

Go to Step 001 on page 2324-2.

041

(From step 039)

HAVE DISK DRIVES BEEN GOING INTO THE REJECTED STATE WITH NO OTHER FAILURE INDICATIONS?

Yes **No**

042

Go to Step 044.

043

This problem can occur if an array is accessed before all the member disk drives are available.

– Ensure that the power system turns on power to all the disk drives before, or when, it turns on the power to the system unit.

044

(From step 042)

WAS SRN 49100 LOGGED, BUT NO ERROR FOUND, WHEN CONCURRENT DIAGNOSTICS WERE RUN?

Yes **No**

045

You have solved all the array problems.

046

An array was in the Exposed state, but is now in the Good state.

This problem might have occurred because a disk drive was temporarily removed from the system.

– Ensure that the power system turns on power to all the disk drives before, or when, it turns on the power to the system unit.

047

(From steps 015, 021, 025, and 037)

HAS A FAILED DISK DRIVE BEEN EXCHANGED FOR A NEW DISK DRIVE?

Yes **No**

048

If you have repaired a power or cabling fault that caused the disk drive to be missing from the system, the drive might now be in a rejected state. You must change that disk drive into a usable disk drive:

- From the Main menu, select **SSA Adapter List**.
- Select the adapter from the SSA Adapter List.
- Select **Rejected Disks**.
- Delete the disk drive that has been restored to the system. This action changes the disk drive to a free resource.
- Ask the customer to choose how the disk drive is to be configured:
  - Hot spare disk drive
  - Attached resource
  - Remain as a free resource.

049

If you exchanged the disk drive by using the procedure that is described in “Exchanging Disk Drives” on page 29, the new disk drive is configured as a new disk drive.

- Do the procedure described in “Converting a New Disk Drive to a Free Resource” on page 53.
- Change the new disk drive to a free resource.
- Ask the customer to choose how the disk drive is to be configured:
  - Hot spare disk drive
  - Attached resource
  - Remain as a free resource.

MAP 2410: SSA Repair Verification

This MAP helps you to verify a repair after a FRU has been exchanged for a new one.

Attention: Unless the system unit needs to be turned off for some other reason, *do not turn off the system when servicing an SSA link or a unit in which SSA devices are installed*. Unit power cables and external SSA cables that connect devices to the system can be disconnected while that system is running.

001

Before you arrived at this MAP, you might have exchanged one or more FRUs for new FRUs. Some of those FRUs (for example, disk drives) have Power lights.

– Check whether all those Power lights are on.

DO ALL THE FRUS YOU HAVE EXCHANGED HAVE THEIR POWER LIGHTS ON (WHERE APPLICABLE)?

Yes **No**

002

– Exchange, for a new one, the FRU whose Power light is off.

Go to Step 004.

003

Go to Step 004.

004

(From steps 002 and 003)

ARE ALL CHECK LIGHTS OFF?

Yes **No**

005

Go to the START MAP for the unit in which the device with its Check light on is installed.

006

– Run concurrent diagnostics to the device that reported the problem.

Notes:

1. Do not run nonconcurrent diagnostics; otherwise, errors are logged on other systems that share the same loop.
2. If you have just exchanged a disk drive or an SSA RAID Cluster Adapter, you must use the configurator to restore the device to the system.

– If the original problem was not reported by a device, run diagnostics to each SSA RAID Cluster Adapter in the system unit.
– Do the problem fix procedure (see “Problem Fix Procedure” on page 48).

Note: If you do not do the problem fix procedure, the diagnostics might create an SRN for a problem that you have already solved.

If you have a RAID array, and the problem remains, go to **RAID Checkout** at MAP 2324 step 032 on page 2324-9.

SSA Link Errors

SSA link errors can be caused if:

- Power is removed from an SSA device
- An SSA device is failing
- An SSA device is removed
- A cable is disconnected.

Such errors might be indicated by:

- SRN 45PAA
- A flashing link status (Ready) light on the SSA device at each end of the failing link
- The indication of an open link by the Disk Service Aid.

SSA Link Error Problem Determination

Instead of using the normal MAPs to solve a link error problem, you can refer directly to the link status lights to isolate the failing FRU. The descriptions given here show you how to do this.

In an SSA loop, SSA devices are connected through two or more SSA links to an SSA RAID Cluster Adapter. Each SSA link is the connection between two SSA nodes (devices or adapters); for example:

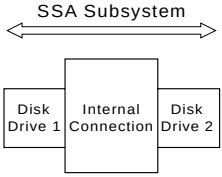
- Disk drive to disk drive
- Adapter to disk drive module
- Adapter to adapter

An SSA link can contain several parts. When doing problem determination, think of the link and all its parts as one complete item.

Here are some examples of SSA links. Each link contains more than one part.

Example 1

This link is between two disk drives that are in the same subsystem. It has three parts.



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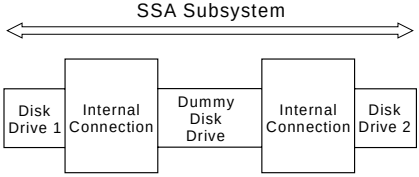
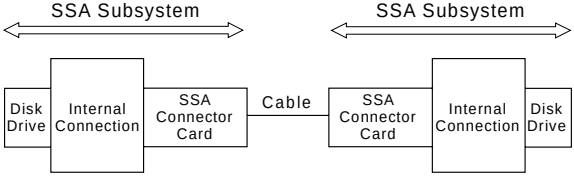
Example 2

This link is between two disk drives that are in the same subsystem. It has five parts.



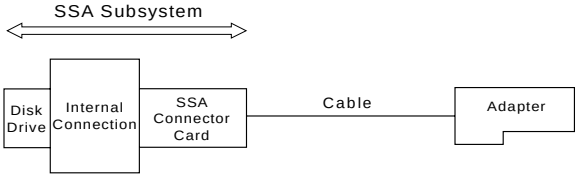
Example 3

This link is between two disk drives that are not in the same subsystem. It has seven parts.



Example 4

This link is between a disk drive and an SSA RAID Cluster Adapter. It has five parts.



Link Status Lights on the Adapter

If a fault occurs that prevents the operation of a particular link, the link status lights of the various parts of the complete link show that the error has occurred.

You can find the failing link by looking for the flashing green status light at each end of the affected link. Some configurations might have other indicators along the link (for example, SSA connector cards) to help with FRU isolation.

The meanings of the disk drive and adapter lights are summarized here.

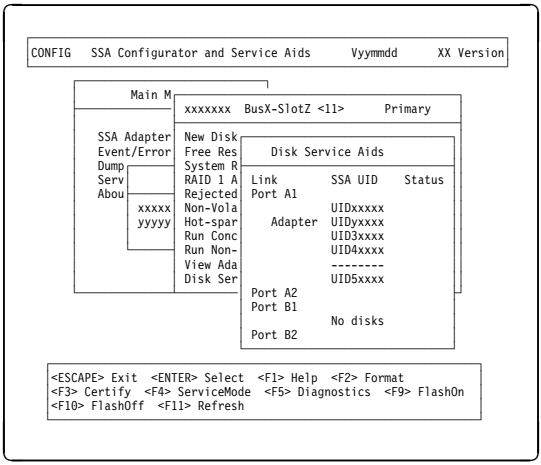
Status of Light	Meaning
Off	Both SSA links are inactive.
Permanently on	Both SSA links are active.
Slow flash (two seconds on, two seconds off)	Only one SSA link is active.

If you need more information about the lights, see:

- For adapter lights, “Introducing the SSA RAID Cluster Adapter for PC Servers, SSA, and RAID” on page 1 in this book.
- For other lights, the service information for the device that contains the lights.

Disk Service Aids

If service aids are available, you can use the Disk service aid to show that the SSA loop is broken.



This example screen shows a break (the dashed line) in the SSA loop between the third and fourth disk drives. In the condition shown by the display, the Ready lights on the second and third disk drives are both flashing.

To help locate these disk drives, select the disk drive, and press F9 (FlashOn). The Check light on the selected disk drive flashes. This action does not affect the customer’s operations.

For more information about the service aids, see “Using the SSA Service Aids and Other Service Tools” on page 37.

Exchanging Disk Drives

If you need to exchange a disk drive for a new one, check whether the disk drive that you are going to remove is a member of a RAID array.

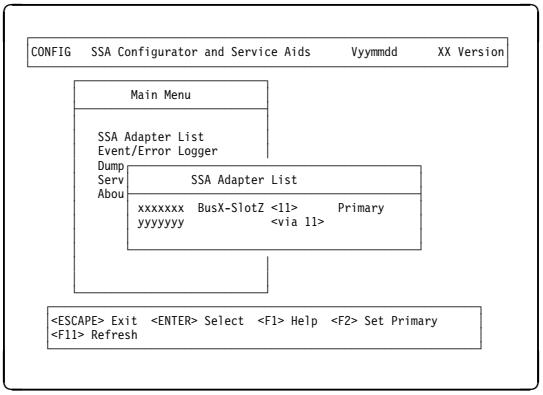
If the disk drive is a member of a RAID array, go to "Exchanging Array Disk Drives."

If the disk drive is ***not*** a member of a RAID array, go to "Exchanging Non-Array Disk Drives" on page 33.

Exchanging Array Disk Drives

1. Start the SSA Configurator and Service Aids Utility (see "Starting the SSA Configurator Functions" on page 51).
2. From the Main menu, select **SSA Adapter List**.

   The SSA Adapter List window opens:



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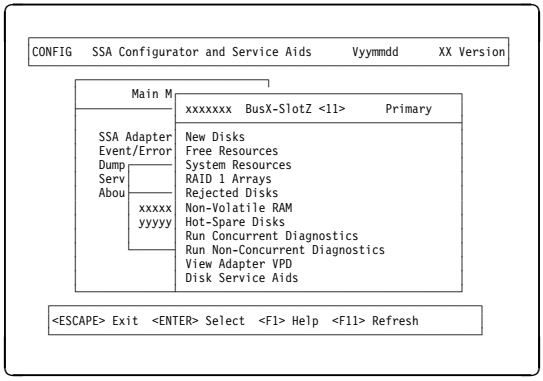
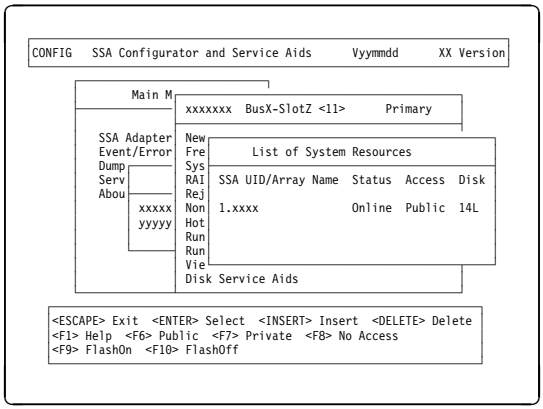
3 Select the required adapter from the SSA Adapter List.

The Adapter Menu window opens:



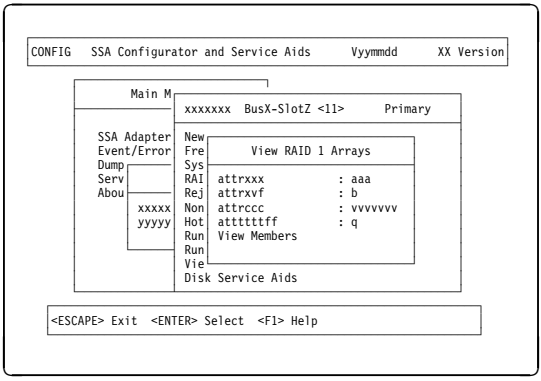
4 Select **System Resources** from the Adapter menu.

A list of system resources is displayed:



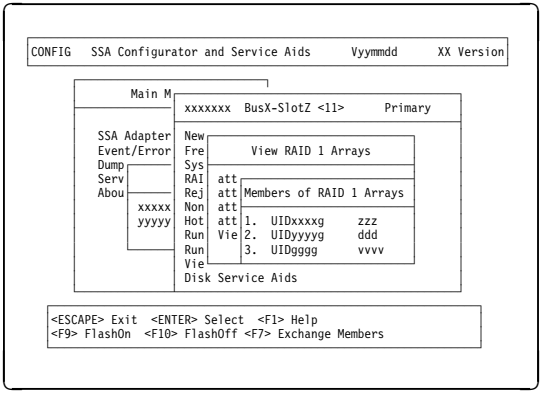
5 Select the required array from the list of system resources.

The View RAID 1 Arrays window is displayed:



6 Select **View Members** from the View RAID 1 Arrays window.

A list of member disk drives is displayed:



7. Select the disk drive that you want to remove, and use the Identify function to find the disk drive. To start the Identify function, press F9 (FlashOn); the Check light flashes on the selected disk drive. To end the Identify function, press F10 (FlashOff).

8. Press F7 (Exchange Members).

9. Select **Blank Reserved**.

   The selected disk drive has now been removed from the array, and replaced by a blank virtual disk.

10. Physically remove the disk drive (see the unit *Hardware Maintenance Manual*).

11. Physically install the replacement disk drive.

12. Convert the newly-installed disk drive into a free resource (see “Converting a New Disk Drive to a Free Resource” on page 53).

13. From the Adapter menu, select **System Resources**.

14. Select the array.

15. Select **View Members**.

16. Select the disk drive that you are going to exchange; that is, the hot spare disk drive that was originally exchanged with the rejected disk drive.

17. Press F7 (Exchange Members).

18. A list of candidate disk drives is displayed.

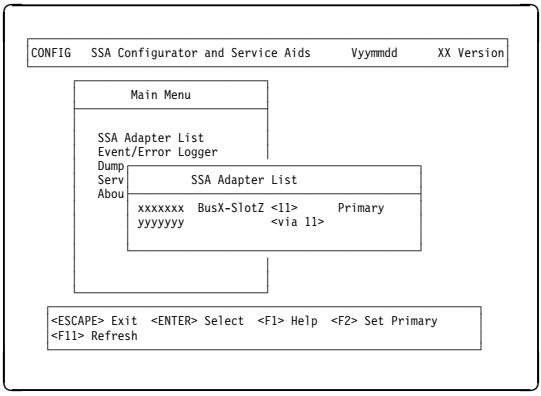
19. Select the disk drive that you want to become the new member of the array.

Exchanging Non-Array Disk Drives

1 Start the SSA Configuration and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).

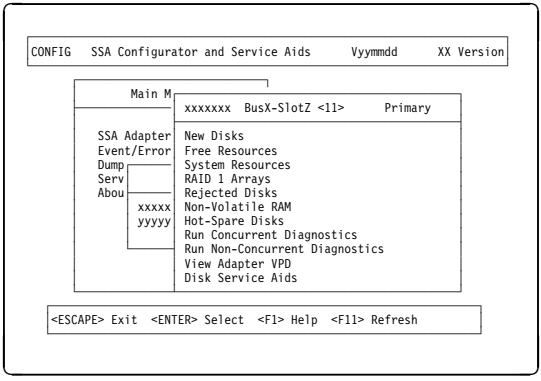
2 From the Main menu, select **SSA Adapter List**.

The SSA Adapter List window opens:



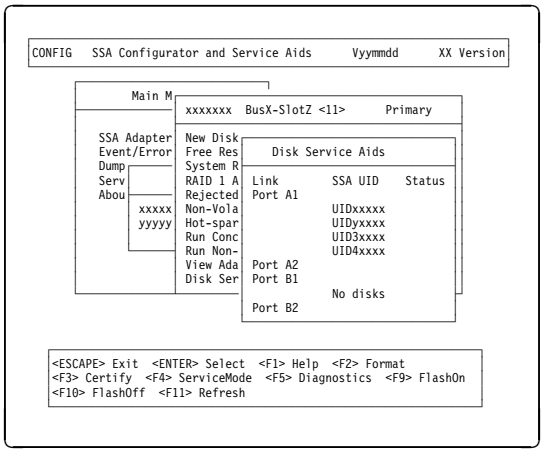
3 Select the required adapter from the SSA Adapter List.

The Adapter Menu window opens:



4 Select **Disk Service Aids**.

A list of disk drives is displayed:



5 From the Disk Service Aids menu find the disk drive that you are going to exchange. If the disk drive that you are going to exchange is not listed, select another adapter, and try again.

6 Select the disk drive that you want to remove, and use the Identify function to find the disk drive. To start the Identify function, press F9 (FlashOn); the Check light flashes on the selected disk drive. To end the Identify function, press F10 (FlashOff).

7 Put the cursor on the disk drive that you are going to exchange, and press F4.

This action puts that disk drive into Service Mode. Only one disk can be in Service Mode at a time.

8 Exchange the physical disk drive for a new one (see the unit *Hardware Maintenance Manual*).

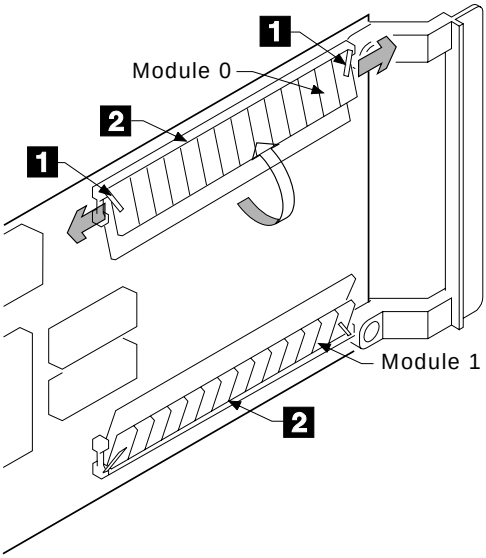
9 Press Esc to exit from the Service Aids window. This action automatically resets Service Mode on the new disk drive.

10 Repeat the procedure for any other disk drive that you are exchanging.

Exchanging DRAMs on the SSA RAID Cluster Adapter

Removing a DRAM

1. Shut down the operating system.
2. Remove power from the system.
3. Remove the adapter from the system unit.
4. Release the clips **1** by carefully pulling them past the ends of the DRAM **2**.
5. Rotate the DRAM away from the adapter card.
6. Pull the DRAM out from the socket.



Installing a DRAM

1. Insert the DRAM into the keyed socket.
2. Press the DRAM into the socket, then rotate the DRAM until the clips **1** click into place.
3. Reinstall the adapter into the system unit (see the service information for the system unit).
4. Turn on the power to the system.
5. Start up the system.

Using the SSA Service Aids and Other Service Tools

The SSA service aids and other tools help you to service SSA systems. This section describes:

- The SSA service aids and how to use them
- Identify function and how to use it
- The Download Disk Drive Microcode function and how to use it
- How to find the physical location of a device
- The Event/Error Log utility and how to use it.

SSA Service Aids

SSA service aids are included in the SSA Configurator and Service Aids Utility. The SSA service aids are:

- **Set Service Mode:** This service aid enables you to determine the location of a particular disk drive on the SSA loop, and to remove that disk drive from the loop.
- **Format Disk:** This service aid formats an SSA disk drive.
- **Certify Disk:** This service aid verifies that all the data on a disk drive can be read correctly.

Attention: Do not run the service aids from more than one system at a time; otherwise, unexpected results might occur.

These service aids are available only from the Disk Service Aids menu. To start a service aid, press the appropriate function (F) key. The assignments for the F keys are shown on the screen.

Before you use the service aids, ensure that you are familiar with the principles of SSA loops. If you are not familiar with these principles, first read “SSA Loops, Links, and Data Paths” on page 3.

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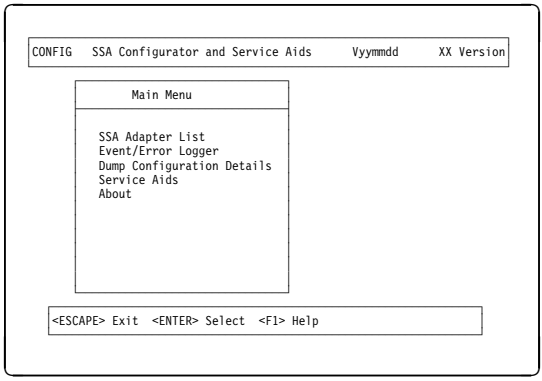
Selecting SSA Service Aids

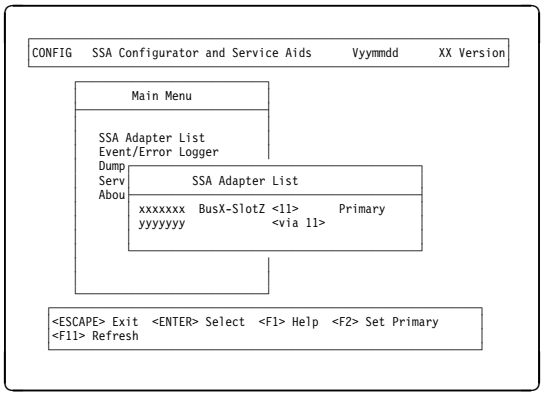
1 Start the SSA Configurator and Service Aids Utility by selecting the icon that was generated when the software was installed, or by running the ISSACFG program.

The Main menu is displayed:



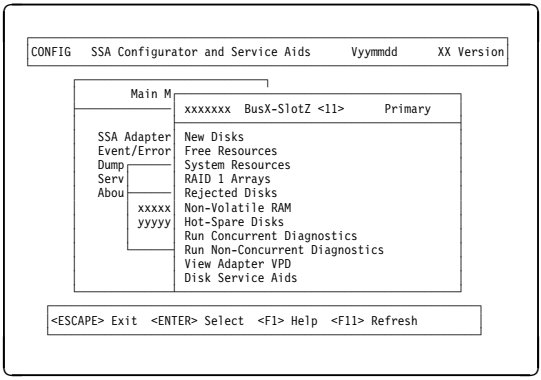
2 From the Main menu, select **SSA Adapter List**.

The SSA Adapter List window opens:



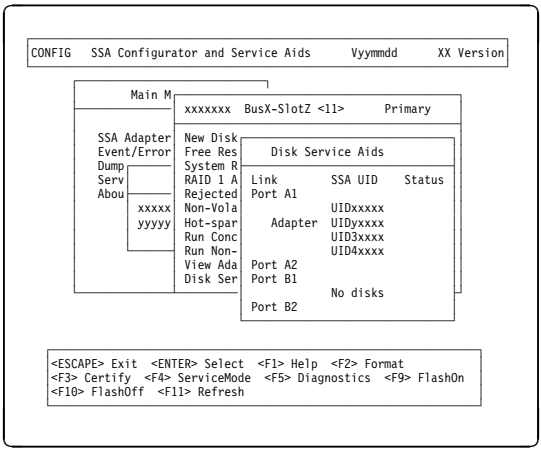
3 Select the required adapter from the SSA Adapter List.

The Adapter menu window opens:



4 Select **Disk Service Aids** from the Adapter menu.

The Disk Service Aids window is displayed:



Notes:

a. The Link column shows the connectors of the SSA RAID Cluster Adapter to which the loop is connected.

b. The SSA UID column shows the unique identifier of each disk drive.

   A dashed line in the SSA UID column shows that the SSA loop is broken. On the screen shown here, the loop is broken between the third and fourth disk drives.

c. The Status column shows the status of the disk drive; for example, “Power” and “Failed”.

Set Service Mode Service Aid

The Set Service Mode service aid enables you to determine the location of a particular disk drive, and to remove that disk drive from the unit in which it is installed. When the Set Service Mode service aid runs:

- The Check light of the disk drive comes on for identification.
- All SSA loop activity through the disk drive stops.
- The disk drive motor stops.
- The Check light (if present) of the unit that contains the selected disk drive comes on.

Only one disk drive at a time can be in Service Mode, and that disk drive must be one that is listed as a new resource or as a free resource. No communication to the disk drive is possible, and the SSA loop is broken.

Before using this service aid, you must make the selected disk drive unavailable to the system; otherwise, an error occurs.

SSA devices can be maintained concurrently; that is, they can be removed, installed, and tested on an SSA loop while the other devices on the loop continue to work normally. If a disk drive has its Check light on, you can remove that disk drive from the SSA loop without taking any special actions.

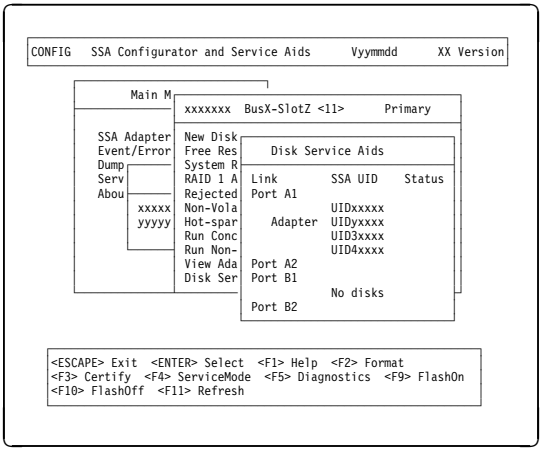
If a disk drive does *not* have its Check light on, the SSA loop that passes through it might still be active, although the disk drive itself might not be working. You must put that disk drive into Service Mode before you remove it from the SSA loop.

If you leave the Disk Service Aids window, Service Mode is reset.

To use the Set Service Mode service aid:

1. Start the SSA Configurator and Service Aids Utility, and select **Disk Service Aids** (see “Selecting SSA Service Aids” on page 38)

   The Disk Service Aids window is displayed:



2. From the Disk Service Aids window, select the disk drive that you want to put into Service Mode.

3. If you want to use the Identify function to identify the disk drive, press F9 (FlashOn).

4. Press F4 to set Service Mode. Confirmation information is displayed.

   Notes:

   a. You can select only one disk drive at time.

   b. If you select Service Mode, and the selected disk drive is not in a closed loop or at the end of a string (see “SSA Loops, Links, and Data Paths” on page 3), your selection fails and an error message is displayed.

   c. If the Check light of the disk drive that you have put into Service Mode does not come on, and you are not sure of the location of that disk drive, use the Identify function to help you find it (see “The Identify Function” on page 45). If necessary, you can identify the disk drives that are on each side of the one that you are trying to find.

5. To reset Service Mode, press Esc.

Format Disk Service Aid

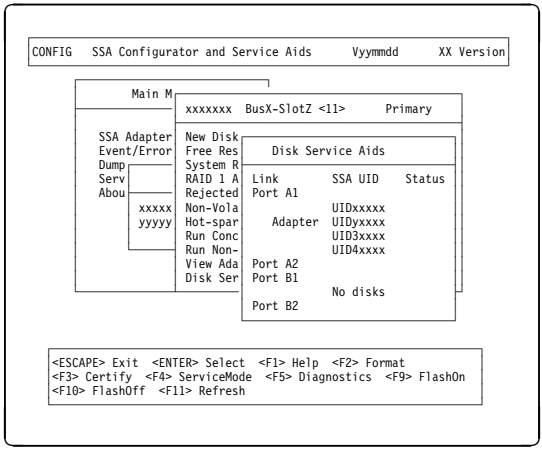
The Format Disk service aid formats SSA disk drives. Only disk drives that are listed as new resources or as free resources can be formatted.

Attention: Formatting a disk drive destroys all the data on that disk drive. Use this procedure only when instructed to do so by the service procedures.

To use the Format Disk service aid:

1 Start the SSA Configurator and Service Aids Utility, and select **Disk Service Aids** (see "Selecting SSA Service Aids" on page 38)

The Disk Service Aids window is displayed:



2 From the Disk Service Aids window, select the disk drive that you want to format.

3 If you are not sure of the identification of the disk drive that you want to format, use the Identify function to get a positive physical identification of the disk drive (see "The Identify Function" on page 45). You can further ensure that you have selected the correct disk drive by verifying that the serial number on the disk drive is the same as the serial number that is displayed on the screen.

4 When you are sure that you have selected the correct disk drive, press F2 (Format). A prompt for confirmation is displayed:

```
CONFIG   SSA Configurator and Service Aids      Vyymmdd      XX Version

         Do you really want to format this disk?

         Yes

         No

         Disk drive      5AEA00A0     has been selected for formatting.
         **** BEWARE - this resource is NOT Free or New!!***

         All data on this physical disk will be lost.
         Note - before formatting a physical disk, ensure that the disk
                has been powered on for at least 30 minutes.
```

5 Answer the prompt.

6 If you want to find out how the format operation is progressing, look at the resource attributes (see "Viewing Resources and Their Attributes" on page 77).

Note: After a format operation, the disk drive becomes a free resource.

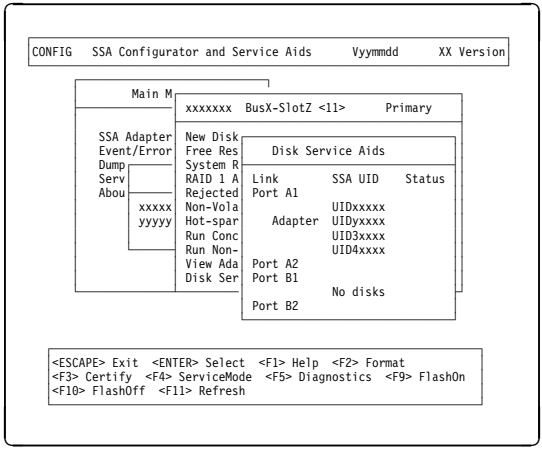
Certify Disk Service Aid

The Certify service aid verifies that all the data on a disk drive can be read correctly. Other maintenance procedures tell you when you need to run this service aid.

To use the Certify Disk service aid:

1. Start the SSA Configurator and Service Aids Utility, and select **Disk Service Aids** (see "Selecting SSA Service Aids" on page 38)

   The Disk Service Aids window is displayed:



2. From the Disk Service Aids window, select the disk drive that you want to certify.

3. If you are not sure of the identification of the disk drive that you want to certify use the Identify function to get a positive physical identification of the disk drive (see "The Identify Function" on page 45). You can further ensure that you have selected the correct disk drive by verifying that the serial number on the front of the disk drive is the same as the serial number that is displayed on the screen.

4. When you are sure that you have selected the correct disk drive, press F3 (Certify).

5. If you want to find out how the certify operation is progressing, look at the resource attributes (see "Viewing Resources and Their Attributes" on page 77).

The Identify Function

The Identify function can be accessed from most of the SSA Configurator and Service Aids Utility displays.

This function enables you to determine the location of a particular disk drive that you want to identify, but do not want to remove. Identify causes the Check light of the disk drive to flash for identification (two seconds on, two seconds off), but has no effect on the normal operation of the disk drive. It also causes the Check light (if present) of the unit containing the selected disk drive to flash. You can use the Identify function on any number of disk drives at the same time.

Instructions displayed by the service aids tell you when you can select the Identify function.

The service aids display the UIDs of the devices. By checking the UID on the serial-number label on the device, you can verify that the correct device has its Check light flashing.

To start the Identify function, press F9 (FlashOn). To end the Identify function, press F10 (FlashOff).

Download Microcode Function

Instructions on how to download microcode are contained in a README.TEXT file that is on the diskette supplied with the adapter.

Finding the Physical Location of a Device

The physical location of a device (for example, a disk drive or an SSA RAID Cluster Adapter) cannot be reported directly by the system because of the way in which the SSA interface works. The address of an SSA device is related to the position of that device on the SSA loop. The address can, therefore, change if the configuration is changed.

Finding the Device When Service Aids Are Available

When the service aids are available, use the Identify function to find the correct disk drive (see “The Identify Function” on page 45). If you want to find a device that does not have a Check light (for example, an adapter), you can either use the Identify function to identify devices that are next to the SSA RAID Cluster Adapter on the SSA link, or use the procedure described in “Finding the Device When No Service Aids Are Available.”

Finding the Device When No Service Aids Are Available

When no service aids are available, you must find the device by using the port (P) and SSA-address (AA) values that are provided by some service request numbers (SRNs). Examples of these SRNs are 43PAA, 44PAA, and 45PAA.

The port (P) value can be a number 0 through 3. It indicates the port connector on the SSA adapter:

0 = Connector A1
1 = Connector A2
2 = Connector B1
3 = Connector B2

The AA value is the decimal SSA-address value. It indicates the position of the device that you are trying to find (counted *along* the SSA loop).

Use the port value to locate the relevant connector on the SSA RAID Cluster Adapter, then follow the SSA cable to the first *real* device. Include other adapters as real devices if they are in the same SSA link. Do not include dummy devices.

The first device that you reach represents SSA-address count 0. Continue to follow the SSA links from device to device, increasing the SSA-address count by 1 for each device, until you reach the device that is indicated in the SRN.

The Event/Error Logger Utility

The adapter software includes an Event/Error Logger utility. This utility is automatically loaded into the system during the installation of the adapter software, and afterward, at each power-on operation. It collects information about SSA errors, and tells you when an error occurs that needs a service action.

| All errors are reported and logged in the Event/Error Log
| files of **both** cluster members.

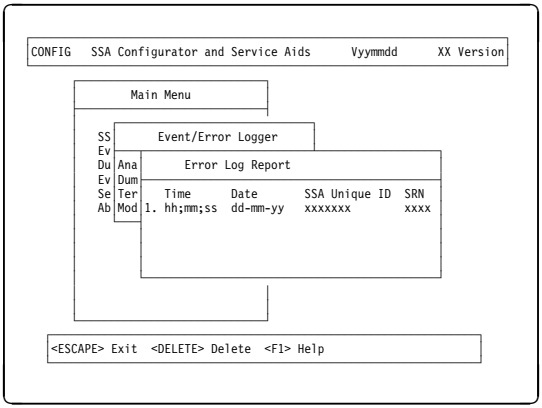
The format in which the Event/Error Logger reports errors is controlled by the file xxxxxx.yyy in zzzzzzz. Details of the settings and how to change them are contained in the header of the control file.

The SSA Configurator and Service Aids Utility provides functions that allow you to use the logged information. These functions are:

- Analyze SSA Event Log
- Problem Fix Procedure
- Dump SSA Event Log
- Terminate SSA Event Log
- Modify SSA Event Logger Time Out.

Analyze SSA Event Log

This function checks the log information that has been collected over the previous twenty-four hours, and displays information about errors that require service actions to be done.



Service Actions are indicated by service request numbers (SRNs): see “Service Request Numbers (SRNs)” on page 13.

Note: The Analyze Log function does not recommend a service action for every log entry. Not all log entries require a service action. In some

conditions, some errors might be related to operational procedures. Such errors do not require service actions.

Attention: If you need to do any service actions, always go first to “MAP 2010: START” on page 2010-1.

Problem Fix Procedure

When you have solved a problem, you must flag all the errors that are related to that problem. Otherwise, the next time that you run the Analyze SSA Event Log function, or diagnostics, another SRN might be created for the problem, which no longer exists.

To flag an error, select the error from the Error Log Report screen (see “Analyze SSA Event Log” on page 47), then press the Delete key.

Dump SSA Event Log

This function translates, and writes to a text file, the contents of the Event/Error Log. You can use any text display to look at the text file.

Note: Not all log entries require a service action. In some conditions, some errors might be related to operational procedures. Such errors do not require service actions.

Terminate SSA Event Log

This function ends the operations of the event/error logger.

To restart the logger, either use the icon that is normally in the STARTUP group folder, or go to the directory that contains the ISSAELOG.EXE file.

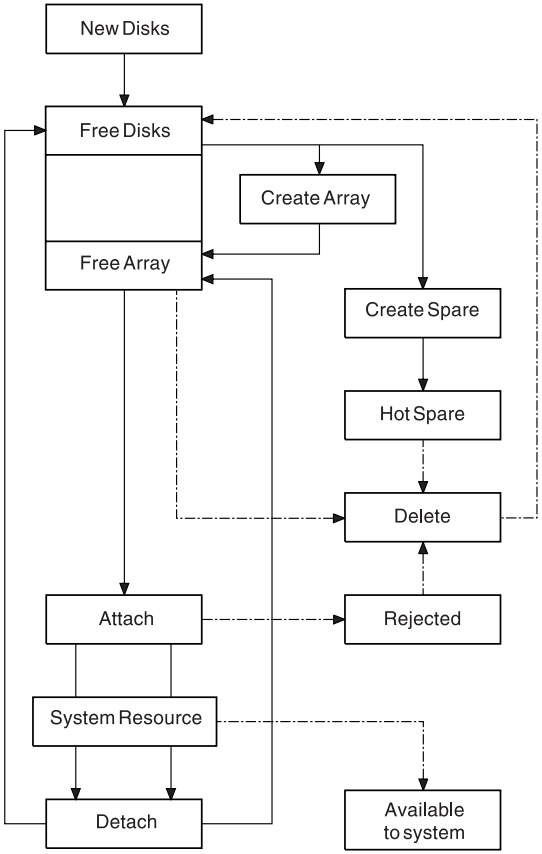
Modify Event Logger Time Out

This function enables you to set a longer time for the event logger to perform the analyze and dump functions. A heavily-loaded system might cause a time out to occur if the time setting is too short.

Using the SSA Configurator Functions

The functions of the SSA configurator are included in the SSA Configurator and Service Aids Utility that is provided on the SSA RAID Adapter diskette for your operating system.

The diagram summarizes functions of the SSA configurator.



You must use the SSA configurator to configure and attach SSA disk drives; otherwise, the operating system cannot use those disk drives. You do not need to run this configurator if you are configuring and attaching other types of device.

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Array States

An array can be in one of the following states:

Good

The array is online and it can be read and written. Both member disk drives of the array are present. No data rebuilding is outstanding. The array is fully protected against the loss of one member.

Exposed State

One member is missing from the array. The first write operation causes the array to enter the degraded state.

After an interval, if a hot spare is available, it replaces the missing member and the array enters the rebuilding state.

Degraded State

One member is missing and a write operation has been received for the array. Read and write operations to the array are supported. If a hot spare disk drive is available, after an interval, the hot spare replaces the missing member and the array enters the rebuilding state.

The missing member is permanently excluded from the array.

Rebuilding State

The array is online and it can be read and written. Both members of the array are present but data is being rebuilt on one of the members.

Offline State

An array is in this state when one of the following conditions exists:

- Both members of the array are missing or have failed.
- One member of the array is missing when a failover occurs.
- The rebuilding of a replacement member is not complete when the remaining original member fails.

Read and write operations to the array are not supported.

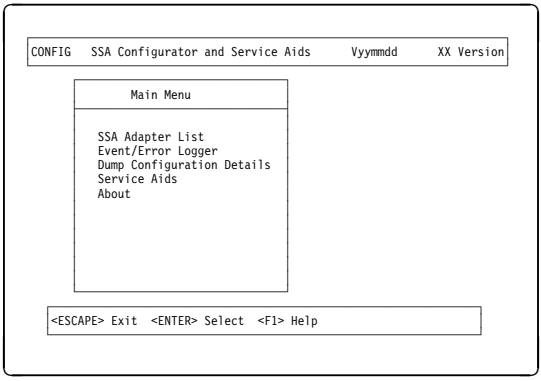
Starting the SSA Configurator Functions

1. ***If the operating system is running***, start the SSA Configurator and Service Aids Utility by selecting the icon that was generated when the software was installed, or by running the ISSACFG program.

   If the operating system is not running, run the stand-alone DOS SSA Configuration Utility (ISSACFG).

2. The Main menu is displayed.

   Note: Under some adapter error conditions, the configurator is not loaded, and an error message is displayed.



Setting the Primary Adapter

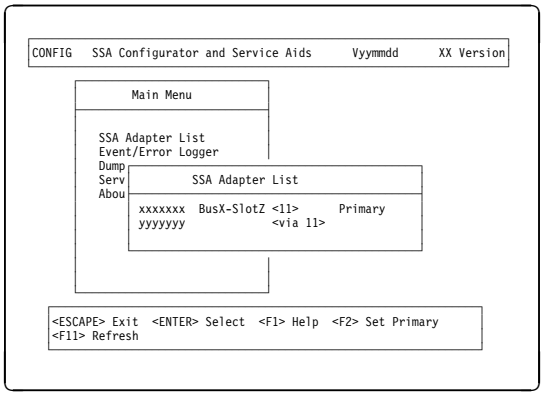
By default, the adapter that has the higher SSA Unique ID is defined to be the primary adapter. The performance of I/O operations to RAID-1 arrays is:

- Highest when the server that contains the primary adapter starts all the I/O operations
- Lowest when the server that contains the non-primary adapter starts all the I/O operations.

To improve the performance of the system, you might choose to define the other adapter as the primary adapter. To do this:

1. Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).
2. From the Main menu, select **SSA Adapter List**.

   The SSA Adapter List window opens:



3. Put the cursor at the adapter that you want to set as the primary adapter, and press F2. That adapter is now the primary adapter.

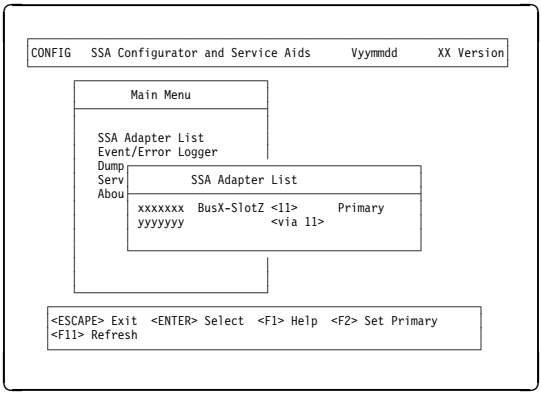
Converting a New Disk Drive to a Free Resource

A new disk drive is one that has not been used previously by the same type of system as that in which it is now installed. Before a new disk can be attached to the system, it must be in the free state.

1 Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).

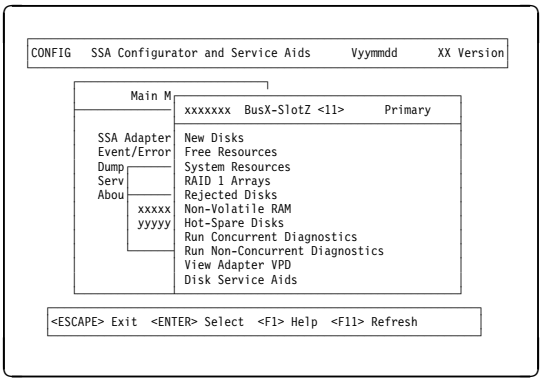
2 From the Main menu, select **SSA Adapter List**.

The SSA Adapter List window opens:



3 Select the required adapter from the SSA Adapter List.

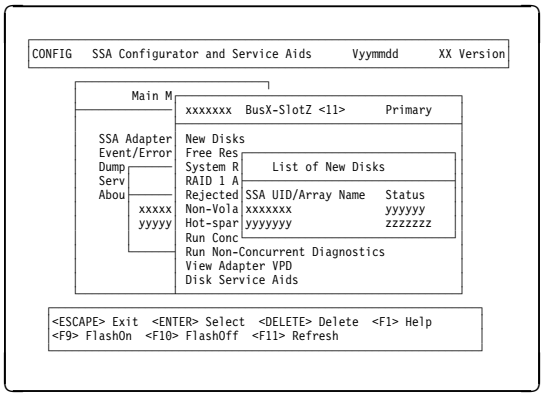
The Adapter Menu window opens:



4 Select **New Disks** from the Adapter menu.

5 If a list of new disk drives is displayed, go to step 6.

If no list is displayed, go to step 7 on page 54.



6 For each disk drive that you want to attach to your system, put the cursor against its name and press Delete. Its name disappears from the list. That disk drive is now in the *free* state.

7 Return to the Adapter menu by pressing Esc.

8 If you want to display a list of disk drives that are in the free state, select **Free Resources** from the Adapter menu. A list of disk drives that are on the selected adapter and in the free state is displayed.

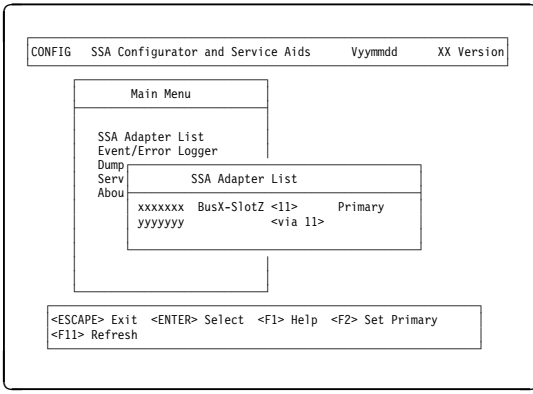
Changing the Access Mode

Note: You can change the access mode only for disk drives that are not members of an array.

1 Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).

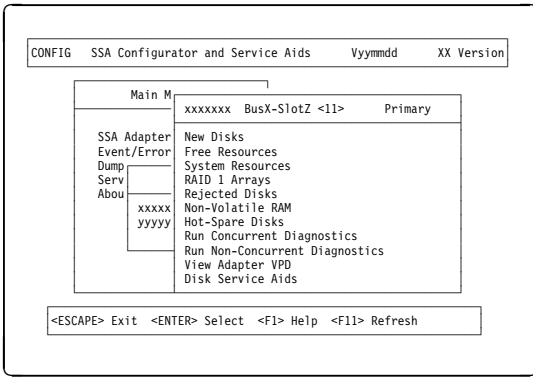
2 From the Main menu, select **SSA Adapter List**.

The SSA Adapter List window opens:



3 Select the required adapter from the SSA Adapter List.

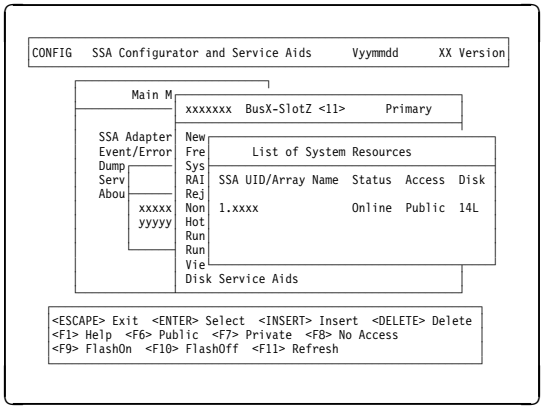
The Adapter Menu window opens:



4 Select **System Resources** from the Adapter menu.

A resource is a device that is to be accessed as a disk drive, a hot-spare disk drive, or an array of disk drives.

The resources are listed in the sequence of disk numbers.



5 Select the disk drive whose access you want to change.

6 Use the F6, F7, or F8 key as appropriate.

F6 Public System access is available to this resource through ***both*** adapters in the loop.

When F6 is pressed, `Public` appears in the Access column for both adapters.

F7 Private System access is available to this resource only through this adapter.

When F7 is pressed, `Local` is displayed in the Access column for the adapter that you have selected, and `Private` is displayed in the Access column for the other adapter in the loop.

F8 No Access System access is not available to this resource through ***either*** adapter in the loop.

When F8 is pressed, `No Access` is displayed in the Access column for both adapters in the loop.

Public mode is the default mode.

If you want to boot a system from an SSA disk, the access mode of the boot disk must be local when

you view the resources through the adapter that is installed in that system.

Creating an Array or a Hot Spare Disk Drive

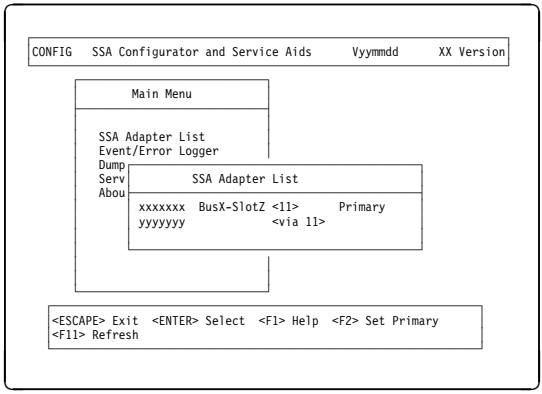
Note: You can create arrays and their associated hot spare disk drives only on the ***primary*** adapter.

To create an array or a hot spare disk drive:

1 Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).

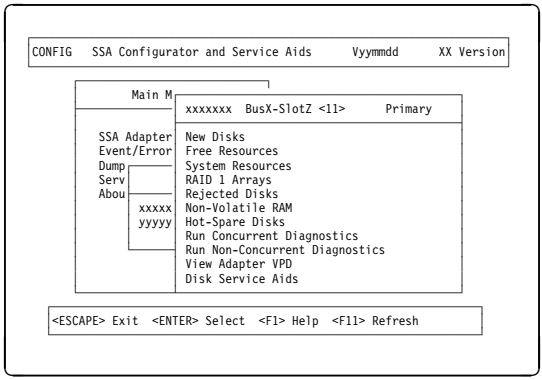
2 From the Main menu, select **SSA Adapter List**.

The SSA Adapter List window opens:



3 From the SSA Adapter List, select the ***primary*** adapter that is to control the array and hot spare disk drives.

The Adapter Menu window opens:



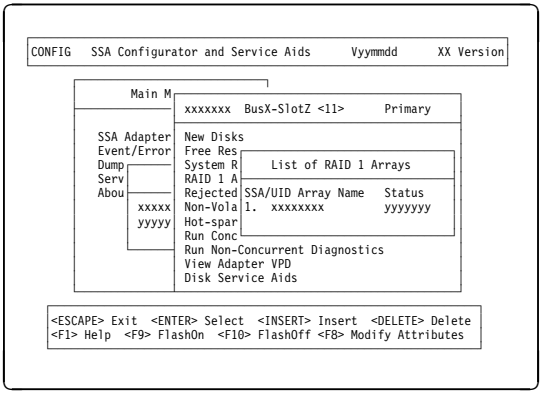
4 If you are creating an array, go to “Creating the Array” on page 59.

If you are creating a hot spare disk drive, go to “Creating the Hot Spare Disk Drive” on page 62.

Creating the Array

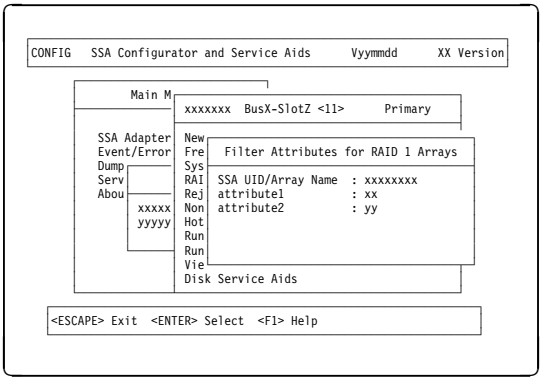
1 From the Adapter menu, select the type of array that is to be created. (You can scroll the contents of the window by using the arrow keys.)

A list of the arrays of this type that are already controlled by this adapter appears in a new window:



2 To add the new array, press Insert.

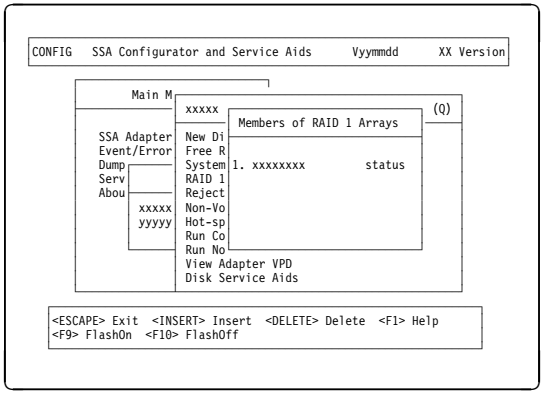
A window opens showing the attributes for the type of array selected:



3 You must type an Array Name for the new array. The default values for the attributes are shown. You can change these values by overtyping them. (The Help screen provides details of the values that are allowed.) Use the arrow keys to scroll the contents of the window, if necessary, to ensure that

you check all the attributes. Press Select to set the attributes.

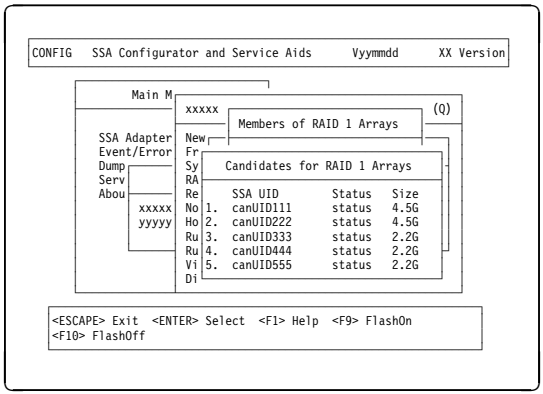
When you set the attributes, the list (initially blank) of members of the array appears in a new window:



4 To select the disk drives for the array:

a. Press Insert.

A list of candidate disk drives is displayed:



b. Select the disk drive that is to be included in the array.

The previous window reappears now showing the selected disk drive as a member of the array.

c. Repeat steps 4a through 4b for each disk drive that you want to attach.

5 When you have selected all the disk drives required, create the array by pressing Esc and following the prompt to confirm the creation of the array.

The screen that is shown in step 1 on page 59 reappears showing the new array in the list.

You can return to the Main menu by repeatedly pressing Esc.

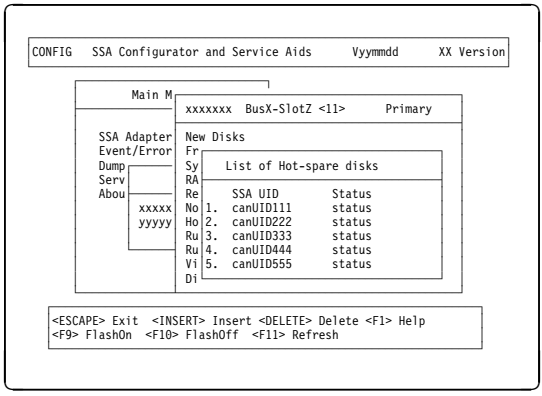
6 The array that you have created is in the *free* state. You must now to attach the array to your system. Go to “Attaching a Resource to the System” on page 63.

Creating the Hot Spare Disk Drive

1 From the Adapter menu, select **Hot-Spare Disks**.

A list of the hot spare disk drives that are controlled by the adapter is displayed.

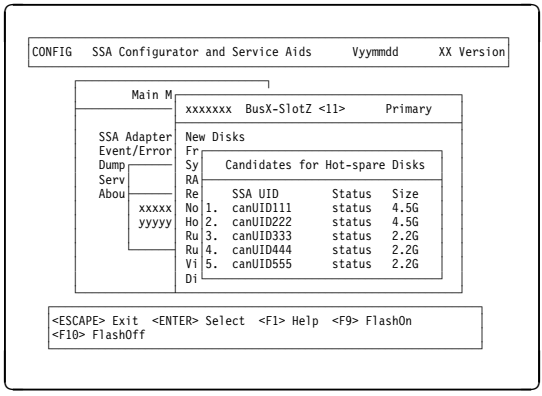
Note: The list might not contain any hot spare disk drives.



2 Press Insert to add the new hot spare disk drive.

3 When asked to specify block size, accept the default size.

A list of candidate disk drives is displayed:



4 Select the hot spare disk drive.

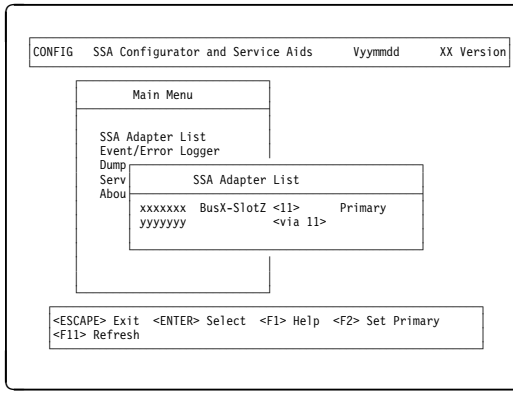
The new hot spare disk drive is added to the list.

Attaching a Resource to the System

1 Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).

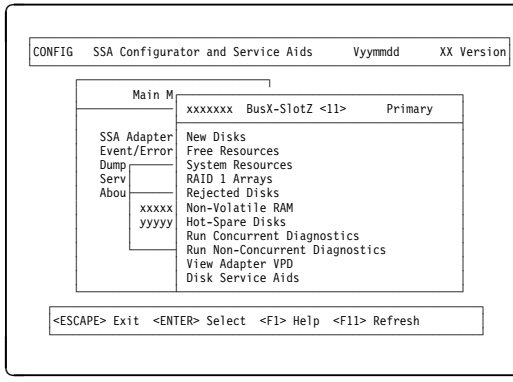
2 From the Main menu, select **SSA Adapter List**.

The SSA Adapter List window opens:



3 Select the required adapter from the SSA Adapter List.

The Adapter Menu window opens:

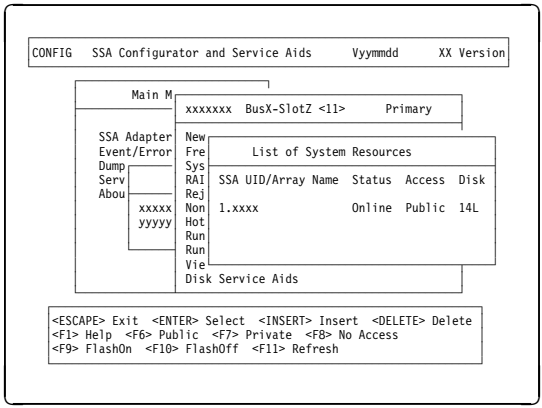


4 Select **System Resources** from the Adapter menu.

A resource is a device that is to be accessed as a disk drive, a hot-spare disk drive, or an array of disk drives.

A list, initially blank, of the resources that are attached to the system is displayed. The list can contain disk drives, arrays, and hot spare disk drives.

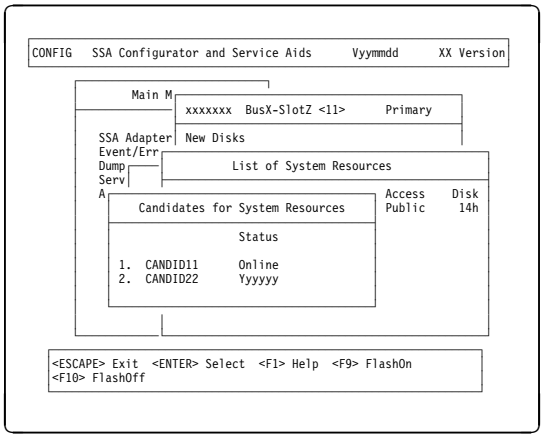
The resources are listed in the sequence of the disk numbers.



The configurator assigns disk numbers that are directly related to the positions, in the resource list, that you have selected for the attachment of the disk drives. At the time that each number is assigned, you are allowed to change that number for a specific number. See “Disk Numbers” on page 12.

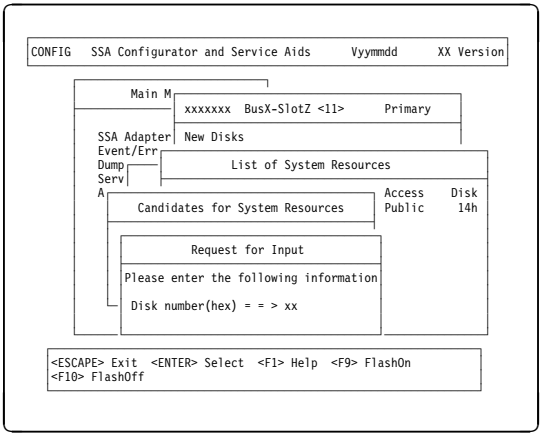
5 Press Insert.

A list of candidate resources is displayed:



These are the resources that are in the free state.

6 Select the resource that you want to attach. Its name disappears from this list, and the Request for Input window appears:



The disk number automatically assigned for the new resource is shown; this will be one greater than the highest disk number already assigned. You can change this by overtyping it.

Notes:

a. At the position in the list that you choose for the new resource, there need not be a gap in the sequence of disk numbers. If there is no gap, the resource that already had the disk number you have chosen is allocated a number one greater than this. This reallocation of disk numbers continues down the list of resources until either a gap in the numbers, or the end of the list is reached.

b. If you are going to boot from an SSA disk drive, that disk drive must be at the top of the list of the first SSA adapter found by the system (that is, the SSA adapter with the highest priority within the system). The access mode of the disk drive must be local to the system that you are booting.

When you have chosen the disk number for the new resource, press Enter.

7 The System resources window reappears with the new resource added to the list. The disk numbers shown include that of the new resource and reflect any reallocation of disk numbers that has been necessary.

8 If you want to specify system access to a particular disk drive, select the disk drive, and use the F6, F7, or F8 key as appropriate.

Note: You can change the access only for disk drives that are not members of an array.

F6 Public	System access is available to this resource through ***both*** adapters in the loop. When F6 is pressed, `Public` appears in the Access column for both adapters.
F7 Private	System access is available to this resource only through this adapter. When F7 is pressed, `Local` is displayed in the Access column for the adapter that you have selected, and `Private` is displayed in the Access column for the other adapter in the loop.
F8 No Access	System access is not available to this resource through ***either*** adapter in the loop. When F8 is pressed, `No Access` is displayed in the Access column for both adapters in the loop.

Public mode is the default mode.

If you want to boot a system from an SSA disk, the access mode of the boot disk must be local when you view the resources through the adapter that is installed in that system.

Public mode is the default mode.

9 Exit the configurator, shutdown your system, and reboot. The reboot enables the system to recognize the devices that you have added to the list of system resources.

10 The SSA subsystem is now ready for use with your system.

11 Ensure that the event/error logger has been started.

If you need to start the event/error logger, either use the icon that is normally in the STARTUP group folder, or go to the directory that contains the ISSAELOG.EXE file.

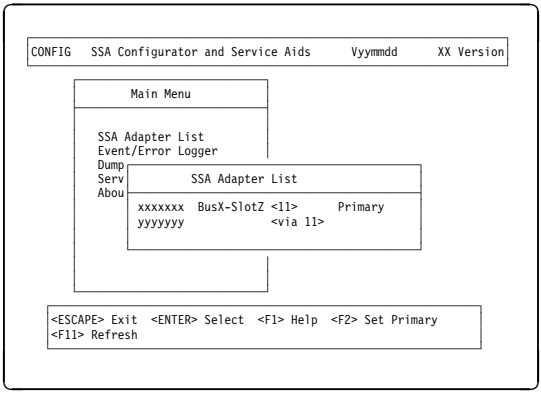
Deleting a Resource from the System Resource List

Note: Only resources that are listed in the system resource list are configured when you next boot the system.

1 Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).

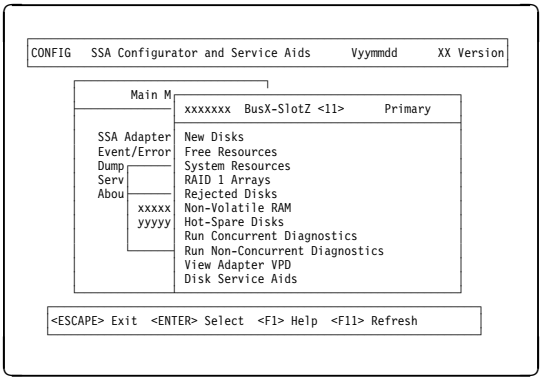
2 From the Main menu, select **SSA Adapter List**.

The SSA Adapter List window opens:



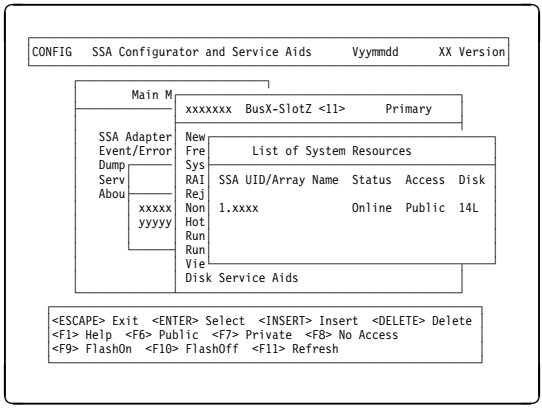
3 Select the required adapter from the SSA Adapter List.

The Adapter Menu window opens:



4 Select **System Resources** from the Adapter menu.

A list of system resources is displayed:



5 Select the resource that you want to remove from the system resource list.

Notes:

a. A resource can be a disk drive, an array, or a hot spare disk drive.

b. If you are removing a disk drive from an array, you must first remove the array from the system resource list.

6 Press Delete. This action moves the resource to the list of free resources. You have removed the resource from the system resource list. If you are removing a disk drive from an array, continue with the next step.

7 From the Adapter menu, select **Free Resources**.

8 Select the array from which you are removing the disk drive.

9 Select **View Members**.

10 Select the disk drive from the list of member disk drives.

11 Press Delete. The disk drive is removed from the array, and becomes a free disk.

12 Reboot the system to bring the changes into effect.

Dealing with RAID Array Problems

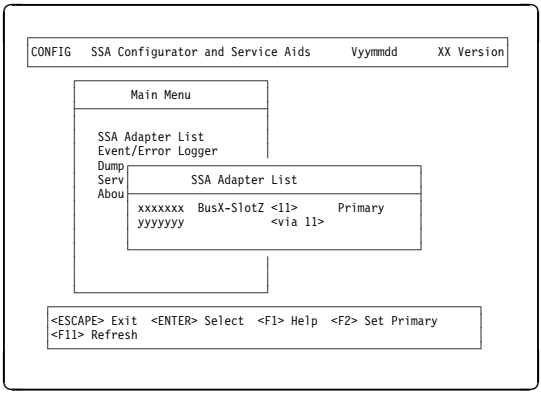
This part of the book describes how to solve problems that might occur on your arrays.

Identifying and Correcting or Removing Failed Disk Drives

1. Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).

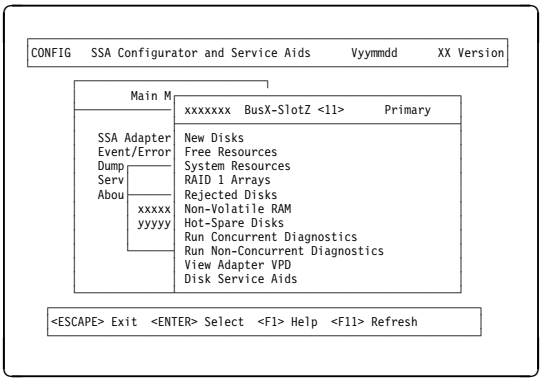
2. From the Main menu, select **SSA Adapter List**.

   The SSA Adapter List window opens:



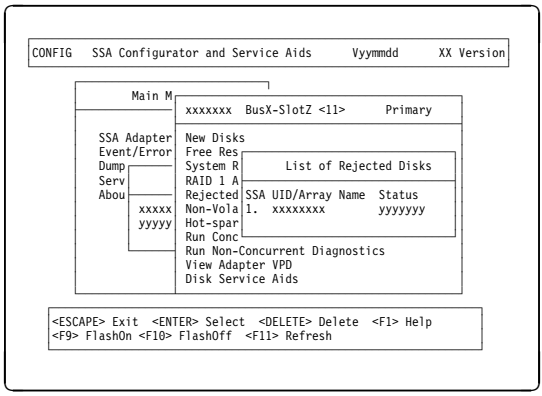
3. Select the required adapter from the SSA Adapter List.

   The Adapter Menu window opens:



4 Select **Rejected Disk** from the Adapter menu.

A list of rejected disk drives is displayed:



5 Check the list of rejected disk drives against other error reports to find out why the disk drive was rejected from the array.

6 If you know the physical location of the rejected disk drive, go to step 7. Otherwise, press F9 (FlashOn) to identify the rejected disk drive.

7 If the disk drive was rejected from the array because the disk drive itself has failed, go to “Removing a Disk Drive from an Array” on page 82.

When you have removed the disk drive from the array, return here and go to step 8.

If the disk drive was rejected from the array because some other part has failed (for example, a power supply unit, or an SSA cable), correct the problem.

8 If, as a result of the problems described in step 7, the rejected disk drive has been exchanged for a hot spare disk drive, you can do either of the following two procedures:

- Let the replacement disk drive be a permanent member disk drive in the array, and convert the rejected disk drive into a hot spare disk drive:
  a. Delete the rejected disk drive from the Rejected list; the disk drive becomes a free resource.
  b. Convert the free resource disk drive into a hot spare disk drive (see “Creating an Array or a Hot Spare Disk Drive” on page 58).

- Exchange the rejected disk drive for a replacement disk drive:
  a. Delete the rejected disk drive from the Rejected list; the disk drive becomes a free resource.
  b. From the Adapter menu, select **System Resources**.
  c. Select the array.
  d. Select **View Members**.
  e. Select the disk drive that you are going to exchange; that is, the hot spare disk drive that exchanged with the rejected disk drive.
  f. Press F7 (Exchange Members).
  g. A list of candidate disk drives is displayed.
  h. Select the disk drive that you want to become the new member of the array.

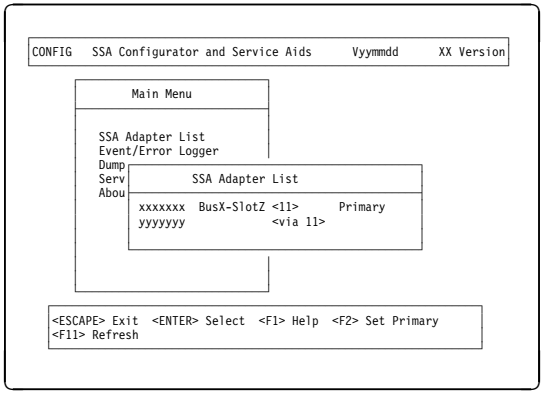
Installing a Replacement Disk Drive (Component Exchange)

1 Physically install the replacement disk drive (see the unit *Hardware Maintenance Manual*).

2 Convert the newly-installed disk drive into a free resource (see “Converting a New Disk Drive to a Free Resource” on page 53).

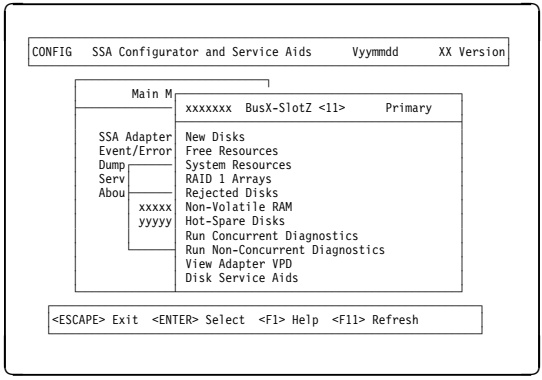
3 From the Main menu, select **SSA Adapter List**.

The SSA Adapter List window opens:



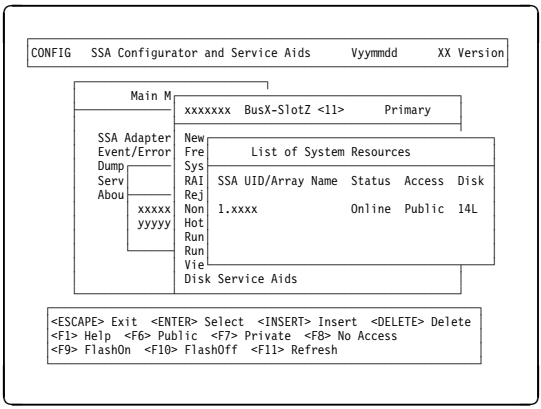
4 Select the required adapter from the SSA Adapter List.

The Adapter Menu window opens:



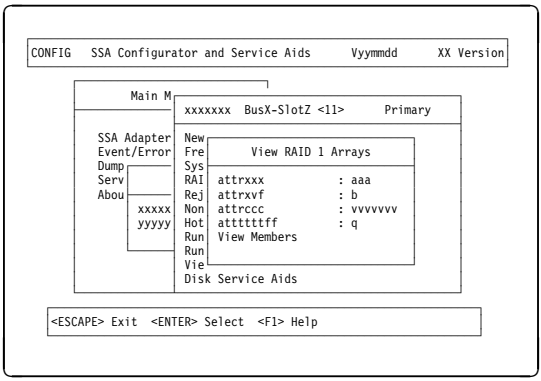
5 Select **System Resources** from the Adapter menu.

A list of system resources is displayed:



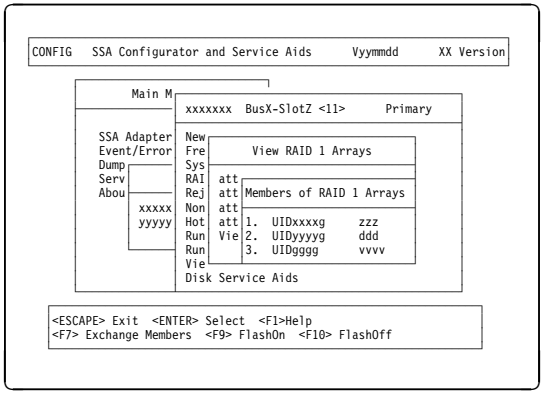
6 Select the required array from the list of system resources.

The View RAID 1 Arrays window is displayed:



7 Select **View Members** from the View RAID 1 Arrays window.

A list of member disk drives is displayed:



8 Select the disk drive that you are going to exchange; that is, the hot spare disk drive that was originally exchanged with the rejected disk drive.

9 Press F7 (Exchange Members).

10 A list of candidate disk drives is displayed.

11 Select the disk drive that you want to become the new member of the array.

Performing Other Array Tasks

This section describes some of the other uses of the SSA Configurator and Service Aids Utility.

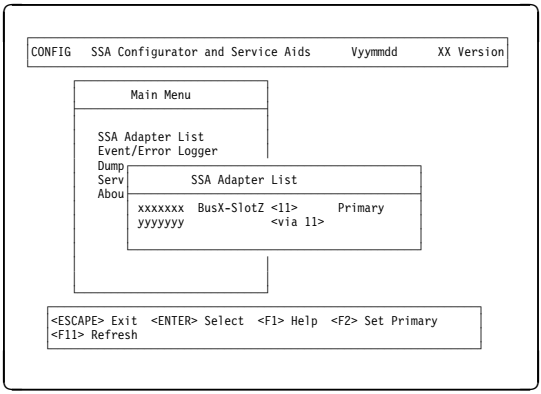
All these tasks use the SSA Configurator Utility that is provided on the SSA RAID Cluster Adapter diskette for your operating system.

Viewing the Physical Configuration

1 Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).

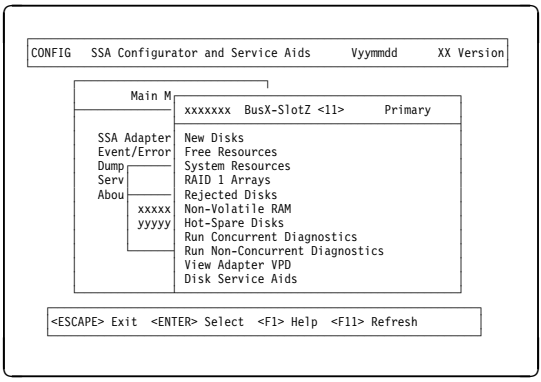
2 From the Main menu, select **SSA Adapter List**.

The SSA Adapter List window opens:



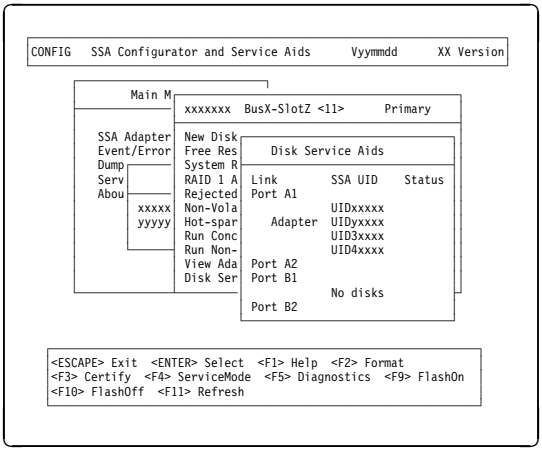
3 Select the required adapter from the SSA Adapter List.

The Adapter Menu window opens:



4 Select **Disk Service Aids** from the Adapter menu.

A list of disk drives is displayed:



In this example, four disk drives are connected between ports A1 and A2 of the adapter, in a loop, in the order shown. No disk drives are connected to ports B1 and B2.

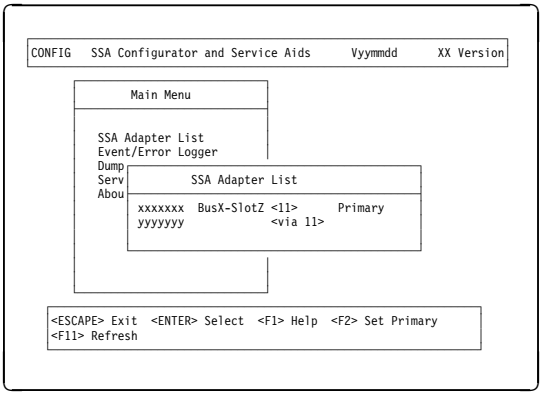
If a dashed line appears in the list of disk drives, the loop is broken at that point.

Viewing Resources and Their Attributes

1 Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).

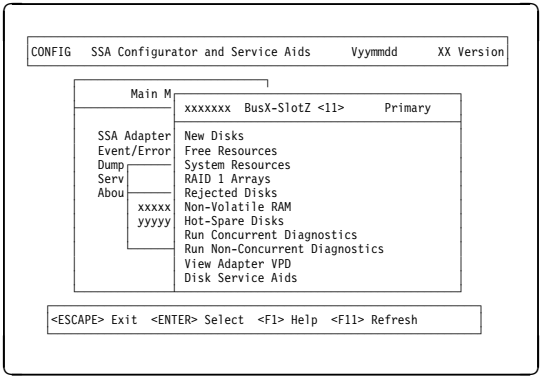
2 From the Main menu, select **SSA Adapter List**.

The SSA Adapter List window opens:



3 Select the required adapter from the SSA Adapter List.

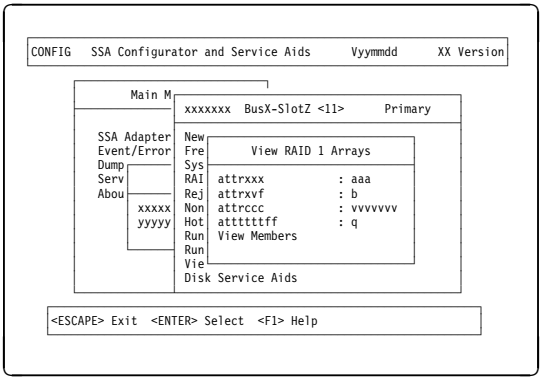
The Adapter Menu window opens:



4 Select one of the following:

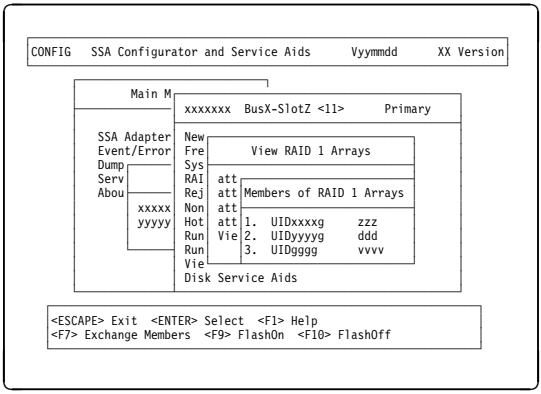
- New Disks
- Free Resources
- System Resources
- RAID 1 Arrays
- Rejected Disks

5 If, for example, you selected a RAID 1 array, the attributes of that array are displayed:



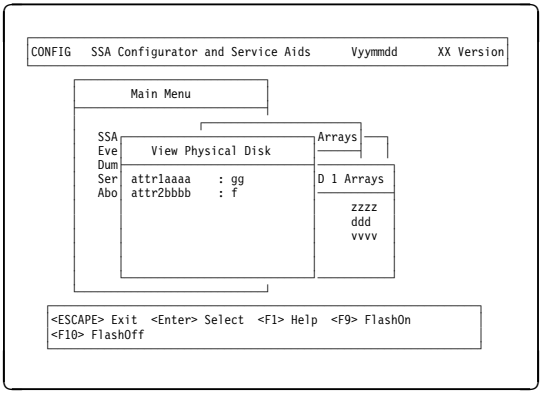
You can scroll through the attributes by using the arrow keys.

6 If you select **View Members** from the View RAID 1 Arrays window, a list of member disk drives is displayed:



If you select a member disk drive, the attributes of that member disk drive are displayed.

If, from your selected resource list, you select a disk drive that is not a member of an array, the View Physical Disk window appears immediately:

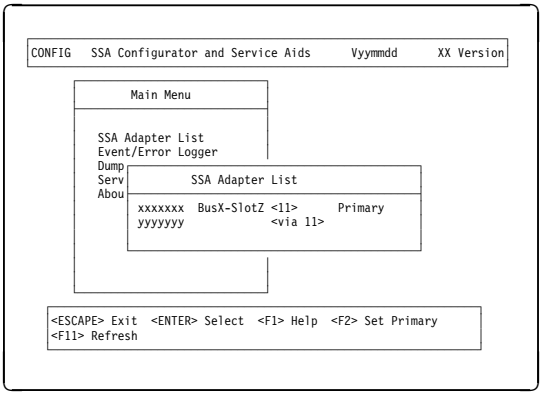


Modifying Attributes of Resources

1 Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).

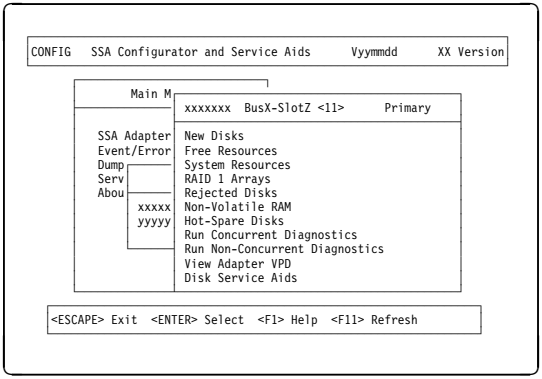
2 From the Main menu, select **SSA Adapter List**.

The SSA Adapter List window opens:



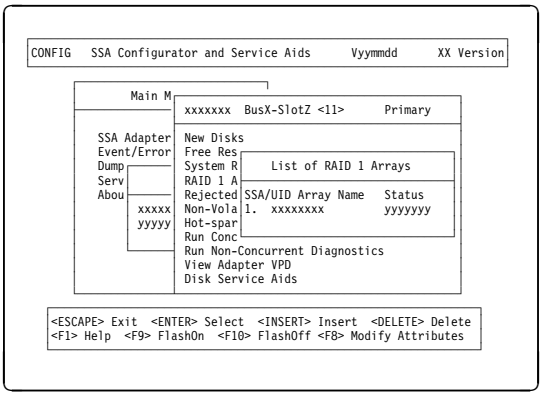
3 Select the required adapter from the SSA Adapter List.

The Adapter Menu window opens:



4 Select **RAID 1 Arrays** from the Adapter menu.

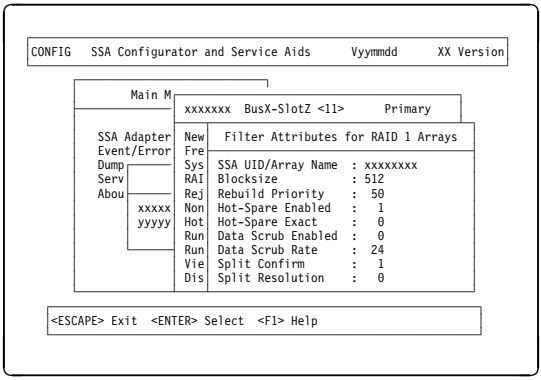
A list of system resources is displayed:



5 Select the array whose attributes you want to change.

6 Press F8 (Modify Attributes).

A list of attributes is displayed:



This screen allows you to modify the attributes for the array. When you press Enter, the cursor moves to the next changeable attribute in the list. When you press Enter on the final changeable attribute, a list of components for the array is displayed.

7 If you need information about the attributes, press F1 for a detailed description of each attribute.

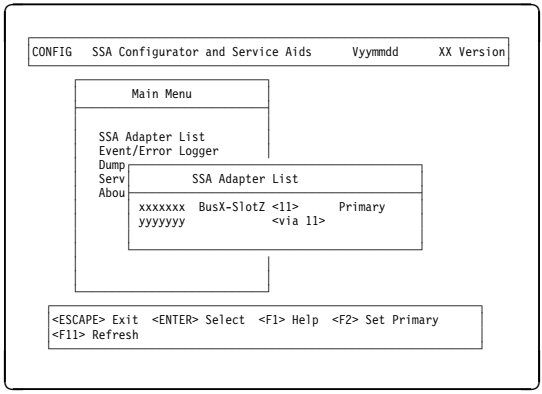
Removing a Disk Drive from an Array

This option allows you to remove a disk drive from an array so that you can install a replacement disk drive. Use this option when you do not have either an available online disk drive, or a spare slot for a replacement disk drive.

1 Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).

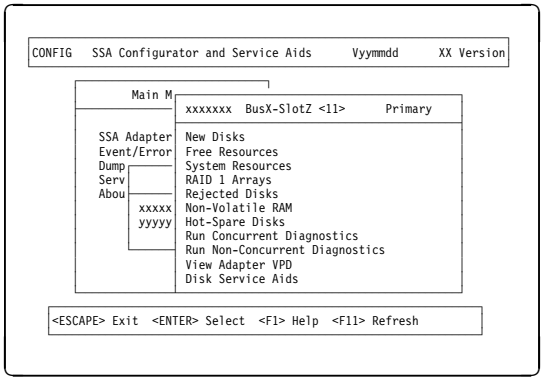
2 From the Main menu, select **SSA Adapter List**.

The SSA Adapter List window opens:



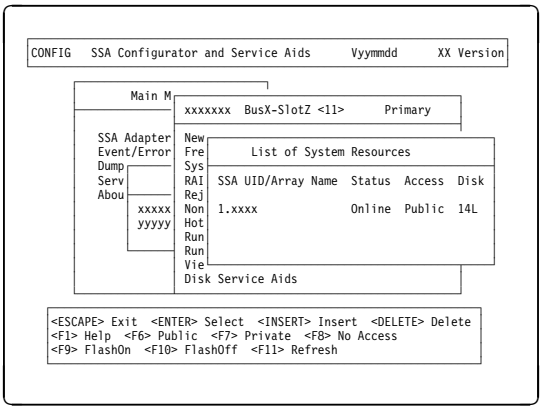
3 Select the required adapter from the SSA Adapter List.

The Adapter Menu window opens:



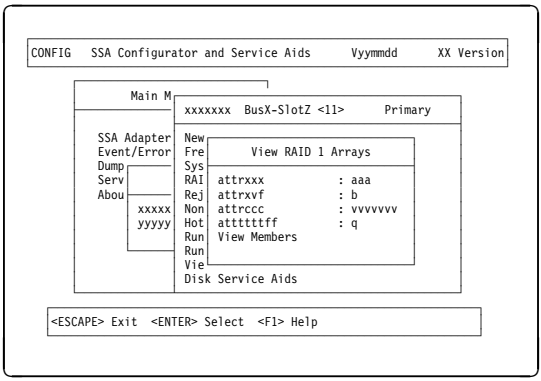
4 Select **System Resources** from the Adapter menu.

A list of system resources is displayed:



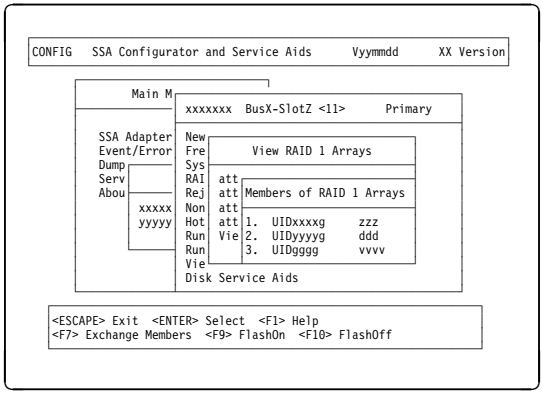
5 Select the array from which you want to remove a disk drive.

The View RAID 1 Arrays window is displayed:



6 Select **View Members** from the View RAID 1 Arrays window.

A list of member disk drives is displayed:



7 Select the disk drive that you want to remove, and use the Identify function to find the disk drive. To start the Identify function, press F9 (FlashOn); the Check light flashes on the selected disk drive. To end the Identify function, press F10 (FlashOff).

8 Press F7 (Exchange Members).

9 Select **Blank Reserved**.

The selected disk drive has now been removed from the array, and replaced by a blank virtual disk).

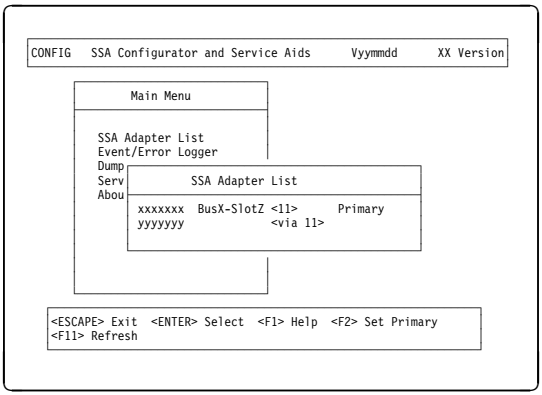
10 Physically remove the disk drive (see the unit *Hardware Maintenance Manual*).

Adding a Disk Drive to an Array

This option allows you to install a replacement disk drive into an array that is running in the Exposed or Degraded state, because you have removed a disk drive. When you install the replacement disk drive, all the data that was contained on the original disk drive is automatically written to the replacement disk drive.

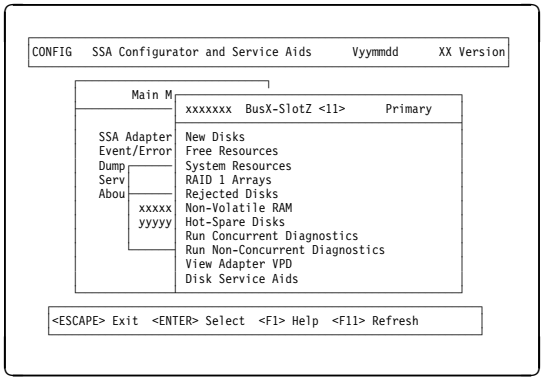
1. Physically install the disk drive (see the unit *Hardware Maintenance Manual*).
2. Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).
3. From the Main menu, select **SSA Adapter List**.

   The SSA Adapter List window opens:



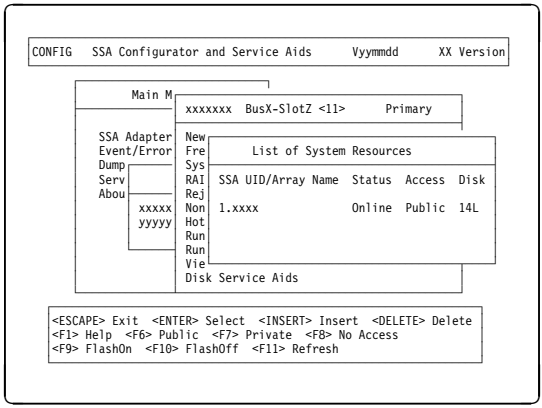
4 Select the required adapter from the SSA Adapter List.

5 The Adapter Menu window opens:



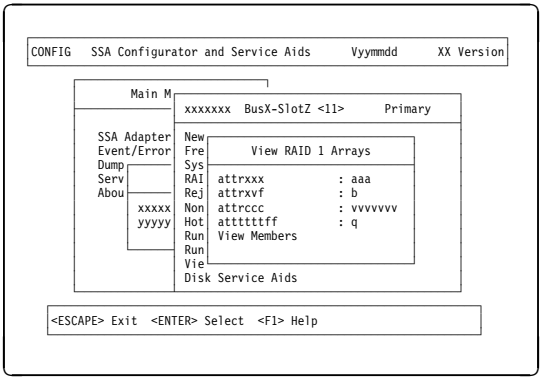
6 Select **System Resources** from the Adapter menu.

A list of system resources is displayed:



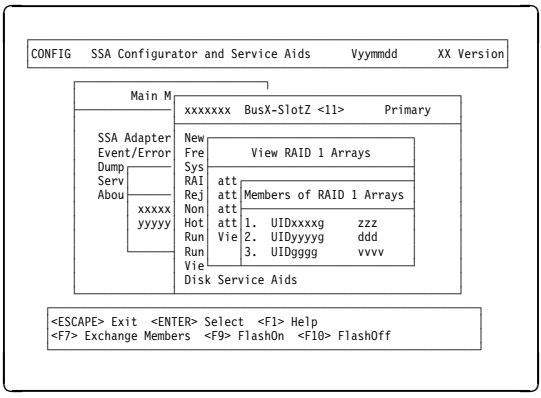
7 Select the array to which you want to add a disk drive.

The View RAID 1 Arrays window is displayed:



8 Select **View Members** from the View RAID 1 Arrays window.

A list of member disk drives is displayed:



9 Select **Not Present (Blank Slot)**.

10 Press F7 (Exchange Members). A list of candidate disk drives is displayed.

11 Select the disk drive that you want to add to the array.

12 Press Enter. The selected disk drive is added to the array.

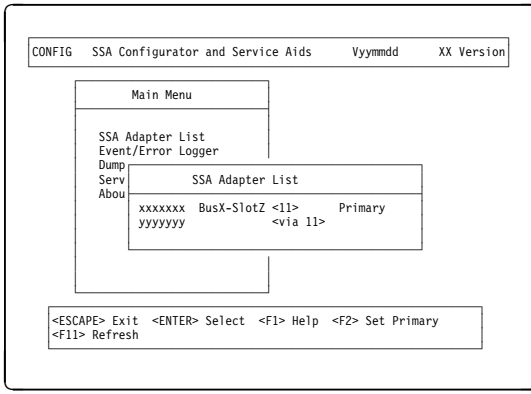
Listing the Disk Drives in an Array

This option allows you to list the disk drives that are contained in a particular array.

1 Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).

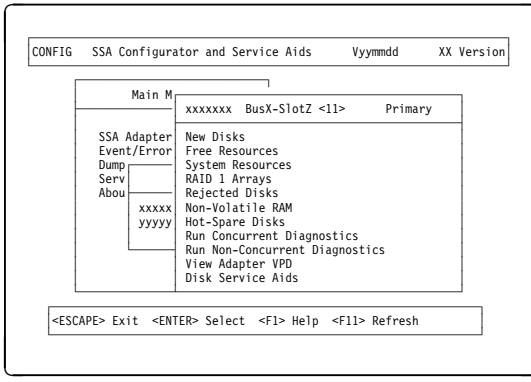
2 From the Main menu, select **SSA Adapter List**.

The SSA Adapter List window opens:

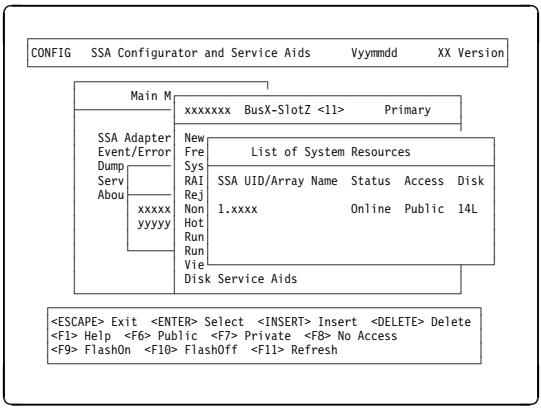


3 Select the required adapter from the SSA Adapter List.

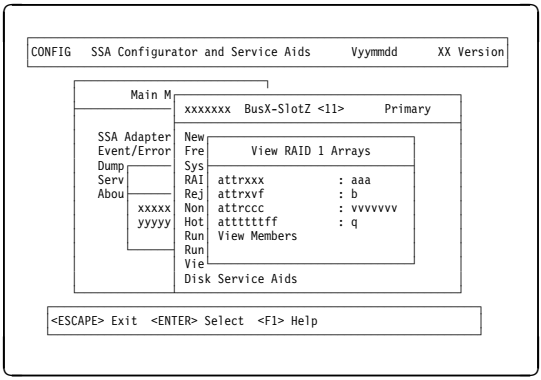
The Adapter Menu window opens:



4 Select **System Resources** from the Adapter menu.
A list of system resources is displayed:

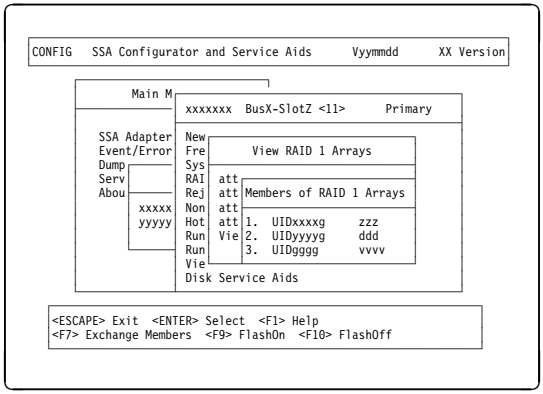


5 Select the array whose disk drives you want to list.
The View RAID 1 Arrays window is displayed:



6 Select **View Members** from the View RAID 1 Arrays window.

A list of member disk drives is displayed:

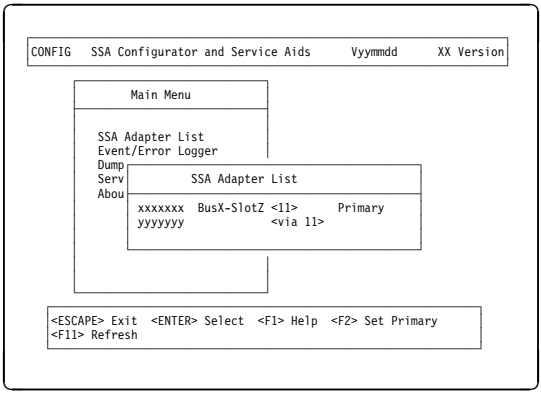


Listing Hot Spare Disk Drives

1 Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).

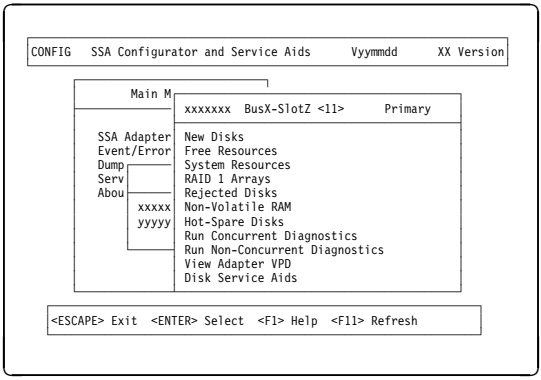
2 From the Main menu, select **SSA Adapter List**.

The SSA Adapter List window opens:



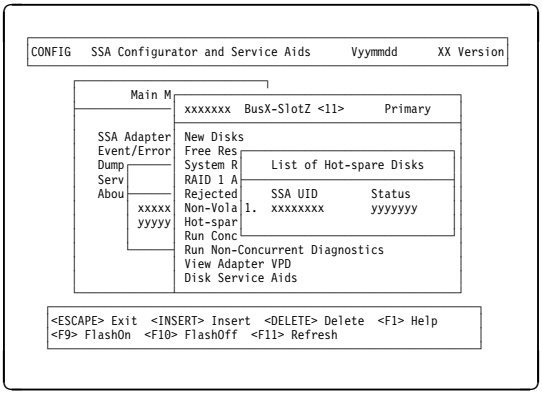
3 Select the required adapter from the SSA Adapter List.

The Adapter Menu window opens:



4 Select **Hot-spare Disk**.

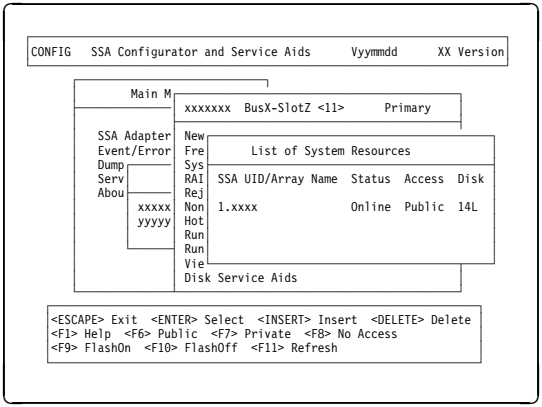
A list of hot spare disk drives is displayed:



5 To check whether a particular array is enabled for hot spare disk drives:

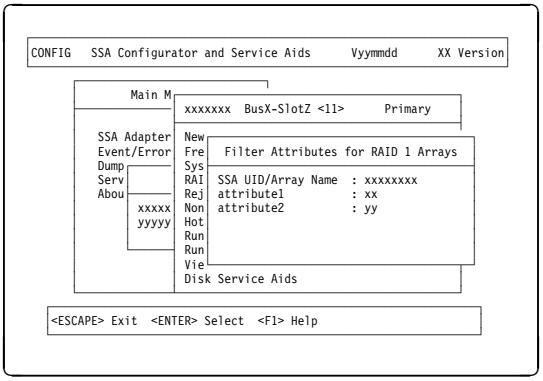
a. From the Adapter menu, select **System Resources**.

A list of system resources is displayed:



b. Select the array.

The attributes for the array are displayed:

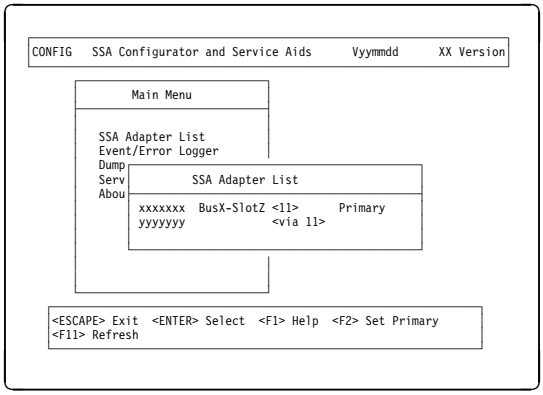


Listing or Deleting Records of Old Arrays in the NVRAM

If an array becomes disconnected from a RAID manager by some method other than the method described in “Deleting a Resource from the System Resource List” on page 67, a record of that array remains in the nonvolatile random access memory (NVRAM). The record must be deleted manually. This option allows you to list the names of such arrays, and to delete the records of those arrays.

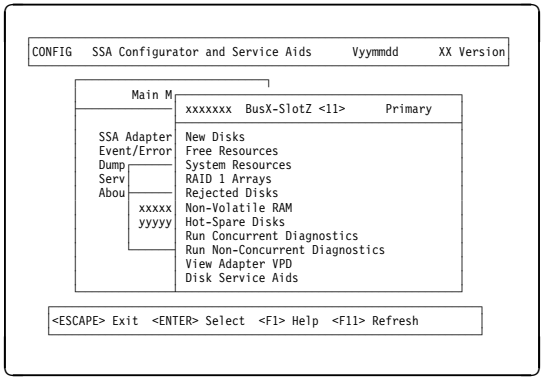
1. Start the SSA Configurator and Service Aids Utility (see “Starting the SSA Configurator Functions” on page 51).
2. From the Main menu, select **SSA Adapter List**.

   The SSA Adapter List window opens:



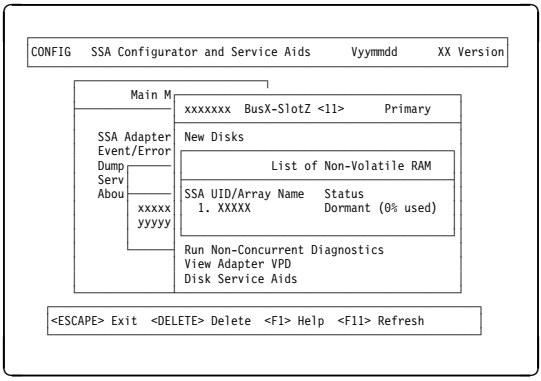
3. Select the required adapter from the SSA Adapter List.

   The Adapter Menu window opens:



4 Select the adapter whose records you are checking.

5 Select **Non-Volatile RAM**. A list of arrays is displayed:



6 An array name that has a status of “Dormant”, is a record of an array that is no longer present, and is not recognized by the adapter.

Press the Delete key to remove the record from the NVRAM.

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