Intel® RAID Controller SRCU32 User's Guide

Disclaimer

Contents

Figures

Tables

1 Introduction and General Information

Intended Audience

To use this product you should have experience in configuring computer equipment. You should be able to install and configure the operating system (OS) to recognize peripherals and you should be able to use software utilities to configure and troubleshoot those installed components. Be sure that you are familiar with the installation and setup of the OS that you are installing. For detailed OS installation procedures, consult the documentation that came with the OS.

Read and adhere to all warnings, cautions, and notices in this guide and the other documents in the user documentation set supplied with this product. Read and adhere to the computer system safety installation instructions.

RAID Levels

RAID 0 - Data Striping

Data blocks are split into stripes based on the adjusted stripe size (for example, 128 KB) and the number of hard drives. Each stripe is stored on a separate hard drive. Significant improvement of the data throughput is achieved using this RAID level, especially with sequential read and write. RAID 0 (Figure 1) includes no redundancy. When one hard drive fails, all data is lost. RAID 0 requires a minimum of two disks.
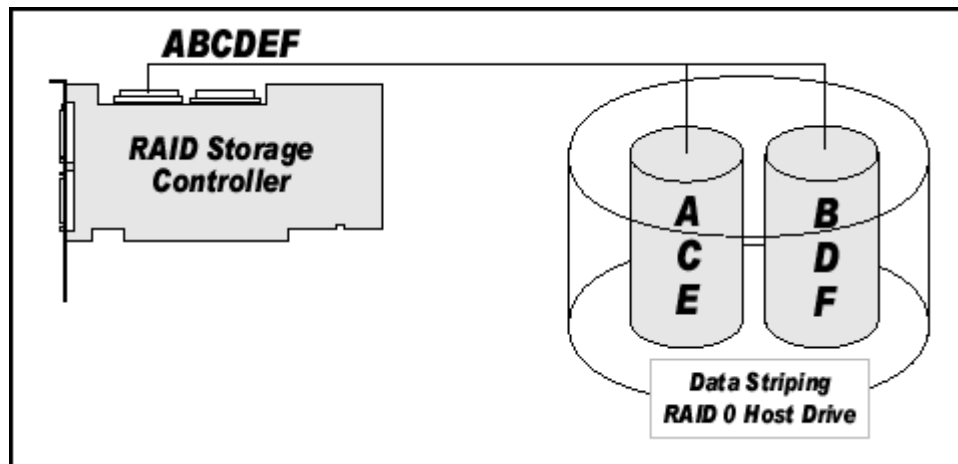
Figure 1. RAID 0 – Data Striping

RAID 1 - Disk Mirroring/Disk Duplexing

All data is stored twice on two identical hard drives. When one hard drive fails, all data is immediately available on the other without any impact on performance and data integrity.

With Disk Mirroring (Figure 2) two hard drives are mirrored on one I/O channel. If each hard drive is connected to a separate I/O channel, it is called Disk Duplexing (Figure 3).

RAID 1 represents an easy and highly efficient solution for data security and system availability. It is especially suitable for installations that are not too large (the available capacity is only half of the installed capacity). RAID 1 requires a minimum of two disks.
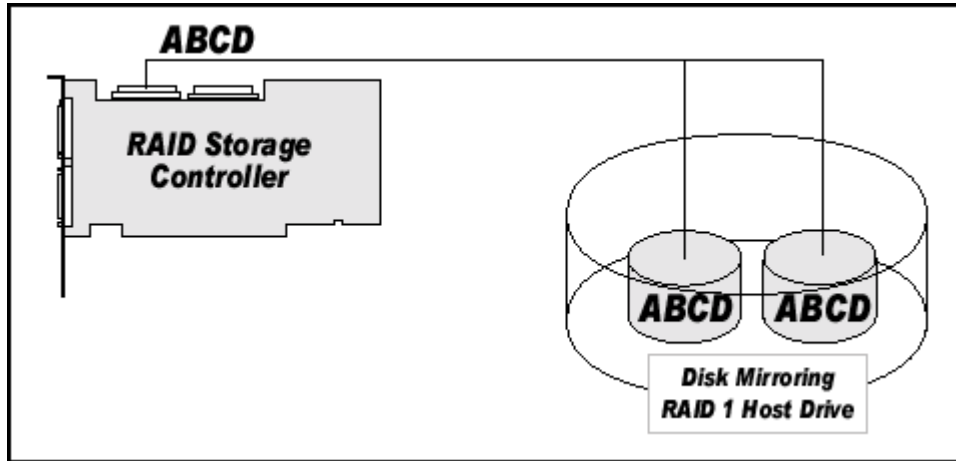
Figure 2. RAID 1 – Disk Mirroring
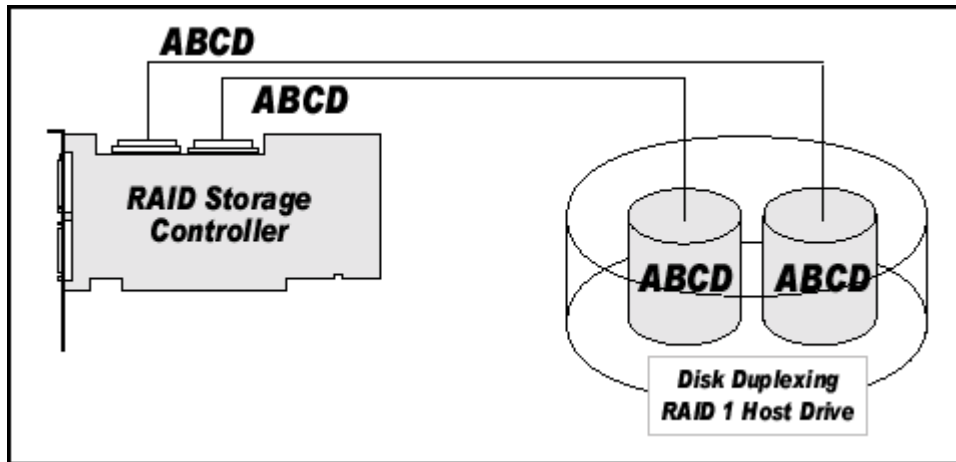
Figure 3. RAID 1 – Disk Duplexing

RAID 4 - Data Striping with a Dedicated Parity Drive

RAID 4 (Figure 4) works in the same way as RAID 0. The data is striped across the hard drives and the controller calculates redundancy data (parity information) that is stored on a separate hard drive (P1, P2). Should one hard drive fail, all data remains fully available. Missing data is recalculated from existing data and parity information.

Unlike in RAID 1 only the capacity of one hard drive is needed for redundancy. For example, in a RAID 4 disk array with five hard drives, 80% of the installed hard drive capacity is available as user capacity, only 20% is used for redundancy. In systems with many small data blocks, the parity hard drive becomes a throughput bottleneck. With large data blocks, RAID 4 shows significantly improved performance. RAID 4 requires a minimum of three disks.
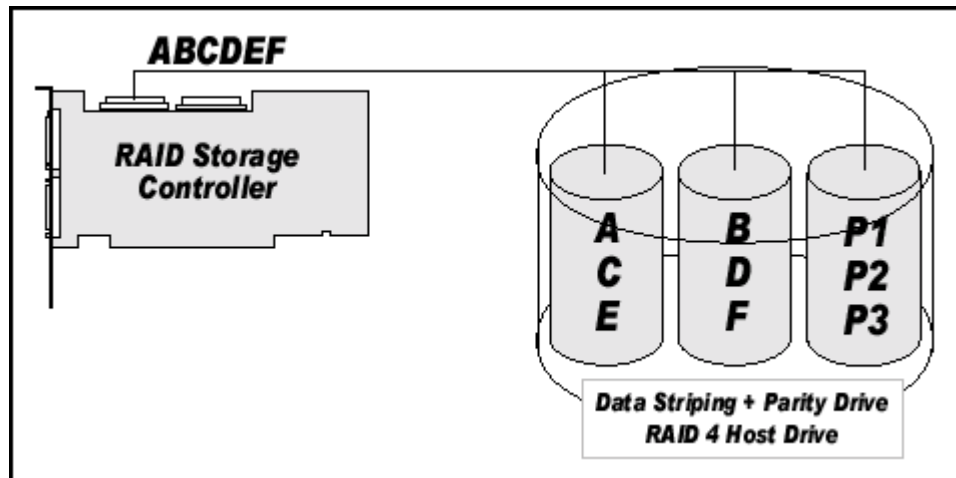
Figure 4. RAID 4

RAID 5 - Data Striping with Striped Parity

Unlike RAID 4, the parity data in a RAID 5 disk array are striped across all hard drives (Figure 5). The RAID 5 disk array delivers a balanced throughput. Even with small data blocks, which are very likely in a multi-tasking and multi-user environment, the response time is very good. RAID 5 offers the same level of security as RAID 4. When one hard drive fails, all data is still fully available. Missing data is recalculated from the existing data and parity information. RAID 4 and RAID 5 are particularly suitable for systems with medium to large capacity requirements, due to their efficient ratio of installed and available capacity. RAID 5 requires a minimum of three disks.
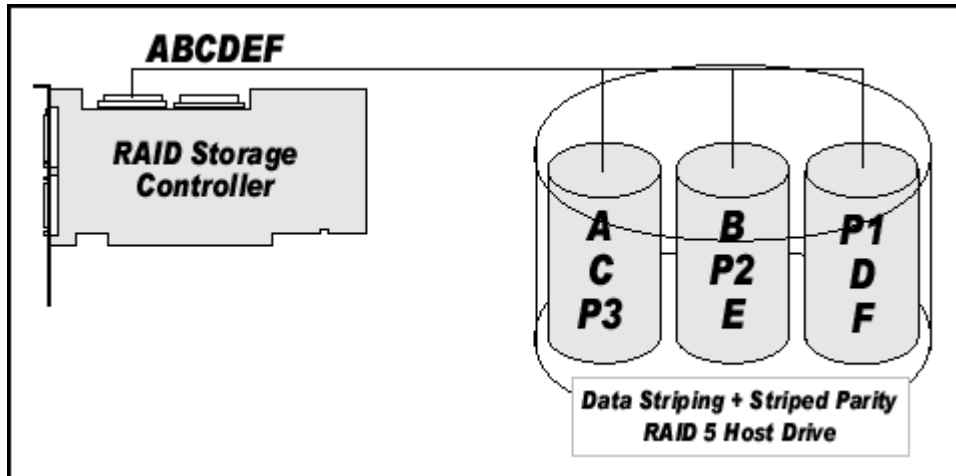
Figure 5. RAID 5

RAID 10 - Combination of RAID 1 and RAID 0

RAID 10 is a combination of RAID 0 (Performance) and RAID 1 (Data Security). Unlike RAID 4 and RAID 5, there is no need to calculate parity information. RAID 10 disk arrays offer good performance and data security (Figure 6). As in RAID 0, optimum performance is achieved in highly sequential load situations. Identical to RAID 1, 50% of the installed capacity is lost through redundancy. RAID 10 requires a minimum of four disks.
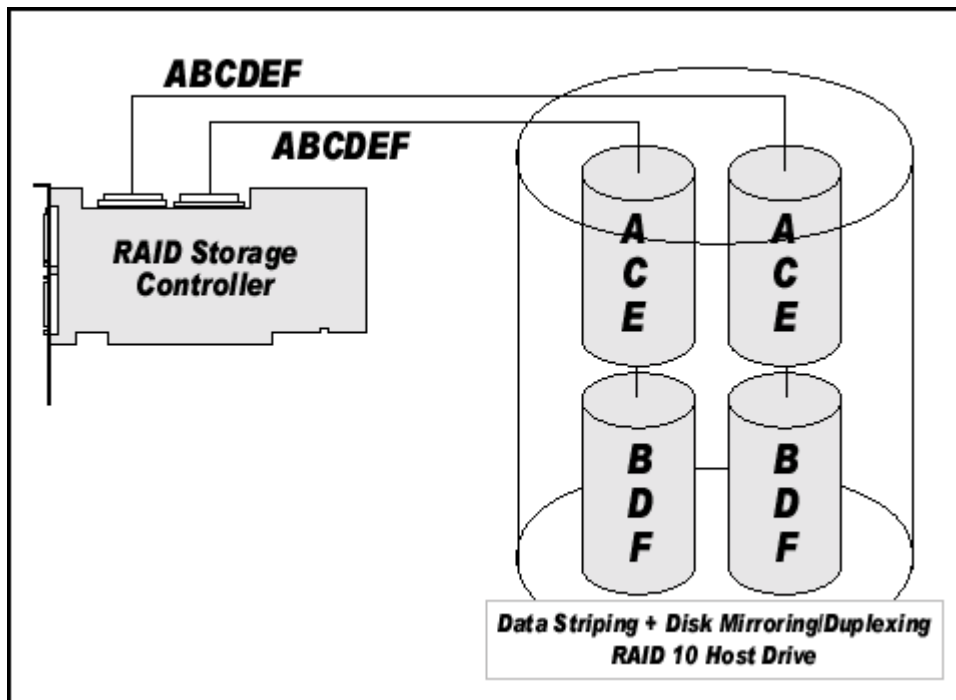
Figure 6. RAID 10

Chaining

The Intel RAID Controller SRCU32 firmware supports Drive Chaining (also referred to as Disk Spanning). Drive Chaining is the process of linking several individual drives to form a large single drive. Chaining is only available after having selected two or more drives in the Storage Console (StorCon) or Storage Console Plus (StorCon+). Chaining is an inexpensive method to obtain a large logical unit from many smaller hard drives.

⚠ WARNING

Disk Chaining does not offer any form of data protection and can result in loss of data. It is therefore recommended not to use logical drives of the type chain as components of array drives.

Configuring a Chaining Set Using StorCon

1. Select "Create New Host Drive."

2. Select two or more drives.

3. Select "Chaining."

Configuring a Chaining Set Using StorCon+

1. Click the "New host drive" icon.

2. Select "Configuration," "Host Drive," and "Create New." A new host drive window appears.

3. Select a drive(s) using <Shift> and arrow keys. Chaining is grayed out before selecting two drives and is available after selecting two drives.

4. Select "Chaining" and press <Enter>.

The System will configure the chain set that is now a logical drive.

Levels of Drive Hierarchy Within the Intel® RAID Controller SRCU32 Firmware

The Intel® RAID Controller SRCU32 firmware is based on four fundamental levels of hierarchy. Each level has its own drives (components). The basic rule is to build up a drive on a given level of hierarchy. The drives of the next lower level of hierarchy are used as components.

Level 1

Physical drives are hard drives and removable hard drives. Some Magneto Optical (MO) drives are located on the lowest level. Physical drives are the basic components of all "drive constructions." However, before they can be used by the firmware, these hard drives must be "prepared" through a procedure called initialization. During this initialization each hard drive receives information, which allows an univocal identification even if the SCSI ID or the controller is changed. For reasons of data coherency, this information is extremely important for any drive construction consisting of more than one physical drive.

Level 2

On the next higher level are the logical drives. Logical drives are introduced to obtain full independence of the physical coordinates of a physical device. This is necessary to easily change the Intel RAID Controller SRCU32 and the channels, IDs, without loosing the data and the information on a specific disk array.

Level 3

On this level of hierarchy, the firmware forms the array drives. Depending on the firmware installed an array drive can be:

- Single Disks: one disk or a JBOD (just a bunch of drives)
- Chaining sets (concatenation of several hard drives)
- RAID 0 array drives
- RAID 1 array drives, RAID 1 array drives plus a hot fix drive
- RAID 4 array drives, RAID 4 array drives plus a hot fix drive
- RAID 5 array drives, RAID 5 array drives plus a hot fix drive
- RAID 10 array drives, RAID 10 array drives plus a hot fix drive

Level 4

On level 4, the firmware forms the host drives. Only these drives can be accessed by the host operating system of the computer. The firmware automatically transforms each newly installed logical drive and array drive into a host drive. This host drive is then assigned a host drive number which is identical to its logical drive or array drive number.

The firmware is capable of running several kinds of host drives at the same time. For example, in Windows[†] 2000, drive C is a RAID 5 type host drive (consisting of five SCSI hard drives), drive D is a single hard drive. On this level the user may split an existing array drive into several host drives.

After a capacity expansion of a given array drive the added capacity appears as a new host drive on this level. It can be either used as a separate host drive, or merged with the first host drive of the array drive. Within StorCon, each level of hierarchy has its own menu:

Level 1 - Configure Physical Devices

Level 2 - Configure Logical Drives

Level 3 - Configure Array Drives

Level 4 - Configure Host Drives

Generally, each installation procedure passes through these four menus, starting with level 1. Installation includes the initializing the physical drives, configuring the logical drives, configuring the array drives (for example, RAID 0, 1, 4, 5, and 10) and configuring the host drives.

Transparency of Host Drives

The structure of the host drives installed with StorCon (see Chapter 7, Storage Console) is not known to the operating system. For example, the operating system does not recognize that a given host drive consists of a number of hard drives forming a disk array.

To the operating system this host drive simply appears as one single hard drive with the capacity of the disk array. This complete transparency represents the easiest way to operate disk arrays under the operating system. Neither operating system nor the PCI computer need to be involved in the administration of these complex disk array configurations.

Using CD-ROMs, DATs, Tapes, etc.

A SCSI device that is not a SCSI hard drive or a removable hard drive, or that does not behave like one, is called a Non-Direct Access Device. Such a device is not configured with StorCon and does not become a logical drive or host drive. SCSI devices of this kind are either operated through the Advanced SCSI programming Interface (ASPI) (MS-DOS[†], Windows, Novell NetWare[†] or OS/2[†]), or are directly accessed from the operating system (UNIX[†], Windows NT[†]).

⇒ **NOTE**

Hard disks and removable hard disks are called Direct Access Devices. However, there are some Non-Direct Access Devices, for example, certain MO drive that can be operated just like removable hard disks if they have been appropriately configured (for example, by changing their jumper settings).

2 Getting Started

What is the Intel RAID Controller SRCU32 Firmware?

We refer to firmware as the operating system that controls the Intel RAID Controller SRCU32 with all of its functions and capabilities. The firmware exclusively runs on the Intel RAID Controller SRCU32 and is stored in the Flash-RAM on the Intel RAID Controller SRCU32 PCB. The controlling function is entirely independent of the PCI computer and the host operating system, and does not drain computing power or time from the PCI computer. According to the system requirements needed, the Intel RAID Controller SRCU32 is available with two firmware variants. The firmware is either already installed on the controller upon delivery, or can be added as an upgrade.

Unlike pure software solutions, for example, for Windows NT, the Intel RAID Controller SRCU32 is a pure hardware RAID solution. All Intel RAID Controllers are equipped with hardware that is well suited for disk arrays. The Intel RAID Controller SRCU32 firmware uses this hardware with efficiency and therefore allows you to configure disk arrays that do not load the host computer (whereas all software-based RAID solutions more or less reduce the overall performance of the host computer).

The basic concept of the Intel RAID Controller SRCU32 firmware is strictly modular, and consequently, in its functioning it appears to the user as a unit construction system.

Standard Firmware

In addition to simple controlling functions regarding SCSI hard drives or removable hard drives, this version of firmware supports disk chaining and array drive configuration (data striping (RAID 0) and disk mirroring or duplexing (RAID 1)).

⚠ WARNING

Disk Chaining does not offer any form of data protection and can result in loss of data. It is therefore recommended not to use logical drives of the type chain as components of array drives.

RAID Hardware Installation and Setup

⟹ **NOTE**

The Intel RAID Controller SRCU32 will work in a 32-bit, 33 or 64 MHz PCI slot; however, a 64-bit 66 MHz slot is recommended for maximum performance.

Minimum Hardware Requirements

- Computer with CD-ROM drive (not attached to the Intel RAID Controller SRCU32). Computer must be on the supported hardware list. For a supported list refer to: *http://support.intel.com/support/motherboards/server/*
- One available PCI slot. *See Note above.*
- PCI 2.2 compliant System BIOS.
- SCSI hard drive(s) (the minimum required to meet the desired RAID level).

Installing and Removing the SDRAM

Installing the SDRAM

1. With clips A1 and A2 (see Figure 7) in the open position (position 2), insert the DIMM into the DIMM connector (the DIMM and connector are keyed to ensure proper insertion).

⚠ **CAUTION**

Align the DIMM carefully to prevent damaging the conductor pads on the DIMM orthe connector. Apply firm pressure but do not force.

2. With the thumbs positioned on each end of the DIMM and two fingers on the DIMM connector, press the thumb and fingers firmly together until the DIMM clips snap into the close position (position 1).

Removing the SDRAM

1. With the thumbs on the DIMM clips, swing the clips from the close position to the open position.

2. Grasp the corners of the DIMM with both hands and firmly pull from the DIMM connector.
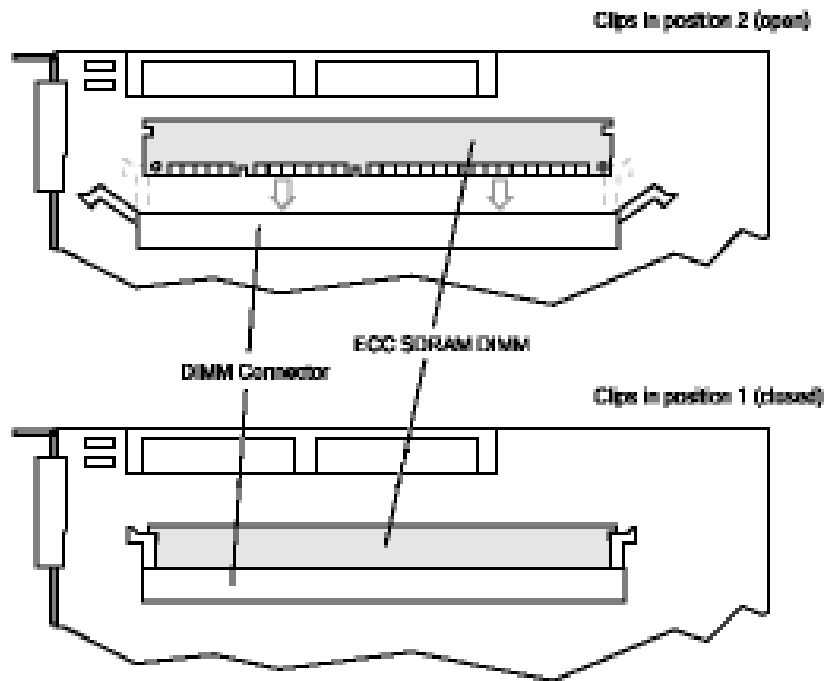
Figure 7. Installing the SDRAM

Install the Intel RAID Controller SRCU32 in the Intel® Server Board

The RAID firmware has already been programmed into the memory. Prior to installing the Intel RAID Controller SRCU32 into the computer, an approved memory module must be installed in the controller. For a list of approved memory modules refer to:
http://support.intel.com/support/motherboards/server/

⚠ CAUTION

Contact the RAID vendor for a list of approved memory modules.

⚠ WARNING

SHOCK HAZARDS may be present inside the unit in which this card is being installed. Disconnect all power cords to the unit before removal of any covers. Follow the warnings noted in the computer's user or service manual before installing this board. ONLY after all the covers are reinstalled should you reattach the power cords and power up the unit for the software installation and use.

⇒ NOTE

Take precautions to prevent electrostatic discharge (ESD) damage before handling the Intel RAID Controller SRCU32.

Install the Intel RAID Controller SRCU32 into an available PCI slot. Refer to the board documentation for details.

1. Shut down and power-off the computer system.

2. Disconnect power cord(s) and remove the system cover.

3. Insert the Intel RAID controller into an available PCI slot.

4. Connect one end of the SCSI cable to the internal (68 pin) or external (VHDCI) SCSI connector located on the SRCU32 Controller. Connect the other end of the SCSI cable to the SCSI drives or drive enclosure.

5. Replace the system cover; reconnect power cord(s).

Programming the FLASH Memory

The Intel RAID Controller SRCU32 normally comes ready to be immediately installed into the computer server board. However, you may need to reprogram the RAID Firmware that's located in the flash memory of the Intel RAID Controller SRCU32. Refer to section 11 Appendix Firmware Update for a normal reprogram of the firmware.

SCSI Termination

Termination

Termination is a commonly overlooked requirement when connecting SCSI devices together. When these devices are connected together, the resulting set of devices is typically referred to as a SCSI bus. SCSI devices such as hard drives and tape drives must be terminated if they are the last physical devices at either end of the SCSI bus (if nothing else is actively terminating the end of the bus such as a terminator or backplane). If a device is inserted into the middle of the SCSI bus, then it (the device itself) should not be terminated. Only terminate each end of the bus.

Setting the Termination Mode of the Intel RAID Controller SRCU32

The onboard termination of the RAID controller can be changed within Storage Console. The default setting is "Auto" (jumpers in 'Soft-Switch mode). In this mode, the controller automatically activates/ deactivates termination based on cable connection (if internal and external connectors are used of a specific channel then the termination is off, otherwise on). "On", "Off" turns the termination on or off regardless of the connected cables. In addition to the "soft-switch" jumper setting, termination jumpers force termination always ON or OFF - no matter of the software settings or cables detected.

CH-A CH-B

Termination
via Soft-Switches
(Default)

CH-A CH-B

Termination
always ON

CH-A CH-B

Termination
always OFF
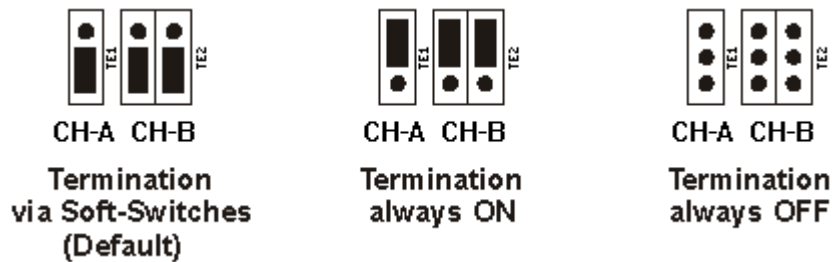
Configurable SCSI Parameters

When a SCSI hard drive is initialized the first time by the RAID controller, its SCSI parameters are automatically set to their optimal settings. Manual configuration is not required. However, the RAID controller allows for the custom configuration of several SCSI parameters on a hard drive-by-hard drive basis. There are several settings that can be configured by using the Storage Console menu Advanced Setup→Configure Physical Devices→Select Physical Drive →SCSI Parameter/Initialize. Most settings are set automatically and cannot be configured manually. See the following table.

Table 1.   Hard Drive SCSI Parameters

Parameter	Setting/Value	Description
Synch. Transfer	Not Configurable	This setting, when enabled, allows the controller to operate in synchronous transfer mode.
Synch. Transfer Rate	Not Configurable	Allows for the setting of the speed for the SCSI hard drives (160 MB/sec for U160 drives). No matter the setting, the SCSI bus will negotiate the fastest speed up to this setting. Lowering the setting will force the hard drive to transfer at the lower speed.
Disconnect	Not Configurable	Enabling this setting allows for the hard drive to disconnect from the SCSI bus when it's not participating in a transfer. This allows for optimal bus utilization by all devices on the bus.

(continued)

Table 1.   Hard Drive SCSI Parameters (continued)

Parameter	Setting/Value	Description
Tagged Queues	Not Configurable	When enabled, this feature allows the SCSI hard drive to execute more than one command at a time.
Disk Read and Write Cache	On / Off	For performance reasons, the Read Ahead and Write cache of the hard drives should always be on.
Domain Validation	Not Configurable	Using the <F4> key while in this menu accesses this parameter. When Domain Validation is set to *On*, Domain validation allows for a cyclical check of the correct data transfer at a given rate.

Choosing a Configuration

How Many Hard Drives Should Be Integrated Into the Disk Array?

The number of physical drives the Intel RAID Controller SRCU32 can run determines the maximum number of physical drives in a disk array. The minimum number of hard drives required for any array depends of the RAID level you wish to realize. The desired usable disk space of the disk array as well as the issues discussed in the following sections (What Level of Redundancy is Needed and Are Hot Fix Drives Needed) have a direct impact on the number of physical hard drives needed for an array.

Table 2.   RAID Level, Array Type, and Hard Drive Requirements

RAID Level	Disk Array Type	Minimum Number of Hard Drives Required
RAID 0	Data Striping	2
RAID 1	Disk Mirroring	2
RAID 4	Data Striping with Parity Drive	3
RAID 5	Data Striping with Striped Parity	3
RAID 10	Data Striping and Mirroring	4

What Level of Redundancy is Needed?

RAID 0 (data striping) provides no redundancy but has high data throughput. With RAID 1 (disk mirroring) the data is 100% redundant because it is mirrored on other SCSI hard drives. RAID 1 provides the highest level of redundancy, but is also the most expensive solution. A combination of RAID levels 0 and 1 is RAID 10. Two RAID 0 stripe sets are mirrored. If one drive fails, the data is available on the mirrored drive.

With RAID 4 (data striping with a dedicated parity drive) and RAID 5 (data striping with parity striped across all RAID disks), parity information is calculated from the data with a simple mathematical operation (eXclusive OR, XOR), and stored either on one dedicated drive (RAID 4) or to all drives (RAID 5). Should one drive fail, the data of the defective drive can be reconstructed using the remaining user data and the previously calculated parity data. RAID levels 4, 5 and 10 can tolerate the failure of one drive just as RAID 1, however RAID 4, RAID 5, or RAID 10 are less expensive because of their efficient ratio of available to installed capacity.

Table 3.   RAID Level, Hard Drives, and Usable Storage Capacity

RAID Level	Available Capacity with 2 Hard Drives*	Available Capacity with 3 Hard Drives*	Available Capacity with 4 Hard Drives*	Available Capacity with 5 Hard Drives*
RAID 0	2 GB	3 GB	4 GB	5 GB
RAID 1	1 GB	1 GB	1 GB	1 GB
RAID 4	NA	2 GB	3 GB	4 GB
RAID 5	NA	2 GB	3 GB	4 GB
RAID 10	NA	NA	2 GB	NA

* Each hard drive is assumed to have 1 GB capacity.

Are Hot Fix Drives Needed?

Assume that one of the hard drives of the RAID 5 disk array fails (Hot Fix drives are available with RAID 1, 4, 5, and 10 arrays). The disk array is without redundancy. Time Without Redundancy (TWR) starts to run. Any unnecessary prolongation of the TWR (the time required to get a replacement drive, or because you did not immediately recognize the failure) increases the risk of data loss that will occur should a second drive fail. Therefore, redundancy should be restored as soon as possible and in an automated manner. Integrating a Hot Fix drive (also referred to as hot spare) as an immediately available and auto-replacing drive is the most effective way to keep the TWR as short as possible. Only a Hot Fix drive can ensure optimal disk array security and constant data availability.

Using a Hot Fix drive is not compulsory. If you control the disk array at regular intervals and immediately replace a defective drive (by shutting down the system or hot-plugging), you can operate the system without a Hot Fix drive.

Intel RAID Controller Hardware Features

This section provides a summary of the key features, configuration options and support interface technology supported by the IIR controller.

Architecture Features (HW)

Table 4.   Hardware Architecture

Component	Feature
I/O Microprocessor	The 80303 uses the 100MHz Intel 80960JT-100 core with a 100MHz/64-bit internal bus with an internal throughput of up to 800MB/sec, to and from the internal IOP peripherals.
Cache Memory	The SRCU32 supports up to 256MB of 64-bit ECC SDRAM operating at 100MHz. Memory is expandable to 64, 128, or 256MB.
Flash Memory	3.3v, 16Mb (2MB) flash memory chip is used to store the RAID firmware
I/O interface (PCI)	PCI 2.2 compliant, universally keyed for 3.3 and 5 volt PCI slots
PCI Transfer Rate	528MB/sec (Burst)
PCI Signaling	5 or 3.3 volt
SCSI Controller: LSI SYM53C1010	Dual channel Ultra160

Environmental Characteristics

Table 5.   Environmental Specifications

Attribute	Condition
Thermal: Non-Operating	-10° C (Celsius) to 60° C
Humidity: Non-Operating	20% to 75% Relative Humidity, non-condensing
Operating Temperature & Voltage Margin	0° C to 55° C +/- 5% V$_{cc}$
Form Factor (physical dimensions)	Height: 98 mm (3.86 inches)
	Length: 200 mm (7.87 inches)
Weight	.35 kg (.77 lb)

Hard Drive Connectivity (SCSI Specifics)

The RAID adapter supports up to 15 SCSI devices per SCSI channel. It supports up to 15 hard disk drives (or 14 hard disks drives if one of the SCSI ID's is occupied by a SAF-TE processor) per channel of the SCSI controller (30 disk drives total for the dual channel SRCU32 controller).

Supported Hard Drive Technology

The IIR controller supports both Single-ended (SE) and Low Voltage Differential (LVD) devices but it is recommended that you use only one type of drive technology (SE or LVD) on any one channel at a time.

The IIR controller supports single-ended drives which operate at up to 40MB/sec depending upon the speed of the drives attached.

The IIR controller supports Ultra-2 LVD SCSI devices operating at up to 80MB/sec and Ultra160 LVD SCSI devices operating at up to 160MB/sec.

⟹ **NOTE**

If both SE and LVD devices are attached to the same channel/bus, the entire bus will operate at the single-ended speed of the slowest device. See Table 6 for the maximum cable length distances that apply to each mode.

The IIR controller is designed to use Ultra160 SCSI hard drives and is backward compatible with older SCSI hard drive specifications. See Table 6 for the SCSI standards supported.

Table 6.   SCSI Drive Standards

SCSI Drive Standard	Speed (MB/Sec)	Bus Width (Bits)	Maximum Cable Length (meters) [1]		Adapter Maximum Devices per SCSI Channel
			Single-Ended	LVD	
SCSI-1 [2]	5	8	6	[3]	8
Fast SCSI [2]	10	8	3	[3]	8
Fast Wide SCSI	20	16	3	[3]	16
Ultra SCSI [2]	20	8	1.5	[3]	8
Ultra SCSI [2]	20	8	3	N/A	4
Wide Ultra SCSI	40	16	N/A	[3]	16
Wide Ultra SCSI	40	16	1.5	N/A	8
Wide Ultra SCSI	40	16	3	N/A	4
Ultra2 SCSI [2, 4]	40	8	[4]	12	8
Wide Ultra2 [4]	80	16	[4]	12	16
Ultra160 (Ultra3)	160	16	[4]	12	16

Notes:

1. May be exceeded in Point-to-Point and engineered specific applications.

2. Use of the word "Narrow", preceding SCSI, Ultra SCSI, or Ultra2 SCSI (for example, Narrow SCSI) is optional.

3. LVD was not defined in the original SCSI standards for this speed. If all devices on the bus support LVD, then 12-meters operation is possible at this speed. However, if any device on the bus is singled-ended only, then the entire bus switches to single-ended mode and the distances in the single-ended column apply.

4. Single-ended is not defined for speeds beyond Ultra.

After Ultra2 all new speeds are wide only.

Support for Non-Hard-Disk-Drive SCSI Devices (Non-Direct-Access Devices)

The RAID controller will pass through to the host operating system direct access to nondirect-access SCSI devices that are connected to a SCSI bus (channel) of the RAID controller. The RAID controller passes through all control of these devices to the host operating system.

Types of supported non-Direct-Access SCSI devices (this does not cover specific vendors and models):

- SAF-TE Processors
- Tape Devices
- CD-ROMs

Array Roaming Compatibility

Array Roaming allows the user the ability to move a complete RAID array from one computer system to another computer system and preserve the RAID configuration information and user data on that RAID array. Compatible RAID controllers must control the RAID subsystems of the two computer systems (see list of compatible controllers in this section). The transferred RAID array may be brought online while the target server continues to run if the hard disk drives and disk enclosure support hot-plug capabilities. The hard disk drives are not required to have the same SCSI ID in the target system that they did in the original system that they are removed from. The RAID array drive that is being roamed must not be of type Private. This includes all non-private host, array, and logical drives.

⚠ WARNING

The SRCU32 adapter, with firmware 2.33.xx, is not compatible with some previous versions of IIR RAID FW running on IIR controllers. Only the versions listed below are compatible. Do not attempt RAID Array Drive Roaming between RAID controllers that are not compatible with the SRCU32 adapter. Unpredictable behavior may include, but is not limited to, data loss or corruption.

Compatible adapters include:

- SRCU31 - Firmware version 6.2.32.xx   (the 6 will not show on boot)
- SRCU31L - Firmware version 6.2.32.xx (the 6 will not show on boot)
- SRCU32 - Firmware version 2.33.xx
- SRCMR - Firmware version 2.32.xx

⟹ NOTE

Compatibility refers only to how data and RAID configuration information are written to the hard disks. Compatible adapters have the same data file format.

Number of Supported Devices

The Intel RAID Controller SRCU32 supports up to 15 different SCSI devices (single hard drives, drive enclosures, controllers, CD-ROM's, tapes, etc). In certain configurations, this number is reduced.

Example: Up to 14 SCSI devices if a SAF-TE processor occupies one of the SCSI ID's.

SCSI Connectors

The Intel RAID Controller SRCU32 includes two internal SCSI-3 Ultra Wide 68-pin connectors and two external VHDCI (Very High Density Connector Interface) 68-pin connectors. Each connector can be fully populated with up to 15 SCSI devices (not to exceed an additive total of 15 devices per channel when using both he internal and external connector for the channel) as long as cable length limitations for each segment are not exceeded.

LED Indicators

There are a number of LED indicators on the RAID controller that indicate the various modes and/or states of the controller.

Function Check

Indicates the activity on the controller. See Table 7 for detail.

Table 7. Function Check

LED	Function
A	Indicates activity on SCSI channel A
B	Indicates activity on SCSI channel B
T	Indicates Bus Master DMA transfers (the brighter the light, the more DMA's)
S	When system is powered, indicates that controller is online (i.e. installed correctly)

Channel Mode

A yellow LED for each Ultra160 SCSI channel, indicates the current SCSI mode of the corresponding channel. If the LED is lit, the Ultra160 SCSI channel is operating in Low Voltage Differential (LVD) mode. If the LED is not lit, this channel is operating in Single-Ended (SE) mode.

PCI Bus Clock

Indicates the clock speed of the PCI Bus interface. If the LED is not lit, the bus speed in 33MHz. If the LED is lit, the bus speed is 66MHz.

Jumpers

In addition to the Termination Jumpers (described earlier in this document), the IIR controller has a series of jumpers that allow for specific configuration of the controller.

External LED Connectors

The IIR Controller has a 6 pin header to allow for connection of additional LEDs. An LED connected with header A lights up whenever there is activity on SCSI channel A. The same applies for header B. An LED connected with the SUM header lights up whenever there is activity on any of the two SCSI channels A and B. See Figure 8 for details.
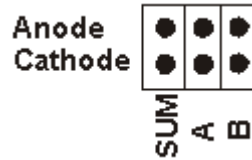
Figure 8. External LED Connectors

Terminator Power

Determines whether termination power (per channel) is supplied by the controller. The Default is ON for both channels (both jumpers set).

Acoustical Alarm

An acoustical (audible) alarm is present on the RAID controller to indicate any of the following events:

- State of controller upon boot-up
- Change in state of array
- Change controller environmental status (during normal operation)
- Hardware failure

If the cause of the event is resolved and/or removed, the audible alarm will cease. The audible alarm can also be turned off manually through StorCon or StorCon plus. If the audible alarm is silenced via management tools, it will only be disabled for the current event and will be ready to sound again at the next event.

Silencing the Acoustical Alarm in StorCon

An option is available in StorCon under Advanced Setup → Configure Controller, press <F4> to silence alarm. The <F4> option is available only if the alarm has been activated.

Silencing the Acoustical Alarm in StorCon+

To silence the alarm in StorCon+, in the "Physical Configuration" view, right-click on the icon for the controller that requires alarm deactivation. Click on "Silence" to deactivate the alarm. If the alarm has not been activated, the "Silence" option will be grayed out and unavailable.

Compatible Intel RAID Controllers

This Intel RAID Controller SRCU32 is compatible with other Intel RAID Controllers SRCU32 and SRCMR and allows for array roaming.

⇒ **NOTE**

Compatible refers to the ability of the Intel RAID Controller SRCU32 to read the RAID configuration information located on hard drives that are members of RAID Arrays that have been created on compatible adapters. Thus RAID Arrays created on compatible adapters are interchangeable between the adapters (Array Roaming).

Optional RAID Features Implemented in the Intel RAID Controller SRCU32

Adapter Device Limitation Support

- RAID Arrays contain
  — Host Drives (at least 1 and up to 16 maximum)
  — Hard Drives up to 30 maximum spanning both channels (all host drives that are created on an existing RAID Array will have their capacity evenly distributed across all member hard drives of the RAID Array)
- Host Drives
  — Can span across both channels
  — Can not span across RAID Arrays

Table 8.   Disk, Volume, and Array Limitations

Adapter Device Limitations								
	Per Adapter		Per RAID Channel		Per RAID Array		Per Host Drive	
	Max	Min	Max	Min	Max	Min	Max	Min
Hard Drives	30		15		30	1	30	
RAID Arrays	16		15				1[2]	
Host Drives	16		16		16	1[1]		

Note:

1. Each Host Drive can only be associated with one RAID Array.

2. To create a new RAID Array you must initially create a Host Drive selecting the hard drives (that are available and not already members of a RAID Array) that you wish to be members of the new RAID Array.

PCI Hot Plug

The SRCU32 adapter supports PCI Hot Plug under the following OS's:

- Windows 2000 Advanced Server SP2, Windows 2000 Server, Windows 2000 Professional
- NetWare 5.1 SP2a

This IIR controller supports the PCI Hot Plug functionality for the Hot Replacement of an adapter. Hot Replacement assumes that the drivers for the adapter being replaced are already loaded.

Operational States of an Intel RAID Controller SRCU32 Firmware Disk Array

Operational States for RAID 4/5

An array drive under the Intel RAID Controller SRCU32 firmware operating system can assume seven different operational states: Idle, Ready, Fail, Build, Rebuild, Expand, and Error. Table 9 describes the operational states for RAID 4/5 while Figure 9 is the operational state diagram for RAID 4/5 Table 10 describes additional operational states.

Table 9.   Operational States for RAID 4/5

State	Description
Idle State	This state is characterized by the fact that the redundant information of the disk array has never been entirely created. The disk array is in this state after its first configuration and until you quit Storage Console (StorCon). Should an error occur while the array is in the build state, the array returns to the Idle state (exception: if during build state the dedicated drive of RAID 4 fails, the state changes to fail.
Build State	After the disk array has been configured for the first time, it assumes the build state as soon as you quit StorCon. While the array is in the Build state, redundancy information is calculated and stored to the hard drives of the array.
Ready State	The disk array is fully operational when in the Ready state. All redundant information is present, that is, a hard drive can fail without impairing the functionality of the disk array. This is the normal state of a disk array. The state ready/expand indicates that the RAID level and/or capacity are currently migrated/expanded.
Fail State	The disk array changes to the fail state whenever a Logical Drive fails. Redundancy information is still present, thus allowing the remaining hard drives to continue working. This state should be eliminated as soon as possible by replacing the defective hard drive. If a so-called Hot Fix drive has previously been assigned to a disk array with StorCon, the controller will automatically replace the defective drive and start the reconstruction of the data and the redundant information. Therefore, under these circumstances the fail state is only temporary and will be eliminated by the controller itself.
Rebuild State	The disk array will assume this state after the automatic activation of a Hot Fix drive or after a manual replacement is carried out with StorCon. The data and the redundant information are reconstructed and stored to the new drive.
Expand State	If the capacity or RAID level of an existing disk array is changed, the disk array changes its state into expand. As soon as the expansion or migration is completed, the state changes back to ready.

Figure 9. Operational State Diagram for RAID 4/5

Table 10. Additional Operational States

State	Description
OK State	The disk array is fully operational when in the OK state. All redundant information is present, that is, a hard drive can fail without impairing the functionality of the disk array. This is the normal state of a disk array.

Methods for Hard Drive Replacement

The Intel RAID Controller SRCU32 and the Intel RAID Controller SRCU32 firmware offer a variety of methods to replace a defective hard drive. When to use them depends on the physical environment of the server. With some servers the hard drives are mounted into the server enclosure. They are not removable. With other servers there is an intelligent backplane (for example, SAF-TE) and which hosts a number of hard drives with a Single Connector Attachment (SCA). Another type of server uses the hard drive in a hot pluggable disk carrier. These carriers are often unintelligent and do not communicate with the Intel RAID Controller SRCU32 or server, though, they can display the hard drive's temperature or the status of its built-in fan. The following table contrasts the various hard drive replacement options.

Table 11. Hard Drive Replacement Options

	Manual Hot Plug	Auto Hot Plug	Automatic Replacement with Hot Fix Drive
Typical Server Environment	Low Cost. Hard drives are physically mounted in the server enclosure and are not removable.	Additional cost for external enclosure, cables, backplanes, etc. Hard drives are removable in an intelligent or non-intelligent subsystem. The subsystem complies with one of the following enclosure standards: "SAF-TE" (SCSI Accessed Fault Tolerant Enclosures) "SES" (SCSI Enclosure Services) "Intelligent Fault Bus" (former DEC™ fault bus) Non-Intelligent subsystems using hot pluggable disk carriers.	Low cost. High availability. The Intel RAID Controller SRCU32 has a spare drive available at all times. Should one hard drive of an array fail, the spare drive (hot fix drive) is automatically built into the array.

Table 11. Hard Drive Replacement Options (continued)

	Manual Hot Plug	Auto Hot Plug	Automatic Replacement with Hot Fix Drive
Description	StorCon or StorCon+ guides the user to the point where a new hard drive can be built into the array drive.	The subsystem must be configured with StorCon or StorCon Plus, before the auto hot plug can work. Thereafter a hard drive can just be pulled out and plugged in, and the Intel RAID Controller SRCU32 "knows" what to do. In addition, SAF-TE and SES report the enclosure status (power supplies, fans, temperature etc.) to the Intel RAID Controller SRCU32 and the Intel RAID Controller SRCU32 driver.	The hot fix drive is assigned to an array drive. There are two types of hot fix drives: Private hot fix drive (Available for one array drive only) Pool hot fix drive (Several array drives share this hot fix drive)

Intel RAID Controller SRCU32 Quick Start

This section is a quick start that can be used when installing the Intel RAID Controller SRCU32 using either Windows 2000 or Red Hat[†] Linux[†] 7.1. For more detailed instructions and to get information when using other operating systems, please refer to the chapters 3 through 10.

Make an OS Installation Diskette

1. Boot from the Intel RAID Controller SRCU32 Software CD.

2. Select "Create Diskettes."

3. Create an operating system installation diskette.
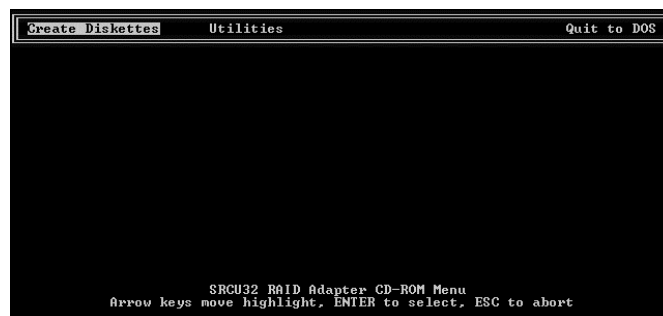
Install the SDRAM

1. Insert the DIMM into the DIMM connector. Make sure the DIMM clips snap to the close position. (Supported DIMMs are 64 MB to 256 MB ECC PC133 unbuffered SDRAM memory).

Install the Intel RAID Controller SRCU32 in the Intel Server Board

Install the Intel RAID Controller SRCU32 into an available PCI slot. Refer to the board documentation for details. The example below refers to the Intel SCB2 server board.

1. Shut down the computer system.

2. Turn the power off.

3. Insert the Intel RAID controller into an available PCI slot.

Use StorCon to Create a RAID Volume

1. Power on the system and press <Ctrl> + <G> when the screen below appears.

```
PCI            Storage RAID Controll B10            Version
Copyright (C) 1991- 2001 by Intel Corporation
All rights reserved!



>>>Press <Ctrl> <G> to enter Intel (R) Storage Console>>>
```
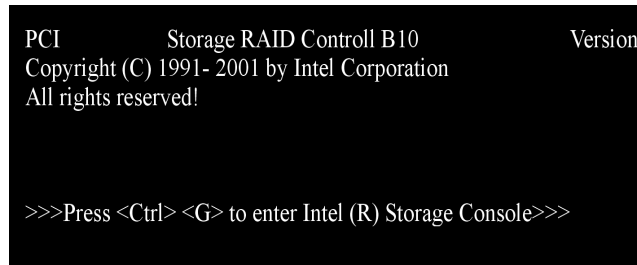
2. The following two messages will appear at the bottom of the screen:
   "Intel (R) Storage Console to start after POST"
   "Please wait to start Intel (R) Storage Console…"

3. When StorCon starts, it will display the Intel RAID Controller SRCU32 installed in the system. Press <Enter> to select this controller.

```
┌──────────────── Select Controller ────────────────┐
│ No.   Name         Position      Features      Firmware    │
│  0    SRCU32       [PCI 0/1]    C 0 1 4 5 10  2.32.00-R002  │
└──────────────── F10: Toggle Colors ────────────────┘
```

4. Select "Configure Host Drives" and press <Enter>.

5. Select "Create New Host Drive." StorCon displays a list of "free" hard drives. These are drives that do not belong to a logical host drive and can be used for new host drives.

6. Use the arrow keys and the space bar to select the number of hard drives that you want to be part of the array (these hard drives become marked with an "*"). For this example, we used four hard drives. Press <Enter>. Move the selection bar with the arrow keys from one entry to another. To deselect a drive, highlight the drive with the selection bar and press the space bar.

7. The "Choose Type" menu offers different host drive types. For this example, we select "RAID 5 + Hot Fix" and press <Enter>.

```
┌─── Choose Type ───┐
│ Single Disk       │
│ Chaining          │
│ RAID 0            │
│ RAID 1            │
│ RAID 1 + HotFix   │
│ RAID 4            │
│ RAID 4 + HotFix   │
│ RAID 5            │
│ RAID 5 + HotFix   │
│ RAID 10           │
│ RAID 10 + HotFix  │
└───────────────────┘
```
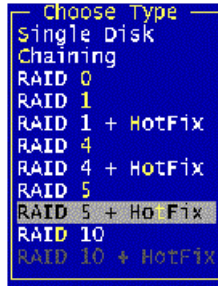
8. For security reasons, you will be asked if you want to use the selected disk to create a host drive. StorCon displays a warning that all data will be destroyed after confirmation. Confirm the choice by pressing <Y>. StorCon creates a new host drive.

```
Do you want to create a host Drive from the selected disk(s) ?
        (CAUTION: All data will be destroyed !) (Y/N)
```

9. Enter the appropriate drive capacity and press <Enter>.

```
Used Capacity per Drive (1..17509 MB): 17000_
```

10. The new host drive is created. Press <F10> to refresh and begin the build process. Its status is still "build," since the Intel RAID Controller SRCU32 synchronizes both drives.

```
┌──────────────────── Select Host Drive ────────────────────┐
│ No. Name      Status      Attr.  Capacity  Type      belongs to │
│                                                            │
│  0   PD_A000  build        RW    17000 MB  RAID-1    RAID-1  4  │
│ Create new Host Drive                                      │
│ ──── F4: Drive Information, F5: Identify Drive, F10: Refresh ─── │
└────────────────────────────────────────────────────────────┘
```

➡ **NOTE**

The array build will continue as a background task. Exit StorCon, by pressing <ESC>, and the array build will continue in the background after BIOS POST upon reboot. You can then proceed with OS installation while the array continues the build process in the background.

11. When leaving StorCon, by pressing <ESC>, a progress window displays the estimated completion time for the build process.

12. Upon successful completion of the build process, the disk array changes to Ready status.

```
┌──── Progress Information: Non-destructive Array Build ────┐
│▓▓▓▓▓▓▓▓▓▓▓▓........................................│  34 %│
│Elapsed Time: 00:08:50      Estimated Time: 00:30:25      │
└──────────────── Press ESC to quit ───────────────────────┘
```
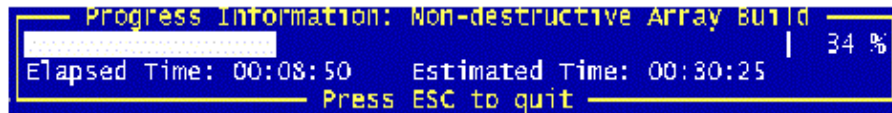
Set the BIOS Boot Order

This step requires entering the system BIOS and setting the proper boot priority. This step may differ from system to system. Refer to the system documentation for details. The example below refers to the Intel® SCB2 server board.

1. During POST, press <F2> to enter the BIOS Setup Utility.

2. Navigate to the "Boot" menu, then access the "Boot Device Priority" submenu and set the following order:
   - Removable Devices
   - ATAPI CD-ROM Drive
   - Hard Drive
   - Intel® Boot Agent

BIOS SETUP UTILITY

<Boot Device Priority
<Hard Drive
<Removable Devices
<ATAPI CD-ROM Drive

1. Removable Devices
2. ATAPI CD-ROM Drive
3. Hard Drive
4. Intel (R) Boot Agent
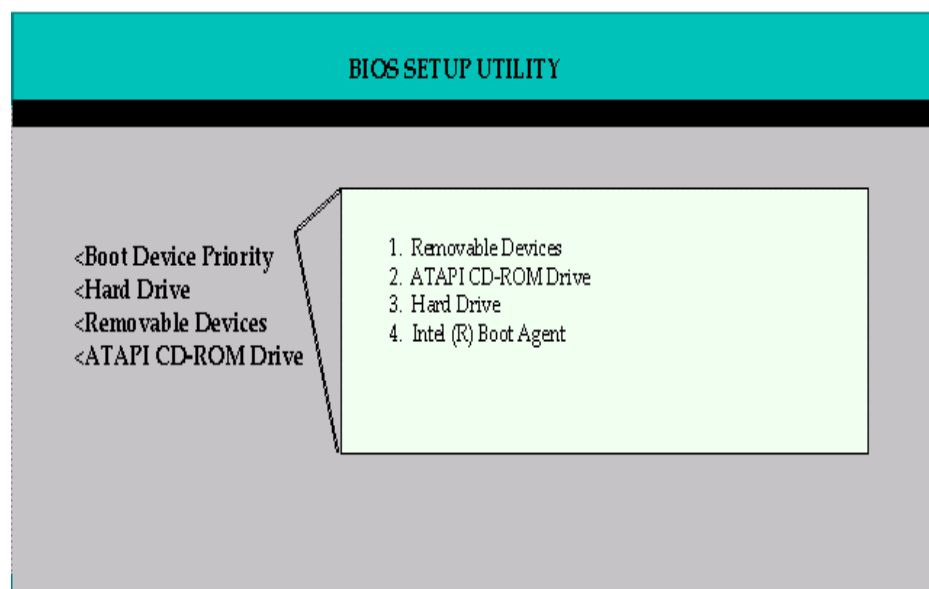
3. Access the "Hard Drive" submenu and make sure the "[Legacy SCSI Option ROM]" is on the top of the priority list.

⇒ **NOTE**

In the "Hard Drive" submenu, "[Legacy SCSI Option ROM]" may have different wording.
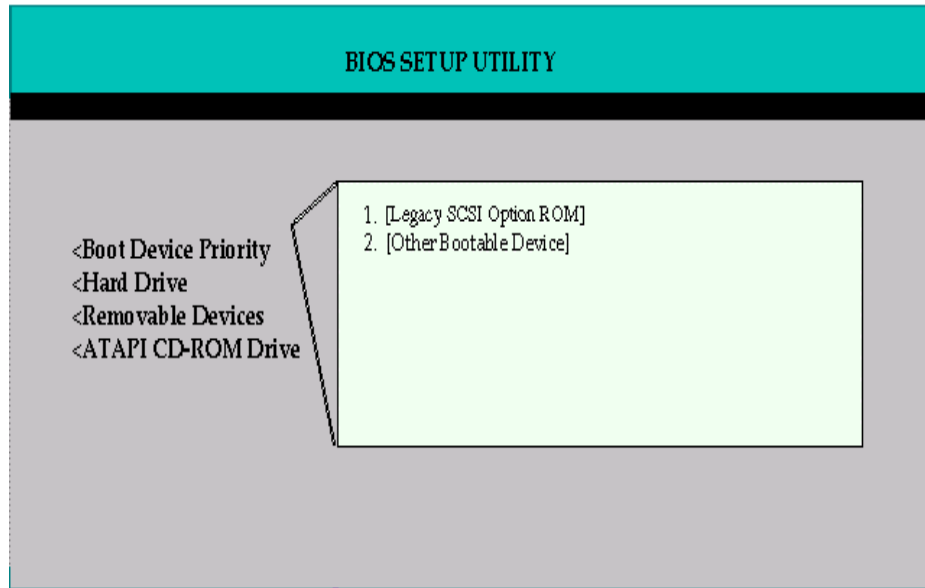
4. Press <F10> to save the changes and exit. The system will reboot.

Install the Operating System (choose from Windows 2000 or Red Hat Linux 7.1)

Installing Windows 2000

Install Windows 2000 Server:

IMPORTANT: When the blue setup screen first appears, hit <F6> key.

1. Boot the system with the Windows 2000 CD-ROM.

2. Press <F6> as soon as the first blue screen appears to bypass mass storage detection.

3. When prompted to specify a mass storage controller:
   - Select "S" to specify additional storage devices.
   - Insert the Windows 2000 Installation driver diskette.
   - Press <Enter> to select the "Installation Driver" and continue with Windows installation.

Install and Launch the StorCon and StorCon+ Utilities:

1. Insert the Intel RAID Controller SRCU32 Software CD.

2. Select "Install" and follow the on screen instructions to install the StorCon and StorCon+ utilities. (As necessary, refer to Chapter 7, Loading StorCon, for detailed instructions).

3. Launch the StorCon and/or StorCon+ utilities by clicking on the icons located on the desktop.

Installing Red Hat Linux 7.1

Install Red Hat Linux Server:

1. Boot the system with the Red Hat Linux CD-ROM.

2. At the install prompt, select "linux dd."

3. When prompted, insert the Red Hat Linux driver diskette.

4. Continue with the Linux OS installation.

Install the Intel RAID Controller SRCU32 StorCon Monitoring Utility:
(As necessary, refer to Chapter 7, Loading StorCon, for detailed instructions).

1. Place the Intel RAID Controller SRCU32 CD-ROM in the CD-ROM drive and mount the CD-ROM:
   ```
   $ mount /dev/cdrom /mnt/cdrom
   ```

2. Copy the StorCon utility archive to /usr/sbin:
   ```
   $ cp /mnt/cdrom/linux/install/storcon-2.02.gz /usr/sbin/storcon-2.02.gz
   ```

3. Unpack the archive file and rename:
   ```
   $ gunzip –d /usr/sbin/storcon-2.02.gz
   $ mv /usr/sbin/storcon-2.02 /usr/sbin/storcon
   ```

4. Launch the StorCon utility by typing "storcon" at any prompt.

5. Select the Linux interface to run the utility locally.

Alternative Method to Creating an Intel RAID Controller SRCU32 Installation Diskette

If you are unable to create the Intel RAID Controller SRCU32 installation diskette by booting from the Intel RAID Controller SRCU32 CD, you can run the CD on a Windows system and create drivers for any OS. Alternately, you can manually create these disks for the following operating systems:

Windows NT†

1. Insert the RAID Software Suite CD-ROM into the CD-ROM drive.

2. Insert a blank floppy diskette in the drive.

3. Go to the directory, \windows\winnt\drivers\i386, and copy all files onto a floppy diskette.

Windows 2000

1. Insert the RAID Software Suite CD-ROM into the CD-ROM drive.

2. Insert a blank floppy diskette in the drive.

3. Go to the directory, \windows\win2000. In this directory you will find four files and two directories. Copy all files and only the "winnt" directory onto the floppy diskette.

SCO UnixWare†

1. Insert the RAID Software Suite CD-ROM and go to the "apps" folder.

2. Create a folder on the system hard drive and copy the "rawrite.exe" application to that folder.

3. Open the "UnixWare" folder on the CD-ROM, then open the "dskimg" folder.

4. Copy "unixw7.img" to the folder created in step 2.

5. Open the command window. From the command prompt, go to the folder created in step 2 and type the following command: "rawrite."

6. Enter the file name: "unixw7.img."

7. When prompted to enter the name of the drive, type in the drive letter of the floppy drive (for example, A:) and then insert a blank floppy diskette in the drive and follow the instructions on the screen.

How to Use Auto Hot Plug with SAF-TE

The Auto Hot Plug option of the Intel RAID Controller Software provides for the insertion of new disks into a system. The way a new disk is used can be different depending on the conditions under which it was inserted. If the system has a degraded array and a disk is hot plugged into the system, the new disk will be used to rebuild the degraded array. If a system had a degraded array and used one of the available hot fix disks to rebuild and then a disk was hot plugged, the new disk will become a hot fix disk replacing the post of the one being used in the array.

Setting Up Auto Hot Plug

Enable SAF-TE on the enclosure.

⟹ **NOTE**

It is possible to have auto hot plug without a SAF-TE enclosure, but that setup is completely different from that described here.

The Intel RAID Controller SRCU32 configures devices in the SAF-TE enclosure. The controller identifies drives as being connected to the SAF-TE backplane and responds appropriately to requests by the SAF-TE device.

Verify the configuration in the Enclosure Slot Configuration menu.

1. Select the Configure Physical Devices while in the Advanced Setup mode.

2. Highlight the SAF-TE processor and press <Enter>.

3. Select the Enclosure Slot Configuration option.

4. The Enclosure Slots screen is displayed. It shows what drives have been identified in which slots of the enclosure. Pressing <Enter> once configures the drives; drive information appears on the page. Pressing <Enter> again removes the drive configuration information from the page. All devices that are to be hot spare replaceable should have information in their respective slots. The lack of drive configuration information indicates the absence of a hot spare. Once the drives have been configured, they are auto hot spare ready.

   Note that disks can only be replaced in positions that have been configured for a device. If there is a degraded array on a controller, and a user plugs in a drive in one of the slots not in use in the enclosure, the drive will not become available to the system.

   If no disks in a volume (array) creation are configured, a message: "Do you want to configure the selected disks for SAF-TE Auto Hot Plug? (Y/N)" appears. If even one disk of the intended array is configured, this message will not appear. However, only the configured disks are auto hot pluggable.

3 Installing Microsoft Windows NT or Windows 2000

This section covers installation issues related to the Microsoft Windows NT and Windows 2000 operating systems. For a successful installation, study the Windows NT/2000 system manuals thoroughly. The required Intel RAID Controller SRCU32 disks can be created from the Intel RAID Controller SRCU32 system CD-ROM.

Operating System Installation Procedures

➡ **NOTE**

Begin the installation process in this chapter if you are installing the OS and Intel RAID Controller SRCU32 or upgrading from the Windows NT OS (the OS is currently installed on a compatible Intel RAID Controller SRCU32) to Windows 2000.

Your installation falls into one of two categories:

- Install the OS on either a RAID volume or single disk that is attached to and configured on the Intel RAID Controller SRCU32 that you are installing,
  OR
- Install the OS on either an IDE hard drive or a SCSI hard drive that is not attached to the Intel RAID Controller SRCU32 that you are installing

Pre-Installation Requirements Checklist

This section identifies the minimum hardware and software required to successfully install the Intel RAID Controller SRCU32 and the accompanying software suite.

Minimum Hardware Requirements

➡ **NOTE**

The Intel RAID Controller SRCU32 will work in a 32-bit, 33 or 64 MHz PCI slot; however, a 64-bit 66 MHz slot is recommended for maximum performance.

- Computer with CD-ROM drive (not attached to the Intel RAID Controller SRCU32). Computer must be on the supported hardware list.
- One available PCI slot. *See note above.*
- PCI 2.2 compliant System BIOS.
- SCSI hard drive(s) (the minimum required to meet the desired RAID level).

Minimum Software Requirements

Microsoft Windows 2000:

- RAID Software Suite CD-ROM
- 9 MB of free hard drive space (for the RAID Software Suite)
- Microsoft Windows 2000 Professional, Server or Advanced Server
- Intel RAID Controller SRCU32 Installation diskette (one blank high density floppy diskette may be required to create the installation diskette)

Microsoft Windows NT 4.0:

- RAID Software Suite CD-ROM
- 9 MB of free hard drive space (for the RAID Software Suite)
- RAID Driver Installation diskette (one blank high density floppy diskette* may be required to create the installation diskette)
- Microsoft Windows NT 4.0 Workstation*, Server* or Server Enterprise Edition*

* Not supplied

Installing an Operating System onto a RAID Volume or Single Disk

If you do not have the Intel RAID Controller SRCU32 *Installation diskette* for the operating system that you are installing, create it before continuing. See Chapter 2 for instructions to create this disk. Also refer to Chapter 2 for instructions to install the Intel RAID Controller SRCU32 and to set up a RAID volume.

⟹ **NOTE**

Prior to installing Windows NT, disable the Delayed Write Cache of the Intel RAID Controller SRCU32.

⚠ **CAUTION**

To avoid this problem and prevent the risk of data corruption, the Delayed Write function of the Intel RAID Controller SRCU32 cache must be disabled during the complete installation. To do so, use the StorCon program. Choose Advanced Setup, Configure Controller, Controller Settings and switch the Delayed Write function OFF. After having completed the Windows NT installation, switch the Delayed Write function ON again.

When you do a warm boot by simultaneously pressing the <Ctrl> + <Alt> + <Del> keys, some PCI server boards carry out a hard reset of the PCI bus. As a consequence, all expansion cards and devices that are connected to the PCI bus, including the Intel RAID Controller SRCU32, are reset. During the installation procedure of Windows NT this anomaly can cause the contents of the Intel RAID Controller SRCU32 cache RAM to be deleted before the data can be written to the disk(s). If this happens, the installation cannot be completed correctly. Such a warm boot automatically takes place after a FAT partition is converted into a NTFS partition at the end of the Windows NT installation procedure.

```
                                    – Version x.x – MM DD YYYY
                        (C) Copyright 2001 – Intel Corporation

                  ── Controller Settings ──
          ┌──│ Cache ....................... (On)
     Confi│ │ Delayed Write .............. (Off)
     Co──┐│ │ BIOS ........................ (Enabled)
     Co│Co││ │ BIOS Warning Level ......... (Fatal errors)
     Co│Fi││ │ SETUP from Flash-RAM ....... (Enabled)
     Co│In││ │ Display <Ctrl><G> .......... (On)
     Re│No││ │ Supported BIOS Drives ...... ( 2 )
      ─│Ad││ │ CD-ROM Boot ................ (Enabled)
     Vi│Cl││ │ Memory Test ................ (No test)
     Vi│Cl││ │
     Vi──┘│ │ Chn. SCSI-A: Termination ... (Auto)
     Save │ │            SCSI-ID ....... ( 7 )
       ──F│ │ Chn. SCSI-B: Termination ... (Auto)
          │ │            SCSI-ID ....... ( 7 )
          │ │ Chn. SCSI-C: Termination ... (Auto)
          │ │            SCSI-ID ....... ( 7 )
          │ │ Chn. SCSI-D: Termination ... (Auto)
          │ │            SCSI-ID ....... ( 7 )
          └─┘
  [PCI 0/1]:
```

Figure 10. Controller Settings

Windows 2000 / NT 4.0 Installation Procedures

This document, when referring to Windows 2000 and Windows NT, applies to the following Windows operating systems unless otherwise noted:

- Windows 2000 Server, Advanced Server, and Professional
- Windows NT 4.0 Server, Enterprise Edition, Terminal Server Edition, and Workstation

Installing the OS

The following installation procedures highlight the Windows setup options that you must install during OS installation to successfully prepare the operating system for the installation of the RAID Software Suite.

Install the operating system software using one of the scenarios (boot diskettes or CD-ROM) below that matches the installation method.

⟹ **NOTE**

For detailed Windows installation procedures, please consult the documentation that came with the computer system or operating system.

Installing Windows Using the Installation Boot Diskettes:

1. During install let Windows detect the storage devices in the system. When device detection is complete, press <S> to specify additional storage devices.

2. Select Other. Insert the Intel RAID Controller SRCU32 installation diskette for Windows into the floppy drive, press <Enter>.

3. Intel RAID Controller SRCU32 is automatically selected. Press <Enter>.

4. Complete the text-based portion of the Windows installation procedures. Reboot and continue with the GUI-based portion of the installation.

5. After the operating system is completely installed, go to Chapter 7, Loading StorCon to complete the installation.

Installing Windows Using the Bootable Windows CD-ROM:

1. Press <F6> as soon as the initial blue screen appears to ensure that the RAID Driver Installation diskette can be loaded when specifying "Other."

2. When device detection is complete, press <S> to specify additional storage devices.

3. Select "Other." Insert the Intel RAID Controller SRCU32 Installation diskette for Windows into the floppy drive. Press <Enter>.

4. Intel RAID Controller SRCU32 is automatically selected. Press <Enter>.

5. Complete the text-based portion of the Windows installation procedures. Reboot and continue with the GUI-based portion of the installation.

6. After the operating system is completely installed, go to Chapter 7, Loading StorCon to complete the installation.

Installing an OS onto an IDE or SCSI Hard Drive Not Attached to the Intel RAID Controller SRCU32

Install the Intel RAID Controller SRCU32:

1. Power-off the computer.

2. Disconnect all power cords.

3. Remove the computer case to expose the server board inside. Observe all warnings and cautions documented with the computer system to avoid shock hazards.

4. Install the Intel RAID Controller SRCU32 into an available PCI slot.

5. Replace the computer case and reconnect power cords.

6. Go to the next section for the operating system to continue the installation.

Windows 2000 / NT 4.0 Installation Procedures

⟹ **NOTE**

This document, when referring to Windows 2000 and Windows NT, applies to the following Windows operating systems:
- Windows 2000 Server, Advanced Server, and Professional
- Windows NT 4.0 Server, Enterprise Edition, Terminal Server Edition, and Workstation

Installing the Operating System

The following installation procedures highlight the Windows setup options that you must install to successfully prepare the operating system for the installation of the RAID Software Suite.

➡ **NOTE**

For detailed Windows installation procedures, please consult the documentation that came with the computer system or operating system.

Install the operating system software using one of the scenarios (boot diskettes or CD-ROM) below that matches the installation method.

Installing Windows with Installation Boot Diskettes

1. Boot from the Windows Installation diskettes to setup Windows.

2. Insert boot diskettes and power up the system.

3. During install let Windows detect the storage devices in the system.

4. When device detection is complete, if the hard drive controller is not detected and listed, press <S> to specify additional storage devices and install the driver.

5. Continue with the Windows installation.

6. After the operating system is completely installed, go to Chapter 7, Loading StorCon to complete the installation.

Installing Windows Using the Bootable Windows CD-ROM

➡ **NOTE**

If the driver for the hard drive controller is on the Windows CD-ROM, then follow prompts and continue at Chapter 7, Loading StorCon. If you are installing a driver that does not come with the Windows installation CD-ROM, for example, the Intel RAID Controller SRCU32 driver created in Chapter 2, then follow the procedure below.

1. Insert the CD-ROM and power up the system. If the drivers for the hard drive controller are not on the bootable Windows CD-ROM, press <F6> as soon as the initial blue screen appears to ensure that the driver diskette can be loaded.

2. When device detection is complete, press <S> to specify additional storage devices and then select "Other." Insert the Intel RAID Controller SRCU32 diskette into the floppy drive and continue the installation (see the next section).

Upgrading an OS (Windows NT 4.0 to Windows 2000) that is Currently Installed on a RAID Volume or Single Disk

Before you Begin:

Ensure that the OS is installed on an Intel RAID Controller SRCU32 that is compatible with the new OS and/or RAID Software Suite that you are about to install. If it is not compatible, then exit this installation procedure.

Upgrading Windows NT 4.0 to Windows 2000:

1. Before beginning, back up any vital data.

2. If you are not installing a new adapter and you are only upgrading the OS and the RAID software, go to step 9.

3. If you are installing a new Intel RAID Controller SRCU32, and transferring the OS to that new adapter, go to step 4.

4. Power off the computer, disconnect all power cords, and remove the computer's cover to access the server board.

5. Disconnect the SCSI cable(s), if applicable.

6. Remove the currently installed Intel RAID Controller SRCU32 and insert the new Intel RAID Controller SRCU32 into an available PCI slot.

7. Connect the SCSI cable, if applicable, to the newly installed Intel RAID Controller SRCU32.

8. Replace the computer's cover, reconnect all power cords, and reboot the computer.

9. Log into NT with administrative user rights.

10. Insert the Windows 2000 CD-ROM. The Windows 2000 upgrade utility will auto-start. Click "Yes" to start the upgrade.

11. When the Welcome to the Windows 2000 Setup Wizard launches, select "Upgrade to Windows 2000" and complete this portion of the upgrade. Windows should auto-reboot. If not, manually reboot the computer.

12. Leave the Windows 2000 CD-ROM in the CD-ROM drive and let the computer boot up. DO NOT touch any key when prompted to boot from the CD-ROM. Let the computer boot to the hard drive to continue the upgrade.

13. When the computer gets to the first blue setup screen, immediately press <F6> to load the RAID drivers for Windows 2000.

14. When prompted press <S> and insert the Intel RAID Controller SRCU32 Installation diskette and continue the Windows 2000 upgrade.

15. Setup will complete the text-based portion of the installation and auto-reboot to continue the GUI portion of the Windows 2000 Upgrade.

16. When the GUI portion of setup completes, the computer will auto-reboot. If it does not auto-reboot, manually reboot the computer to continue the upgrade.

17. Go to the "Installation to an Existing OS" section to complete the upgrade.

Swapping Out / Replacing Compatible Intel RAID Controller SRCU32 in Windows 2000

While running Windows 2000, swapping or replacing a SCSI host adapter with another compatible but different model SCSI host adapter is similar to the procedure for adding a host adapter. The important distinction is that you add the new SCSI adapter into the system first, before removing the old adapter.

⇒ **NOTE**

If you do not install the new host adapter first, it may result in a Windows 2000 boot failure.

To swap compatible Intel RAID Controller SRCU32, follow these steps:

1. Power down the computer.

2. Insert the new (compatible) Intel RAID Controller SRCU32 into an available PCI slot, leaving the existing Intel RAID Controller SRCU32 intact.

3. Power up the computer. Windows 2000 should load up as normal and detect the new Intel RAID Controller SRCU32. Install the Windows 2000 driver if prompted to. If a Driver Install Wizard starts, follow the driver installation procedures.

4. Reboot if prompted.

5. Once the new Intel RAID Controller SRCU32 is functioning properly, power down the computer.

6. Remove the old Intel RAID Controller SRCU32 (leave the new Intel RAID Controller SRCU32 in the slot that it was initially installed in and detected by Windows 2000) and move all desired devices to the new adapter.

7. All attached devices should be recognized upon reboot.

⇒ **NOTE**

For a list of compatible Intel RAID Controller SRCU32, see the User's Guide.

Installation to an Existing OS

This section covers all installations of the Intel RAID Controller SRCU32 into computers with existing (previously installed) operating systems.

Minimum Requirements:

- Fully functional OS already installed and running on the computer
- Administrative level privilege on the computer
- Hard Drive Space: 9 MB Minimum
- Installed Intel RAID Controller SRCU32

Once all these requirements are met and you are logged on to the computer, continue to the next section.

Installing Drivers for the Intel RAID Controller SRCU32

Method 1 (preferred method):

1. Insert the RAID Software Suite CD-ROM in CD-ROM drive.
2. Click "Install" to install the Windows drivers.
3. The InstallShield Wizard starts. Select "Modify." Click "Next."
4. In the File Download screen, select "Run this program from its current location."
5. The "Select Components" window appears. Select "Device Drivers."
6. Click "Next" and follow the instructions up to and including system reboot.

Method 2 (alternate):

1. Insert the RAID Software Suite CD-ROM in CD-ROM drive.
2. If the CD does not start automatically, then run the "\autorun.exe" file.
3. Click "OS Diskette" and then click "Windows." Select the appropriate Windows version.
4. A command prompt window appears requesting that you insert a formatted floppy diskette.
5. Insert the floppy in the floppy drive and press <Enter>. The command prompt window closes automatically after the diskette has been written.
6. Open the Device Manager for the given OS and scan the PCI bus for new hardware.
7. Select "Intel RAID Controller SRCU32" in the "hardware found" list, and then click "Next."
8. Select "Search" for a suitable driver for my device, and then click "Next."
9. Select "Floppy Drive."
10. Click "Next" and follow the instructions up to and including system reboot.

4 Installing Linux

This section discusses installation issues related to the Red Hat Linux operating systems. For a successful installation, study the Linux system manuals thoroughly. The required Intel RAID Controller SRCU32 installation disks can be created from the RAID Software Suite system CD-ROM. See Chapter 2 for instructions to create these disks.

Before you Begin

Available Drivers and Tools on the Intel RAID Controller SRCU32 Software Suite CD-ROM

gdth.tgz	Intel RAID Controller SRCU32 driver sources
storcon-2.02.gz	StorCon for i386 systems, version 2.02
srcd-1.10-redhat.tgz	Remote RAID Configuration Service with start/stop script for Red Hat Linux, version 1.10

Assumptions About Path Names

Since the user may have received StorCon on the CD-ROM or as a download from the web, and because Linux administrators may mount volumes with a variety of names, certain assumptions were made in this document. These assumptions are listed in the following table.

Table 12.   Linux Path Names

Path Names	Note
/mnt/cdrom	If the Linux driver and StorCon is not being installed from the CD-ROM, the /mnt/cdrom part of the path may be changed to the proper directory.
$	Assumes this is the current directory level.
/dev/hda	Path entries such as the example on the right are assumptions and may be changed to match what the administrator has selected for the particular system.

General Installation Notes

For detailed hardware requirements, specifications, and installation procedures, specific to the Intel RAID Controller SRCU32, refer to Chapter 2.

Minimum Hardware Requirements

➡ **NOTE**

The Intel RAID Controller SRCU32 will work in a 32-bit, 33 or 64 MHz PCI slot; however, a 64-bit 66 MHz slot is recommended for maximum performance.

- Computer with CD-ROM drive (not attached to the Intel RAID Controller SRCU32). Computer must be on the supported hardware list (for example, Intel SCB2 server board).
- One available PCI slot. *See note above.*
- PCI 2.2 compliant System BIOS.
- SCSI hard drive(s) (the minimum required to meet the desired RAID level).

Minimum Software Requirements

- RAID Software Suite CD-ROM
- 10 MB of hard drive space
- RAID Driver Installation Diskette for Linux
- Linux Red Hat 7.x Installation CD-ROMs
- Root access on the Linux server

Installing Red Hat Linux 7.x on a RAID Volume (Host Drive)

To install Red Hat Linux 7.x on to a host drive, first create the appropriate driver disk from the Intel RAID Controller SRCU32 CD-ROM:

1. In the system BIOS, ensure that the computer is set to boot off of the CD-ROM drive.

2. Place the RAID Software Suite CD-ROM in the CD-ROM drive and boot the system.

3. Select the option to make diskettes.

4. Select Red Hat Linux and the appropriate driver for the system. When driver disk is created, follow the procedure below to create a host drive to install to.

5. Ensure the Intel RAID Controller SRCU32 is installed in the system and is connected to drives on which you intend to create a host drive.

6. Boot the system and when prompted press <Ctrl> + <G> to enter StorCon. Create a single host drive from the selected disks.

7. For more information on creating host drives using the StorCon, see Chapter 7, Configure New Host Drive.

8. Read the Red Hat documentation to understand the disk space/size requirements for the Red Hat 7.x installation.

9. Ensure the system is set to boot from the CD-ROM drive and boot to the Red Hat 7.x CD-ROM. At the boot prompt, type "linux dd" and press <Enter> to continue.

10. Insert the floppy driver disk created in the previous procedure when prompted by the installer.

When the installation is complete, remove the floppy disk from the drive and reboot the system.

Installing an Intel RAID Controller SRCU32 onto an Existing Linux Server

Installation of Driver Sources from the Intel RAID Controller SRCU32 CD-ROM

The same procedure can be used for updating a currently installed Intel RAID Controller SRCU32 driver using the driver sources.

1. If you are installing the driver sources from the Intel RAID Controller SRCU32 CD-ROM, and if the CD InstallShield has not started automatically, place the Intel RAID Controller SRCU32 CD-ROM in the CD-ROM drive and use the following procedure:
   a. Mount the CD-ROM by typing the following command:
      $ mount /dev/cdrom /mnt/cdrom
   b. Copy the driver sources to /usr/src/linux/drivers/scsi
   c. Enter the following command:
      $ cp /mnt/cdrom/linux/drivers/gdth.tgz /usr/src/linux/ drivers/scsi*
   d. Unpack and unzip the tar file using the following command:
      $ tar -zxvf /usr/src/linux/drivers/scsi/gdth.tgz

   * Linux kernel versions are specific. For example, the directory /usr/src/linux-2.4.2 is specific to Linux kernel version 2.4.2 found in Red Hat version 7.1. You should be aware of the specific path for the distribution.

2. Compile a new kernel with module support and "GDTH SCSI" support enabled. This procedure depends on the Linux distribution. "Make config," "make dep," and "make clean" may be necessary to install the RAID volume. Refer to the specific Linux distribution documentation for help.

3. Compile the modules. This procedure depends on the Linux distribution. Refer to the specific Linux distribution documentation for help.

4. Configure "Lilo.conf" to use the new module support. This procedure depends on the Linux distribution. Refer to the specific Linux distribution documentation for help.

GDT Driver Parameters

Reservation of SCSI Devices

The reservation of SCSI devices becomes necessary if you want Direct Access Devices (for example, hard drives, removable hard drives like IOMEGA or SyQuest, some MOs) to be directly controlled by Linux and not the Intel RAID Controller SRCU32's firmware (for example, they are not configured as host drives).

Reservation of SCSI devices is also called raw-service. In this case, the Intel RAID Controller SRCU32 does not cache the data to/from the reserved SCSI device. This reservation is important for removable hard drives. If they are controlled by the Intel RAID Controller SRCU32 and are a host drive, a media change is very difficult.

Non Direct Access Devices like CD-ROMs, Streamers, DATs, etc. do NOT require a reservation.

⚠ **CAUTION**

The reservation of SCSI devices is only possible with not-initialized SCSI devices. (Use StorCon to de-initialize an already initialized device.)

From driver version 1.10 on you can add the parameters for the reservation with the LILO append command:
Excerpt of /etc/lilo.conf:

```
# End LILO global section

# Linux bootable partition config begins

image = /boot/vmlinuz

root = /dev/sda2

label = Linux

append = "gdth=reserve_list:1,0,6,0"

# Linux bootable partition config ends
```

This "gdth" driver parameter reserves the SCSI device that is connected with Intel RAID Controller SRCU32 1 (the second Intel RAID Controller SRCU32), SCSI Bus 0 (channel A), ID 6, LUN 0 for Linux (raw service).

After each change in "/etc/lilo.conf" LILO must be loaded once.

Driver parameters may also be entered at the LILO boot prompt, (for example: gdth=reserve_list:1,0,6,0).

Further Driver Parameters

irq1,irq2, etc.	Only for RAID EISA Controllers with disabled BIOS (irq1, irq2, etc. correspond with the IRQs of the RAID controllers)
disable:Y	deactivates the RAID driver
disable:N	activates the RAID driver
reserve_mode:0	reserves no SCSI devices*
reserve_mode:1	reserves all not-initialized removable hard drives*
reserve_mode:2	reserves all not-initialized SCSI devices*
reserve_list:h,b,t,l,h,b,t,l,...	reserves SCSI devices at the corresponding coordinates with h=Hostadapter, b=SCSI Bus, t=Target ID, l=LUN
reverse_scan:Y	reversed scanning order of the PCI controllers
reverse_scan:N	normal scanning order of PCI controllers according to the system BIOS
max_ids:x	x = number of target IDs per SCSI channel (accelerates the boot process)
rescan:Y	rescan all SCSI channels / Ids
rescan:N	scan only those SCSI devices found during system power up*

* The driver parameters reserve_mode and rescan:N require Intel RAID Controller SRCU32s with firmware version FW x.23.00 or higher.

The current default settings of the driver are:

- "gdth=disable:N,reserve_mode:1,reverse_scan:N,max_ids:127,rescan:N."
- If "gdth" is loaded as a module, these parameters can also be added with a special syntax.
- IRQ parameters are entered as "IRQ=" (for example, IRQ=10). Several parameters are not separated with a comma (,"") but a space (" "). All ":" are substituted with "=," all "Y" with "1" and all "N" with "0."
- Default: "modprobe gdth disable=0 reserve_mode=1 reverse_scan=0 max_ids=127 rescan=0."

Installation of Intel RAID Controller SRCU32 StorCon Monitoring Utility

Installation of StorCon from the Intel RAID Controller SRCU32 CD-ROM

1. If you are installing the StorCon from the Intel RAID Controller SRCU32 CD-ROM, then place the Intel RAID Controller SRCU32 CD-ROM in the CD-ROM drive and mount the CD-ROM:

   ```
   $ mount /dev/cdrom /mnt/cdrom
   ```

2. Copy the StorCon utility archive to /usr/sbin:

   ```
   $ cp /mnt/cdrom/linux/install/storcon-2.02.gz /usr/bin/storcon-2.02.gz
   ```

3. Unpack the archive file and rename:

   ```
   $ gunzip -d /usr/sbin/storcon-2.02.gz
   $ mv /usr/sbin/storcon-2.02 /usr/sbin/storcon
   ```

Using StorCon Monitoring Utility

To run the StorCon utility, type "storcon" at any prompt. Select the interface (Linux if locally run, TCP/IP sockets if remote).

While using StorCon from the Linux system console, the StorCon screen may be overwritten by system/kernel log messages. To avoid this, execute the following command (entered at the prompt from a console session):

```
dmesg -n 1
```

When finished using StorCon, the console log level can be set back to the default level using the following command:

```
dmesg -n 7
```

This behavior is not observed if the StorCon utility is used from an X-windows terminal window.

Remote Monitoring with the Intel® SRCD Remote Access Service

"srcd" is the remote access service for Intel RAID Controller SRCU32. With "srcd" running, you can manage disk arrays from a remote workstation using storage management software (for example, StorCon) via TCP/IP.

Configure /etc/srcd.conf to send SNMP traps or execute an external program (for example, mail) when a disk array controller event occurs. See comments in /etc/ srcd.conf for details.

SRCD Installation Instructions from the Intel RAID Controller SRCU32 CD-ROM

1. Copy the srcd archive to /etc (may be srcd-1.10 redhat.tgz):
   ```
   $ cp /mnt/cdrom/linux/install\srcd-v.vv-xxxx.tgz /etc/srcd-v.vv-xxxx.tgz
   ```

2. Unpack srcd-v.vv-xxxx.tgz:
   ```
   $ tar /etc/xvfz srcd-v.vv-xxxx.tgz
   ```

3. Run install.sh. It will interactively set up a start script and a file /etc/ srcd.conf:
   ```
   $ ./install.s.
   ```

4. Edit /etc/srcd.conf to send SNMP traps or execute an external program when controller events occur.

5. If srcd is not running, start it by executing one of the following commands:
   For Red Hat Linux: ```$ /etc/rc.d/rc2.d/srcd start```

Intel RAID Controller SRCU32 User's Guide

5 Installing Novell Netware

This section discusses installation issues related to the Novell NetWare operating system and covers versions NetWare 4.2 and NetWare 5.1. For a successful installation, study the NetWare system manuals thoroughly. The information provided in this section refers to the loading of the Intel RAID Controller SRCU32 NetWare driver(s) only. The required Intel RAID Controller SRCU32 disks can be created from the Intel RAID Controller SRCU32 system CD-ROM.

Pre-Installation Requirements Checklist

This section identifies the minimum hardware and software required to successfully install the Intel RAID Controller SRCU32 and the accompanying RAID Software Suite.

Minimum Hardware Requirements

➡ **NOTE**

The Intel RAID Controller SRCU32 will work in a 32-bit, 33 or 64 MHz PCI slot; however, a 64-bit 66 MHz slot is recommended for maximum performance.

- Computer with CD-ROM drive (not attached to the Intel RAID Controller SRCU32). The computer must be on the supported hardware list (for example, Intel SCB2 server board).
- One available PCI slot. *See note above.*
- PCI 2.2 compliant System BIOS.
- SCSI hard drive(s) (the minimum required to meet the desired RAID level).

Minimum Software Requirements

- RAID Software Suite CD-ROM
- 20 MB of hard drive space
- RAID Driver Installation Diskette for NetWare
- Novell NetWare 4.2 or 5.1 Software

New Installation of NetWare 4.2 and 5.1

The following procedures assume that the Intel RAID Controller SRCU32(s) is(are) already installed in the system. If you plan to install the OS to a RAID volume, you must first configure the RAID volume through the XROM version of StorCon. At system boot time, press <Ctrl> + <G> when prompted to invoke the XROM version of StorCon.

⟹ **NOTE**

Install all Novell patches and updates prior to installing the Intel RAID Controller SRCU32 driver and StorCon. These updates can be found at:
http://www.novell.com

New Installation of NetWare 4.2 with the SRCRX.HAM Driver

1. Create a driver diskette from the RAID Software Suite CD-ROM. See Chapter 2 for details to create this disk.

2. Start the OS installation from the NetWare CD-ROM. (NetWare 4.2 CD-ROMs are NOT bootable so you must have a bootable DOS partition installed on the target hard drive and have the appropriate DOS driver for the CD-ROM.)

3. At the driver summary menu select "modify drivers."

4. Insert the driver diskette into drive A:

5. Press <Enter> on the SRCU32 driver list.

6. Press <Insert> in the SRCU32 controller driver menu.

7. Press <F3> and change the path to A:\DRIVERS\4XX then press <Enter>.

8. Select the SRCRX.HAM driver and complete the installation.

New Installation of NetWare 5.xx with the SRCRX.HAM Driver

1. Create a driver diskette from the RAID Software Suite CD-ROM. See Chapter 2 for details to create this disk.

2. Start the OS installation from the NetWare bootable CD-ROM.

3. At the storage driver summary menu select "modify drivers."

4. Insert the driver disk into drive A:

5. Press <Enter> on the storage driver list.

6. Press <Insert> in the storage controller driver menu.

7. Press <F3> and change the path to A:\DRIVERS\5XX then press <Enter>.

8. Select the SRCRX.HAM driver.

9. Complete the installation.

NOTE
➡ **NOTE**

The above procedures install only the controller drivers. To install the StorCon NLM, follow the procedure under Add Intel RAID Controller(s), drivers, and/or StorCon to and existing NetWare installation and select Storage RAID Controller Tools Kit (STORCON.NLM) option.

Adding Intel RAID SRCU32 Controller(s), Drivers, and/or StorCon to an Existing NetWare Installation

Install all Novell patches and updates prior to installing the Intel RAID Controller SRCU32 driver and StorCon. These updates can be found at:
http://www.novell.com

1. Create a driver diskette from the RAID Software Suite CD-ROM. See Chapter 2 for details to create this disk.

2. Power off the system and add the Intel RAID Controller SRCU32 card(s).

3. Power on the system and boot to the OS.

4. Load INSTALL.NLM (For 4.2 only).

5. Load NWCONFIG.NLM (For 5.x and above).

6. Insert the driver diskette into drive A:

7. Do one or both of the following to install the desired packages (you do not need to reinstall the driver package if you initially installed the driver using one of the steps under New Installation of NetWare 4.2 and 5.1).

Installing the Intel RAID Controller SRCU32 Driver Package

1. Select "Product options," then "Install a product not listed."

2. Change the path to A:\INSTALL and press <Enter> to continue.

3. Select "Storage RAID Controller Driver" (SRCRX.HAM) by setting the cursor on its menu item and pressing the space bar (an X will appear in the item's checkbox).

4. Press <F10> to accept the selected item.

5. After the file copy is complete, select "Return to previous menu" to get back to the INSTALL/NWCONFIG main options.

6. Select "Driver Options."

7. Select "Configure disk and storage device drivers."

8. Select "Discover and load additional drivers."

9. Press <Enter> to continue past any module load errors not related to the Intel RAID Controller SRCU32.

10. Press <F3> to continue past any non Intel RAID Controller SRCU32 related hardware found by NetWare for which a matching driver was not found.

11. NetWare will now load the SRCRX.HAM driver for each hardware instance you added in the system and update the STARTUP.NCF file so the driver will load for each subsequent restart of the server.

12. Select "Return to previous menu twice" to get back to the INSTALL/NWCONFIG main options.

Installing the Intel RAID Controller SRCU32 Tools Kit Package

➡ **NOTE**

STORCON.NLM will not find any controllers unless SRCRX.HAM is already loaded and running.

1. Select "Product options," then "Install a product not listed."

2. Change the path to A:\INSTALL and press <Enter> to continue.

3. Select "Storage RAID Controller Tools Kit" (STORCON.NLM) by setting the cursor on its menu item and pressing the space bar (an X will appear in the item's checkbox).

4. Press <F10> to accept the selected item.

5. NetWare will copy the necessary files, automatically load STORCON.NLM, and modify the AUTOEXEC.NCF file to load STORCON.NLM for each subsequent restart of the server.

Configuring Tools for Remote Access

1. Create a group SRC_Operator in the NDS.

2. Add the Admin and all other users who will use this interface.

3. Load SRCIPX.NLM.

4. Start Storage Console (STORCON.exe) or Storage Console Plus (Storcon+.exe) from a workstation using a user name of the group SRC_Operator and his/her NetWare password.

ASPI Support for NetWare 4.2 and 5.1

You must ensure that the file NWASPI.CDM is in the server's search path. For NetWare 4.2, NWASPI.CDM is already located in the server's startup directory (C:\NWSERVER) so no action is required. For NetWare 5.1, copy NWASPI.CDM into the server's startup directory from C:\NWSERVER\DRIVERS.

➡ **NOTE**

Since the debut of Media Manager (MM.NLM) and the NetWare Peripheral Architecture (NWPA.NLM), the need for ASPI in NetWare is rare. However, there may be a few applications that require ASPI. Unless the application(s) require it, do not install ASPI.

This procedure describes how to manually install Novell's ASPI manager module, but be aware that you may need to follow specific instructions from the application vendor to correctly configure ASPI.

1. With the server loaded and running, load INSTALL.NLM (Netware 4.2) or NWCONFIG.NLM (NetWare 5.1).

2. Select "NCF Files Option" from the main menu.

3. Select "Edit Startup.ncf."

4. Add the following line at the end of the .CDM section of STARTUP.NCF:

   ```
   LOAD NWASPI.CDM
   ```

5. Reboot the server.

Tips and Tricks

Optimize Data Throughput

High performance RAID controllers are designed for multi-I/O operations and are capable of processing several I/Os simultaneously. Cache controllers with powerful on-board RISC CPUs can handle many I/Os per second. NetWare offers the option of adjusting the number of write I/Os which are loaded on the mass storage subsystem. To gain optimum performance and speed from modern high performance disk controllers, the amount of the so-called maximum concurrent disk cache writes has been increased with every further development of NetWare. Looking back to NetWare 3.11, only 100 concurrent disk cache writes were possible. With NetWare 4.10, it can be as much as 1000.

The number of concurrent disk cache writes delivering the best performance is highly dependent on the performance of the installed disk controller, the amount of cache RAM on the controller and the hard drives. The Intel RAID Controller SRCU32's can easily cope with up to 500 simultaneous requests. The following command line enables the adjustment of a new number under NetWare (default value = 50):

```
set maximum concurrent disk cache writes = xxxx
```

Where "xxxx" represents the required number of concurrent disk cache writes.

"Cache Memory Allocator Out of Available Memory" in PCI-ISA Systems

PCI systems which are not equipped with an EISA Bus behave in the same way as an ISA mainboard with regard to the available RAM memory. NetWare therefore does not automatically recognize the available memory above 16 MB. The command `register memory` allows the registration of memory above 16 MB. Memory shortage can appear while loading several applications simultaneously on the server, especially where large volumes are concerned. This is because the register memory command is normally carried out in the "autoexec.ncf" file. This is usually located in the SYS volume. An "autoexec.ncf" file placed in the DOS partition of the NetWare Server helps to get around this problem. To carry out this process, the hard driver must be removed from the "startup.ncf" and inserted into the "autoexec.ncf" in the DOS partition. After completing this process, the hard driver must be loaded directly after the register memory command as indicated in the following "autoexec.ncf" file example:

```
register memory 1000000 1000000

LOAD C:SRCRP312

....
```

An additional start file can be loaded on the SYS volume for differentiation, for example, with the name "autonet.ncf."

Installing NetWare 4.1 - Wrong Drive Name

The following problem often occurs when installing NetWare 4.1 server. While copying the module "cdrom.nlm," the system hangs. This problem only occurs when the CD-ROM drive's name under MS-DOS is "cdrom." For example, the config.sys/autoexec.bat contains the following files:

```
DEVICE=aspicd.sys /D:cdrom
```

and

```
mscdex /D:cdrom
```

To avoid this problem, change the CD-ROM's name in DOS to another name. For example, use:

```
/D:scsicd' instead of '/D:cdrom
```

NetWare-Server Not Stable When Under High Utilization

High server utilization combined with a large number of applications running on the server can lead to an increase in the number of dirty cache buffers resulting in an unstable server. To avoid this situation, modify the following parameters.

- Increase the number of concurrent disk cache writes for the disk subsystem. Set maximum concurrent disk cache writes. This parameter can be increased up to 500 for high performance controllers and fast hard drives.
- Decrease the delayed write standard parameter. Set dirty disk cache delay time. This parameter sets the time where dirty buffers are written (flushed) from the cache of NetWare to the hard drive. The minimum value is 0.8 seconds. Care should be taken not to go below 0.8 seconds because this value influences server performance substantially.

Intel RAID Controller SRCU32 and Non-ASPI Compatible Controllers

If an Intel RAID Controller SRCU32 is operated under NetWare together with another controller/host adapter which does not support the ASPI standard, SCSI raw devices cannot be operated on both controllers (tapes, CD-ROMs).

In general, NetWare gives preference to controllers which support the ASPI Standard (for example, Intel RAID Controller SRCU32, Adaptec†). As soon as "aspitran.dsk" is loaded (auto-loading module) tapes and CD-ROMs on the ASPI non-compatible controller are no longer recognized. To avoid this problem, the "aspitran.dsk" file can be deactivated via a modification.

To deactivate "aspitran.dsk," find the string "ASPI_Entry" by using a Disk-Monitor in "aspitran.dsk" (please pay attention to upper case letters etc). Modify the string by replacing "A" with an "X" (for example, "XSPI_Entry"). The modified "aspitran.dsk" enables the operation of raw devices on non-ASPI-compatible controllers.

⇒ **NOTE**

After this modification, no other raw devices (tapes, CD-ROMs) are recognized on the Intel RAID Controller SRCU32 or Adaptec.

Last Status Information

All Intel RAID Controller SRCU32 Controllers temporarily store the status information from all hard drives that are connected to that controller. This information can be useful when searching for possible causes of disk failures or interferences. The last status information consists of a hexadecimal, 8-digit number and can be displayed via the StorCon or saved in a SAVE INFORMATION ASCII file. The information is temporarily available in the Intel RAID Controller SRCU32's RAM. Therefore, it is important to check this information before switching off and before carrying out a Reset if a disk failure has occurred or if interference was present. The last status information is divided into controller-specific and SCSI-specific messages. A detailed description can be found in the "laststat.pdf" file.

Adding Additional Capacity After an Online Capacity Expansion

The additional capacity resulting from an online capacity expansion of an existing array drive is introduced to the system as a new host drive. To be able to make use of the new capacity without having to down the server, type "scan for new devices" on the server console to recognize the new capacity. Use "Install" to build new partitions and volumes.

Notes on ARCserve[†]

Make sure that you always have the latest version of the ARCserve software.

The back-up program ARCserve can be used in connection with the Intel RAID Controller SRCU32. The communication between the tape device (for example, DAT, DLT) and the Intel RAID Controller SRCU32 takes place through the ASPI interface. For this purpose, the Intel RAID Controller SRCU32 ASPI Manager "aspitran.dsk" is needed. When loading the regular Intel RAID Controller SRCU32 NetWare driver (for example, srcrp311.dsk), the ASPI Manager is automatically loaded, too. During the installation of ARCserve, choose Adaptec ASPI Manager as the interface.

6 Installing UnixWare

This section discusses installation issues related to the UnixWare operating systems (UnixWare 7.1.1). For a successful installation, study the SCO UNIX system manuals thoroughly. The required Intel RAID Controller SRCU32 disks can be created from the Intel RAID Controller SRCU32 system CD-ROM.

General Installation Notes

This section identifies the minimum hardware and software required to successfully install the Intel RAID Controller SRCU32 the accompanying RAID Software Suite.

Minimum Hardware Requirements

⟹ **NOTE**

The Intel RAID Controller SRCU32 will work in a 32-bit, 33 or 64 MHz PCI slot; however, a 64-bit 66 MHz slot is recommended for maximum performance.

- Computer with CD-ROM drive (not attached to the Intel RAID Controller SRCU32). Computer must be on the supported hardware list (for example, Intel SCB2 server board).
- One available PCI slot. *See note above.*
- PCI 2.2 compliant System BIOS.
- SCSI hard drive(s) (the minimum required to meet the desired RAID level).

Minimum Software Requirements
- RAID Software Suite CD-ROM
- 20 MB of hard drive space
- RAID Driver Installation Diskette for UnixWare
- SCO UnixWare 7.1 OS software

Installing the Intel RAID Controller SRCU32 as an Additional Controller

Two cases are discussed below.

No Intel RAID Controller SRCU32 Has Yet Been Configured for UnixWare

In this case, the Intel RAID Controller SRCU32 driver must be installed from the UnixWare BTLD-Disk by means of the UnixWare desktop and the options "System Setup," "Application Setup." Alternatively, this procedure can be carried out from the UnixWare shell: "pkgadd -d /dev/ dsk/f0t" (Intel RAID Controller SRCU32 driver disk in drive 0).

An Intel RAID Controller SRCU32 Has Already Been Configured for UnixWare

In this case, you only have to add an additional entry for the new Intel RAID Controller SRCU32. This is carried out by the command.

```
/etc/scsi/pdiadd -d DRQ -v IRQ -m MEM srch
```

For DRQ use 0 (not necessary for PCI boards). For IRQ write the IRQ number that Intel RAID Controller SRCU32 uses. MEM corresponds to the DPMEM address of the Intel RAID Controller SRCU32 (which is displayed in the BIOS message of the Intel RAID Controller SRCU32 after power up). In both cases, you have to carry out a cold boot to use the new Intel RAID Controller SRCU32 under UnixWare.

Example: `/etc/scsi/pdiadd -d 0 -v 12 -m c8000 srch.`

Then reboot of the UnixWare system. No kernel link is required because the driver will be dynamically loaded.

Installing an Operating System onto a Host Drive or Single Disk

⇒ **NOTE**

When installing UnixWare, create only one RAID device (host drive) on which the operating system is to be installed.

1. Create and configure *one* RAID device from the BIOS of Intel RAID Controller SRCU32 StorCon (accessed by pressing <Ctrl> + <G>).

2. Insert UnixWare 7.1 installation diskette 1 of 2 which was included with the OS user's manual. Installation begins.

During the installation UnixWare prompts you to insert a Host Bus Adapter (HBA) diskette. Insert the Intel RAID Controller SRCU32 *installation diskette*. If you do not have the Intel RAID Controller SRCU32 installation diskette for the operating system that you are installing, then create it before continuing. See Chapter 2 for instructions to create this disk.

3. During the installation of UnixWare, you will be prompted to install the Network Information Services (NIS) package. By default the installation will configure the system as an NIS client. See the system administrator for configuration of the NIS services.

⟹ **NOTE**

Installation of this service may take an extended period of time.

If you do not plan on using the NIS or there is not an NIS server present on the network that you are installing this system onto, defer installation of NIS at this time by pressing <F8> at the NIS configuration screen.

4. After completing the OS installation, proceed to the next paragraph to complete the Intel RAID Controller SRCU32 installation.

Installation of the RAID Software Suite for UnixWare

1. Ensure that the minimum configuration requirements have been met. See the Minimum Hardware and Software Requirements sections.

2. Login into the UnixWare server with administrative (ROOT) rights.

3. Insert the RAID Software Suite CD-ROM in the CD-ROM drive and mount the CD-ROM.
   — Create a directory to mount the file. For example, type "mkdir cdfiles" at the prompt.
   — Mount the CD-ROM to the folder by typing:

   ```
   mount -F cdfs -r /dev/cdrom/cdrom1 /cdfiles
   ```

Coordinates of SCSI Devices

Host Adapter Number (HA)

The host adapter number assigned to the Intel RAID Controller SRCU32 is derived from the PCI slot number of the Intel RAID Controller SRCU32. Therefore, if there is only one Intel RAID Controller SRCU32 installed in the PCI bus computer system, the host adapter number is 0. If there are two Intel RAID Controller SRCU32s installed, the Intel RAID Controller SRCU32 with the lower PCI Slot number is assigned host adapter number 0 and the Intel RAID Controller SRCU32 with the higher PCI slot number is assigned host adapter 1.

After a cold boot, the Intel RAID Controller SRCU32 BIOS displays two messages, each beginning with the controller's PCI slot number, for example, "[PCI 0/3] 4 MB RAM detected." The number after the "/" is the slot number of the controller. This will help determine the order of the Intel RAID Controller SRCU32s and which host adapter number is assigned to them by UnixWare.

UnixWare Bus Number, Target ID and LUN

Target IDs and LUNs for "Non-Direct Access Devices" (devices like streamers, tapes and CD-ROMs and therefore not configurable via StorCon), are directly assigned to the SCSI ID and the channel of the Intel RAID Controller SRCU32. Host drives are assigned in increasing order to the free coordinates (bus number and target ID; LUN is always 0).

Configuration Example

In the PCI computer are two Intel RAID Controller SRCU32s (HA 0 = First Intel RAID Controller SRCU32, HA 1 = Second Intel RAID Controller SRCU32), each with two SCSI channels.

1 Hard Drive	as host drive no. 0 on HA0
1 Hard Drive	as host drive no. 0 on HA1
1 Hard Drive	as host drive no. 1 on HA1
1 Streamer	SCSI ID 2, LUN 0 on SCSI channel A of HA0
1 CD-ROM	SCSI ID 3, LUN 0 on SCSI channel B of HA0
1 DAT	SCSI ID 2, LUN 0 on SCSI channel A of HA1

The resulting HA, Bus, Target ID, and LUN are indicated in the following table.

Table 13.   UnixWare Bus Number, Target ID, and LUN

HA	Bus	Target ID	Lun	Device
0	0	0	0	First hard drive, host drive no. 0 (boot drive)
0	0	2	0	Streamer
0	1	3	0	CD-ROM
1	0	0	0	Hard drive, host drive no. 0
1	0	1	0	Hard drive, host drive no. 1
1	0	2	0	DAT
1	0	3	0	Hard drive, host drive no. 2

Additional Information

- During the installation of the Intel RAID Controller SRCU32 driver, additional tools are copied into the /etc directory. Before you can use them you have to create a special device file named /dev/ rsrch by means of "link." This device file has to be placed on a device of an Intel RAID Controller SRCU32 host drive.
- With "RAIDSYNC" from the /etc directory, you can determine the coordinates of an Intel RAID Controller SRCU32 host drive. Usually the first host drive has the coordinates c0b0t0d0.
- A special device file (character device) is /dev/rdsk/c0b0t0d0s0. In this case, /dev/rsrch can be generated with: ln /dev/rdsk/c0b0t0d0s0 /dev/rsrch.
- (c0 = HA, b0 = Bus number, t0 = Target ID 0, d0 = LUN 0, s0 = UnixWare partition).
- All new SCSI devices are automatically recognized and a corresponding special-device-file is generated.
- Host drives must be partitioned and a file system/file system(s) must be created. You can do this with "diskadd cCbBtTdD."
- When using Direct Access Devices with exchangeable media (for example, removable hard drives) that are not reserved for the raw service, media has to be inserted either when the system is booted, or with StorCon (mount/unmount). Otherwise the device will not be available under UnixWare.
- The Intel RAID Controller SRCU32 UnixWare driver supports Direct Access Devices (for example, hard drives and removable hard drives) as SCSI-raw devices. This is especially important if you use removable hard drives which you want to exchange with other controllers. How to reserve a device for the SCSI-raw service is described in the "space.c" file on the Intel RAID Controller SRCU32 BTLD disk (example and documentation).
- Multi-processor support: The Intel RAID Controller SRCU32 device drivers for UnixWare 7.1.1 support multi-processor systems.

7 Storage Console

Storage Console (StorCon) is a helpful and flexible setup and diagnosis tool for the configuration, monitoring, maintenance and tuning of mass storage subsystems that are based on one or more Intel RAID Controller SRCU32. Unlike Storage Console Plus (StorCon+), a GUI-style application for Windows 9x/NT/2000, StorCon's user interface is character-oriented and available for all operating systems. Information on StorCon+ is found in Chapter 8, Storage Console Plus. StorCon is also part of the Intel RAID Controller SRCU32's Flash-RAM and can be loaded at system boot level by pressing <Ctrl> + <G>.

⟹ **NOTE**

Some features are only available from the BIOS/Flash-RAM version of the StorCon to prevent users from experiencing unrecoverable events.

StorCon Features

- Diagnosis and configuration functions
- Online capacity expansion of disk arrays
- Host drives which can be setup and configured under normal operation
- Monitoring functions which indicate the performance of the various components, cache statistics
- Enhanced repair functions for disk arrays with failed drives

StorCon Is

- Available as both an executable program under various operating systems, and a rom-resident program loadable with <Ctrl> + <G> at system boot level (for example, without an operating system)
- Available for NetWare 5.1, Windows NT, Windows 2000, Linux, and SCO UnixWare
- Loadable locally (on the server) or remotely from an authorized workstation (support of various protocols)

Loading StorCon

The StorCon program is available for various operating systems (NetWare 5.1, Windows NT, Windows 2000, Windows 95/98, Linux, and SCO UnixWare). It can be used either locally or remotely. All Intel RAID Controller SRCU32s in a network can be monitored and serviced from one or several workstation(s).

Loading the StorCon Program Under NetWare

The StorCon program for NetWare is part of the Intel RAID Controller SRCU32 System CD-ROM. StorCon can be used under NetWare 5.1. There are two methods of loading StorCon.

- Loading StorCon on the fileserver
- Loading StorCon on an authorized workstation (remote)

Loading StorCon on a Fileserver

⇒ **NOTE**

The Intel RAID Controller SRCU32 NetWare driver and the auto-loading module CTRLTRAN must have been previously loaded on the fileserver. Use the following command to load StorCon:

```
LOAD StorCon
```

Loading StorCon on a Workstation

⇒ **NOTE**

The Intel RAID Controller SRCU32 NetWare driver, the auto-loading module CTRLTRAN and module CTRLIPX.NLM must have been previously loaded on the fileserver console. This module searches for a file named CTRLIPX.CFG. This file must be located in the same directory as CTRLIPX.NLM. Additionally, the system administrator must set up a user group named IIR_OPERATOR. All users belonging to this group are given access (through StorCon) to the Intel RAID Controller SRCU32(s) in this specific fileserver (Access level 0).

Load the StorCon program from one (or more) workstation(s) using the following command:

```
StorCon
```

Loading the StorCon Program Under Windows NT/2000

1. Ensure that Windows has been configured to meet all the requirements of the RAID Software Suite setup.

2. If the Intel RAID Controller SRCU32 has not been installed into the computer, then install it before continuing. Consult Chapter 2 for details when installing the Intel RAID Controller SRCU32.

3. Log into Windows using a user account with administrative rights.

4. Insert the RAID Software Suite CD-ROM in the CD-ROM drive. Select "Install" to install StorCon.

5. Click "Yes" if you agree with the License Agreement.

6. Click "Next" after reading "Information."

7. Select Components - Select one of the following (Remote or Local administration):
   a. Local Administration:
      Select the components that you wish to install or select the default selections (Windows NT, see Figure 11) (Windows 2000, see Figure 12). Click "Next" to continue the installation.
   b. Remote Administration:
      Select "Remote Storage Console" under "Management Tools" (Windows NT, see Figure 11) (Windows 2000, see Figure 12). Click "Next" to continue the installation.

8. Choose "Destination Location." Use the default directory for installation and click "Next."

9. Select the "Program Folder." Use default Program Group and click "Next."

10. After the file copy completes, restart the computer to complete the installation for NT. For Windows 2000 where the OS is installed on a non-RAID device, continue with step 12.

11. Windows 2000 Only: Reboot the server and log into Windows. If the OS is not on a RAID device, you will see a pop up message, "Found New Hardware." The OS has detected the RAID management driver.

12. Continue by clicking "Next." The OS will attempt to locate the drivers for this device.

13. Do not let the OS locate the driver. When prompted, uncheck the boxes for "Floppy" and "CD-ROM." Place a check in the "Specify Location" box.

14. Type the following location: "c:\program files\raid software suite\drivers."

⟹ **NOTE**

This is the default installation location. If you have not chosen the default during installation, type in that location. This is important to keep the Found New Hardware pop up from appearing each time you log into Windows.

15. Finish the installation and reboot.

This completes the installation procedure for Windows.
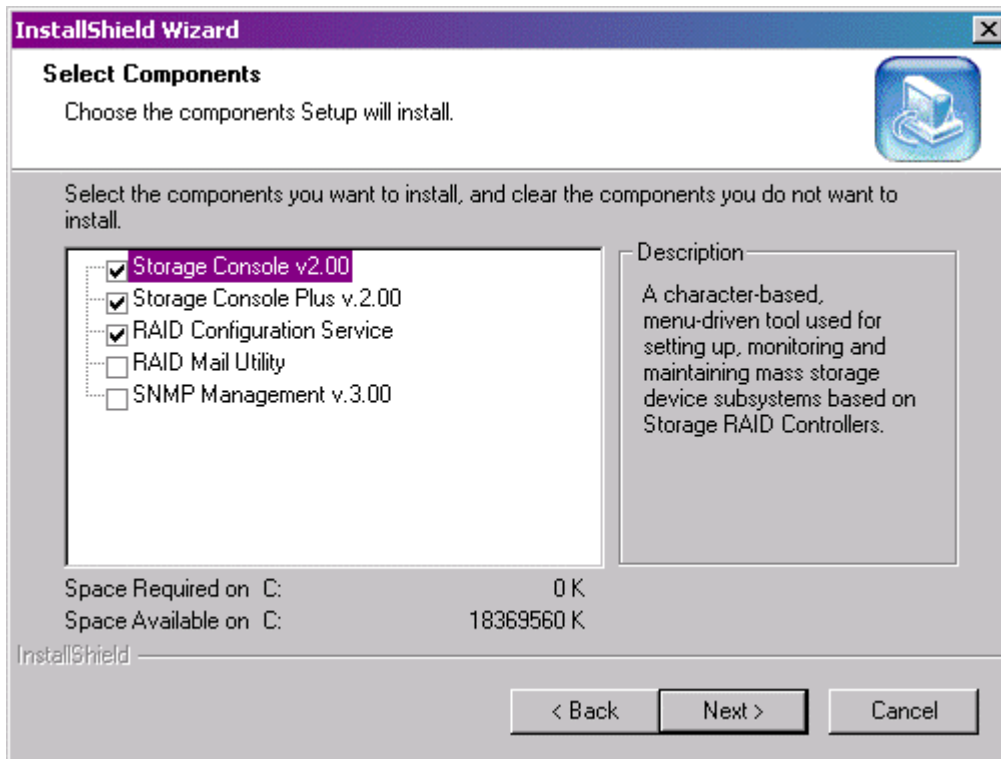
Figure 11. Component Selection (Windows NT)
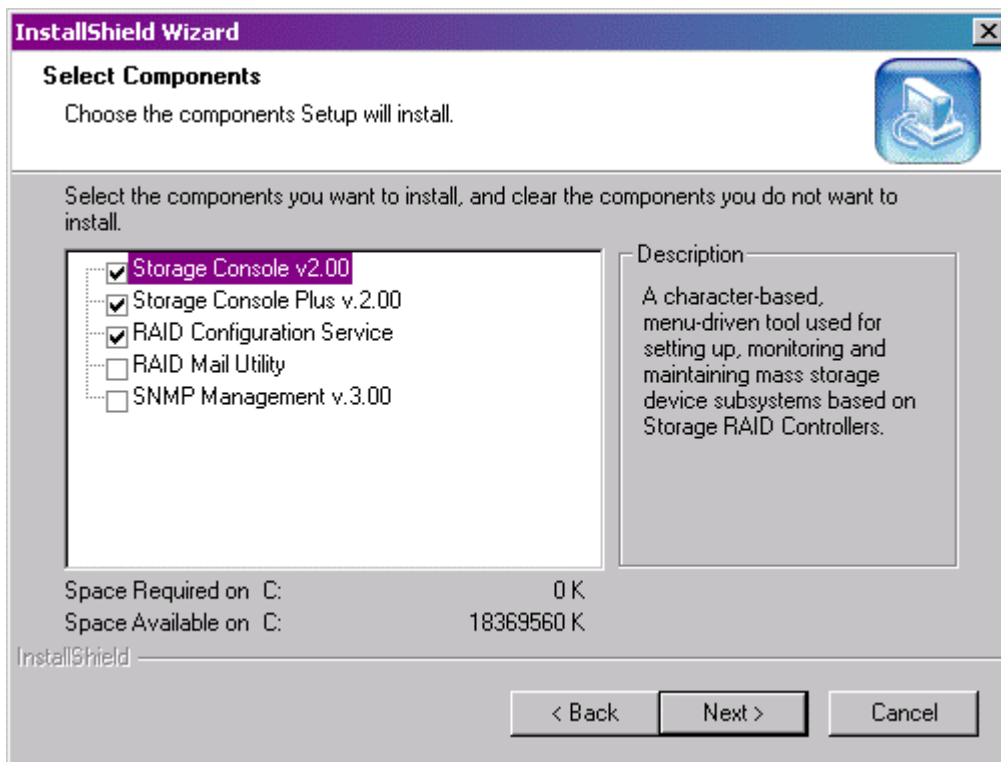
Figure 12. Component Selection (Windows 2000)

Uninstalling the RAID Software Suite

⚠ WARNING

*Uninstalling the **RAID Software Suite** from a computer that has the operating system installed on a host drive or pass-through disk will result in the inability to reboot the operating system. This could result in data loss.*

To remove the RAID Software Suite from Windows 2000 follow the instructions below.

1. Ensure that you have closed all applications and are logged in with administrative rights.

2. Open the Control Panel and launch the Add/Remove programs icon.

3. Select the RAID Software Suite and click "Change/Remove" for Windows 2000 or "Add/ Remove" for Windows NT.

4. The InstallShield Wizard begins.
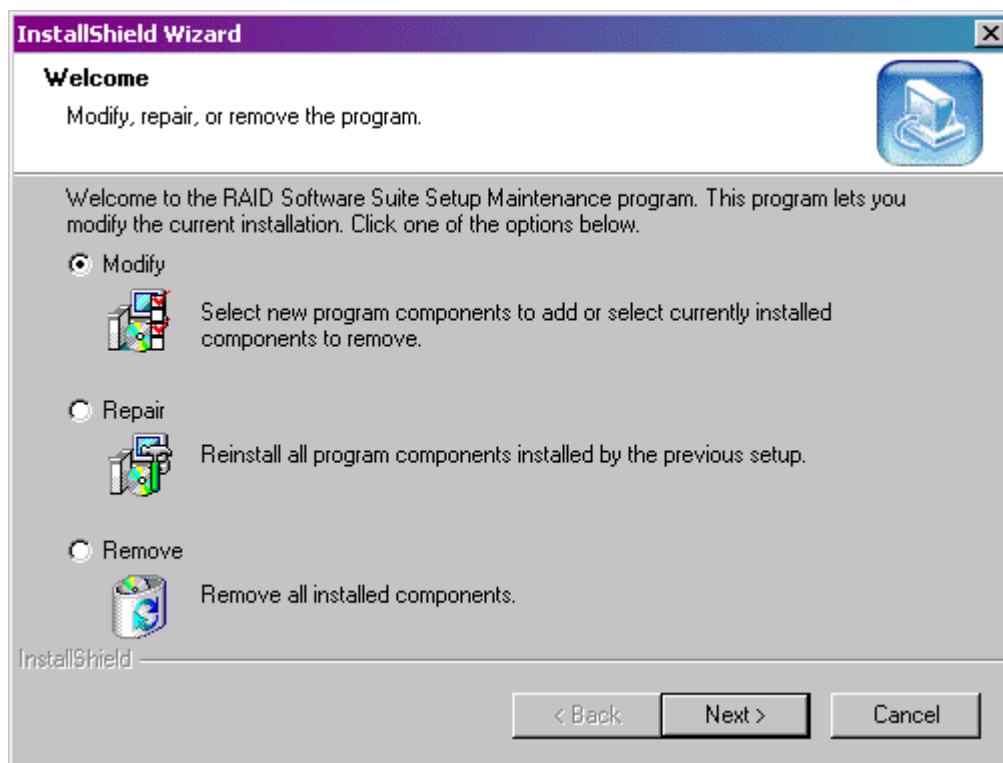
Figure 13. Add/Remove Programs (Windows 2000 Example)

Windows 2000:
    a. Select "Remove" and click "Next."
    b. A progress window appears as files are removed. (Note: The RAID device driver will not be removed. Only the RAID software components will be removed).
    c. When finished, the Maintenance Complete window is displayed. Click "Finish" to complete the removal of the RAID software components.

Windows NT 4.0:

    a. Select "Modify" and click "Next."

    b. The Select Components screen will launch. Remove the check from the check box in front of each component that you wish to remove. Do not remove the check from the box in front of the RAID Device Drivers component unless you intend to remove the device drivers.

⇒ **NOTE**

If you remove the device drivers and you are booting to a host drive, you will be unable to reboot back into Windows. The operating system will be inaccessible. Click "Next."

    c. A Question Box will appear if you have deselected Storage Console(s). Click "Yes" to continue the uninstall.

    d. The InstallShield Wizard Complete window is displayed. Click "Finish" to close the window.

5. After file removal finishes, reboot the computer to complete the uninstall.

Loading the StorCon Program Under Windows 95/98

The StorCon program for Windows 95/98 is part of the Intel RAID Controller SRCU32 System CD-ROM. To load the program under Windows 95/98, type the following command at the prompt:

```
StorCon <Enter>
```

⇒ **NOTE**

To monitor the server(s) remotely using StorCon, load MON4SOCK.DLL in the same directory as StorCon. It supports SPX†/IPX and TCP/IP network protocols (for NetBIOS you can load instead MON4NETB.DLL).

Loading StorCon Under Linux

The Intel RAID Controller SRCU32 System CD-ROM for Linux includes the archive:

- StorCon.tgz, StorCon, and object files (Intel).
- This archive includes all object files to create StorCon, as well as an executable StorCon compiled on a current Linux version.

Load StorCon by typing the following at the prompt:

```
StorCon <Enter>
```

⇒ **NOTE**

To monitor the server(s) remotely using StorCon, load MON4SOCK.DLL in the same directory as StorCon. This DLL supports SPX/IPX and TCP/IP network protocols (for NetBIOS you can load instead MON4NETB.DLL).

Loading StorCon Under SCO UnixWare

Load StorCon by typing the following at the prompt:

```
StorCon <Enter>
```

⇒ **NOTE**

To monitor the server(s) remotely using StorCon, load MON4SOCK.DLL in the same directory as StorCon. This DLL supports SPX/IPX and TCP/IP network protocols (for NetBIOS you can load instead MON4NETB.DLL).

The StorCon Program

The structure of the Intel RAID Controller SRCU32 firmware has four different levels of hierarchy. Level 1 where the Physical Devices are found, level 2 containing the Logical Drives (made up of one or several physical drives), level 3, the Array Drives, and finally, level 4, the Host Drives. Only host drives are known to the operating system. Using the drives of the next lower level as components always sets up the drive of a given level of hierarchy.

The structure of the Intel RAID Controller SRCU32 firmware has four different levels of hierarchy. Level 1 where the Physical Devices are found, level 2 containing the logical drives (made up of one or several physical drives), level 3, the array drives, and finally, level 4, the host drives. Only host drives are known to the operating system. Accordingly, StorCon has various menu options, each referring to a level of hierarchy.

Host Drives	Level 4
Arrays Drives	Level 3
Logical Drives	Level 2
Physical Devices	Level 1

Intel RAID Controller SRCU32 can simultaneously control most types of host drives. For example, a given system's drive C is a host drive (consisting of a single hard drive), drive D is a type RAID 5 array drive, drive E is a Chain host drive, and drive F is a CD-ROM which communicates with the OS through corelSCSI and the ASPI manager.

The following table lists the host drive types that can be created with the Intel RAID Controller SRCU32 Firmware.

Table 14.   Host Drive Types

Type of Host Drive	Description of Host Drive	Minimum Number of Hard Drives Required
Disk	1:1 assignment: host drive to hard drive (sometimes also called JBOD)	1
Chain	Concatenation of several hard drives	2
RAID 1	Mirroring	2
RAID 0	Data Striping	2
RAID 4	Data Striping with parity drive	3
RAID 5	Data Striping with striped parity	3
RAID 10	Combined RAID 0 and RAID 1	4

After loading StorCon, the screen in Figure 14 appears (press <F10> to toggle between a black and white or color display).

Select Interface

Interface represents the way in which StorCon connects with the Intel RAID Controller SRCU32. In this example "WIN 9x/NT/2k," (see Figure 14) indicates that the StorCon is the Windows version and is loaded on a Windows system. If you press <Enter>, StorCon scans the local system for Intel RAID Controller SRCU32s.
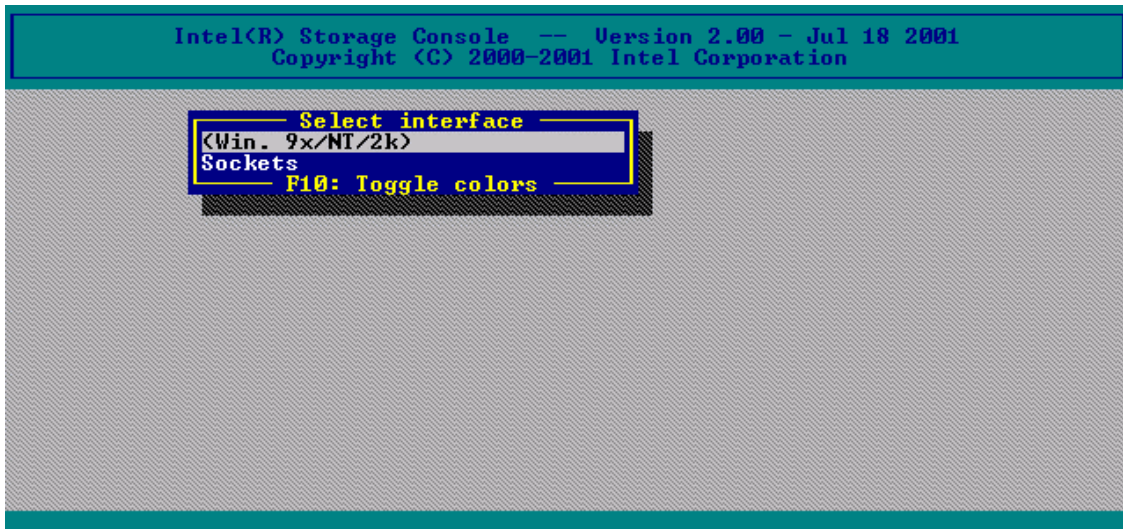
Figure 14. Select Interface

Selecting "Sockets" allows for the remote connection of this workstation with servers using Intel RAID Controller SRCU32s. Select TCP/IP or IPX/SPX network protocols. To access the servers with Intel RAID Controller SRCU32s, the corresponding remote service must be loaded on the server. Users must be assigned access rights (Name, password). See Figure 15. After selecting "Sockets" and "TCP/IP" you may enter the IP address of the server (if you choose "SPX/IPX" StorCon will scan the network for suitable servers which have SPX/IPX protocol). Enter user name and password as appropriate.
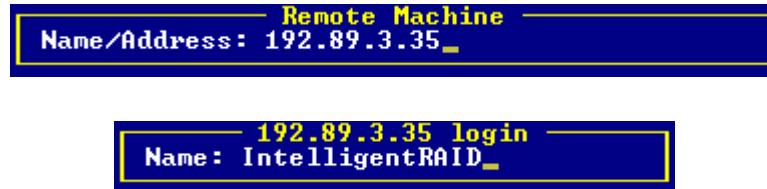
Figure 15. Remote Machine

Select Controller

After the login procedure StorCon displays a list of Intel RAID Controller SRCU32s which are installed in the server (in this example one SRCU32, see Figure 16). This list includes controller name, the PCI Bus system (0=primary, 1=secondary, etc.) and the PCI slot number, the controller's features (C=Chaining, 0=RAID 0, 1=RAID 1, 4=RAID 4, 5=RAID 5, 10=RAID 10), and the firmware level. After selecting the controller by pressing <Enter>, all further changes to these settings within StorCon refer to this Intel RAID Controller SRCU32 and the connected devices.

Figure 16. Select Controller

Monitor and Express / Advanced Setup

StorCon offers two fundamentally different operating modes, Monitor with monitoring functions and Express Setup/Advanced Setup with configuration functions. See Figure 17.
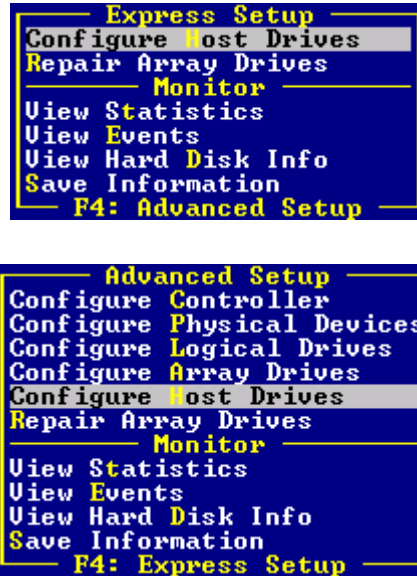
Figure 17. Monitor and Express Setup / Advanced Setup Menu

Menu options can be selected either with the cursor up/down keys, or by pressing the highlighted character. Press <F4> to switch between the Advanced Setup and Express Setup modes.

Monitor Menu

The monitor menu has the following menu options. See Figure 17.

- Use View Statistics to supervise the performance of the different components of the RAID subsystem.
- View Events is an enhanced event recorder for RAID and controller-specific events.

Use View Hard Drive Info to view detailed information on the connected devices (important are the retries, reassigns, grown defects, and last status information).

Use Save Information to create a complete protocol file of the current RAID subsystem including all settings of the Intel RAID Controller SRCU32 and the drives. This file can be used for remote diagnosis.

Express Setup / Advanced Setup Menus

Express Setup and Advanced Setup (Chapter 7) have the following menu options. See Figure 17.

1. Use "Configure Host Drives" to configure already existing host drives or create new ones. For example, you can create a new host drive under normal operation without shutting down the computer.

2. Use "Repair Array Drives" to repair array drives which have failed drives.

3. Use "Configure Controller" to setup the Intel RAID Controller SRCU32. Here, you can change the cache settings, termination, and memory test, etc.

4. Use "Configure Physical Devices" to initialize the devices at the physical level, for example, change the SCSI protocol, transfer rates, etc.

5. Use "Configure Logical Drive" to configure or create logical drives.

6. Use "Configure Array Drives" to configure or create array drives.

Monitor Menu

View Statistics

The View Statistics menu (Figure 18) displays the performance of the drives and their corresponding level of hierarchy. The throughput of the drives is displayed in KB's (KiloBytes per second) and I/O's (I/Os per second, number of I/O's on the controller). The performance figures reflect the load on the controller and not necessarily the maximum performance the controller can deliver.
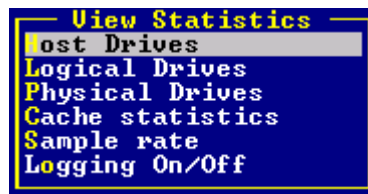
Figure 18. View Statistics Menu

When selecting a drive's statistics, StorCon displays a list of all drives for a particular RAID level (for this example the physical drive for RAID level 1). In addition to the performance report on the drives, the menu monitor displays the hard drive I/O channel, hard drive ID, hard drive name and hard drive gross capacity (1 MB = 1024 KB). See Figure 19. The figures shown at TOTAL represent the performance of the host drives as a whole. With the left arrow and right arrow keys you may change the scale of the graphical KB/s indication. With the up arrow and down arrow keys you can scroll the screen to see additional drives (if available).
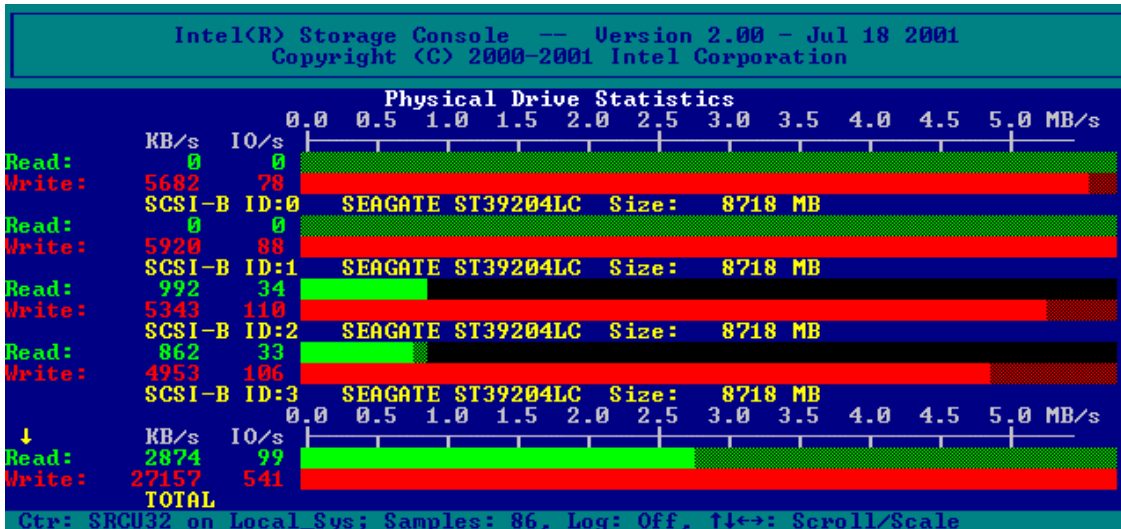
Figure 19. Physical Drive Statistics

Use "Cache Statistics" to view the utilization of the Intel RAID Controller SRCU32's caches (read cache and write cache). This menu also displays the size of the cache in KB and the settings of both caches (on or off). The figures for "cache hits" show how often requests can be serviced out of the cache, for example, without triggering an immediate disk I/O.

Use "Sample Rate," to choose the interval at which the Intel RAID Controller SRCU32 delivers new measurements. Depending on the operating system used, the sampling rate can be set to a maximum of 60 seconds. The default setting is 1 second.

Use "Logging On/Off," to create a log file which records all the statistical values over a longer period. If you choose On, StorCon asks for the path/name of the log file. See Figure 20.

Figure 20. Logfile Name

View Events

Use "View Events" to display Intel RAID Controller SRCU32 events. Events can also be recorded and saved into a log file. This menu option gives the administrator the ability to analyze and supervise array drives. See Figure 21.

Figure 21. Controller Events

View Hard Drive Info

View Hard Drive Info menu shows information for hard drives. The hard drive information (shown in Figure 22) includes SCSI Channel, SCSI ID, Vendor, Product Type, Retries/Reassigns, Grown Defects, and Last Status.

Figure 22. Hard Drive Information

The Retries Counter

The Retries counter records the number of retries to a hard drive (the counter is incremented by one unit whenever the Intel RAID Controller SRCU32 retries to access a hard drive. If the counter continues to increase, it is likely that the cable is not adequate for the selected data transfer rate (cable is too long, of poor quality or connectors are of poor quality) or that the SCSI bus is not properly terminated (too many terminators on the cable or a missing terminator). In very few cases is the hard drive defective. The retries counter also increments when the SCSI parameters of a hard drive are changed.

The Reassigns Counter

The Reassigns counter records the number of media defects which occur on a hard drive. Defective blocks of a hard drive are assigned substitute blocks (spare blocks) that are either on the same track, or on alternate ones if all spare blocks on the same track are already in use. The administration of the reassignments is carried out by the hard drive through reassignment tables. If you observe that the number of reassigns is constantly increasing, you may assume that something is wrong with the drive.

If a hard drive works with alternate tracks, it is generally no longer suitable for applications with high performance expectations. Whenever a defective block is being accessed, the read/write actuator has to move to an alternate position and this requires extra time.

The Grown Defects Counter

The Grown Defects counter records the number of media defects that have occurred since the device was first operated with an Intel RAID Controller SRCU32. A hard drive is in good condition when it has 0 grown defects. Any value greater than 0 indicates a grown defect condition. For more information on grown defects see Chapter 7, View Status/Defects.

Last Status

Last Status information should always be 0x00000000. After a device failure or other significant events, a different value may be displayed here. This value is volatile and is reset to 0x00000000 after each power up and/or reset. If you press <Enter> on a Drive, StorCon displays additional information on the SCSI parameter settings, as shown in Figure 23.

```
┌──────────── Hard disk Information ────────────┐
│ Name ................: SEAGATE ST39204LC      │
│ Capacity ............: 8718 MB                 │
│                                               │
│ Sync. Transfer .....: Enabled                 │
│ Sync. Transfer Rate : 80.0 MB/s               │
│ Sync. Transfer Mode.: ST                      │
│ Data Path Width ....: Wide                     │
│ Domain Validation ..: On                       │
│ Disconnect .........: Enabled                  │
│ Disk Read Cache ....: On                        │
│ Disk Write Cache ...: On                        │
│ Tagged queues ......: On                        │
│                                               │
│ Grown defects ......: 0                        │
│ Last status ........: 0x00000000               │
└───────────────────────────────────────────────┘
```

Figure 23. Hard Drive Last Status

Save Information

Use the Save Information menu option to save the configuration information of the selected Intel RAID Controller SRCU32 and its devices in an ASCII-file. See Figure 24. Such system information/ documentation would be helpful should you require support.

```
───────────────── View Information ─────────────────
        Intel(R) Storage Console  ──  Version 2.00 - Jul 18 2001
        ==========================================================

Date/Time:          Tue Aug 07 17:39:18 2001
Operating system:   Windows 9x/NT/2000, Version: 5.00, Rev. 2195
Driver version:     3.02
Processor:          x86 Family 6 Model 8 Stepping 3
Physical memory:    130540 KB


                    Controller Information
                    ======================

Type:               SRCU32          Slot/Address:    0/1
Firmware version:   2.32.00-R002    Serial no.:      00FF7DF8
Features:           C 0 1 4 5 10    Channel count:   2
Cache:              On              Delayed Write:   On
```

Figure 24. Save Information

At the end of this protocol is a chronological listing of boot messages and other events stored in the Flash-RAM of the Intel RAID Controller SRCU32. If the buffer is full, the oldest events are deleted first.

⟹ **NOTE**

In the menu "Configure Controller" the logging buffer can be cleared with "Clear Log Buffer." The log is a good source of information for analyzing complex events and problems. See Figure 25.

Figure 25. Screen Service Messages and Async. Events

Express Setup

Configure Host Drives

Express Setup Configure Host Drives allows for easy installation of new host drives.

⟹ **NOTE**

Creation of a host drive as Single Disk, RAID0, RAID1 or RAID10 is non-destructive so that the partition table of the new drive (which could have conceivably been used on another SCSI HBA) could have valid data. To prevent this from occurring, run a surface check on each disk before creating hosts.

⟹ **NOTE**

Apart from minor differences, this menu option is identical to menu option Configure Host Drives *in Advanced Setup, Chapter 7. In Express Setup, the user may not select a stripe size (defaults to 128 KB) or use the Split/Merge functions.*

Host Drive States

After clicking on Configure Host Drives, StorCon displays a list of existing host drives. In a new system this list shows no host drive entries. In the example in Figure 26 one host drive is available, and it is a RAID 5 array drive (with approximate 17 GB capacity). The status is ready, meaning that this host drive is fully available and redundant.
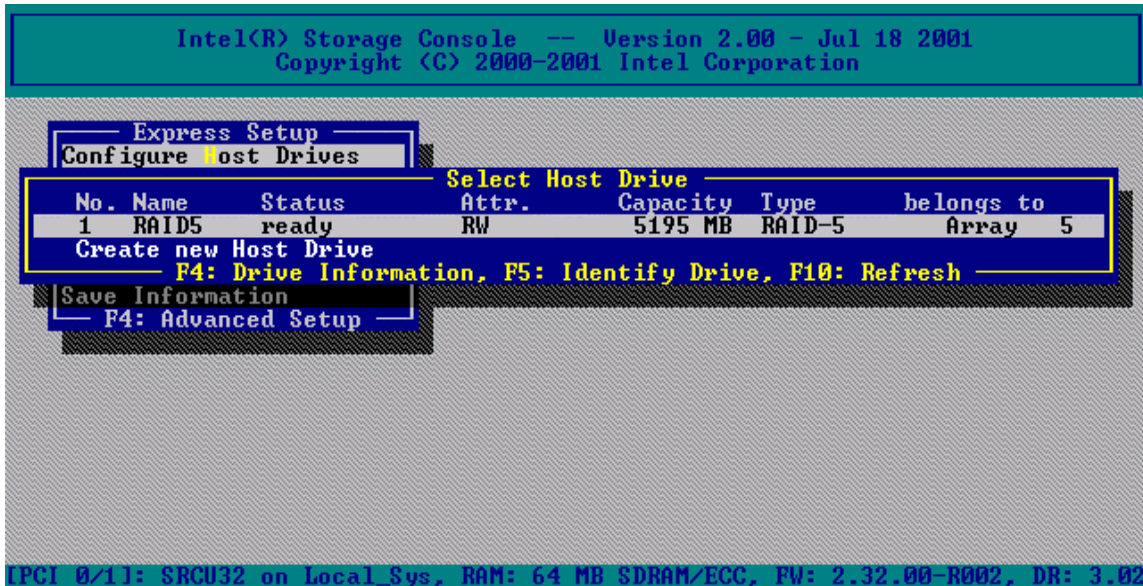
```
          Intel(R) Storage Console  --  Version 2.00 - Jul 18 2001
                  Copyright (C) 2000-2001 Intel Corporation

      ┌── Express Setup ──┐
      │Configure Host Drives│
      ┌────────────────────────── Select Host Drive ──────────────────────┐
      │ No. Name      Status      Attr.     Capacity  Type       belongs to │
      │  1   RAID5     ready        RW         5195 MB  RAID-5       Array   5 │
      │ Create new Host Drive                                                 │
      └──────── F4: Drive Information, F5: Identify Drive, F10: Refresh ──────┘
      │Save Information│
      └─ F4: Advanced Setup ─┘



[PCI 0/1]: SRCU32 on Local_Sys, RAM: 64 MB SDRAM/ECC, FW: 2.32.00-R002, DR: 3.02
```

Figure 26. Select Host Drive

Some of the states listed below may have the addition of /patch (for example build/patch, ready/patch). This indicates that the original array drive went through a significant procedure, for example, the parity information was recalculated anew. Or, the array drive has been patched from the error state into the fail state. This may become helpful in a situation where two logical drives of an array drive fail at the same time, but only one of the two logical drives is really defective and the other was blocked out since it was connected with the same I/O channel as the defective one. The array drive's state is error and normally all data would be lost. Intel RAID Controller SRCU32 includes some functions that allow the patch of this array drive from the error state into the fail sate. Before the actual patch, the defective drive has to be physically removed from the array drive. Such a patch procedure should only be used after a consultation with a trained support person (a printout of the Save Information file, is extremely helpful).

Pressing <F4> delivers level-by-level detailed information on a host drive and its components. This may assist in getting an overview of a specific host drive. After pressing <F5>, the Intel RAID Controller SRCU32 switches the LEDs (if available) of the hard drives belonging to that host drive on and off.

Idle State:

The idle state is characterized by the fact that the redundant information of the disk array has never been entirely created. The disk array is in this state after its first configuration and until you quit StorCon. Should an error occur while the array is in the build state, the array returns to idle. The exception is that if during build mode the dedicated drive of RAID 4 fails, the mode changes to fail.

Build State:

After the disk array has been configured for the first time, it assumes the build state as soon as you quit StorCon. While the array is in the build state, redundancy information is calculated and stored to the hard drives of the array.

Ready State:

The disk array is fully operational when in the ready state. All redundant information is present, for example, a hard drive can fail without impairing the functionality of the disk array. This is the normal state of a disk array. The state ready/expand indicates that the RAID level and/or capacity are currently migrated/expanded.

Fail State:

The disk array changes to the fail state whenever a logical drive fails. Redundancy information is still present, thus allowing the remaining hard drives to continue working. This state should be eliminated as soon as possible by replacing the defective hard drive. If a so-called hot fix (hot spare) drive has previously been assigned to a disk array with StorCon, the controller will automatically replace the defective drive and start the reconstruction of the data and the redundant information. Therefore, under these circumstances the fail state is only temporary and will be eliminated by the controller itself.

Rebuild State:

The disk array will assume the rebuild state after the automatic activation of a hot fix drive or after a manual replacement carried out with StorCon. The data and the redundant information are reconstructed and stored to the new drive.

Expand State:

If the capacity or RAID level of an existing disk array is changed, the disk array changes its state into expand. As soon as the expansion or migration is completed, the state changes back to ready.

Error State:

Should a second hard drive fail while the disk array is in the fail or rebuild state, it is not possible to continue the working session without restrictions. The disk array is still available for I/Os, but data loss and error messages on the host level are possible.

Configure New Host Drive

After selecting Configure New Host Drive, the Intel RAID Controller SRCU32 scans all channels for free hard drives (for example, hard drives which are not yet part of a host drive) and displays these units in a list (see Figure 27). Use the arrow up and down keys to move the selection bar from one hard drive to another and the space bar to select/deselect hard drives. Marked hard drives show an "*" in the first column.

In the Choose Type window in Figure 27 all host drive types are displayed (the possible types depend on the number of selected hard drives and the firmware level of the Intel RAID Controller SRCU32). Finish the selection by pressing <Enter>.
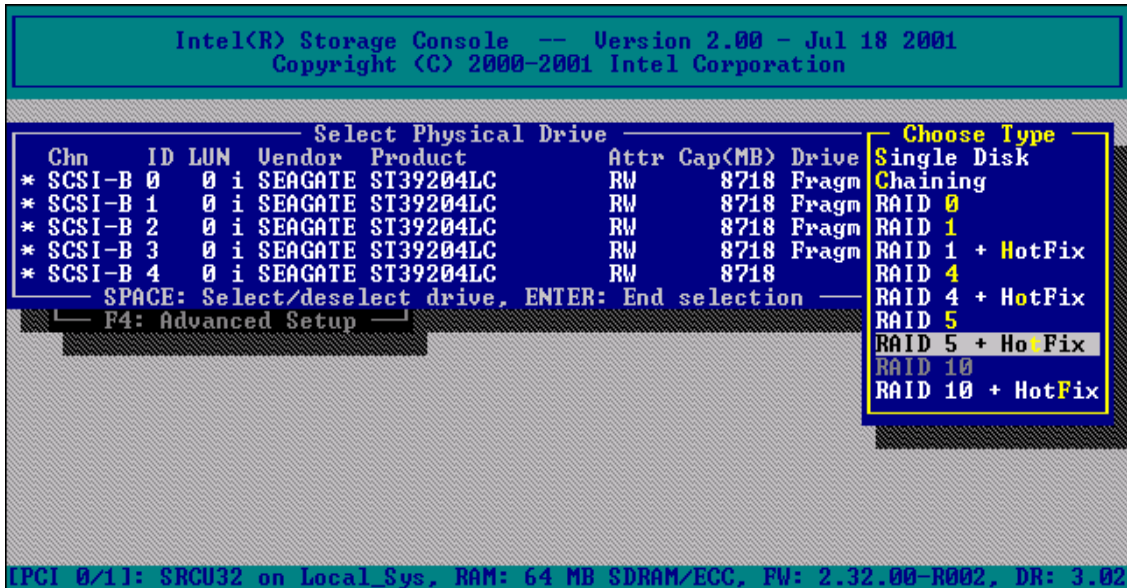
Figure 27. Choose Type

StorCon displays a security message pointing out that all existing data on the selected hard drives will be destroyed. Confirm by pressing <Y> (Figure 28).

Figure 28. Create Host Drive Confirmation

After pressing <Y> the user may limit the capacity of each hard drive selected for the new host drive (Figure 29). This can be helpful when procuring future spare hard drives. StorCon then creates and configures the new host drive and adds it to the list. All SCSI parameters are adjusted to optimum values.

Figure 29. Hard Drive Capacity

⟹ **NOTE**

If the entire hard disk capacity is not used when configuring a RAID 1 host drive, you cannot use the remaining capacity to expand the array drive in the future.

Figure 30. Drive Status

After leaving StorCon or after pressing <F10> (for refresh) the Intel RAID Controller SRCU32 begins the build process on the new host drive. In our example it calculates the parity information and writes it to the hard drives. The status during this process is build. When the build is successfully finished the status changes to ready.

Host Drive Options

Select a host drive and press <Enter> to open the host drive options dialog (Figure 31).

Figure 31. Host Drive Options

Change Drive Name:

Use Change Drive Name to change the name of a host drive. The name serves to identify a host drive with StorCon. For example, you could name the boot host drive "Boot" and the data host drive "Data."

Swap Host Drives:

When a PCI computer is switched on, the host drives are initialized in the order of the host drive list, which means that the operating system is booted from the host drive with the lowest number. For reasons of flexibility, a host drive's position in the list can be changed. However, the position of the host drive from which the operating system is booted and the position of the host drive from which StorCon (disk version) was started (both can be the same), cannot be changed. If you wish to change the position of these drives, you have to boot the operating system and StorCon from a floppy disk or use StorCon from the Flash-RAM of the Intel RAID Controller SRCU32. To change the position of a host drive in the host drive list, highlight the host drive and confirm with <Enter>. Then, type in the new position and press <Enter>.

Remove Host Drives:

Removing a host drive results in the loss of all data. All data will be lost after removal. If you remove a host drive belonging to an array drive for which several host drives exist (after capacity expansion, or after splitting), all other host drives will also be removed.

Split Host Drive:

For some purposes you might need to split an existing host drive into two or several host drives, in which case each host drive looks like a single hard drive to the operating system. Since the new host drives have smaller capacities, StorCon has to write new header information on the host drives. All data will be lost from the original host drive.

The Split Host Drive menu is only available if StorCon is loaded with <Ctrl> + <G> from the Intel RAID Controller SRCU32's Flash-RAM.

Merge Host Drives:

This function reverses the Split Host Drive operation. Only host drives that belong to the same array drive or logical drive can be merged. Since the new host drive has a larger capacity, StorCon has to write new header information on the new host drive. All data from the original host drives will be lost.

The Merge Host Drives menu is only available if StorCon is loaded with <Ctrl> + <G> from the Intel RAID Controller SRCU32's Flash-RAM.

Partition Host Drive:

This option is not available when loading StorCon from the Flash-RAM of the Intel RAID Controller SRCU32. Before you can partition a new host drive it may become necessary to first reboot the system. The partitioning menu has similar functions as the MS-DOS program FDISK. You can create and delete a partition and also change the active partition. MS-DOS can only be booted from an active partition. Just like FDISK, StorCon can handle primary partitions, extended partitions, and logical drives within the extended partitions.

Add Hot Fix Drive:

Add Hot Fix Drive allows you to add a hot fix drive to an existing RAID 1, RAID 4, RAID 5, or RAID 10 array drive. There are two different types of hot fix drives: Private and Pool hot fix drives. A pool hot fix drive is a spare drive within the so-called hot fix pool. A drive in a hot fix pool is available for several array drives as a hot fix drive. Thus, several array drives can share one hot fix drive. Once this drive has been used by one of the array drives, it is no longer available to the others. A private hot fix drive is dedicated to one RAID 1, RAID 4, RAID 5, or RAID 10 array drive.

Remove Hot Fix Drive:

Remove Hot Fix Drive allows you to remove a previously assigned hot fix drive.

Overwrite Master Boot Code:

This option creates a valid and consistent master boot record on the selected host drive and should be carried out on any new host drive on which Windows NT is installed. Never use this function when the host drive contains valid data, as all data will be lost.

Repair Array Drives

This function allows the online repair of array drives which show failed drives. After selecting this menu option, StorCon displays a summary of all installed array drives and the number of array drives which are in critical states (Figure 32). In the example in Figure 33 there is one array drive in the Fail state. For example, the array drive is still operating but no longer redundant.

Figure 32. Array Drive Summary

After pressing any key, StorCon displays a list of array drives which are candidates for online automatic repair.

⟹ **NOTE**

Array drives that are in the Error *state are very critical and have lost two or even more drives. These array drives cannot be repaired with the* Repair Array Drives *function. In such critical cases data integrity can no longer be maintained.*

After selecting the array drive, StorCon displays the drive that failed. In the example in Figure 33 it is the hard drive which forms logical drive 5.

Figure 33. Failed Hard Drive

After confirmation, the failed drive must be removed from the system and the new one configured on the same ID and installed in the system. See Figure 34 and Figure 35.

Figure 34. Select Drive to Repair

```
The Disk SEAGATE ST39204LC at channel SCSI-B, ID 3 will be replaced.
      Please plug in a disk at the same channel with the same ID.
   YOU MUST NOT DO ANY UNPLUGGING OR PLUGGING ON OTHER CHANNELS

                  Press any key after hot plug.
```

Figure 35. Replace Hard Drive Prompt

StorCon detects the new drive and expects clearance to build this drive as a replacement into the array drive. See Figure 36.

```
You plugged in the disk SEAGATE ST39204LC , ID 3 at channel SCSI-B.
          Do you want to add this disk to the Array? (Y/N)
```

Figure 36. Add Disk to Array Confirmation

When clearance is given, the state of the array drive changes to "Rebuild," for example, the missing data is reconstructed out of the remaining data and redundancy information. See Figure 37.

```
                      Summary

       2 Array Drives installed

       0 Array Drives in FAIL state
       0 Array Drives in ERROR state
       0 Array Drives in BUILD state
       1 Array Drives in REBUILD state
       0 missing Private HotFix Drives

              Press any key.
```

Figure 37. Array Drive Summary

The Error state of an array drive is critical. There are several procedures in the Intel RAID Controller SRCU32's firmware to handle such cases and bring back the array drive into operation without losing data. See Figure 38.

```
Drive in ERROR state cannot be repaired automatically!
     Contact your SysAdmin or the customer support of
                  Intel Corporation.
```

Figure 38. Array Drive Error State Dialog

Advanced Setup

Configure Controller

Controller Settings

Use the Controller Settings dialog to change Intel RAID Controller SRCU32 parameters and settings. All information concerning physical, logical, array and host drives are stored twice (primary and secondary configuration data) on each hard drive. For example, the Intel RAID Controller SRCU32 itself carries no configuration data of a specific disk array. For this reason the migration of host drives between Intel RAID Controller SRCU32s is very easy and secure, even if the SCSI IDs and channels are changed. Simply connect the hard drives to the new Intel RAID Controller SRCU32, and the host drives will be automatically available. See Figure 39.

Figure 39. Controller Settings Dialog

Table 15.   Controller Settings

Parameter	Alternatives	Description
Cache	On	Intel RAID Controller SRCU32 cache (write and read cache) On
	Off	Intel RAID Controller SRCU32 cache (write and read cache) Off
Delayed Write	On	Write cache On
	Off	Write cache Off
BIOS	Enabled	BIOS enabled
	Disabled	BIOS disabled, but <Ctrl> + <G> allowed
	Removed	BIOS and <Ctrl> + <G> disabled

Table 15. Controller Settings (continued)

Parameter	Alternatives	Description
BIOS Warning Level	All Messages	All Intel RAID Controller SRCU32 BIOS warnings and errors are displayed
	Fatal Errors	Only fatal messages are displayed
SETUP from Flash-RAM	Disabled	<Ctrl> + <G> not possible
	Enabled	<Ctrl> + <G> allowed
Display	Off	<Ctrl> + <G> not displayed at system boot level
	On	<Ctrl> + <G> displayed at system boot level
Supported BIOS Drives	2	The Intel RAID Controller SRCU32 BIOS supports 2 drives under MS-DOS
	7	The Intel RAID Controller SRCU32 BIOS supports 7 drives under MS-DOS
CD-ROM Boot	Enabled	Boot from CD-ROM enabled
	Disabled	Boot from CD-ROM disabled
Memory Test	No test	No test at all
	Standard	Standard test
	Double scan	Double scan test
	Intensive	Intensive test (takes longer)
Chn. SCSI-A Termination	Off	SCSI termination of the channel Off
	On	SCSI termination of the channel On
	Auto	SCSI termination according to occupied connectors
SCSI ID	0,1,2,3,4,5,6,7	Possible SCSI IDs for the channel

Firmware Update

The firmware, BIOS and StorCon program of the Intel RAID Controller SRCU32 are stored in Flash-RAM which is part of the Intel RAID Controller SRCU32 hardware. In contrast to EPROMs, Flash-RAMs can be reprogrammed many times without the complicated UV-light erasing procedure. Firmware, BIOS and StorCon are part of the SRC_PFW file. The file has an extension (for example, SRC_PFW.009) which indicates the version stepping.

⟹ **NOTE**

This option is not available when StorCon is accessing the Intel RAID Controller SRCU32 remotely.

Intelligent Fault Bus

The Intelligent Fault Bus is an older subsystem standard, which is no longer used in modern subsystems or backplanes. Intel RAID Controller SRCU32's Ultra/Wide Disk Array Controllers were the last Intel RAID Controller SRCU32s supporting this standard, sometimes also called "DEC Fault Bus."

Today's modern subsystems are either using SAF-TE (SCSI Accessed Fault Tolerant Enclosures) or SES (SCSI Enclosure Services) as communication links to the controller. These intelligent subsystems are normally built on so-called backplanes, which host hard drives equipped with SCA (Single Connector Attachment) connectors. The backplane has dedicated electronics with microprocessor and firmware which allows intelligent communication between the subsystem/backplane and the Intel RAID Controller SRCU32. Through this channel the subsystem can report its temperature and the power supply status to the Intel RAID Controller SRCU32. The major objective of SAF-TE or SES is auto hot plug. In contrast to hot plug, auto hot plug allows a defective drive to be simply removed from the subsystem and the replacement unit installed in its place. Both the Intel RAID Controller SRCU32 and the subsystem control this process so that problems on the SCSI/FC-AL bus are eliminated and the rebuilding of the missing data is initiated automatically. No further user interaction is necessary.

Non-Intelligent Enclosures

Since SAF-TE or SES subsystems are expensive, Intel RAID Controller SRCU32 integrates functionality which allows for the control of up to 16 non-intelligent enclosures with up to 15 hard drives each, and provides for auto hot plug.

In the example in Figure 40 one subsystem is defined. The hard drives with their disk shuttles could also be mounted directly into the server enclosure. The term enclosure in this case is a definition set, which includes all hard drives which should be auto hot pluggable.

```
────────────────── Select Enclosure ──────────────────
No.  Vendor        Name        Status
 0   MALIBU        PA46-350    Configured
 1                             Not Configured
 2                             Not Configured
 3                             Not Configured
 4                             Not Configured
 5                             Not Configured
 6                             Not Configured
 7                             Not Configured
 8                             Not Configured
 9                             Not Configured
10                             Not Configured
11                             Not Configured
12                             Not Configured
13                             Not Configured
14                             Not Configured
15                             Not Configured
────────── ENTER: Select,  F4: Edit Vendor/Name ──────────
```

Figure 40. Select Enclosure

The example in Figure 41 shows the slots of the enclosure which have been assigned with hard drives. To fill an empty slot, press and select the desired hard drive. See Figure 41.
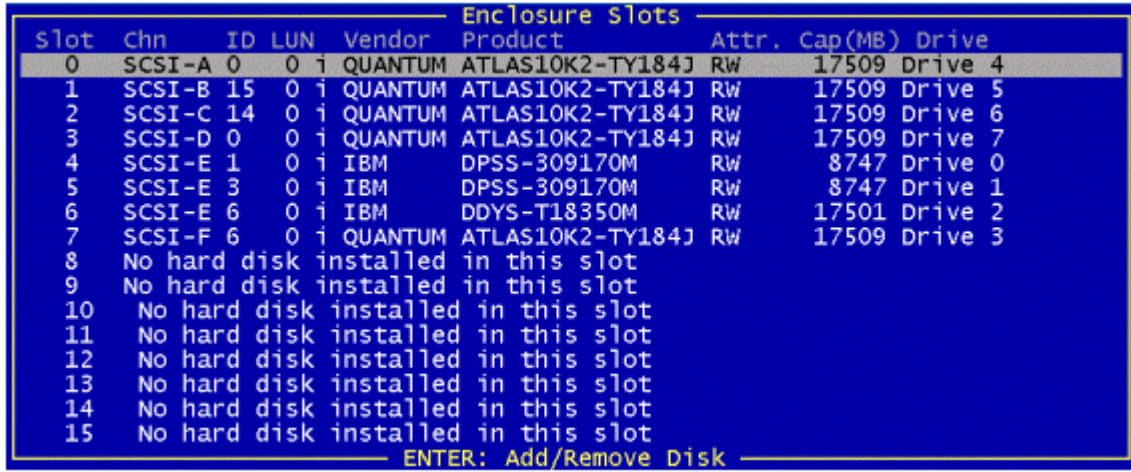
```
┌──────────────────── Enclosure Slots ────────────────────┐
│ Slot  Chn    ID LUN  Vendor  Product       Attr. Cap(MB) Drive │
│   0   SCSI-A  0   0 i QUANTUM ATLAS10K2-TY184J RW    17509 Drive 4 │
│   1   SCSI-B 15   0 i QUANTUM ATLAS10K2-TY184J RW    17509 Drive 5 │
│   2   SCSI-C 14   0 i QUANTUM ATLAS10K2-TY184J RW    17509 Drive 6 │
│   3   SCSI-D  0   0 i QUANTUM ATLAS10K2-TY184J RW    17509 Drive 7 │
│   4   SCSI-E  1   0 i IBM     DPSS-309170M     RW     8747 Drive 0 │
│   5   SCSI-E  3   0 i IBM     DPSS-309170M     RW     8747 Drive 1 │
│   6   SCSI-E  6   0 i IBM     DDYS-T18350M     RW    17501 Drive 2 │
│   7   SCSI-F  6   0 i QUANTUM ATLAS10K2-TY184J RW    17509 Drive 3 │
│   8   No hard disk installed in this slot │
│   9   No hard disk installed in this slot │
│  10    No hard disk installed in this slot │
│  11    No hard disk installed in this slot │
│  12    No hard disk installed in this slot │
│  13    No hard disk installed in this slot │
│  14    No hard disk installed in this slot │
│  15    No hard disk installed in this slot │
└──────────────────── ENTER: Add/Remove Disk ────────────────────┘
```

Figure 41. Enclosure Slots

SAF-TE and SES are recommended for auto hot pluggable subsystems. Only with these systems can a secure auto hot plug be guaranteed. For non-intelligent subsystems we recommend only the best quality components (disk shuttles, cables, terminators, etc.).

Advanced Settings

Within Advanced Settings there are three settings which control the configuration and address behavior of the Intel RAID Controller SRCU32's BIOS and DPMEM. See Figure 42 and Table 16 for setting details.

```
┌──────────── Advanced Settings ────────────┐
│Shrink BIOS after POST ...... (Auto)        │
│BIOS RAM allocation method .. (Auto)        │
│DPMEM mapping .............. (Do not move)   │
└────────────────────────────────────────────┘
```

Figure 42. Advanced Settings Dialog

Table 16.   Advanced Settings

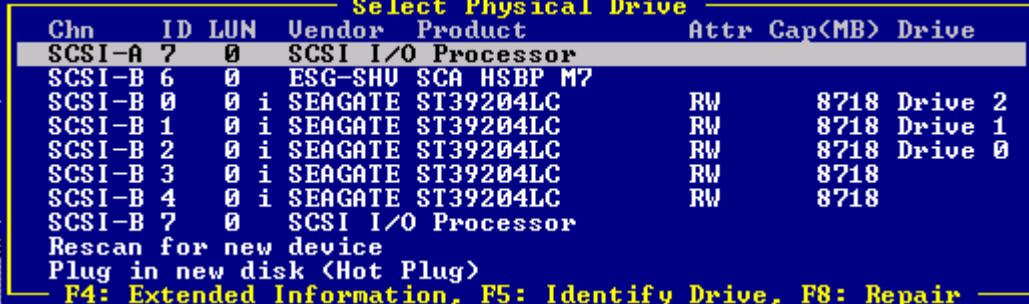| Parameter	Alternatives	Description
Shrink BIOS after POST	Off	The BIOS is not shrinked after the post phase.
	On	The BIOS is always shrinked after the post phase.
	Auto	The Intel RAID Controller SRCU32 decides on the BIOS shrink.
BIOS RAM allocation method	Auto	The BIOS address space is automatically allocated.
	Older	The BIOS address space is allocated according to an older PCI specification.
DMEM mapping	Move below 1MB	The DPMEM address space is allocated below 1 MB.
	Do not move	The DPMEM address is always above 1 MB.

Clear Log Buffer

The Intel RAID Controller SRCU32 records certain events in a logging buffer which is part of the Flash-RAM. Clear all events in the buffer when using the Intel RAID Controller SRCU32 in a new system. The Clear Log Buffer function detects and deletes entries from the log buffer.

Configure Physical Devices

This menu option displays a list of I/O channels (SCSI or Fibre Channel) and available devices. See Figure 43.

Scroll the list with the cursor up/down keys. The first column displays the I/O channel ("SCSI" stands for SCSI and "FCAL" for Fibre-Channel). The next column shows the ID followed by the LUN (Logical Unit Number; normally always 0). The next column is either filled with a lowercase "i" (for initialized), or empty. Initialization means the creation of Intel RAID Controller SRCU32-specific configuration data on the hard drives and the adjustment of hard drive specific operating parameters (protocol, transfer rate, etc.). The next entry lists the vendor and type of device, followed by the drive's attributes (RW for Read/Write; RO for Read Only). The I/O processors and SAF-TE processors (in our example channel B ID 8: SDR, Inc. GEM312 REV001) to not have attributes. The next column lists the capacity of the hard drive in MB (1 MB = 1024 KB; 1 GB=1024 MB). The last column gives information on the assignment of this physical device to a logical/array/host drive.

Figure 43. Select Physical Drive

Keyboard Commands

With Intel RAID Controller SRCU32 Fibre Channel RAID Controllers, <F4> delivers extended information on Fibre Channel drives (World Wide Name, firmware-level, and the Link-status of the drive).

By pressing <F5> the Intel RAID Controller SRCU32 periodically turns the LED (if available) of the corresponding drive on and off. This helps to physically identify a specific drive in an array of many drives.

By pressing <F8> you can repair the configuration data of a physical drive. If the Intel RAID Controller SRCU32 should ever display during the boot sequence a message like "Detected Primary Configuration Data error, using Secondary," you can try to repair the data by pressing <F8>.

If you press <Enter> on a specific drive, StorCon opens the Configure Disk menu. Here, all relevant adjustments and modifications concerning the physical drives can be carried out.

➡ **NOTE**

If you create new host drives with the Express Setup function, the StorCon and the Intel RAID Controller SRCU32 will automatically adjust all parameters to their respective best values. The transfer rate per drive depends on circumstances like cables, terminators, etc. For example, if a certain configuration does not allow 160 MB/sec, the drive is automatically "throttled" down to the next trouble-free transfer rate. See Figure 44.
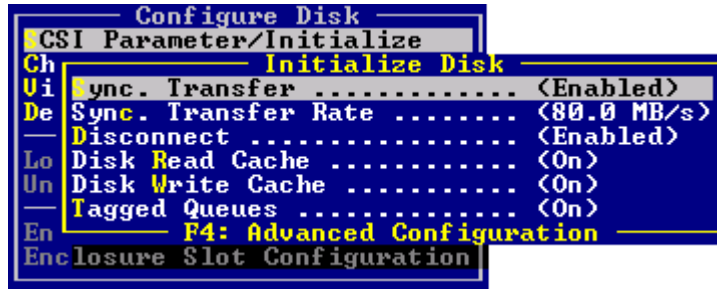
Figure 44. Initialize Disk

SCSI Parameter / Initialize

When a SCSI hard drive is initialized the first time by the RAID controller, its SCSI parameters may or may not be set automatically set to their optimal settings. The following section describes manual configuration of these settings. **For certain RAID controllers and/or situations, certain parameters described in this section may not be configurable.**

⚠ **CAUTION**

This option can destroy all data on the hard disk.

StorCon copies Intel RAID Controller SRCU32 specific configuration blocks on the hard drive, a primary block, and a mirrored secondary block. The possible settings are different if you select a SCSI hard drive or a Fibre Channel hard drive. With a FCAL hard drive there are only a few settings which are relevant. You should always check that they are all "Enabled" or "On." If the hard drive you have selected is an Ultra1 60 device and the Intel RAID Controller SRCU32 has Ultra160 SCSI channels, <F4> "Advanced Configuration," allows you to configure the so-called "Domain Validation" (a cyclical check of the correct data transfer at a given rate). Normally this parameter is OFF.

The SCSI bus can operate two methods of data transfer: asynchronous and synchronous. Each SCSI device must be able to perform the asynchronous transfer; the synchronous is optional. The advantage of the synchronous transfer is a higher data transfer rate, since the signal transfer times on the possibly long SCSI cable have no influence on the transfer rate. This mode is only effective if both devices support synchronous transfer and can communicate with each other in this mode.

Sync. Transfer Rate:

This is the synchronous data transfer rate in MB/s. Ultra160 SCSI allows up to 160 MB/s.

If a SCSI cable does not permit a certain transfer rate, the transfer rate can be reduced to a value that permits trouble-free data transfer. Lowering the transfer rate may also become necessary when using a configuration which does not allow full speed.
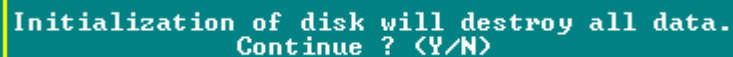
Disconnect: Enabled:

You can connect several components to a SCSI bus. It is particularly important to guarantee a high degree of overlapping action on the SCSI bus. This high degree of overlapping becomes possible when a SCSI device has Disconnect enabled.

Disk Read Cache / Disk Write Cache / Tagged Queues:

For performance reasons, the read ahead and write cache of the hard drive should be always ON. Tagged Queues is a SCSI feature which allows the drive to execute more than one command at a time. If available, it should also be ON.

If you leave this configuration form with <Esc> and you have made changes, StorCon displays a security request. The warning of the destruction of all data (Figure 45) may require different evaluations, depending on the device's current state and the options you selected.

Figure 45. Disk Initialization Confirmation

If this operation is the first initialization of the device, for example, the drive was previously connected to a different controller, all data will be lost. If the device has already been initialized, and only internal parameters such as Disconnect, Synchronous Transfer, and Disk Read/Write caches, or Tagged Queues have been changed, the data on the drive remains intact. Only the functional state of the device changes.

Check Surface

⚠ **WARNING**

This option destroys all data on the hard disk.

This option checks of the surfaces of the hard drive media. The Intel RAID Controller SRCU32 writes and reads certain data patterns and checks them for correctness.

After confirming the security request, a progress information is displayed. You can interrupt the Check Surface option by pressing <Esc>.

View Status/Defects

Table 17. View Status/Defects

Status/Defects	Description
Grown Defects	Number of media defects that have occurred in addition to the media defects the hard drive had upon delivery. See Figure 46.
Primary Defects	Number of media defects that the hard drive had upon delivery.
Last Status	The Last Status gives detailed information on the last failure of a hard drive. The information is only present until the next hard reset of the system and may help for deeper failure analysis or tracing.

Figure 46. View Status/Defects

De-Initialize Disk

⚠ WARNING

This option destroys all data on the hard disk.

This menu option allows you to de-initialize a hard drive which has previously been initialized for use with the Intel RAID Controller SRCU32. By doing so, the specific Intel RAID Controller SRCU32 information present on the device is removed. Obviously, the de-initialization cannot restore data that was lost during initialization.

Lock/Unlock Disk

This option is only highlighted when you have selected a removable hard drive (for example, SyQuest[†], Iomega[†]). Before you can initialize a cartridge you must lock it. Before removing it you must unlock it.

Enclosure Status

After selecting this option you can either view the Enclosure Status or view/configure the enclosure slots. Before you can use the auto hot plug with a SAF-TE subsystem, you must configure the subsystem (more precisely its intelligence, the so-called SEP SAF-TE Enclosure Processor). See Figure 47.

⇒ NOTE

Non-initialized disks cannot be configured as no RAID configuration information can be stored on these disks.

Figure 47. Enclosure Status

To assign a specific hard drive to a SAF-TE enclosure slot, press <Enter> on the empty slot and choose one of the hard drives. See Figure 48.

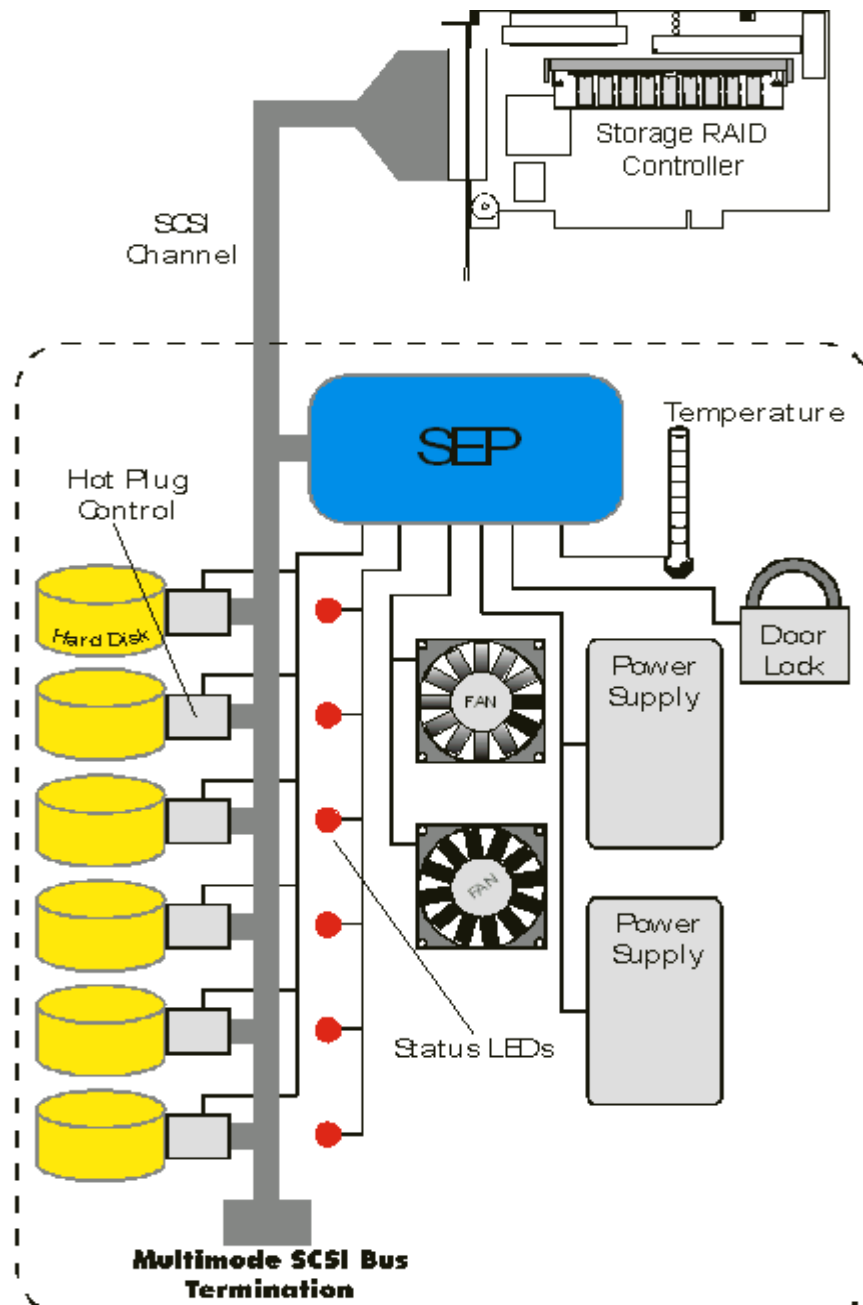**Figure 48. Enclosure Slots**

Figure 49. Block Diagram of a SAF-TE Subsystem

Configure Logical Drives

Logical drives (hierarchy level 2) are installed in the Advanced Setup menu.

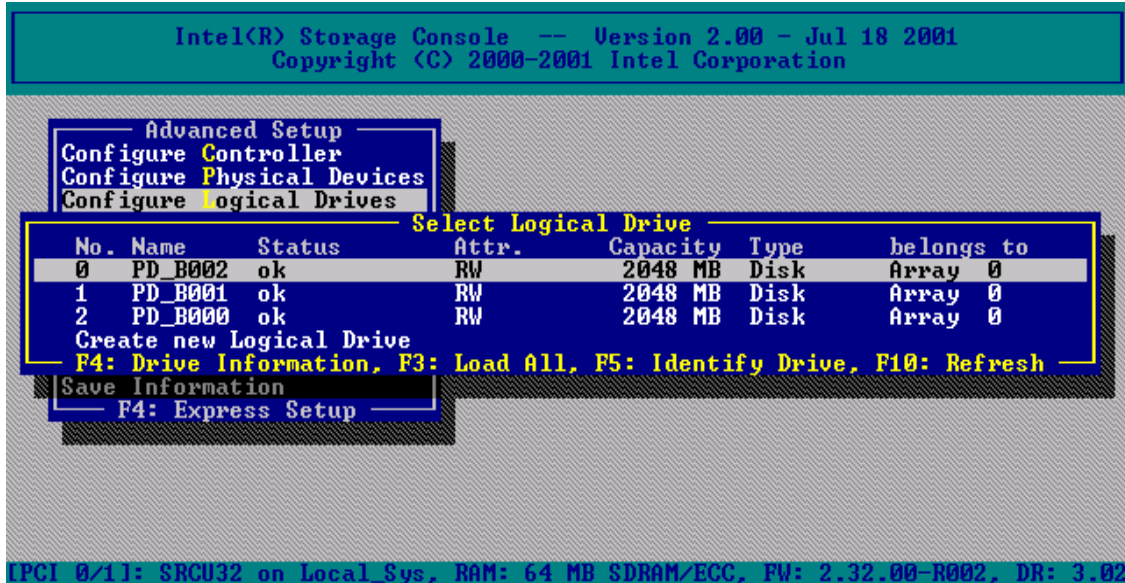The Configure Logical Drives screen is shown in Figure 50.

Figure 50. Select Logical Drive

Keyboard Commands

Use the <F4> key to lists all hard drives of a logical drive. If it is a logical drive of the type Disk, it only consists of one single hard drive. If a logical drive consists of more hard drives, it is of the type Chain (concatenation of several hard drives). <F3> loads all hard drives and <F5> identifies drives by turning the hard drives LED on and off.

To configure and setup a new logical drive, select "Create new Logical Drive." StorCon displays a list of free physical drives (which are not already part of a logical drive). See Figure 51.
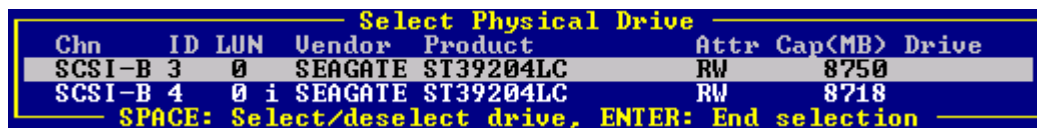

Figure 51. Select Physical Drive

If you select one physical drive with the <Space> key and press <Enter>, StorCon suggests to create a single drive out of this hard drive. See the example in Figure 52.
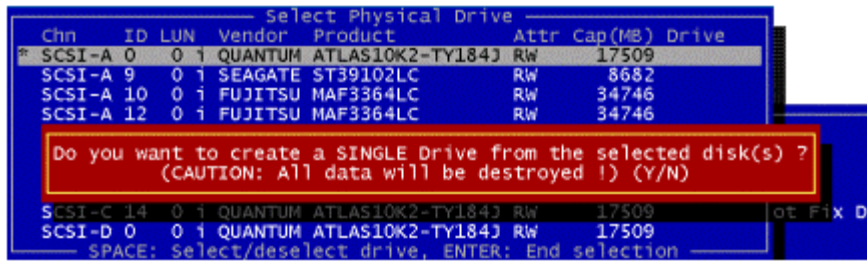

Figure 52. Create Single Drive

Next, enter the appropriate drive capacity and press <Enter>. See Figure 53. StorCon allows you to limit the hard drive size for this host drive. This becomes important when you configure disk arrays and you want to ensure that future drives added to the disk array fit in the array (for replacement purposes). Should a new drive have less than the required capacity, StorCon could not accept it. In this example limit the capacity of each drive to 17000 MB. Any new 18 GB drive must have at least that capacity.

Figure 53. Drive Size

If you select two or more physical drives with the space bar and press <Enter>, StorCon suggests the creation of a logical drive of the type Chain. In some literature disk chaining is also called Disk Spanning. Picture the functioning mechanism of a type Chain logical drive as follows: all hard drives forming the logical drive are linked together one by one in the exact same order in which they were selected with the space bar. This concatenation can be compared to a chain. If, for example, the logical drive consists of four hard drives with 2000 MB each, the logical drive will have a capacity of 8000 MB. When data is written to this logical drive, the first hard drive is filled first, then the second, and so on.

Although it is not advisable, logical drives of the type Chain can also be components of array drives.

Configure Array Drives

The Configure Array Drive menu option allows you to configure array drives (hierarchy level 3). Array drives with the following listed RAID levels can be configured within this. See Figure 54.

RAID 0   Pure Data Striping without Redundancy

RAID 1   Disk Mirroring

RAID 4   Data Striping with Dedicated Parity Drive

RAID 5   Data Striping with Striped Parity

RAID 10   RAID 0 Combined with RAID 1

Intel RAID Controller SRCU32 can manage up to 35 array drives (with different RAID levels) simultaneously. Obviously, the number of hard drives will limit the number of parallel arrays that can be used.

Figure 54. Select Array Drive

⇒ **NOTE**

A RAID-1 component build will not appear on the select array drive list.

Keyboard Commands

<F4> displays level-by-level detailed information on the selected array drive (the structure, the order, and which hard drives are part of the array drive). Use <F5> to turn on LEDs of all hard drives belonging to this array drive. This can help to identify hard drives. If you press <Enter> on a specific array drive StorCon displays a menu of options. See Figure 55.

Figure 55. Array Drive Menu

Change Drive Name

The Change Drive Name command allows you to change the name of an array drive. The name serves to identify an array drive in StorCon or StorCon+. This can be helpful for configurations where several host drives of various types are operated by a single controller.

Expand Array Drive

The Expand Array Drive option, which is also available with StorCon+, contains three major functions.

Function	Description
Conversion	Conversion of a free space on the logical drives into a separate host drive.
Migration	Migration of the RAID level of an array drive: • RAID 0 to RAID 4 and vice versa • RAID 0 to RAID 5 and vice versa
Expansion	Expansion of the capacity of an array drive.

⟹ **NOTE**

*If the entire hard disk capacity is not used when configuring a RAID 1 host drive, you **cannot** use the remaining capacity to expand the array drive in the future.*

⟹ **NOTE**

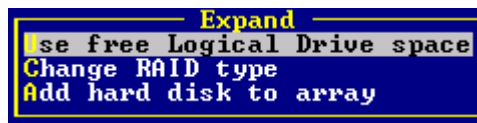*If StorCon is closed, migration of the RAID level may not complete.*

Figure 56. Expand Array Dialog

To migrate or expand a RAID 4/5 array drive, the state must be ready. The data on the array drive remains intact and is not affected by the expansion. The additional capacity is introduced as a new host drive. If a logical drive fails during the expansion, the expansion process continues until the expansion is finished and the array drive changes into the fail state.

Add RAID 1 Component

This function allows you to add to a logical drive which is member of an array drive, another logical drive as a mirror drive (RAID 1).

Example: You have configured an array drive with 4 logical drives. One logical drive has failed and the array drive has gone into the fail state. Another failure would cause data loss. Unfortunately, you find another logical drive which is likely to fail (for example, you hear a strange noise from it, or it's grown defect counter explodes). If you initiate a hot plug it is very likely that this critical logical drive will also fail, resulting in a data loss. To avoid that problem, mirror a new good logical drive to the critical one. When the copying is finished you remove the critical logical drive and then carry out a hot plug procedure. You can also use this function to mirror RAID 4/5 array drives (RAID 5+1, RAID 4+1).

Replace Array Component

If a logical drive of an array drive without a hot fix drive should fail (or is likely to fail), you should replace the defective hard drive with a new one as soon as possible because the array drive is without redundancy. The replacement logical drive has to have at least the same capacity as the failed one. The replacement is carried out either with StorCon or StorCon+. After installing the replacement hard drive as a new logical drive, add it to the array drive. After selecting the logical drive that needs to be replaced, StorCon offers a list of existing logical drives which can be used as replacement units. The array drive's state changes into rebuild and the missing data is automatically reconstructed on the new logical drive.

Remove RAID 1 Component

This option corresponds to the Add RAID-1 Component option. It allows you to remove a previously configured RAID-1 combination. Figure 57.

Figure 57. Remove Drive Confirmation

Remove Array Drive

Use the *Remove Array Drive* command to remove an existing array drive.

⚠ WARNING

This option destroys all data on the array drive.

⇒ NOTE

*If an array drive has been removed, there is a possibility that it could be rebuilt without data loss if it is reconstructed in the exact same order it had been built before, if the components of the array drive, that is the host drives, have not been modified, if the stripe size and RAID level are the same and if a Non-Destructive Build is carried out. **In all other cases ALL DATA WILL BE LOST.***

Add Hot Fix Drive

This submenu option allows you to add a hot fix drive to an existing RAID 1, RAID 4, RAID 5, or RAID 10 array drive. There are two different types of hot fix drives: Private and Pool hot fix drives. A pool hot fix drive is a spare drive within the so-called hot fix pool. A drive in a hot fix pool is available for several array drives as a hot fix drive. Thus, several array drives can share one hot fix drive. Of course, once this drive has been used by one of the array drives, it is no longer available for the others. A private hot fix drive is dedicated to one RAID 1, RAID 4, RAID 5, or RAID 10 array drive.

Only drives that meet the following requirements are suitable as hot fix drives:

- It must not be an active component of another array drive.
- It must have a storage capacity greater than or equal to the storage capacity of the smallest logical drive of the array drive. Example: A type RAID 5 array drive consists of the following components:
  — Logical Drive 0   2000MB
  — Logical Drive 1   1500MB
  — Logical Drive 2   1100MB
  — Logical Drive 3   2000MB

This array drive has a usable storage capacity of 3300MB. A hot fix drive for this array must have at least 1100MB of storage capacity.

⟹ **NOTE**

To avoid wasting valuable storage capacity, it is recommended that all logical drives forming an array drive have the same storage capacity.

In the Event of a Drive Failure

The controller will substitute a failed logical drive with a hot fix drive only if the array drive was in the ready state before the failure. In other words, a hot fix drive can only be activated if the corresponding array drive had a state of data redundancy at the moment of failure.

1. The controller's alarm activates.

⟹ **NOTE**

The alarm is activated only when the array drive is being accessed.

2. The controller activates the fail operation mode. In this mode, the array drive remains fully operational. The data located on the failed drive is generated by means of the redundancy information stored on the other drives, without causing any decrease in performance.

3. The controller integrates the hot fix drive into the array drive and begins reconstructing the data and redundancy information. The array drive is now in the rebuild mode.

Obviously, no other hard drive may fail until all data has entirely been reconstructed on the hot fix drive (because the system is operating without redundancy) without the array drive going into error mode.

In some literature, hot fix drives are also referred to as hot spare *drives. You can also add or remove hot spare drives using StorCon+.*

Remove Hot Fix Drive

This option allows you to remove a hot fix drive from an existing array drive.

Hot Fix Pool Access

By selecting the Hot Fix Pool Access option, the access of a specific array drive to the hot fix pool can be enabled or disabled.

Parity Verify

The redundancy information calculated during an array build or rebuild is stored on a dedicated logical drive (RAID 4), or is distributed over all logical drives of the array drive (RAID 5). This information is often called parity data. The calculation is made with an exclusive OR function (XOR). If a logical drive of an array drive fails, its data can be recalculated by means of the data present on the other logical drives of the array drive and the parity data. The Parity Verify function allows you to check the consistency of an array drive's parity data. The verification may take quite a long time, but you can terminate it by pressing <Esc>.

⇒ **NOTE**

When using the escape key <Esc>, the progress indicator will close. However, parity verify continues to run unless the "A" key is used to abort parity verify.

⇒ **NOTE**

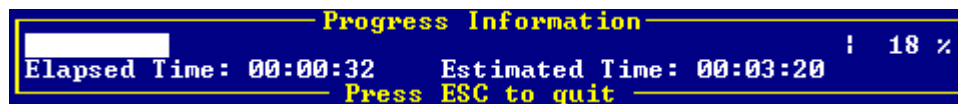*Parity verify has the capability to repair bad parity sectors automatically.*

Figure 58. Progress Information

Periodic Parity Verify

If the parity information of a given array drive is defective, the Parity Recalculate function may be used to recalculate it.

Allows you to schedule parity verify activity as described in previous section. Configurable variables include: Start Parity Verify (frequency of days to run, default is none), At Time (what time to run on the days specified), and Error Handling (what to action to take when an error in encountered during the parity verify).

Build/Rebuild Progress

Whenever an array drive is in the build or rebuild state, you can select "Build/Rebuild Progress" to get progress information and estimates for the required time to build or rebuild.

Create New Array Drive

In Advanced Setup, select "Configure Array Drives" and press <Enter>. The Select Array Drive window appears. StorCon lists all logical drives which are free (not yet part of an array or host drive). The selection bar is moved with the arrow up/down keys and a logical drive is selected/deselected with the space bar.
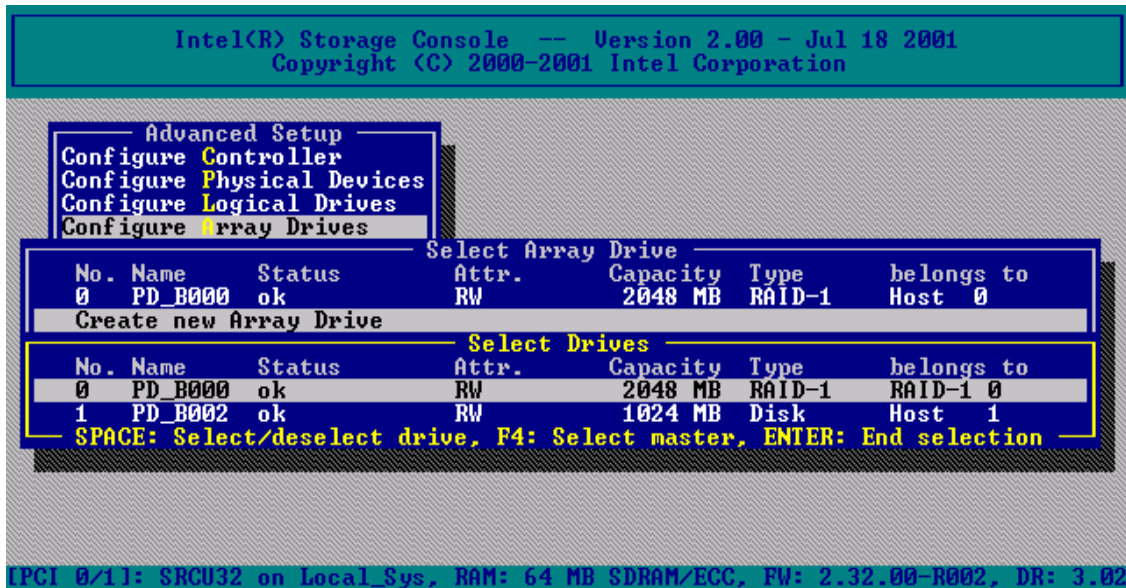
Figure 59. Create New Array Drive

For a striping array (RAID 0, 4, 5, 10), the master drive (indicated by "M") is the first logical drive in the array (see Figure 61). For a RAID 1 array (mirroring) the master drive is the first logical drive in the array that contains the valid data copied to the second logical drive.

After pressing <Enter>, StorCon displays a list of possible RAID levels. See Figure 60. Then StorCon prompts you for the stripe size. This is the size of the stripes into which the data is divided. Valid values are 16KB, 32KB, 64KB or 128KB. The default is 128KB. See Figure 61.
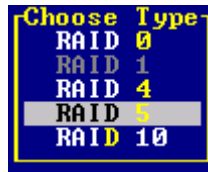

Figure 60. Choose Type

Figure 61. Strip Size

The Build Type decides how the redundancy information is created. The Destructive Build (only available if StorCon was loaded with <Ctrl> + <G>) fills all hard drives with "0" and no further parity calculation is necessary. This build method is pretty fast, but the build must be successfully finished before you can leave StorCon (otherwise the build mode is automatically changed to Non-destructive during the next boot). The Non-destructive build calculates the redundancy information from the contents of the data stripes. It takes longer, but can run in the background, for example, during the installation of the operating system. See Figure 62.

Figure 62. Choose Build Type

A warning displays that all data will be destroyed after confirmation. (Figure 63). Confirm the choice by pressing <Y>. The array drive is created.

Figure 63. Create Array Drive Confirmation

If necessary you can limit the array drive's capacity. In this example the entire capacity of the drive is used. See Figure 64.

```
Drive Size (1..17436 MB): 2048
```

Figure 64. Drive Size Dialog

The array drive enters the build state, for example, the parity information is generated. After completion of the build process the array drive's state is ready, or fault tolerant. See Figure 65.
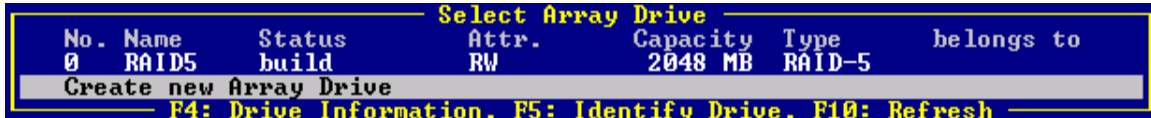
```
                         Select Array Drive
  No. Name      Status      Attr.    Capacity  Type      belongs to
  0   RAID5     build       RW       2048 MB   RAID-5
  Create new Array Drive
         F4: Drive Information, F5: Identify Drive, F10: Refresh
```

Figure 65. Array Drive Status

Notes on the Configuration of RAID 0, 1, 4, 5 and 10 Arrays Drives

Use logical drives of the type disk to build an array drive.

RAID Array drives can be configured with logical drives of the type chain also, but security should be taken into consideration. For regular RAID Array drives, type disk logical drives are used.

Logical drives of an array drive should have the same storage capacity.

To avoid wasting valuable storage capacity, use only logical drives that have the same storage capacity as the logical drive being replaced on that array.

A hot fix drive provides the most security.

One of the reasons RAID Array drives are used, lies with the data redundancy they provide, that is, the data security you have in the event of a hard drive failure. For the purpose of the following considerations, we define the term time without redundancy (TWR) as the time it takes to replace a failed hard drive (assuming there is no hot fix drive installed in the system). The time without redundancy should be kept as short as possible, not including the time needed to set up the array drive (state build).

Assume that one of the hard drives of a RAID 5 array drive has failed. The array drive is without redundancy. TWR begins. Any superfluous prolongation of the TWR (because you have to get a replacement hard drive, or because you did not realize the failure immediately since you didn't hear the Intel RAID Controller SRCU32's alarm signal, or because no one checked the file server) increases the risk of data loss should a second hard drive fail. Therefore, new redundancy should be created as soon as possible and in an entirely automated manner. Integrate a hot fix drive as an immediately available and auto-replacing hard drive to keep the TWR as short as possible. Only a hot fix drive can ensure optimal array drive security and constant data availability. Of course a hot fix drive is not mandatory. If you control the array drive at regular intervals and immediately replace a defective hard drive (by shutting down the system or using a hot fix), you can minimize the risk of data loss.

Configure Host Drives

The Configure Host Drives option (Figure 66) allows you to configure host drives (level of hierarchy 4). These are the drives that the host computer is aware of. Host drives can consist of a single hard drive, or of many hard drives built to create a RAID 5 array drive. The menus Split/Merge Host Drives and Partition Host Drive are only available if StorCon is loaded with <Ctrl> + <G> from the Intel RAID Controller SRCU32's Flash-RAM. The additional capacity resulting from an online capacity expansion is shown as another host drive. If you expanded the capacity of the array drive a second time, there would be three host drives belonging to the same array drive. Since there is currently no operating system which supports "growing hard drives," this expansion method is the only safe way to introduce new capacity.
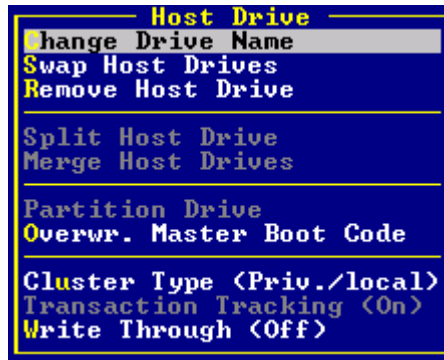
Figure 66. Host Drive Configuration

Change Drive Name

Use this command to change the name of a host drive. The host drive name serves to identify a host drive within StorCon and StorCon+.

Swap Host Drives

When the PCI computer is switched on, the host drives are initialized in the order of the host drive list, which means that the operating system is booted from the host drive having the lowest number. For reasons of flexibility, a host drive's position in the list can be changed. However, the position of the host drive from which the operating system is booted and the position of the host drive from which StorCon (disk version) was started (both can be the same), cannot be changed. To change the position of these drives, you have to boot the operating system and StorCon from a floppy disk or use the StorCon loadable from the Flash-RAM of the controller. To change the position of a host drive in the host drive list, highlight the host drive and confirm with <Enter>. Then, type in the new position and press <Enter>.

Remove Host Drives

⚠ **CAUTION**

All data is lost after the removal of a host drive.

If you remove a host drive belonging to an array drive to which several host drives belong (after capacity expansion, or after splitting), the data on ALL other host drives will be lost.

Split Host Drive

For some purposes it might be necessary to split an existing host drive into two or several host drives using the *Split Host Drive* option. To the operating system, each host drives looks like a single hard drive.

Since newly split host drives have smaller capacities, StorCon must write new header information on the new host drives. **This command results in all data being lost**.

Merge Host Drives

This function reverses the Split Host Drive option. Only host drives which belong to the same array drive or logical drive can be merged. Since the new host drives have a larger capacity, StorCon has to write new header information on the new host drives. **This command results in all data being lost**.

Partition Host Drives

The partitioning menu has similar functions to the MS-DOS program FDISK. You can create and delete a partition and also change the active partition. MS-DOS can only be booted from an active partition. Just like FDISK, StorCon can handle primary partitions, extended partitions, and logical drives within the extended partitions.

Overwrite Master Boot Code

This option creates a valid and consistent master boot record on the selected host drive and should be carried out on any new host drive on which Windows NT is installed. Never use it on host drives containing valid data, otherwise all data will be lost.

8 Storage Console Plus

Introduction

Storage Console Plus (StorCon+) is a tool for setting up, monitoring and maintaining mass storage subsystems based on Intel RAID Controller SRCU32. Different from StorCon, StorCon+ is a GUI style application, designed for the operation under Win32 Operating Systems. The primary function of StorCon+ is to help the user accomplish the following tasks.

Setup Hard Drives Controlled by Intel RAID Controller SRCU32:

- Setup and initialize physical drives, change the SCSI parameters and cache settings.
- Easy setup and installation of single disks or array drives consisting of one or more physical drives (chaining, RAID 0, 1, 4, 5, or 10).
- Online installation of host drives based on a single disk or an array drive.

Maintenance and Tuning of Existing Array Drives, Host Drives and Intel RAID Controller SRCU32:

- Cache Memory Configuration
- Update the controller firmware
- Change the device parameters
- Check or recalculate the parity data of RAID 4 and RAID 5 array drives
- Online capacity expansion of array drives
- Split and merge host drives
- Hot Plug. Replace a failed member of an array drive
- Hot Fix. Configure a spare disk for an array drive
- Configure SAF-TE compliant enclosures

Monitoring of the Whole Subsystem

- Watch the performance and throughput of virtually every part of the subsystem. Simply drag-and-drop the device on the statistics window.
- Check the hard drives for retries and reassigns (replacements of defective sectors on a hard drive) to trace problems which might become potential in the future.
- Check the grown defect table of the hard drives to replace a defective drive in time.

Remote Configuration and Maintenance

- Except for the hot plug function, all of the above features can be accessed via network. You can maintain and monitor a customer's server via the Internet.
- Supported protocols: IPX/SPX, TCP/IP, NetBIOS.
- The access to the Intel RAID Controller SRCU32 can be protected by password. The password is encrypted.

To install the StorCon+, use the Intel RAID Controller SRCU32 tools program on the Intel RAID Controller SRCU32 System CD-ROM.

The StorCon+ Controls

The Toolbar

The toolbar can be made visible or hidden by selecting "Toolbar" from the "View" menu.

Figure 67. StorCon+ Plus Toolbar

Click on the buttons to open and close the windows of the corresponding programs of StorCon+.

The toolbar can be moved away from the top of the StorCon+ window and shown in a small window. To place the toolbar back under the menu bar you can double click on the top window bar of the toolbar or drag and drop the toolbar back under the menu bar. You can also place the toolbar on the bottom of the StorCon+ window.

Table 18.   Toolbar Icons

Icon	Opens / Closes	Description
	Select Controller	Select a local or remote Intel RAID Controller SRCU32 for further actions.
	Physical Configuration	Show and/or modify the Intel RAID Controller SRCU32 and device settings.
	Logical Configuration	Show and/or modify the logical drive configuration.
	Statistics	Show statistics.
	Events	Show the Intel RAID Controller SRCU32 events.
	Help	Show Information and the StorCon+.
	Context Sensitive Help	Click on this icon and then on the icon you want online help.

The Status Bar

The status bar at the bottom of the main window displays status information on the icon or the menu option the mouse pointer is currently placed on. The status bar can be displayed or hidden by selecting "Status Bar" from the View menu.
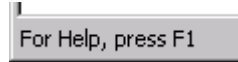

Figure 68. Status Bar

Window Menu Commands

These commands allow you to arrange the windows in the StorCon+ application window or to activate an open window.
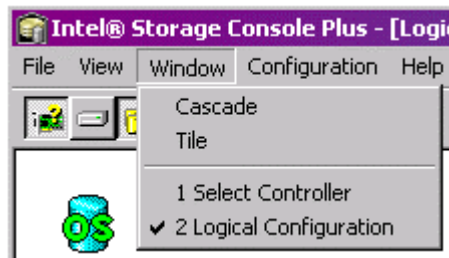

Figure 69. Window Menu

Help Menu Commands

Use the Help menu to access online help.
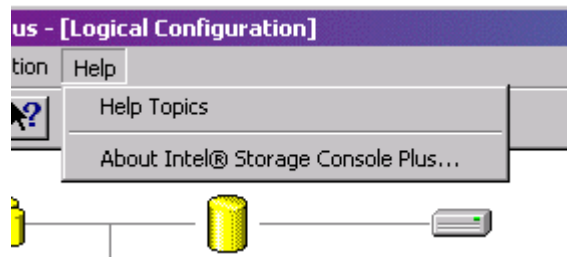
Figure 70. Help Menu

File Menu Commands

Use the command below to end the StorCon+ session. Shortcut: Press <Alt>+<F4>.

Figure 71. File Menu

View Menu Commands

Use the items in this menu to open or close the windows of the main components of StorCon+ or change the appearance of the main window.
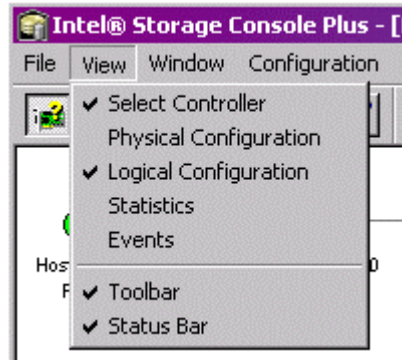
Figure 72. View Menu

The Chart Menu

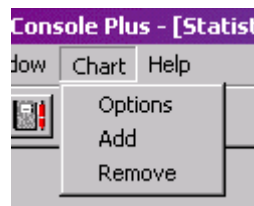The chart menu appears when you open the statistics window. Here you can add and remove data sources and configure the chart.

Figure 73. Chart Menu

The Configuration Menu Commands

The configuration menu appears when you select the Physical Configuration window or the Logical Configuration window.
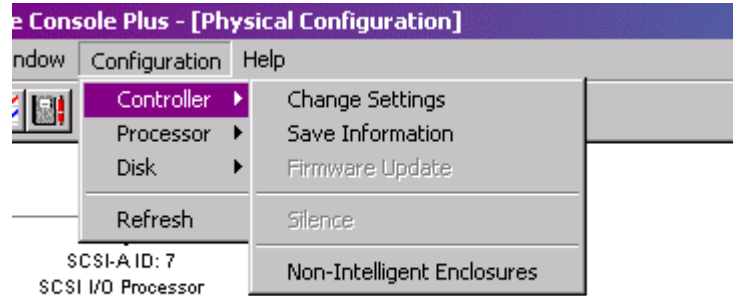
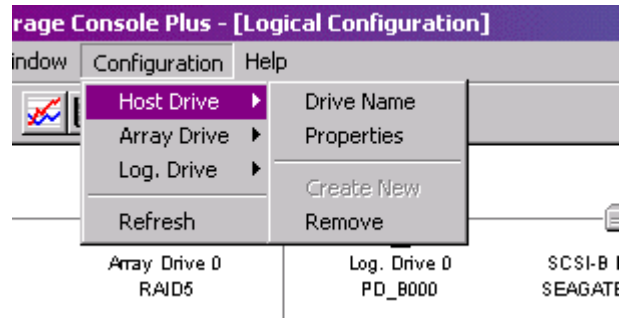

Figure 74. Physical Configuration Menu

Figure 75. Logical Configuration Menu

Set the refresh rate for the Physical or the Logical Configuration windows. This is the rate that is used by StorCon+ to update the contents of the physical and logical configuration windows. See Figure 76.
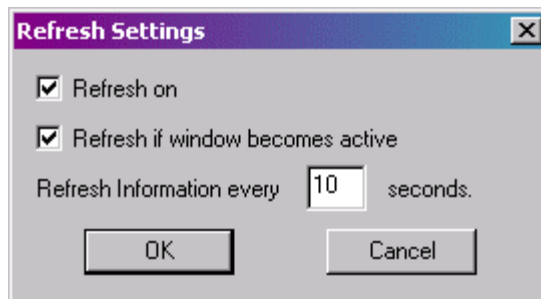

Figure 76. Refresh Rate Settings Dialog

These menu options are also available if you click the right mouse button on the corresponding icon in the Physical or the Logical Configuration windows. See the following table.

Table 19.   Configuration Menu Refresh Settings

Option	Description
Refresh on	Activates and deactivates the window update.
Refresh if window becomes active	Update the window if it becomes active.
Refresh information every ... seconds	Sets the frequency for automatic window refreshes.

Select Controller

The Select Controller window is used to select an Intel RAID Controller SRCU32 for all further actions within StorCon+. See Figure 77.
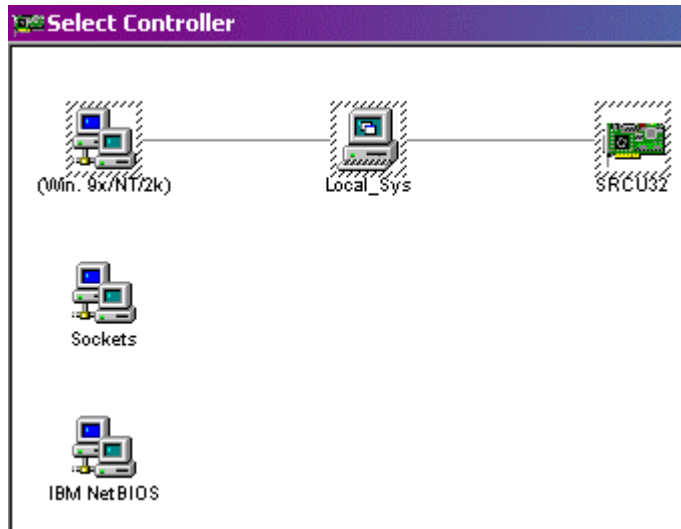

Figure 77. Logical Configuration Menu

Select the desired protocol (Windows NT/95/98, Sockets, IBM† NetBIOS) for the communication between the StorCon+ and the system equipped with the Intel RAID Controller SRCU32 by double clicking on the protocol icon on the very left side of the window. If you want to select an Intel RAID Controller SRCU32 via TCP/IP (sockets), type in the corresponding TCP/IP address or the server system's name. Enter a user name and password. This information is transmitted with encryption.

After the protocol is selected, select the system that contains the Intel RAID Controller SRCU32 and then the Intel RAID Controller SRCU32 itself. Double click on the Intel RAID Controller SRCU32 to select or deselect. The selected protocol, system and Intel RAID Controller SRCU32 are shown in a dashed yellow frame.
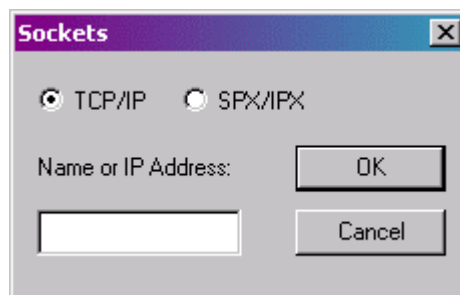

Figure 78. Select Controller

Figure 79. Sockets

Physical Configuration Window

The Physical Configuration window shows the physical configuration of the SCSI or fibre channel busses of the selected Intel RAID Controller SRCU32 and the devices connected with these busses. Click on the physical configuration icon to open the window. See Figure 81 for an example of a physical configuration window.
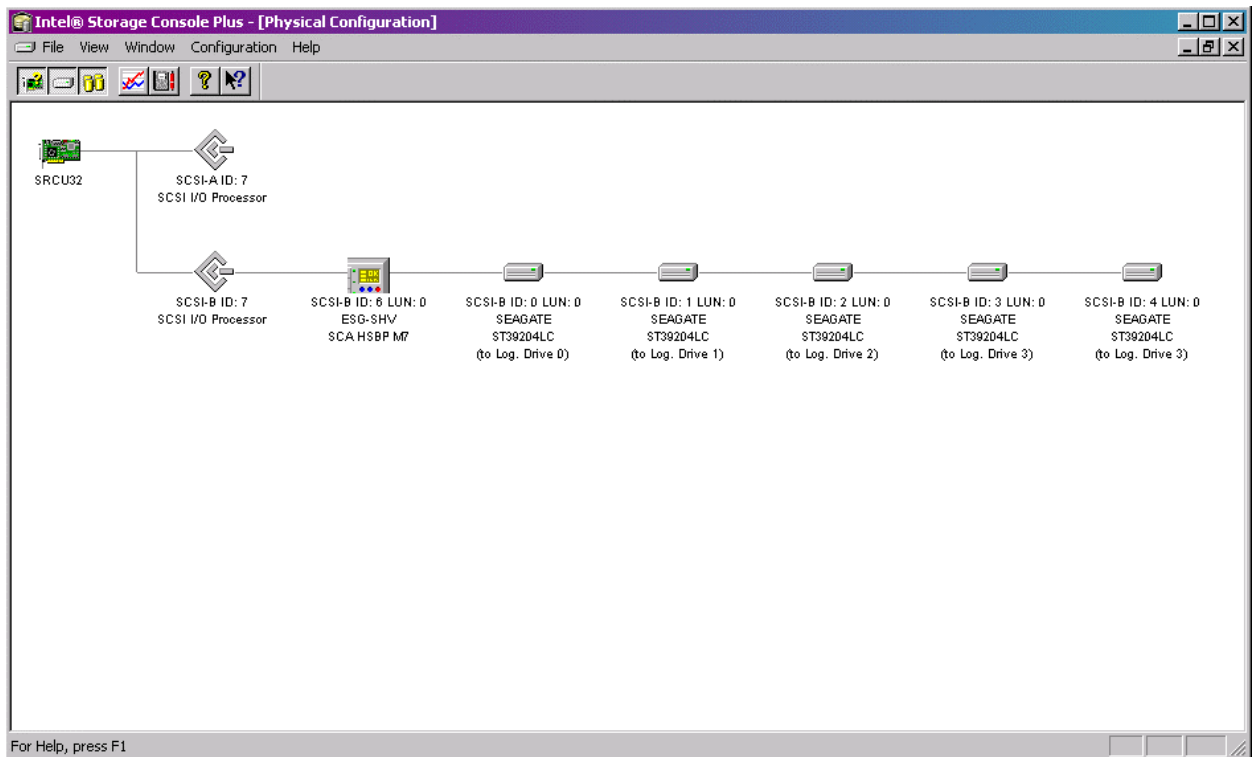

Figure 80. Physical Configuration Icon

Figure 81. Example of a Physical Configuration and the Controller Settings

Double click on the icon shown in Figure 82 to get detailed information on a controller (see the first controller settings dialog in Figure 83). Right click on the icon to Change Settings, Save Information or do a Firmware Update. These configuration setting selections are described below.
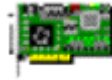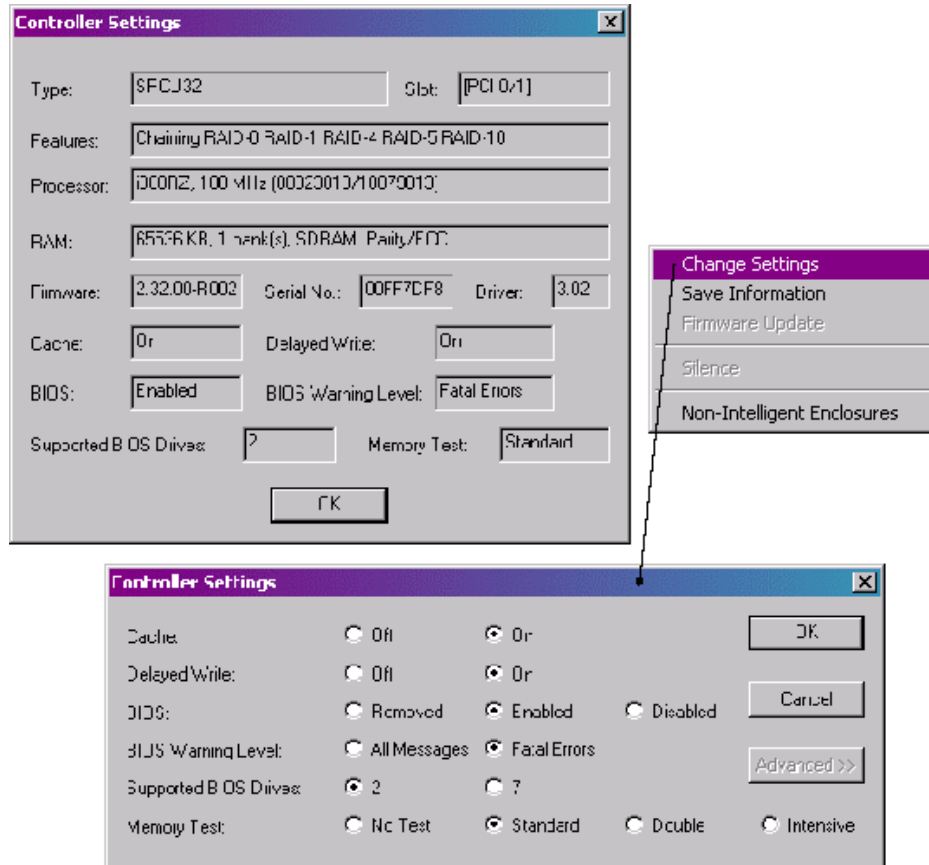

Figure 82. Controller Icon

Figure 83. Controller Settings Dialogs

Controller Configuration Settings

Change Settings

To change the physical configuration of the controller, right click the controller icon and select "Change Settings." See Figure 83. The controller settings are described in the table below.

Table 20.   Controller Settings

Setting	Description
Cache	Enables or Disables the Intel RAID Controller SRCU32 cache. For optimum performance the cache should be always On.
Delayed Write	Enables or disables the write cache function of the Intel RAID Controller SRCU32 cache. For optimum performance the write cache should be always On.
BIOS	The BIOSterms_bios of the Intel RAID Controller SRCU32 is needed to boot the computer and the operating system from a host drive.
BIOS Warning Level	Enables or disables the display of non-critical boot messages of the Intel RAID Controller SRCU32 during the system boot phase.
Supported BIOS Drives	Adjust the number of host drives which are supported by the Intel RAID Controller SRCU32's BIOS. This is the number (2 or 7) of host drives which are available under DOS without loading a special driver.
Memory Test	Configures the strategy and duration of the Intel RAID Controller SRCU32 cache memory test during the boot phase. A more intensive test requires more time.

Save Information

Right click the controller icon and select "Save Information." See Figure 83.

This option opens a file dialog allowing you to specify the path and name of the Save Information file. This file has a standard ASCII format and can be viewed or printed with a text editor or word processing system.

The Save Information file contains all relevant information on the Intel RAID Controller SRCU32 (including firmware version, cache size, connector assignment, termination assignment), the connected devices (for example, firmware version, SCSI parameters, selected transfer rate, number of grown defects, last status information), the logical drives, array drives and host drives. Thus, it represents an easy and effective way to create a detailed document of the Intel RAID Controller SRCU32 (s) and disk array(s).

The Save Information file can also be very helpful for a remote diagnosis of a system. If a trained support person has a copy of this file (by fax, by email), it can be used to bring the system back to full operation.

Firmware Update

Right click the controller icon and select "Firmware Update." See Figure 83.

The firmware, the BIOS and StorCon of the Intel RAID Controller SRCU32 are stored in Flash-RAM which is part of the Intel RAID Controller SRCU32 hardware. In contrast to EPROMs, Flash-RAMs can be reprogrammed many times and without the complicated UV light erasing procedure. Thus, both software modules can be easily updated without having to remove the controller from its PCI slot. Firmware and BIOS are part of the SRC_PFW file.

To get the latest firmware for the Intel RAID Controller SRCU32, visit our website at: *http://support.intel.com*

The file has an extension (for example, SRC_PFW.009) which indicates the version stepping. Download the packed files which contain the latest programs/drivers for the operating system used on the system. Observe the following order when carrying out the updating procedure:

1. Get the latest SRC_PFW file for the Intel RAID Controller SRCU32. The file does NOT need to be expanded!

2. Format a 3.5" HD disk (1.44MB) and copy the SRC_PFW file on this disk.

3. After selecting the Firmware Update option, a file dialog opens where you specify the path (A:). A list of firmware versions (normally only one) is displayed. After selecting the new firmware and final confirmation, the new firmware is programmed into the Flash-RAM of the Intel RAID Controller SRCU32.

The new firmware becomes active after the next cold boot.

⇒ **NOTE**

All user-specific settings concerning the Intel RAID Controller SRCU32 and the disk arrays are not affected by the firmware update.

I/O Processors

I/O processors of the Intel RAID Controller SRCU32 are represented in the physical configuration window in Figure 81 and in the table below. Each processor controls one I/O channel.

Table 21.   I/O Processor Icons

Item	Description
	SCSI processor SE (single ended)
	SCSI processor LVD/SE (low voltage differential / single ended)
	FC processor FC AL (fibre channel arbitrated loop)

Double click on the processor icons (shown in Table 21) to get channel information on a processor (see the channel info dialog in Figure 84). Right click on the icon to Change Settings, Rescan ID(s) or do a Hot Plug: Add Disk. See Figure 84. These selections are described below.
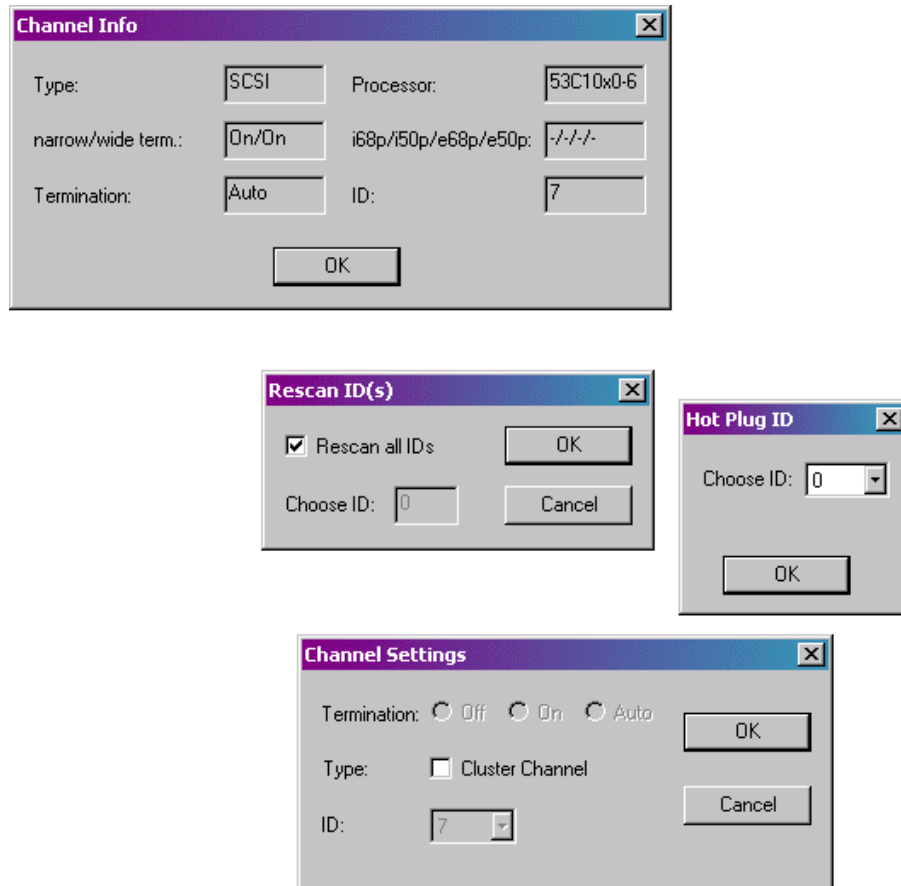

Figure 84. Processor Information

Channel Settings

Termination

The termination terms_termination for this channel of the Intel RAID Controller SRCU32 can be set to three different states:

ON: The termination of the lower (low byte) and upper data lines (high byte) is enabled or disabled depending on the occupied SCSI connectors of this channel

OFF: No lines are terminated

AUTO: All 8/16 data lines are terminated

ID

Changes the SCSI ID terms_scsi_id of the SIOP (0-7)

⚠ WARNING

The SCSI bus termination of the Intel RAID Controller SRCU32 must match the existing SCSI cabling and cable termination. If the Intel RAID Controller SRCU32 represents one end of the SCSI bus, its termination must be ON or AUTO. If you change the termination to OFF, it is likely that the SCSI bus will be unstable and the connected devices may fail. Due to the different technology, these settings cannot be changed with an FC I/O processor (fibre channel).

Rescan ID(s)

This function allows you to rescan one or all ID's terms_scsi_id of the selected SCSI channel. It displays an overview of all powered SCSI devices which are currently connected with the SCSI bus.

⚠ WARNING

If the hard disk contains valid host drive or array drive information, it will be deleted when creating new logical drives terms_logical_drive. All data will be lost.

Hot Plug: Add Disk

With the hot plug terms_hot_plug function you can add a new hard drive while the system is running. Before starting the hot plug procedure, you should prepare the new hard drive and set the jumpers according to the free SCSI IDs and SCSI bus termination. Ensure the correct termination terms_termination of the SCSI bus and set the ID terms_scsi_id of the hard drive to a free address if that is not done automatically by the storage subsystem. If you do not know which IDs are in use on the selected SCSI channel, you can find this out in the physical configuration window. Wrong SCSI bus termination and/or SCSI ID conflicts will cause a failure of the complete SCSI channel.

During the hot plug procedure enter the ID of the new hard drive (all free IDs are offered) and then confirm a security request. Thereafter the SCSI channel is halted. While the channel is halted, you have 45 seconds to plug in the new hard drive. (Note: Since the operating system will timeout, the channel cannot be halted longer). If you do not complete the hot plug procedure manually, the channel will automatically start again after 45 seconds. After the successful completion of the hot plug, the new physical drive appears in the physical configuration window. You can use it to build a new host drive, replace a failed drive or expand an existing array drive. You should only use the hot plug function with servers and/or subsystems which are designed and certified for hot plugging of hard drives.

⚠ WARNING

If the new plugged-in hard disk contains valid host drive or array drive information, they will be deleted when creating a new logical drive terms_logical_drive. All data will be lost.

Direct Access Devices

Direct access devices can be initialized and subsequently used for logical drives. The Intel RAID Controller SRCU32 caches the I/Os of these devices. Logical drives are the components of array drives. These devices are represented in the physical configuration window in Figure 81 and in Table 22.

⇒ NOTE

If you want to change the media of a removable disk during operation, the media MUST NOT BE INITIALIZED with StorCon or the StorCon+. Also, these devices have to be reserved terms_reserve for the raw service. Thus, the removable disk is handled like a non-direct access device.

Table 22.   Direct Access Device Icons

Icon	Description
	Physical Disk
	Removable Disk

Double click on the processor icons to get physical drive information (see Figure 85). Right click on the icon to open SCSI Parameter/Initialize, Format Disk, Check Surface, Deinitialize Disk, Progress Information, Lock Disk, Unlock Disk and Hot Plug: Remove Disk. See Figure 85. The selections are described below.
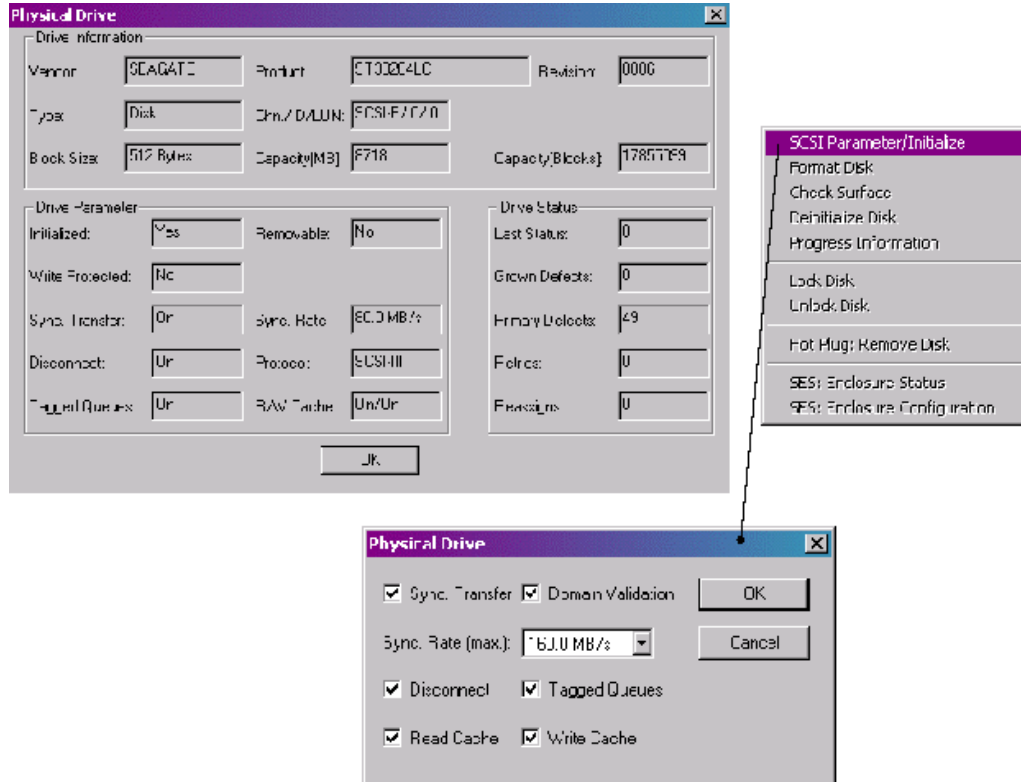

Figure 85. Physical Drive Information

The SCSI Parameter/Initialize

The SCSI parameters configure a physical drive (especially its performance). By changing the SCSI parameters, you can:

- Set the Synchronous Transfer Rate terms_sync_transfer
- Change the Settings of the Hard Drive Cache terms_cache_settings
- Enable or Disable the Disconnect Feature terms_disconnect
- Enable or Disable the Tagged Queues terms_tagged_queues

⚠ WARNING

By changing these parameters on a new hard disk or a hard disk that has been connected to a non-compatible RAID controller, the hard disk will be initialized terms_initialization and all data on this hard disk will be lost.

You can access the change SCSI Parameters / Initialize menu by clicking the right mouse button on a physical drive in the Physical Drives Windows view_physical_conf (View > Physical Configuration).

Synchronous Transfer

Different to the older asynchronous transfer mode, synchronous transfer offers higher transfer rates on the SCSI bus. The maximum synchronous data transfer rate depends on the width of the SCSI bus (8 bit narrow SCSI, 16 bit wide SCSI) and the frequency of the signals on the SCSI bus (10 MHz for Fast SCSI, 20 MHz for Ultra SCSI and 40 MHz for Ultra2 SCSI and Ultra160 SCSI). The maximum data transfer rates are shown in the table below.

Table 23.   Data Transfer Rates

	Narrow SCSI (8 Bit)	Wide SCSI (16 Bit)
Fast SCSI	10 MB/s	20 MB/s
Ultra SCSI	20 MB/s	40 MB/s
Ultra2 SCSI	-	80 MB/s*
Ultra160	-	160 MB/s*

* (LVD SCSI (low voltage differential) only)

➡ NOTE

The maximum synchronous data transfer rate between a SCSI device and the Intel RAID Controller SRCU32 can be limited. This limitation may become necessary if a particular SCSI cabling does not allow the maximum rate the controller and the drive could achieve. Adjust the synchronous transfer rate in the SCSI parameters / Initialize menu pdisk_parameters.

➡ **NOTE**

To select a transfer rate above 10 MB/s the protocol must be set to SCSI-III. Higher frequencies (single ended SCSI) require better cabling, shorter cables and a professional termination terms_termination of the SCSI bus.

Disconnect

This SCSI feature enables a SCSI device to disconnect from the SCSI bus. By releasing the SCSI bus while the device doesn't need it, the bus becomes free for other devices to transfer or receive data. An example of a disconnect situation is a hard drive that needs time to read data from its media after receiving a read command. It may then disconnect from the SCSI bus so that other devices can transfer data. Later on it reconnects when it is able to deliver the data instantly. You can change the disconnect setting for a hard drive in the SCSI parameters / Initialize menu pdisk_parameters.

Tagged Queues

This feature enables modern hard drives to receive several commands at one time and then process them in an optimized order. A few, mainly older drives, do not support this feature. You can change the tagged queues setting for a hard drive in the SCSI parameters/Initialize menu pdisk_parameters.

SCSI Read Cache / SCSI Write Cache

These settings enable or disable the write and read caches of the hard drives. Turning these caches OFF degrades the performance of the hard drive. You can change the cache settings of a drive in the SCSI parameters / Initialize menu pdisk_parameters.

De-Initialize a Physical Disk

De-initializing a physical drive removes the Intel RAID Controller SRCU32 initialization sectors terms_initialization. The physical drive cannot be member of a logical drive once it is deinitialized.
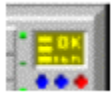
Lock / Unlock a Removable Disk

With this function you can lock or unlock a removable drive containing a removable medium. If the physical drive is locked, the medium cannot be ejected with the eject button while the system is running.

Non Direct Access Devices (Raw Devices)

Non direct access devices cannot become components of logical drives, array drives or host drives. These devices are controlled by a software driver (for example, an ASPI module), the operating system or by an application. Non direct access devices cannot be initialized or configured in StorCon+.

Table 24.   Non Direct Access Devices

Icon	Description
	CD-ROM / CDR
	Tape Drive
	SAF-TE-Processor
	Scanner
	SCSI Printer

Logical Configuration Window

The Logical Configuration window shows the logical configuration of host drives terms_host_drives, array drives and logical drives terms_logical_drive controlled by the selected Intel RAID Controller SRCU32. The complete configuration is shown as a tree starting from the left with the host drives, followed by the array drives, the logical drives, and the physical drives. See the logical configuration window in Figure 86. Click on the logical configuration icon (Figure 94) to open the window.

Figure 86. Logical Configuration

To get detailed information on a drive, double click on an icon (shown in Table 25). (The window that opens depends on the type of the device.) To change the logical configuration of a drive, click the right mouse button on the desired drive or select an option from the configuration menu. Drive types are described below.

Host Drives

⇒ **NOTE**

Intel RAID Controller SRCU32 does not support clustering.

Table 25.   Host Drive Icons

Icon	Description
	Host Drives. Double click to open information on a drive. Right click to change the logical configuration of a drive.
	Create a New Host Drive. Double click to create a new host drive.

Normal Host Drive

This host drive belongs to the selected Intel RAID Controller SRCU32 on a non-clustering I/O channel.

Array Drives

Array drives consist of logical drives. They can be fault tolerant, depending on the RAID level. The RAID level is displayed under the array drive icon.

Double click on an icon to get more information on the state of an array. See Figure 87. Right click the desired drive to select an array drive option.

Table 26.   Array Drive Icons

Icon	Description
Idle Build Ready Fail Error	RAID 4/5/10 Right click to select a drive option Drive Name Parity Verify Parity Recalculate Expand Array Progress Information Add Hot Fix Remove Hot Fix Hot Fix Pool Access Add RAID1 Component Remove RAID1 Component Hot Plug: Add RAID1 Component
Build Ready Fail	RAID 1
	RAID 0

Logical Drives

Logical drives consist of one or more physical drives.

Table 27.   Logical Drive Icons

Icon	Description
Single Disk	Right click to select drive option Drive Name Add RAID1 Component Replace Drive Hot Plug: Replace Drive
Hot Fix Drive	
Failed / missing Hot Fix or Single Disk	
Chaining Drive	

Physical Drives

Physical drives are hard drives. Setting changes are not possible here. If you want to change the settings, you must do so in the physical configuration window.

Table 28.   Physical Drive Icon

	Physical Disk	Use the Physical Configuration window to change disk settings.

The Host Drive Information Window

Double click on the host drive icon. This window contains information on a host drive terms_host_drive. See Figure 87.

Figure 87. Host Drive Information Window

Drive No   The host drive number. The host drives are reported to the system in order, beginning with the lowest Drive Number. If the corresponding Intel RAID Controller SRCU32 is the first controller in the system, the system will boot from the host drive with the lowest number.

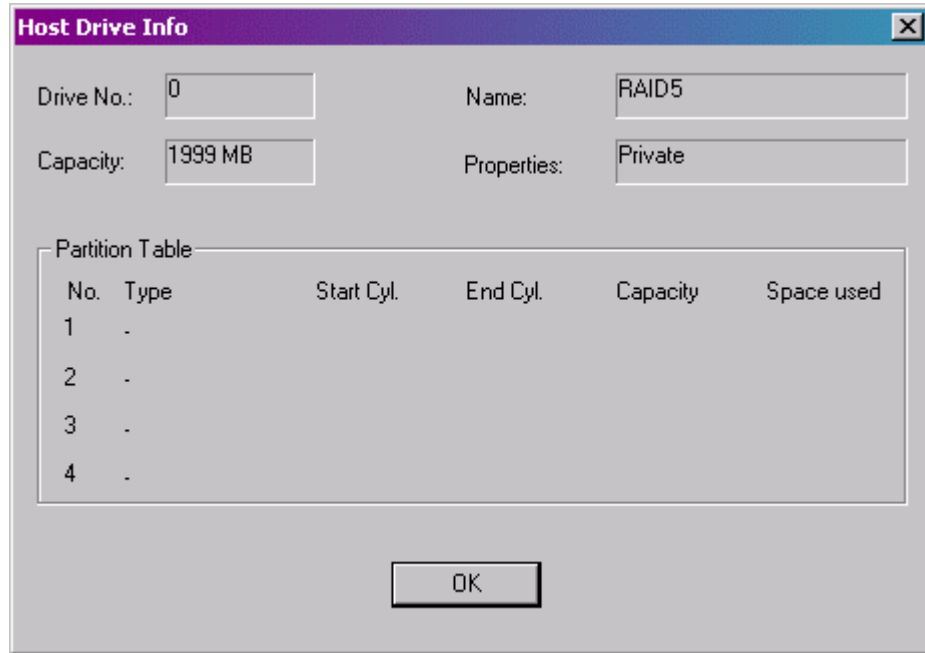|	
Name	The name of the host drive. A host drive is automatically given a name during the configuration. It can be renamed by selecting the menu Drive Namelogical_name of the menu list you get after clicking with the right mouse button on the host drive icon.
Capacity	The host drive capacity reported to the operating system. The size of a host drive can be smaller than the size of the logical drive or the array drive the host drive is a part of.
Partition Table	The partition table of a host drive can contain up to four partition entries. Partition type, its location on the host drive, its size and the percentage of space used by this partition are shown.

The Array Drive Information Window

Double click on the array drive icon. This window shows information on an array drive (for example, a disk array). See Figure 88.
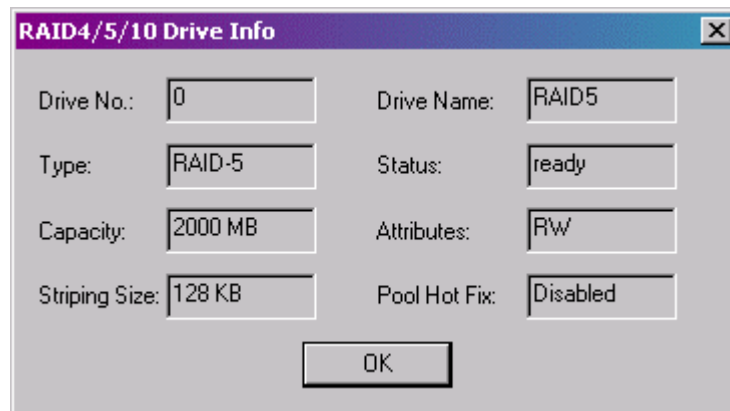
Figure 88. Array Drive Information Window

Drive No	The logical number of the array drive.
Drive Name	The name of the array drive.
Type	RAID level of the array drive. Possible levels are RAID 0 (data striping, no redundancy), RAID1 (mirroring), RAID 4 (striping with parity drive), RAID 5 (striping with striped parity) or RAID 10 (combination of RAID 1 and RAID 0).
Status	The status of an array can be ready (operational), fail (one drive missing, still operational but not redundant), error (more than one drive failed, not operational), rebuild (one drive is being integrated), build (initial preparation of the array), idle (new defined array, before build process has started), or expand (one or several drives are added online to the array drive).
Capacity	This is the capacity available for the corresponding host drives.

Attributes   The attribute of an array drive is usually read/write ([RW]). If a component of a disk array is missing during startup and the operator decides not to activate fail mode, the array is set to the read only attribute ([RO]). When the missing drive becomes available, the array drive shows the ready status (for example, attribute [RW]).

Striping Size   (RAID 0, 5, 10) Data written on RAID 0, 4, 5, or 10 drives is distributed over all drives (striping). The striping size can only be changed at the time the drive is created (standard setting is 32KB).

Invalid/Missing   (RAID 1) These two values show the number of invalid/missing drives. In this condition invalid drives exist during the build process (initial copy of data from the master to the slave).

Pool Hot Fix   Indicates when the pool hot fixterms_hot_fix access is enabled or disabled. A pool hot fix drive is a spare drive within the so-called hot fix pool. A drive in a hot fix pool is available for several array drives as a hot fix drive (assuming it has appropriate capacity). Thus, several array drives can share one hot fix drive. Once this drive has been used by one of the array drives, it is no longer available for the others. Hot fix drives can also be configured as private hot fix drives. A private hot fix drive can only be used by the array drive it was configured for. Clicking with the right mouse button on the array drive icon can change the pool hot fix access.

The Logical Drive Information Window

Double click on the logical drive icon. This window shows information on a logical drive. A logical drive can be either a single disk, or a chaining group of disks (concatenation), or a stripe set of several disks. See Figure 89.
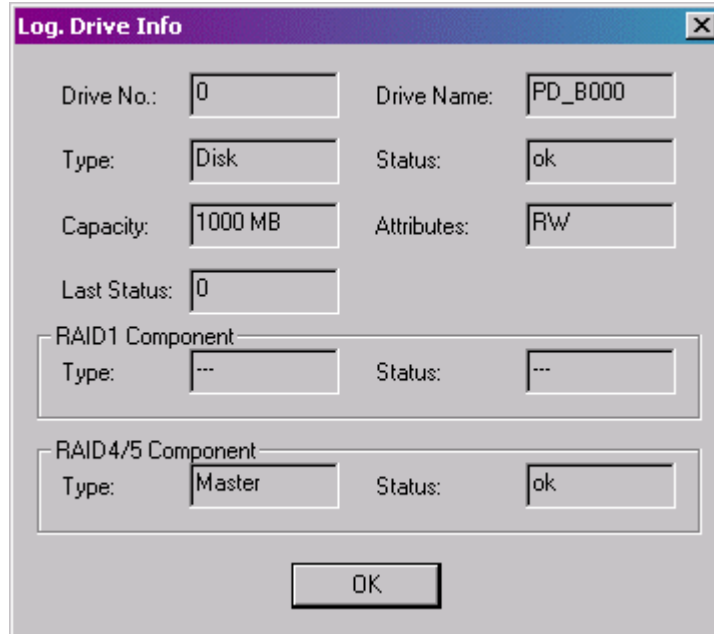
Figure 89. Logical Drive Information Window

Drive No	The number of the logical drive.
Drive Name	The name of the logical drive.
Type	The type of the logical drive. A logical drive can be either a single disk, or a chaining group of disks (concatenation), or a stripe set of several disks.
Status	This is the state of the logical drive. It can be ready, missing (not available after reset) or failed (for example, no longer available for the controller).
Capacity	The available capacity of array drives or host drives.
Attributes	The attribute of a logical drive is usually read/write ([RW]). If a component of a disk array is missing during startup and the operator decides not to activate fail mode, the array is set to the read only attribute ([RO]). When the missing drive becomes available, the array drive shows the ready status (for example, attribute [RW]).
Last Status	The last status information of a logical drive. This is different from the last status information of physical drives.

RAID 1 Component	If the logical drive is a member of a RAID 1 array, it can be either master or slave. If a RAID 1 component is added to a logical drive, the data is read from the master and written to the added logical drive (the slave). One master may have several slaves.
RAID 4/5 Component	As a member of a RAID 4 or RAID 5 array a logical drive can be the master or a component. Different from RAID 1 arrays, this is only important for the internal structure of the array.

Change the Name of a Drive

Click the right mouse button on the drive icon. This menu option opens a dialog for entering a new name for the selected drive (up to 7 characters).

Remove a Host Drive

Click the right mouse button on the host drive icon. By selecting this menu item you can delete a host drive.

⚠ WARNING

*When deleting a host drive, all other host drives which are part of the same array drive or logical drive, the array drive or logical drive itself and all its components are deleted. **ALL DATA WILL BE LOST.***

To prevent the operating system from crashing and to hinder the unintentional deletion of drives, all partitions on the host drive (and its related host drives if it is split into several host drives) must be deleted before the host drive can be removed.

Create a New Host Drive

Double click on the new host drive icon. Only host drives are "visible" to the operating system.

The structure of the host drives is not known to the operating system. The operating system does not recognize that a given host drive consists of a number of hard drives forming a disk array. To the operating system this host drive simply appears as one single hard drive with the capacity of the disk array. This complete transparency represents the easiest way to operate disk arrays under any operating system. Neither operating system nor the computer need to be involved in the administration of these complex disk array configurations. To create a new host drive, you need one or more physical drives which are not yet part of another host drive. After double clicking on the new host drive icon a new window opens. See Figure 90.
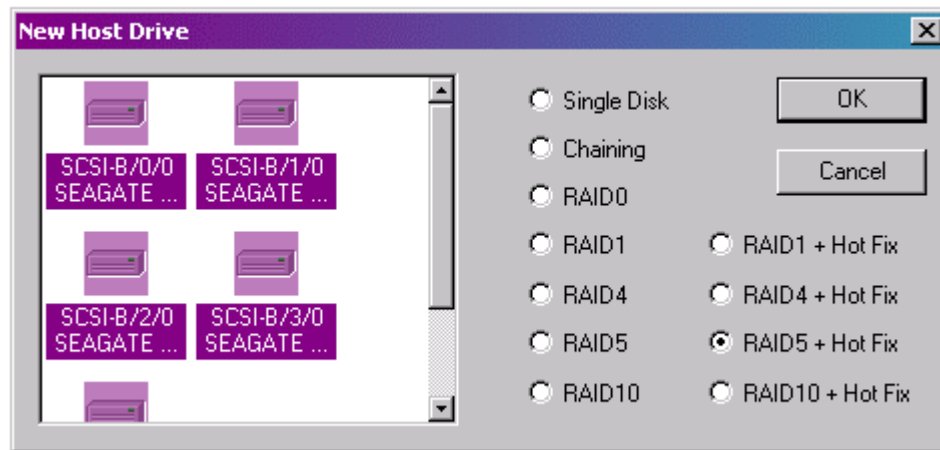

Figure 90. Create a New Host Drive

On the left side of the window are the available physical drives. Under the drives you can see their physical coordinates (channel/ID/LUN), the manufacturer and the vendor-unique name. On the right side you see a list of all possible host drive types that can be configured. When there is no physical drive selected in the left box, all possibilities are disabled. While selecting physical drives for the new host drive, more attributes become selectable.

You can select a single physical drive by clicking on it. If you want to select more than one physical drive, simply draw a frame around the physical drives, or press the <Ctrl> key and then click on all the physical drives you want to combine to a new array.

When you have finished the selection of the physical drives, choose the type of host drive you want to create and click on OK.

If the selected host drive uses data striping (RAID 0, 4, 5, or 10) you can change the default striping size. If you have selected a configuration with hot fix terms_hot_fix drives, you can choose between a private hot fix drive or a pool hot fix drive. After the host drive was created, you can partition and format the host drive with the corresponding operating system utility.

If an array build has begun, you can monitor the progress of the array build by clicking the right mouse button on the host drive and then selecting progress information logical_progress_info. See Figure 91.
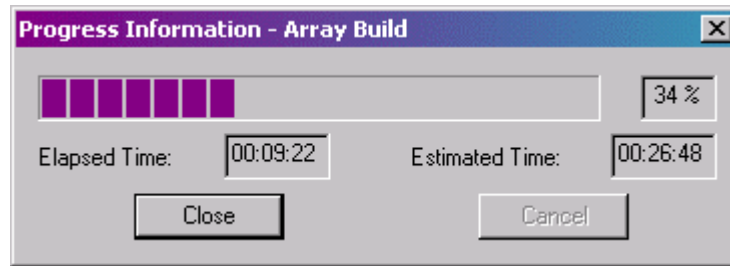

Figure 91. Array Build Information Dialog

Parity Verify

Click the right mouse button on the array drive icon.

RAID 4 and RAID 5 drives contain parity information, which is used in the event of drive failure. The parity information is calculated from the user data on the disk array. On RAID 4 disk arrays the parity data is stored on a single disk (parity disk), on RAID 5 disk arrays the parity data is distributed over all drives (parity striping). This option verifies online the parity information of the selected RAID 4 or RAID 5 array drive. If this option is selected for several array drives, the processes are put into a queue and performed one after the other.

If a parity error is detected, find the reason for the data corruption. A good indication of data corruption can be retries terms_retry on the SCSI bus. If the retry-counter shows high numbers, this might be the problem. Possible reasons for parity error are bad cabling terms_cabling, termination terms_termination or hardware error from a defective drive or an overheated drive. After removing the reason of the data corruption you can carry out parity recalculate logical_precalc to ensure that the parity information of this disk array becomes valid.

Figure 92. Parity Verify

Parity Recalculate

Click the right mouse button on the array drive icon.

A parity recalculate can be used to repair parity errors which have been previously detected with the parity verify command logical_pverify. A parity recalculation initiates the same process used for a build on an array drive. The user data on the drives is read, parity information is calculated from this user data and the parity information is written anew.

While the parity recalculate is in progress the array is in the build state state_build. During this time the array drive is not redundant. You can view the progress of the build process by clicking the right mouse button on the array drive icon and selecting progress information logical_progress_info.

After the parity recalculate is completed the array drive's state changes again into ready with the addition of /patch. This notification has no relevance to the operation of the array drive but is a reminder that the parity information of the array drive has been recalculated once.

Progress Information

Click the right mouse button on the array drive or physical drive icons.

The progress information window shows the progress (elapsed time, estimated time, and percentage of completion) of a parity verify logical_pverify, a disk array build state_build, or a surface check pdisk_check. During an array drive rebuild, the information (user data and/or parity) of a specific logical drive is calculated from the user data and parity information of the other logical drives and written to this new logical drive. During a build of an array drive parity information is calculated and written to a specific logical drive (RAID 1/4) or striped over the array drive (RAID 5).
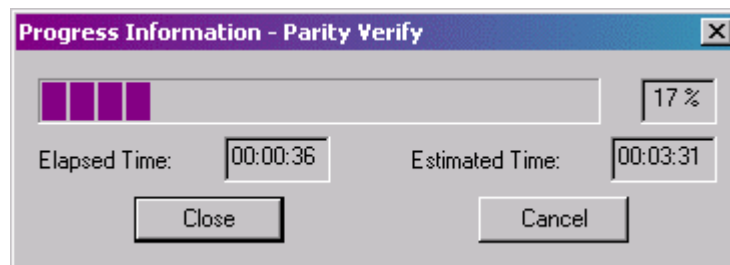

Figure 93. Parity Verify Progress Information

Expansion of an Array

Click the right mouse button on the array drive icon.

There are two functions that are available within this option:

- migrate the RAID level of the selected RAID Array drive
  (RAID 0 → RAID 4 and vice versa, RAID 0 → RAID 5 and vice versa) and/or
- expand the capacity of the selected array drive by adding one or several new hard drives.

Both functions can be selected at the same time. For example, migrate from RAID 0 to RAID 5 and add a new drive. To initiate a migration or expansion with a RAID 4/5 array drive, the state must be ready. The data on the array drive remain intact and are not affected by the expansion. The additional capacity is introduced as a new host drive. If a logical drive fails during the expansion, the expansion process continues until the expansion is finished. The array drive changes into the fail state. The new capacity is available as a new host drive. Windows NT (Tool: Disk Administrator) and Novell NetWare ("Scan for new Devices" and then Tool: Install) allow the online integration of new disk capacity. Depending on the RAID level the current array drive has, selecting a different one will cause the Migration of the RAID level of the array drive. If you select the same RAID level, the following procedure will expand the capacity of the array drive only.
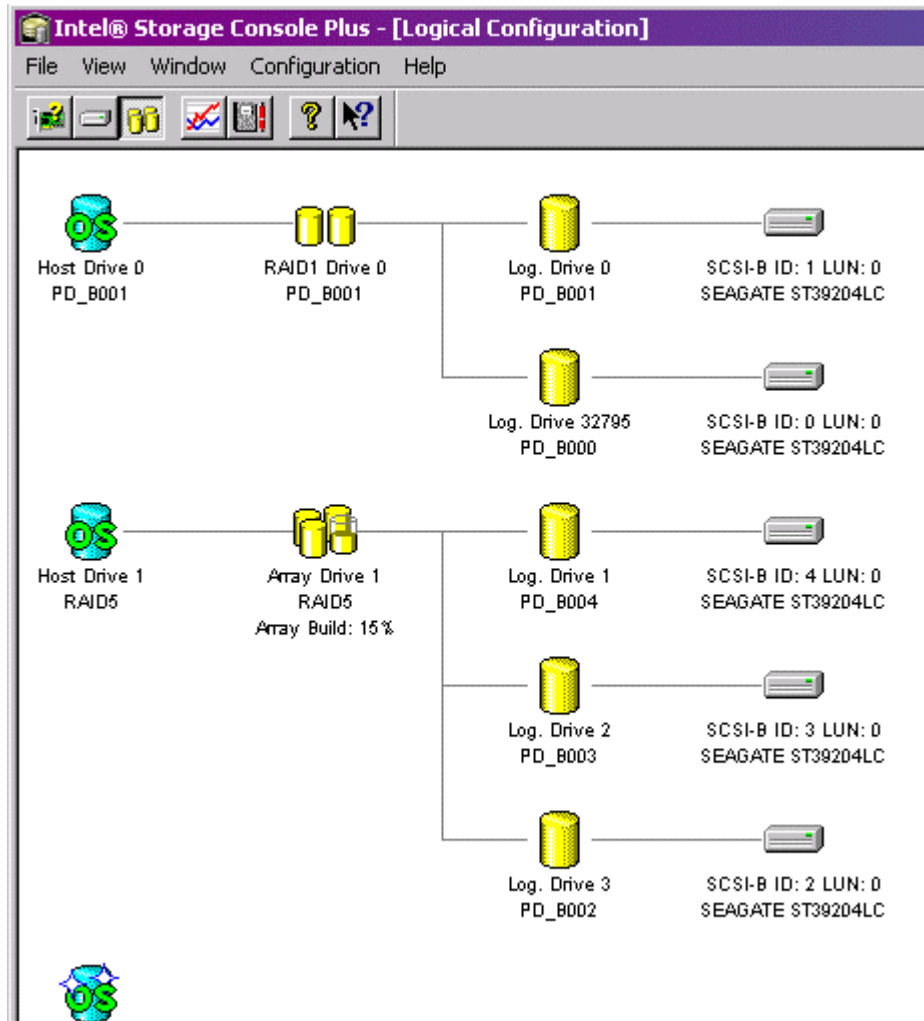
Figure 94. Logical Configuration

If you want to add additional drives to the array drive, select them from the box on the left side of the window. It is possible to add more than one drive at a time.

If no physical drives are offered, you have to use the "Hot Plug: Add Disk" function first, to add new drives. You can open the progress information window to monitor the progress of the expansion. If you have previously limited the capacity of the array drive, you are asked if you want to convert this free space to a new host drive.

⚠ **CAUTION**

Before starting an expansion it is absolutely necessary to back up all data on the system. If the expansion process includes a new, unknown hard disk and there are problems with this disk or with the cabling of this disk, then there is a risk of data loss. Some expansions take a long time, so it is advisable that there be a minimal amount of traffic on the system.

Add a Hot Fix Drive

Click the right mouse button on the array drive icon.

Use this option to add a hot fix terms_hot_fix drive to an array drive (RAID 1/4/5/10). Add a private hot fix drive or a pool hot fix drive. Private hot fix drives are assigned to a specific array drive and are activated if a member of this array drive fails. Pool hot fix drives can be used by any array drive with pool hot fix access enabled. RAID 1 array drives allow only pool hot fix drives. After choosing the type of hot fix drive, you can select a physical drive from the box that shows all suitable drives.
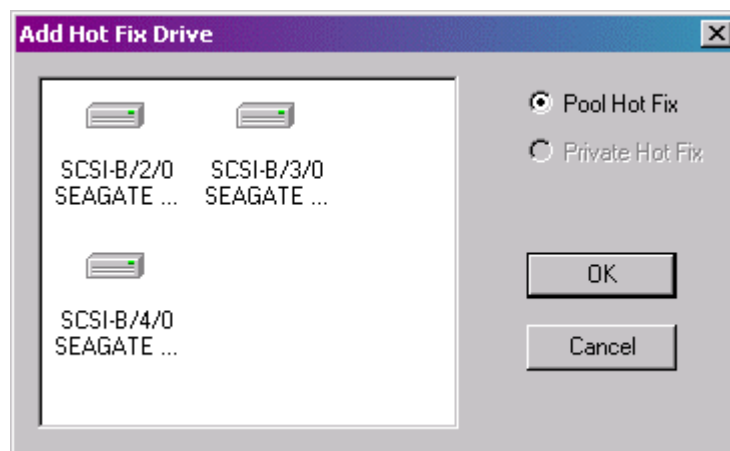

Figure 95. Add Hot Fix Drive

The capacity of the hot fix drive has to be larger or equal than the capacity of the components of the array drive. For example: The logical drives of the array drive have 4.2GB capacity, thus the capacity of the hot fix drive has to be 4.2GB or larger.

The spindle motor of the hot fix drive is normally stopped (for example, when the hot fix drive is not needed). Thus, it may take a few seconds to get a response when you click on that drive.

Some general notes on hot fix drives.

One of the reasons RAID Array drives are used, lies with the data redundancy they provide, that is, the data security you have in the event of a hard drive failure. For the purpose of the following considerations, we define the term time without redundancy (TWR) as the time it takes to replace a failed hard drive (assuming there is no hot fix drive installed in the system). The time without redundancy should be kept as short as possible, not including the time needed to set up the array drive (state build).

Let us assume that one of the hard drives of a RAID 5 array drive fails. The array drive is without redundancy. TWR begins. Any superfluous prolongation of the TWR (because you have to get a replacement hard drive, or because you did not realize the failure immediately since you didn't hear the Intel RAID Controller SRCU32's alarm signal, or because no one checked the file server) increases the risk of data loss should a second hard drive fail. Therefore, new redundancy should be created as soon as possible and in an entirely automated manner. Integrate a hot fix drive as an immediately available and auto-replacing hard drive to keep the TWR as short as possible. Only a hot fix drive can ensure optimal array drive security and constant data availability. Of course a hot fix drive is not mandatory. If you control the array drive at regular intervals and immediately replace a defective hard drive (by shutting down the system or using a hot fix), you can minimize the risk of data loss.

Remove a Hot Fix Drive

Click the right mouse button on the array drive icon.

This option opens a box showing available hot fix terms_hot_fix drives. Select the hot fix drive you want to remove from the array drive and then confirm the selection. You can remove any pool hot fix drives or a private hot fix drive from the selected array drive.

Hot Fix Pool Access

Click the right mouse button on the array drive icon.

Enable or disable the access of an array drive to the pool hot fix terms_hot_fix of hot fix drives. If the access is enabled this means that if a member of an array drive fails, a drive can be taken from the hot fix pool and built automatically into the array drive. To be able to activate this feature, there must be suitable logical drives in the hot fix pool. You can add drives to the hot fix pool using the function Add Hot Fix Drive, logical_add_hotfix. By doing so, the hot fix pool access for this specific array drive is activated automatically. For all other arrays drive you must activate the access manually.

Add a RAID 1 Component (Mirror a Drive)

Click the right mouse button on the logical drive icon.

This function allows you to add to a logical drive which is a member of an array drive, another logical drive as a mirror drive (RAID 1).

Example: You have configured an array drive with 4 logical drives. One logical drive has failed and the array drive went into the fail state. Another failure would cause data loss. Unfortunately, you find another logical drive that is likely to fail (for example, you hear a strange noise from it, or it's grown defect counter explodes). If you initiate a hot plug it is likely that the critical logical drive will also fail. To avoid that problem, mirror a new good logical drive to the critical one. When the copying is finished, remove the critical logical drive and carry out a hot plug procedure.
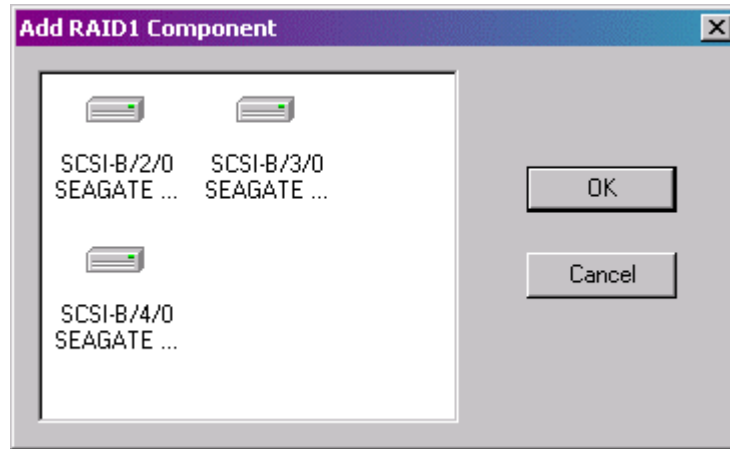
Figure 96. Add RAID 1 Component

1. To add a RAID 1 component, select a logical drive, the master. All suitable logical drives (with a capacity equal to or larger than the capacity of the master) are shown in a box.

2. Choose the logical drive you want to add, the slave. After confirming, a new RAID 1 array drive is built, for example, all data from the master is copied to the slave drive(s). When this process is finished all logical drives in the RAID 1 array drive are identical (there is no longer a difference between master and slave).

Remove a RAID 1 Component (Remove a Mirror Drive)

Click the right mouse button on the logical drive icon.

Here you can remove a drive from a RAID 1 array drive. If the array drive is in the build state_build or fail state_fail state, you may only remove invalid RAID 1 components.

To remove a logical drive from a RAID 1 array drive, select the logical drive you want to remove. This is done by selecting a logical drive from a box where you see all members of the RAID 1 array drive. After confirmation the logical drive is removed. If the RAID 1 array drive consists of two drives, the RAID 1 array drive disappears and only one logical drive is left. You can create a new RAID 1 array drive by selecting add RAID 1 logical_add_raid1.

Replace a Logical Drive

Click the right mouse button on the logical drive icon.

If a logical drive of an array drive without a hot fix drive should fail (or is very likely to fail), you should replace the defective hard drive with a new one as soon as possible, because the array drive is without redundancy. The replacement logical drive has to have at least the same capacity as the failed one. The replacement is carried out with StorCon or the StorCon+. Before the logical drive can be removed, you must select a new logical drive from the box with available physical drives that is shown after this option is selected. If no physical drive is offered, you have to use the Hot Plug: Replace Drive hotplug_replace_drive function to add a new drive. After the confirmation, the old logical drive is removed. Next, the data is rebuilt on the new logical drive. During this process the array is in the rebuild state state_build and therefore not redundant.

The Different States of an Array Drive

Some of these states may have the addition of /patch (for example, build/patch, ready/patch). This indicates that the original array drive. For example, the parity information was recalculated or the array drive has been patched from the error state into the fail state. This may become helpful in a situation where two logical drives of an array drive fail at the same time, but only one of the two logical drives is really defective and the other was blocked out since it was connected with the same I/O channel as the defective one. The array drive's state is error and normally all data would be lost. Intel RAID Controller SRCU32 includes some functions that allow the patch of this array drive from the error state into the fail sate. Before the actual patch, the defective drive has to be physically removed from the array drive. Such a patch procedure should only be used after a consultation with a trained support person (a printout of the Save Information file, is extremely helpful).

The Ready State

The array drive is fully operational when in the ready state. All redundant information is present, that is, a hard drive can fail without impairing the functionality of the array drive. This is the normal state of an array drive. The ready/expand state indicates that the RAID level and/or capacity are currently migrated/expanded.

Figure 97. The Ready State

The Idle State

This state is characterized by the fact that the redundant information of the array drive has never been entirely created. The array drive is in this state after its first configuration. Should an error occur while the array is in the build state, the array returns to the idle state Exception: if during build mode the dedicated drive of a RAID 4 array drive fails, the state changes to *fail*.

Figure 98. The Idle State

The Build / Rebuild State

After the array drive has been configured for the first time, and the build process has begun the array drive assumes the build state. While the array drive is in the build state, redundancy information is calculated and stored to the components of the array drive.

The disk array will assume the rebuild state after the automatic activation of a hot fix drive or after a manual replacement (hot plug). The data and the redundant information are reconstructed and stored to the new drive.

While in the build and rebuild states, the array drive is not redundant.

You can monitor the progress of the array build/rebuild by clicking the right mouse button on the host drive and then selecting progress information.

⟹ **NOTE**

User traffic on an array drive that is in the build/rebuild state, slows down the build/rebuild process.

Figure 99. The Build / Rebuild State

The Fail State

The array drive changes to the fail state whenever a logical drive fails. Redundancy information is still present, thus allowing the remaining hard drives to continue working. This state should be eliminated as soon as possible by replacing the defective hard drive. This can be done by using a physical drive that is already connected with the controller, but not yet used for a logical drive, with the replace drive logical_replace function, or by using the Hot Plug: Replace Drive hotplug_replace_drive function. If a hot fix drive has previously been assigned to an array drive, the Intel RAID Controller SRCU32 will automatically replace the defective drive and start the reconstruction of the data and the redundant information. Therefore, under these circumstances the fail state is only temporary and will be eliminated by the controller itself.

Use the last status physical_drive_laststat from the physical drive information to analyze the cause of the drive failure. Additionally, check for retries terms_retry and/or reassigns terms_grown_defect.

A drive failure may also be the result of bad cabling terms_cabling, wrong termination terms_termination or overheating.

Figure 100. The Fail State

The Error State

Should a second hard drive fail while the array drive is in the fail or rebuild state, it is not possible to continue the working session without restrictions. The disk array is still available for I/Os, but data loss and error messages on the host level are possible.

Usually you must remove the array drive and build a new one. In some situations (see below) it might be possible to reset the array.

Use the last status physical_drive_laststat from the physical drive information to analyze the cause of the drive failure. Additionally, check for retries terms_retry and/or reassigns terms_grown_defect.

A drive failure may also be the result of bad or cabling terms_cabling, wrong termination terms_termination or overheating.

Figure 101. The Error State

The Statistics Window

Figure 102. Statistics Window Icon

The statistics window displays the throughput of physical, logical and host drives. The vertical axis show throughput, the horizontal axis, time. You can add drives by dragging and dropping them from the physical and logical configuration windows into the statistics window. To change the layout of the lines, adjust the scales of the axis or remove drives from the statistics windows using the chart menu_chart menu.

Scale the statistics window using the arrow keys. Scale time down/up using the left/right arrow keys. Scale throughput using the up/down arrow keys.
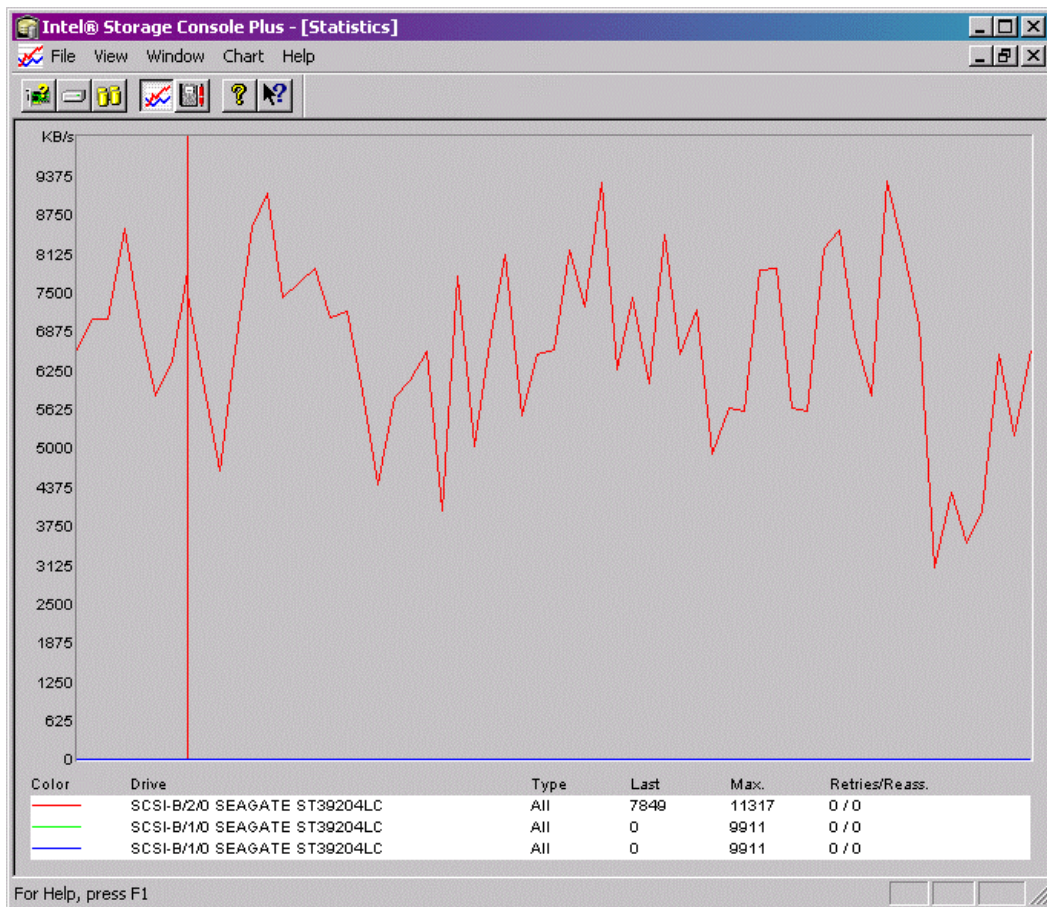

Figure 103. Statistics Window

The Controller Events Window

Figure 104. Controller Events Window Icon

The controller events window shows the history of events (since the log was last cleared). The table below illustrates the severity of events.

Table 29.   Event Window Icons

Event Icon	Event Description
	Information: This event is non critical. It occurs, for example, at the completion of an array build.
	Warning: This event is critical. It occurs, for example, if an array drive's state changes from ready to fail.
	Error: An error has occurred. This event could be a drive failure.

The first column in the event window contains icons representing the severity of the event. The second column lists how often the event occurred. Note that some events may occur often. The next column lists the date and the time when the event occurred. The last column describes the event. At the bottom of the window there is the Settings button. Here you can change the polling interval and enable the auto save function. Logs that are not saved on the hard drive are lost when the system is reset. The auto save function saves the current log in the time intervals selected there. The default name for this logfile is "srcevt.evt." The "Save As" button allows you to write the contents of the event log to a specific file on the hard drive. The Load button loads an older event log and displays it. The last two buttons delete the log file and clear the event buffer.
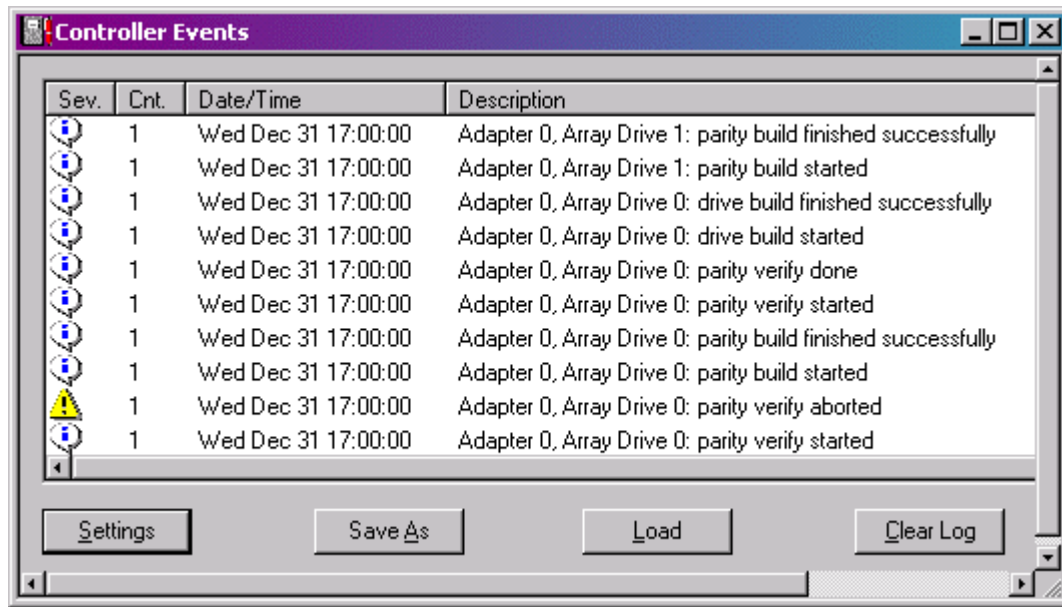
Figure 105. Controller Events

StorCon+ Help

StorCon+ includes an online help function. You can choose the Help menu or the pointer with the question mark to obtain online help for an icon or function. There is also an index that allows you to search for certain keywords and/or topics.
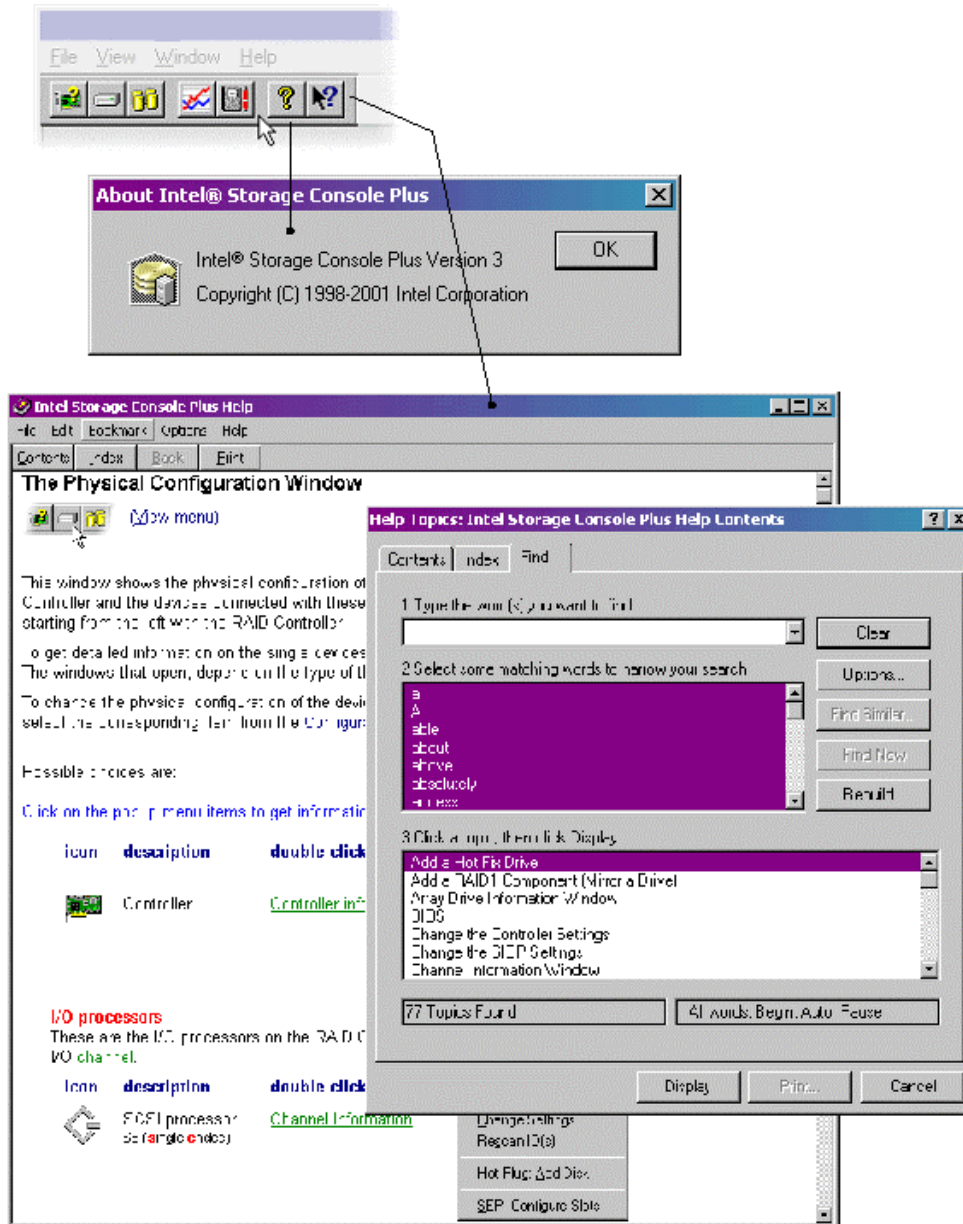
Figure 106. StorCon+ Help

Intel RAID Controller SRCU32 Service and Intel RAID Controller SRCU32 Mail

There are additional tools list below which are part of StorCon+ delivery.

Intel RAID Controller SRCU32 Service	Allows remote access to an Intel RAID Controller SRCU32 in a Windows NT server
Intel RAID Controller SRCU32 CTRLSRV	Allows remote access to an Intel RAID Controller SRCU32 in a Novell server
Intel RAID Controller SRCU32 Mail	Converts Intel RAID Controller SRCU32 messages into standard mails (for Windows 9x/NT, MAPI format)

It is recommended that you install the Intel RAID Controller SRCU32 Service / Intel RAID Controller SRCU32 CTRLSRV and the Intel RAID Controller SRCU32 Mail tool on each server that is equipped with Intel RAID Controller SRCU32. Thus, remote access to Intel RAID Controller SRCU32s in a network can be easily managed from one or several authorized users.

1. To install the Intel RAID Controller SRCU32 Service under Windows NT, copy IIRSRV.EXE and IIRSRV.CPL into the winnt\system32 directory and from the command line load ..\IIRSRV –i.

2. In the control panel load the "services" program and activate the Intel RAID Controller SRCU32 Service with the Start button.

To start the Intel RAID Controller SRCU32 Service during every new boot of the system automatically, click "Startup" button. See Figure 107.
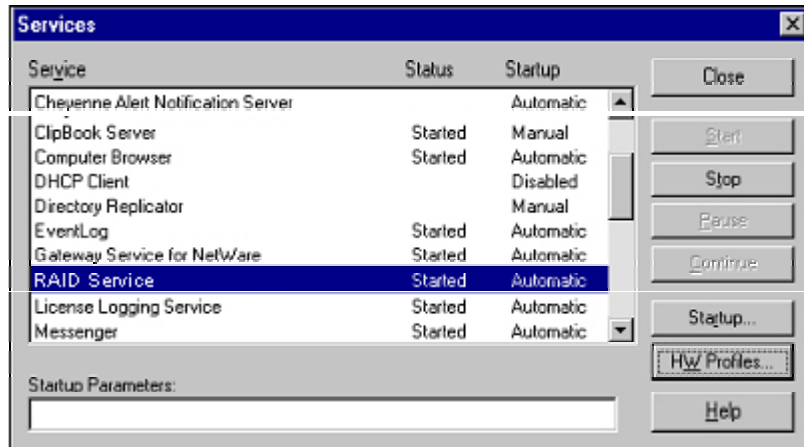

Figure 107. Services

To configure the Intel RAID Controller SRCU32 Service double click on the Intel RAID Controller SRCU32 Service icon. See Figure 108.

- The Poll-Interval determines the time between two message acquisitions of the Intel RAID Controller SRCU32 Service.
- Under Workstation you can add workstations that receive broadcast messages from the Intel RAID Controller SRCU32.
- In the device driver section you can add or remove parameters for the RAIDSRC.SYS driver (for example, reserve parameters for raw devices).
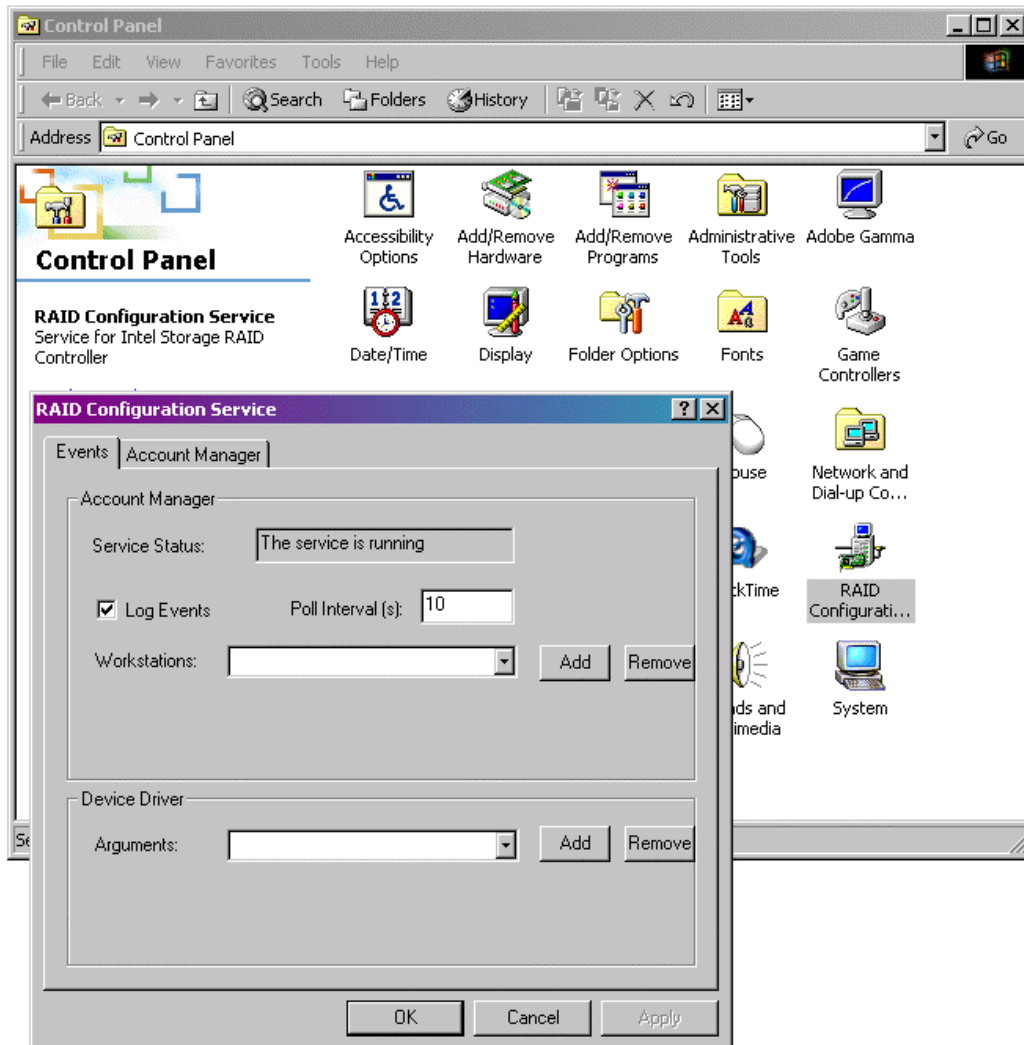

Figure 108. RAID Configuration Services

In the IOCTLSrv property sheet you can add / remove users which have remote access to the Intel RAID Controller SRCU32 via StorCon+. Passwords are encrypted. See Figure 109.
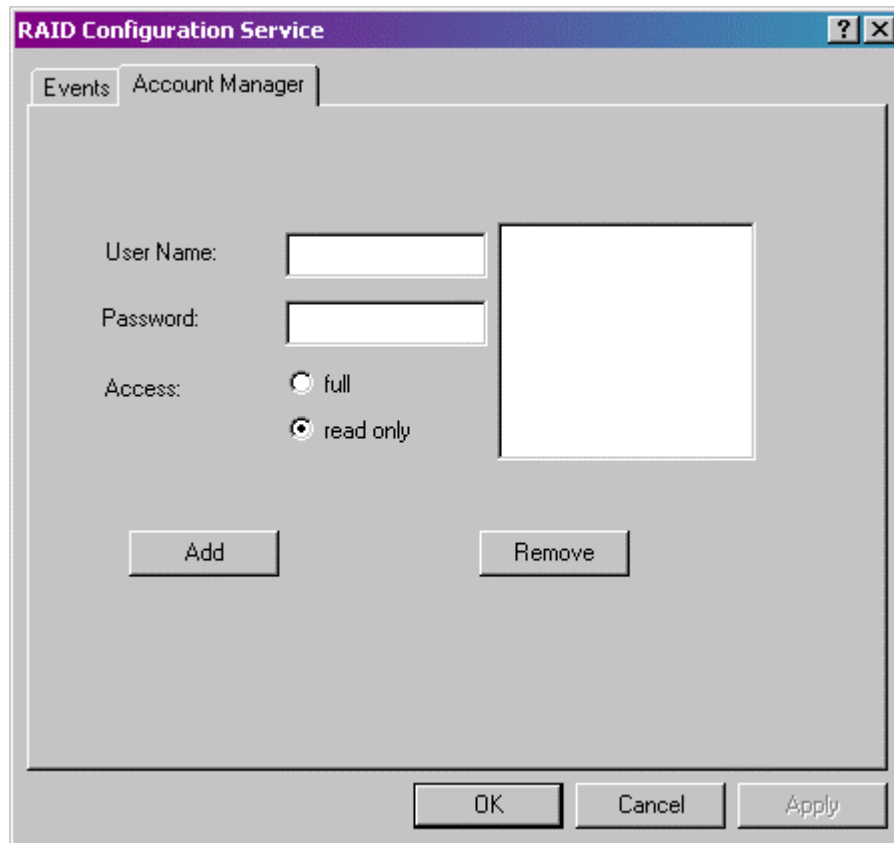
Figure 109. RAID Configuration Service Add/Remove Users

The Intel RAID Controller SRCU32 Mail tool gathers messages from the Intel RAID Controller SRCU32 Service, generates standard mail messages and sends them to pre-defined workstations. See Figure 110.
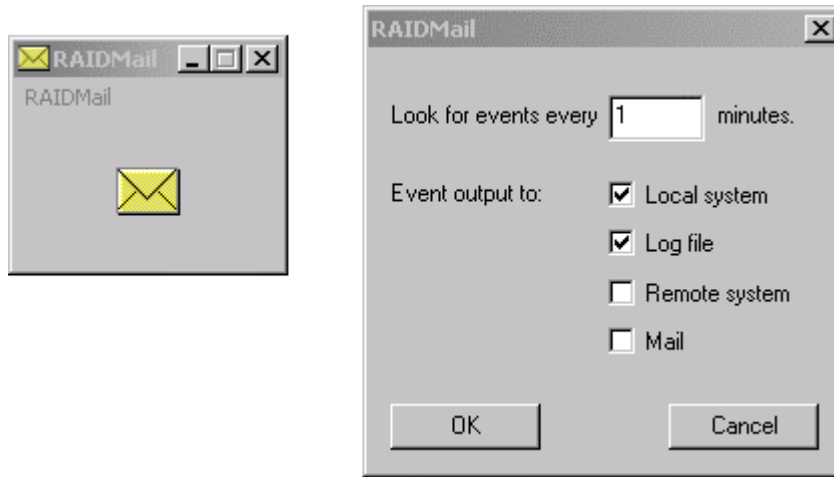

Figure 110. RAIDMail

After loading IIRMAIL.EXE and selecting "Settings," configure the mail tool.

If you select "Local System" all messages are displayed on the server itself. If you select "Log file," you are asked for a log file path/name. See Figure 111. All messages are recorded into this file (Figure 111). "Remote System" allows you to add workstations to which messages are sent. See Figure 113
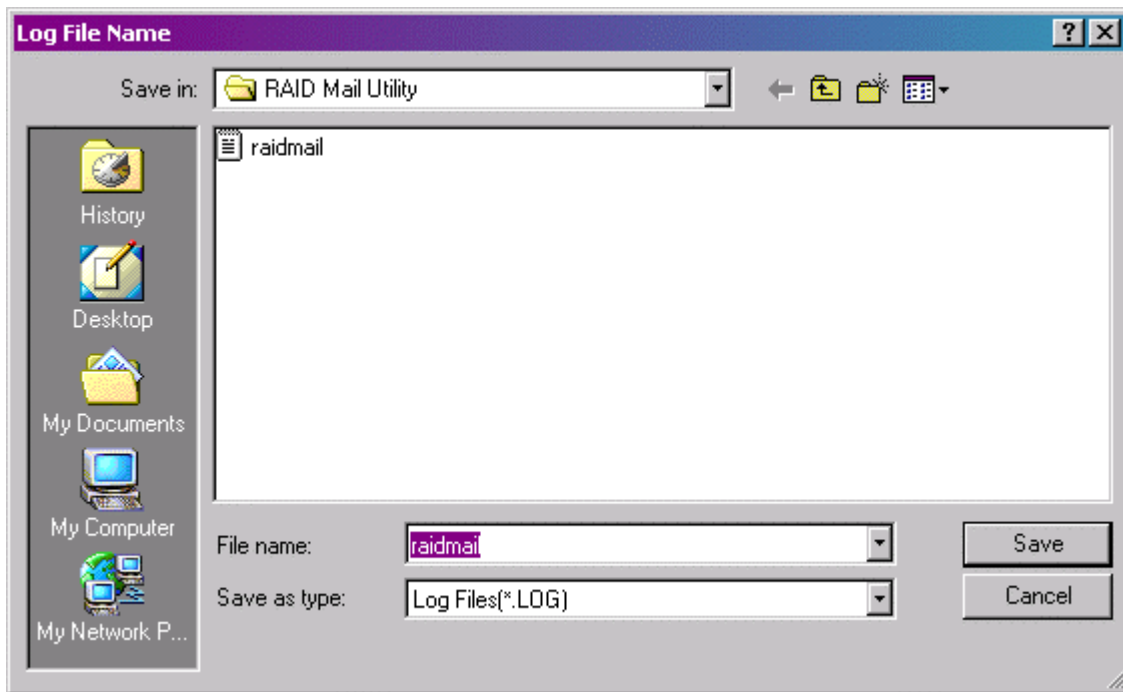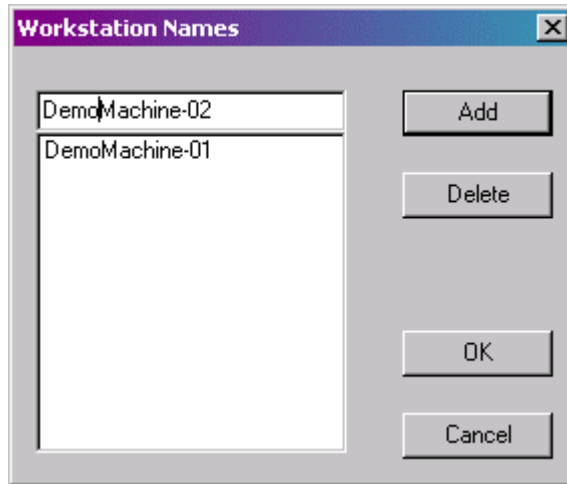

Figure 111. Log File Name

Figure 112. Workstation Names

Figure 113 illustrates a typical message generated by Intel RAID Controller SRCU32 Mail. The "Mail" option allows the interfacing to a standard mailing system (like Microsoft Outlook or Exchange).
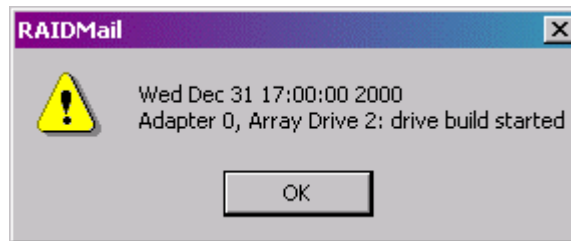

Figure 113. RAID Mail Utility

9   Getting Help

World Wide Web

http://support.intel.com/support/motherboards/server/

Telephone

Talk to a Customer Support Technician* (Intel reserves the right to change pricing for telephone support at any time without notice). Credit card calls billed at U.S. $25 per incident, levied in local currency at the applicable credit card exchange rate plus applicable VAT (Intel reserves the right to change pricing for telephone support at any time without notice).

*Or contact the local dealer or distributor. For an updated list of telephone numbers, please see: *http://www.intel.com/support/9089.htm*

In U.S. and Canada:
- 1-800-404-2284

In Europe:
- UK 0870 6072439
- France 01 41 918529
- Germany 069 9509 6099
- Italy 02 696 33276
- Spain 91 377 8166
- Finland 9 693 79297
- Denmark 38 487077
- Norway 23 1620 50
- Sweden 08 445 1251
- Holland 020 487 4562

In Asia-Pacific Region:

- Australia 1800 649931
- Hong Kong 852 2 844 4456
- Korea 822 767 2595
- PRC 800 820 1100
- Singapore 65 831-1311
- Taiwan 2 2718 9915
- India 0006517-2-830 3634
- Indonesia 001-803 65 7249
- Malaysia 1-800 80 1390
- New Zealand 0800 444 365
- Pakistan 632 6368415 IDD via Philippines
- Philippines 1-800 1 651 0117
- Thailand 001-800 6310003
- Vietnam 632 6368416 IDD via Philippines

In Japan:

- 0120-868686 (Domestic)
- 81-298-47-0800 (Outside country)

In Latin America:

- Brazil 0021-0811-408-5540
- Mexico 001-800-628-8686
- Colombia 980-9-122-118
- Costa Rica 0-800-011-0395
- Panama 001-800-628-8686
- Miami 1-800-621-8423
- Chile 800-532-992
- Ecuador 999-119, 800-628-8686 (via AT&T)
- Guatemala 99-99-190, 800-628-8686 (via AT&T)
- Venezuela 800-11-120, 800-628-8686 (via AT&T)
- Argentina 001-800-222-1001, 800-628-8686 (via AT&T)
- Paraguay 008-11, 800-628-8686 (via AT&T)
- Peru 0-800-50000, 800-628-8686 (via AT&T)
- Uruguay 000-410, 800-628-8686 (via AT&T)

10 Regulatory and Certification Information

⟹ **NOTE**

This card is intended for use in UL Listed computers or equivalent that have instructions detailing installation.

Product Regulatory Compliance

The Intel RAID Controller GDT8623RZ-I (SRCU32) add-in card, when correctly integrated per this guide, complies with the following safety and electromagnetic compatibility (EMC) regulations.

Product Safety Compliance
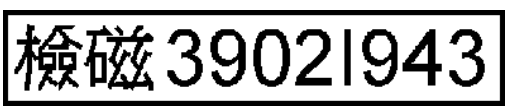
- CSA C22.2, No. 60950/UL 60950, 3rd Edition (US/Canada)
- EN 60 950 (European Union)
- IEC 60 950 (International)
- CE - Low Voltage Directive (73/23/EEC) (European Union)

Product EMC Compliance

- FCC/ICES-003, Class B Emissions (USA/Canada) Verification
- CISPR 22, 3rd Edition, Class B Emissions (International)
- EN55022, Class B Emissions
- EN55024: 1998, Immunity
- CE - EMC Directive 89/336/EEC
- AS/NZS 3548, 1995 Class B Emissions (Australia / New Zealand)
- BSMI CNS13438, Class A Emissions (Taiwan)
- RRL, MIC Notice No. 1997-41 (EMC) & 1997-42 (EMI) (Korea)

Product Regulatory Compliance Markings

The Intel RAID Controller GDT8623RZ-I (SRCU32) add-in card will be marked with the following regulatory markings:

CULus Listing Marks	LISTED ITE E139761 (UL mark) C / US
CE Mark	CE
FCC Marking (Class B)	intel. GDT8623RZ-I / FC / Tested to Comply With FCC standards / FOR HOME OR OFFICE USE
Australia C-Tick Mark	N232
Taiwan BSMI Marking (Class A)	檢磁 39021943
Korea RRL MIC Mark	MIC

In addition, the Intel RAID Controller GDT8623RZ-I (SRCU32) add-in card meets the following regulations:

Canada EMC Marking (Class B)	**CANADA ICES-003 CLASS B** **CANADA NMB-003 CLASS B**

Electromagnetic Compatibility Notices

FCC Verification Statement (USA)

Product Type: GDT8623RZ-I (Intel RAID Controller SRCU32)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Intel Corporation
5200 N.E. Elam Young Parkway
Hillsboro, OR 97124-6497
Phone: 1-800-628-8686

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and the receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment. The customer is responsible for ensuring compliance of the modified product.

All cables used to connect to peripherals must be shielded and grounded. Operation with cables, connected to peripherals that are not shielded and grounded may result in interference to radio and TV reception.

ICES-003 (Canada)

Cet appareil numérique respecte les limites bruits radioélectriques applicables aux appareils numériques de Classe Aprescrites dans la norme sur le matériel brouilleur: "Appareils Numériques," NMB-003 édictée par le Ministre Canadian des Communications.

(English translation of the notice above.) This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the interference-causing equipment standard entitled "Digital Apparatus," ICES-003 of the Canadian Department of Communications.

CE Declaration of Conformity (Europe)

This product has been tested in accordance to, and complies with the Low Voltage Directive (73/23/EEC) and EMC Directive (89/336/EEC). The product has been marked with the CE Mark to illustrate its compliance.

BSMI (Taiwan)

The BSMI ID certification number is located on the primary (top) side of the product.

Warnings and Cautions

Warnings

The connection of a non-shielded equipment interface cable to this equipment will invalidate the FCC certification of this device and may cause interference levels that exceed the limits established by the FCC for this equipment. It is the responsibility of the user to obtain and use a shielded equipment interface cable with this device. If the equipment has more than one interface connector, do not leave cables connected to unused interfaces unless otherwise instructed to do so in the user's manual.

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Cautions

Take precautions to prevent electrostatic discharge (ESD) damage before handling the Intel RAID Controller SRCU32. ESD can damage adapter card components. Perform the described procedures only at an ESD workstation. If no such station is available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the computer chassis.

11 Appendix

BIOS Information

Background I/O's

Due to memory manipulation done during the PCI configuration cycle, background I/O's on the Intel RAID Controller SRCU32 cannot be run until the OS is up and running.

BIOS Boot Messages

When booting the Intel RAID Controller SRCU32, the boot message in Figure 114 appears. In this example, an Intel RAID Controller SRCU32 has been detected in PCI slot 3, and it has 32 MB of RAM installed on the controller. A detailed explanation of the boot message follows.

Figure 114. BIOS Boot Message

⇒ **NOTE**

Because each SCSI channel has its own span process running in parallel, the POST scan of SCSI devices does not display in sequential order.

```
BIOS at 0x000C90000 – 0x000CE7FFF
```

Unlike ISA or EISA computers where the BIOS address of a peripheral expansion card is set manually (ISA, jumpers) or with the help of a configuration file (EISA, cfg file) and the address space is determined by the user, the PCI system-BIOS automatically maps the BIOS of a PCI compatible peripheral expansion card to a memory address. At each cold or warm boot, it determines which address space to assign to the BIOS of an expansion card. The message shown in Figure 114 reports the physical address occupied by the Intel RAID Controller SRCU32 firmware BIOS.

```
[PCI 7/14]
```

PCI device, bus system 7, slot 14. The PCI 2.x specification allows several PCI bus systems to be present in one PCI computer. All Intel RAID Controller SRCU32's have been designed to support multiple PCI bus system computers. The slot number indicated in the message above does not refer to the 14th PCI slot, but indicates that the Intel RAID Controller SRCU32 is plugged into a slot which is the 14th of the PCI chipset that the PCI computer can access. To determine which physical PCI slot this corresponds to, consult the PCI computer system manual.

```
DPMEM (B) at 0xFA0000000 - 0xFA003FF INT A = IRQ 11
```

"DPMEM" stands for Dual Ported Memory. The Intel RAID Controller SRCU32 needs this address space of the PCI computer for the command communication. As with the Intel RAID Controller SRCU32 BIOS, this mapping is also automatically carried out by the PCI system-BIOS. This information is essential when installing "Expanded Memory Managers" under DOS and Windows. The Intel RAID Controller SRCU32 DPMEM address space has to be excluded from the control of such a manager. Also, this message informs that the "PCI INT A" of the Intel RAID Controller SRCU32 has been assigned to the system IRQ 11. This assignment is also carried out automatically if the PCI system-BIOS is 100% PCI 2.x compatible.

```
SRCU32 – HWL0 -- 64 MB SDRAM / ECC - 2048KB Flash-RAM
```

"SRCU32 -- HWL0" stands for the type of Intel RAID Controller found by the Intel RAID Controller SRCU32 firmware BIOS. ("HWL" means hardware level.) "64 MB SDRAM / ECC" indicates that the installed DIMM is a 64 MB ECC SDRAM module. "2048 KB" indicates the size of the installed Flash-RAM. Depending on the size of the installed RAM, the following messages are possible ("xx" = 32, 64, 128, 256):

xx MB SDRAM/ECC

xx MB ECC-SDRAM-Module

```
async
```

SCSI devices are indicated as "async" until they have been initialized by the Intel RAID Controller SRCU32.

```
SCSI-B
```

Indicates SCSI devices which have been detected on the controller's SCSI channels.

```
Press <Ctrl><G> to enter INTEL(R) Storage Console
```

After pressing <Ctrl> + <G>, the message "…Please wait…" appears. The I/O bus scan is completed and the built-in StorCon configuration program is loaded. You are now free to configure RAID array drives.

FLASH Memory Programming

Firmware Update Procedure via XROM StorCon

The Storage Console (StorCon) is a full-featured monitoring and configuration utility with a text-based user interface. StorCon manages all aspects of the RAID subsystem as well as many features of the RAID adapter.

You can use StorCon to update the firmware image. The menu option, Firmware Update, allows you to update the firmware, BIOS and expansion ROM (XROM). StorCon is currently programmed on the flash memory of the IIR controller. Because the Flash-RAM can be reprogrammed many times, the software modules can be easily updated without having to remove the controller from its PCI slot.

The firmware, BIOS and XROM StorCon are part of the file, SRC_RXFW.xxx, where the file extension xxx indicates the version stepping. The current firmware file can be found on the RAID Software Suite CD-ROM. To get the latest firmware for the IIR controller, visit our website at: http://support.intel.com.

➡ **NOTE**

The Firmware Update option is not available when StorCon is accessing the IIR controller remotely.

Follow the procedure below to update the firmware via XROM StorCon.

1. Download the firmware image containing the latest programs/drivers from the website. Format a 3.5" HD disk (1.44MB) and copy the SRC_RXFW file onto the disk.

2. With the adapter installed in the system, boot the computer and press <Ctrl>+<G> when prompted to enter the BIOS version of StorCon.

➡ **NOTE**

When upgrading a major firmware version number (e.g. 2.32.00 to 2.33.00), it will be necessary to boot to DOS and run StorCon.exe to perform your firmware upgrade.

3. Select the applicable IIR controller and press <Enter>.

4. If the Express Setup menu is displayed, press <F4> to display the Advanced Setup menu. Select the menu option, Configure Controller and press <Enter>. Insert the floppy containing the latest firmware file into the floppy disk drive.

5. From the Configure Controller submenu, select Firmware Update and press <Enter>.

6. XROM StorCon searches for the firmware file from the floppy drive, a:\. After finding the file, StorCon displays the name, description and version of the firmware. Press <Enter>.

7. StorCon reads and checks the firmware file, then displays a warning. Press <Y> to confirm the firmware update.

StorCon programs the flash EPROM.

⚠ **WARNING**

Do not interrupt the update process to avoid damaging the firmware image in the flash. If the firmware update is interrupted and/or the firmware becomes unusable, please contact your RAID controller vendor. See the appendix titled Firmware Recovery before contacting your RAID controller vendor.

8. After StorCon indicates that the update is complete, press any key. The focus returns to the Configure Controller submenu.

9. Press <Esc> several times to close the menus and press <Y> to quit StorCon. StorCon detects the firmware update and requires a system reboot.

10. Press any key to reboot.

When the update process has completed, reboot the computer for the change to take effect. During the boot, the system displays the updated firmware version. You can also relaunch StorCon and select the applicable IIR controller to view its new firmware version at the bottom of the console (for example, FW:2.32.00-Rxxx).

You can also use the OS version of StorCon to update the firmware. Refer to the StorageConsole chapter of the Software Guide for more details.

Firmware Recovery

If your firmware has been corrupted, the following procedure may be helpful before contacting your RAID controller vendor:

Before you begin:
*   Have a DOS bootable diskette available
*   Have the DOS version of Storage Console executable (STORCON.EXE, obtained from web site or CD) available.
*   IIR firmware file (e.g. SRC_RXFW.xxx), obtained from http://support.intel.com

Procedure:

1. Copy STORCON.EXE and the IIR firmware file on to bootable DOS diskette.

2. Place diskette in drive A: and boot your system.

3. Once booted, type "storcon /defect" at the A:\ prompt.

4. When Storage Console loads, perform the firmware update procedure, starting at step 3, as described in the appendix section titled FLASH Memory Programming.

PCI Hot Plug Overview

The PCI Hot Plug (PCI HP) specification defines the requirements for adapter cards, system platforms, and system software to enable the insertion and removal of PCI adapter cards without turning off the platform or rebooting the operating system. The process may include stopping a portion of the software or controlling the power cycle of a portion of the hardware such as, in this case, a PCI slot. This industry standard offers customers higher system availability by helping to eliminate both planned and unplanned downtimes.

PCI HP requires network operating system (NOS) and PCI adapter driver support. PCI HP is different from other types of hot swapable devices since such devices (like a fan or power supply) do not require the cooperation or knowledge of the NOS or any specialized driver in order to perform an online replacement.

A PCI Hot Plug system requires a hot plug platform, a hot plug OS, and hot plug adapter drivers. A system can include any combination of hot plug and conventional versions of each of these components, including a mix of both hot plug and conventional adapter drivers. However, a particular adapter can be hot plugged only if all three components for that adapter support hot plug operation.

PCI Hot Plug enables the features of replacement/repair (Hot Replacement), addition (Hot Addition), adapter update, and deletion (Hot Deletion) of PCI adapters. Hot Replacement consists of replacing a malfunctioning adapter in a system utilizing, in sequence, the *Hot Removal* followed by the *Hot Insertion* functions of PCI Hot Plug. Hot Addition consists of adding a completely new device to the system utilizing the *Hot Insertion* function of PCI Hot Plug. Hot Deletion consists of removing (but not replacing) an existing adapter in a system utilizing the *Hot Removal* function of PCI Hot Plug.

There are two basic functions of PCI Hot Plug:

Hot Insertion

The insertion of a device into a powered-down PCI HP slot only (the system remains powered on) and power up of that slot once device is inserted. This assumes that driver for (PnP) device being inserted does not require reboot or driver is already loaded.

Hot Removal

Removal of a device by first powering down the HP PCI slot on which the device is inserted then physically removing the device from the HP PCI slot. Surprise Removal, the removal of the card while the slot still powered, is not supported.

⚠ WARNING

Prior to initiating the removal of the adapter via PCI Hot Plug, the user is responsible for closing all applications that communicate to the adapter and for verifying that there is no I/O activity to the IIR controller.

Refer to the appropriate Hardware Guide to determine the PCI Hot Plug features implemented on the IIR controller.

Integrated support for PCI Hot Plug can be found with the following operating systems:

- Novell NetWare 4.11 and 5.x
- SCO UnixWare 7.x
- Microsoft 2000

Windows NT 4.0 is capable of supporting Hot Replacement but only with special drivers. Refer to the section of the manual titled PCI Hot Plug of the IIR controller to determine the specific operating systems being supported.