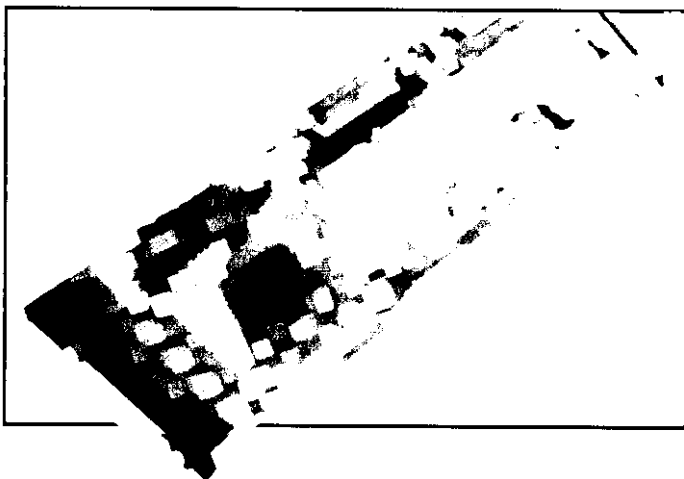


User's Manual



GDT RD Series

PCI - Fibre Channel
Disk Array Controllers



C o m p e t e n c e i n C o n t r o l l e r s

User's Manual

ICP Controllers of the GDT RD Series

PCI-Fibre Channel RAID Controllers

1st Edition

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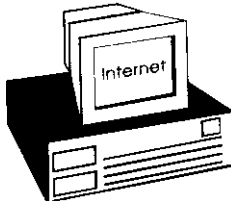
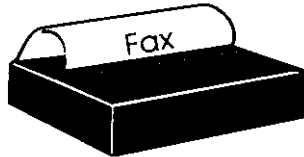
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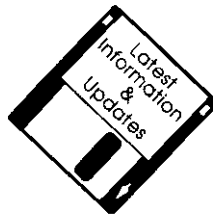


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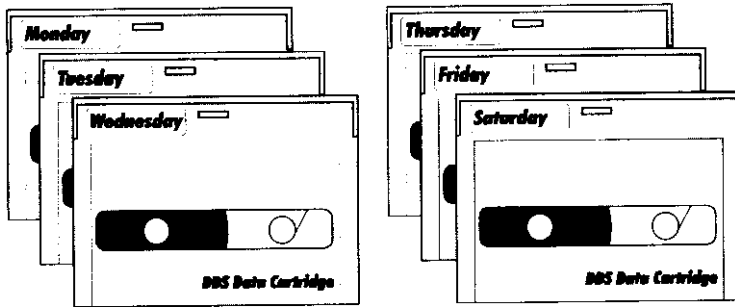
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Important Note

Using modern RAID Systems significantly increases data security and availability. *Under no circumstances* does it relieve you from a careful and daily backup on tape or a similar backup media. This is the only method to protect your valuable data against total loss (e.g., through fire or theft), accidental deletion, or any other destroying impacts.



Many Thanks to all my Friends

Monika & Wolfgang (the grandmasters)
AnnDee, Lois, Ken and Andreas (the Phoenix Crew)
Achim, Dieter, Norbert, Otto, Ralph, Wolfgang (WOS), Vitus (GG), (they are the real wizards)
Alfred (AB, "We need ultra2. I say we have it")
Andreas (AK, or "Kopf nur mit 8")
Michael (Mipf, "where is my CPU ?")
Jürgen (logo, "Hi, is Jürgen there ?")
Ruth (RA, "she had to proof-read that thing. ...")
Johannes (JS, "I want my ice with a red cap ... or Dr. Oops-Click-Click...")
Jürgen (JB, "diesbezüglich & hinsichtlich or probably")
Klaus (KLM, "...not an Airline...")
Markus (Malu, "Luuuuu...")
Uwe & Steffen (the two from the soldering station, 5 Paninis for Reinhardt)

All the fantastic "rest" of this incredible company

It is not only a pleasure to work here, it is a passion.



FCC Compliance Statement

Information for the User

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in residential installations. 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:

- Reorientate or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Plug the equipment into an outlet on a circuit different from that to which the receiver is powered.
- If necessary, consult the dealer or an experienced radio/T.V. technician for additional suggestions.

The use of a non-shielded interface cable with the referenced device is prohibited. Changes or modifications not expressly approved by ICP vortex Computersysteme GmbH could void the authority to operate the equipment.



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Chapter A

General

Information



A. Introduction

GDT RD Series: Hardware RAID Disk Array Controllers with 1 or 2 Fibre Channel Interfaces and 1 Wide & Ultra SCSI Channel for PCI Bus Computer Systems

In order to take full advantage of modern operating systems, high performance computer systems are needed. When assessing the performance of a computer system, the aspects speed and security of the mass-storage subsystem are gaining increasing importance. As a result of the constantly growing acceptance of the RAID technology (Redundant Array of Inexpensive Disks) in these computer systems, and the identification of the RAID controller as the essential part of a disk subsystem, a strong demand for suitable RAID controllers has emerged during the past few years.

Since 1990, ICP vortex has been intensively engaged in the research and development of RAID products for the highest performance and security requirements. Due to our products' outstanding performance, our expertise and continuity in development, ICP Controllers are accepted and known as top leading-edge products all over the world. ICP Controller products within the GDT RD Series offer customers a wide variety of RAID controllers, suitable for the most different platforms and applications. All ICP Controllers of the GDT RD Series are *pure-bred hardware solutions*. All functionality required for the sometimes very complex tasks is hardware-implemented on the controller. Thus, RAID is fully independent of the computer system (the host) and the operating system.

Thanks to the wide operating system support and easy-to-use installation and maintenance utilities, setting up and using high performance and fault-tolerant mass-storage subsystems for almost every purpose is child's play.

We would like to thank you for purchasing an ICP Controller of the GDT RD Series.

ICP - Intelligent Computer Peripherals ®

A.1 Product Identification

In order to meet the various customer and system requirements, ICP vortex offers two Fibre Channel RAID Disk Array Controllers for PC-based PCI computer systems. The main differences between the two controllers lie in the number of Fibre Channel Interfaces.

| Order Number | ICP Controller Name | Number of Fibre Channel Interfaces | Supported RAID Levels |
|--------------|---------------------|------------------------------------|-----------------------|
| 7917 | GDT6519RD | 1 | 0, 1, 4, 5, 10 |
| 7927 | GDT6529RD | 2 | 0, 1, 4, 5, 10 |



A.1.1 Key Features of the ICP Controllers of the GDT RD Series

- Hardware RAID Controllers with RAID 0, RAID 1, RAID 4, RAID 5 and RAID 10 Array Drives at controller level, completely independent of the computer system and the operating system. Several Array Drives can be operated simultaneously.
- "Private" (i.e., for one Array Drive) or "Pool" (i.e., for several Array Drives) Hot Fix Drives.
- Online Capacity Expansion. Add one or several new disk drives to an existing Array Drive to expand its capacity. During the Expansion all data are redundant.
- Online RAID Level Migration. Online change of an Array Drive's RAID Level, e.g., from RAID 0 to RAID 5.
- Online Capacity Expansion and RAID Level migration can be performed simultaneously.
- Configuration Utility (GDTSETUP) in ROM. Express Setup option to easily setup Array Drives. Press "CTRL-G" to load GDTSETUP, long before the operating system is booted.
- Advanced Multi-Processor RISC Technology.
- On-Board i960RD © Intelligent I/O Processor. Completely offloads the host CPU.
- 1, or 2 Fibre Channel Interfaces with HP Tachyon and onboard copper transceivers with 100MB/s channel. Support of Arbitrated Loop Topology.
- Up to 25 meters with copper cable. Standard DB9 connectors.
- Support of MIAs for large cable length.
- 1 full-featured additional Wide/Ultra SCSI channel for legacy SCSI devices (hard disks, CD-ROMs, etc.) with third generation 32 SCSI RISC processors and an active, software-switchable termination. Dual connector system (50 pin and 68 pin connector). Synchronous data transfer rate up to 40MB/sec.
- Cache RAM: 8MB, 16MB, 32MB, 64MB, or 128MB. One standard 72 PIN, 32 Bit or 36 Bit PS/2 SIMM. FPM (Fast Page Mode) or EDO (Extended Data Out) Dynamic-RAM technology. With EDO SIMMs increased performance. Automatic Cache RAM detection.
- Intelligent multi-level cache-algorithm with adaptive delayed write and read ahead functions. This ensures an optimized cache for various load profiles and system requirements.
- On-Board PCI 2.x compatible BIOS (Plug & Play).
- BIOS, Firmware and GDTSETUP in Flash-RAM. Easy update through floppy disk or BBS-download.
- GDTMON, Monitor program for the diagnosis (also remote) of ICP Controllers & Array Drives. The tool allows you to optimize existing configurations.
- Drivers for MS-DOS, Novell NetWare, SCO UNIX V/386, Interactive UNIX, UnixWare, Linux, Windows NT, Windows 95 and OS/2. ASPI-Managers for DOS, Windows and Novell NetWare. I₂O ready controller design.



A.2 Copyrights, Patents

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7. This agreement is subject to the laws of the Federal Republic of Germany. Place of jurisdiction for both parties is the domicile of ICP vortex Computersysteme GmbH.

A.4 General Information

The ICP Controller should be installed by an authorized ICP vortex distributor. Precondition for the safe installation is an anti-static work place (earthed mat on the table with wrist



bands connected to an earth). ICP vortex does not take any responsibility for damage arising out of improper installation. This manual contains all the information available at the time it was written. Errors and/or incomplete information are possible. We are grateful for any ideas or suggestions for improvement. Additional information may be found in the information file "**README.ENG**" on the enclosed System Disk "DOS". Besides up-to-date information, this file also contains a list of all programs on the ICP System Disks.

The contents of the file README.ENG must be read before the ICP Controller is used for the first time. Output is possible on printer or screen.

This **User's Manual** explains the installation and the operation of the ICP Controller. For information on the use of the computer system and its operating system, please refer to the corresponding system manuals. A short list of recommended literature can be found in the appendix of this manual.

A.4.1 Unpacking the ICP Controller

Open the show box and take out the ICP Controller (leaving it in its anti-static bag), the disk package and this manual.

WARNING: Never take the GDT PCB (Printed Circuit Board) out of the anti-static bag unless this is done at an anti-static work place, and the person handling the ICP Controller is secured with wrist bands against electrostatic charge. If these instructions are not observed, the CMOS components on the ICP Controller may be damaged or destroyed.

Store the show box in a safe and dry place.

A.4.2 Delivery Contents

The following items are delivered with the ICP Controller:

1. ICP Controller in a sealed anti-static bag.
2. Sealed GDT CD/disk package with driver and installation disks and/or CD.
3. This User's Manual.

A.4.3 Contents of the GDT Driver Disks and/or CD

A list of the files delivered with GDT can be found in the file **README.ENG** on the enclosed GDT System Disk DOS or the ICP CD. The contents of this file can be viewed on screen or output on your printer. You should not use the GDT System Disks as your working disks. Use an appropriate utility program (for example DISKCOPY of MS-DOS) to make functional copies of all system disks (please observe the software license agreement). Store your original system disks in a safe and dry place.

A.4.4 Before You Start

In order to avoid damage caused by improper or faulty usage or handling, **we strongly recommend** reading this manual carefully before installation or first operation.

A.5 Product Description

A.5.1 Intel i960RD I/O Processor

The i960RD I/O processor is a member of a new RISC CPU generation which was specifically designed for I/O applications. This CPU on an ICP Controller can reach a performance of **40 MIPS** and supervises all tasks of the Fibre Channel / SCSI devices, the RAID controlling and



the communication with the PCI computer. In doing so, it significantly offloads the PCI computer, leaving it free to perform its original tasks.

A.5.2 Architecture - General 32 BIT

To meet the demands on a high performance controller, the bus architecture of the ICP Controller has a general **32-bit** layout.

- 32-bit control processor (i960RD (TM) I/O Processor)
- 32-bit Fibre Channel processors
- 32-bit SCSI processor
- 32-bit bus-interface (PCI)
- 32-bit Cache RAM

A.5.3 Cache RAM - Expandable to 128MB

The cache RAM of a ICP Controller consists of one standard PS/2, 72 PIN, 32-bit or 36-bit, SIMM (**S**ingle **I**ncline **M**emory **M**odule). This can be a Fast Page Mode (FPM) SIMM with an access time of 60ns (or less), or an Extended Data Out (EDO) SIMM with an access time of 50ns. Operation of the controller with an EDO SIMM increases the controller's overall performance.

The cache size is flexible as different memory sizes can be obtained by using different SIMMs. Thus, the memory can be expanded to 8MB, 16MB, 32MB, 64MB or 128MB. An intelligent multi-level cache algorithm ensures that a high hit rate (cache hit) is achieved. Both, look-ahead and special delayed-write cache functions are implemented. With the GDT configuration program "GDTSETUP" and the monitoring utility GDTMON, the user can adjust various cache parameters.

A.5.4 Compatibility - PCI

The controllers of the GDT series have been developed in accordance with the 2.1 PCI-Bus specifications. They perform full bus-master DMA.

A.5.5 Up to 2 Fibre Channel Interfaces plus 1 Ultra/Wide SCSI Channel

The ICP Controllers are available with one or two Fibre Channel interfaces and have always one Wide/Ultra SCSI channel for legacy SCSI devices. Per Loop up to **126 devices** can be connected. The maximum data transfer rate is **100MB/sec on the Fibre Channel** and **40MB/sec on the Wide/Ultra SCSI channel**.

The Wide/Ultra SCSI channel is equipped with a SCSI-2-compliant (*alternative 2*), active, and software-switchable SCSI bus termination, which allows for a separate termination of the lower and higher byte of the SCSI bus.

A.5.6 ICP Controller Firmware RAIDYNE™, PCI-BIOS and GDTSETUP

The firmware, the BIOS of the ICP Controller and the configuration program GDTSETUP are stored in a Flash-RAM on the ICP Controller PCB. The firmware is designed for parallel processing and it controls all resources of the ICP Controller. This means that the entire administration of the devices and RAID is exclusively carried out by the ICP Controller. Thus, the host is significantly offloaded. In addition, this hardware-implemented solution guarantees the highest achievable security. The controller-BIOS provides a complete PCI compatible INT13 interface (with 8GB DOS-partition extension) and expands the respective functions of the system BIOS. It also ensures that operating systems using the INT13 (i.e. MS-DOS, Windows NT) can be booted directly from a device / RAID Array Drive connected



to the ICP Controller. The RAIDYNE-Firmware allows for the simultaneous operation of disk arrays with the RAID Levels 0, 1, 4, 5, 10. RAIDYNE is also capable of performing an online capacity expansion of an existing array by adding one or more new hard disks. During expansion the array is fully operational. Another feature of RAIDYNE is the online RAID Level Migration of an existing array, e.g., from RAID 0 to RAID 5.

A.5.7 Configuration Program GDTSETUP

GDTSETUP is either loadable from the Flash-RAM of the ICP Controller (press <CTRL><G> after the ICP shows the controller BIOS), or from the command prompt under MS-DOS. GDTSETUP has a graphical user interface. It provides besides others the following functions:

- Configuration of SCSI and Fibre Channel devices connected to the ICP Controller and administrated by the GDT cache. Devices not controlled by the cache (CD-ROM, DAT, DLT, WORM, MOD, etc.) are either operated by means of the ASPI interface, or are directly supported by the operating system.
- EXPRESS and ADVANCED configuration of single disks, or RAID 0, 1, 4, 5 and 10 Host Drives
- Configuration of the ICP Controller's cache and intelligent fault bus.

A.5.8 Diagnosis Program GDTMON

The diagnosis program (or simply *monitor*) GDTMON (GDT MONitor) is a very flexible software tool that offers many different diagnosis and maintenance functions during full-operation conditions. GDTMON can be used on the fileserver, or remotely from an authorized workstation. The main functions of GDTMON are:

- Monitoring the disk subsystem performance (KB/sec and I/Os per sec. of host-, cache- and physical drives)
- Monitoring the utilization of the on-board GDT cache
- Online configuration of the GDT cache memory
- Online changes of device parameters
- Online check of the parity information of RAID 4 and RAID 5 Array Drives
- Online capacity expansion of existing Array Drives
- Hot Plug and Hot Fix



A.5.9 Operating System Driver Software

Drivers for the following operating systems are available:

| Operating System | Driver included with the Controller Package |
|---|--|
| MS-DOS 3.3 to 6.x | Yes |
| Novell NetWare 3.11, 3.12, 4.x | Yes |
| SCO UNIX System V/386 3.2v5.x | Yes |
| Interactive UNIX V/386 3.2v3, 3.2v4 | Yes |
| SCO UnixWare 2.x | Yes |
| IBM OS/2 2.x, Warp 3, Warp 4 | Yes |
| Windows NT 3.5x, 4.x | Yes |
| Windows 95 | Yes |
| Linux 1.2.13, 1.3.37, 1.3.97, 2.0.00, 2.0.18 | Yes |
| QNX 4.22 | Yes |

The following table shows how various devices are integrated by different operating systems. Please refer to the corresponding chapters of this User's manual and the operating system documentation for detailed installation information.

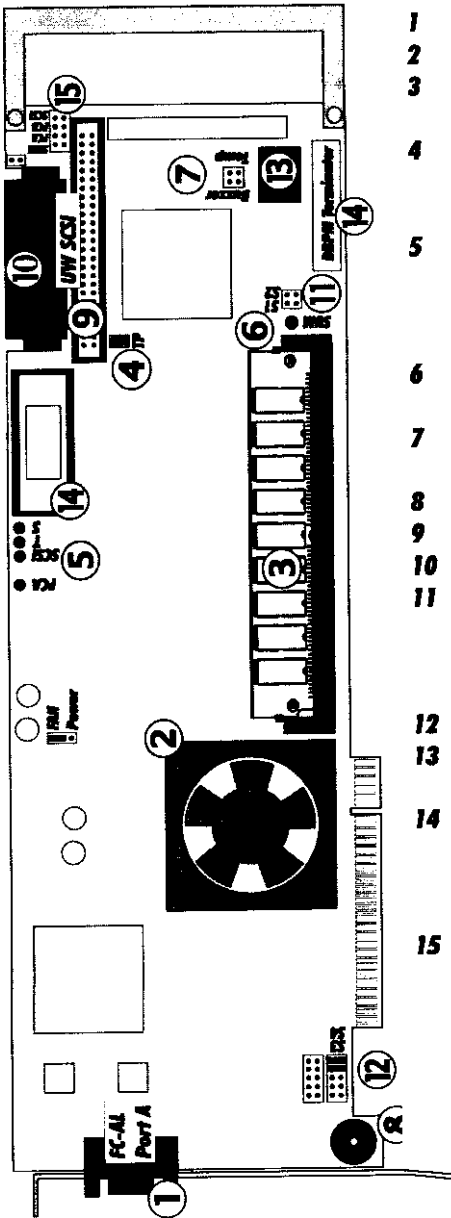
| | Hard Disk | Remov. HDD | CD-ROM | Streamer | WORM | MOD |
|----------------|------------------|-------------------|---------------|-----------------|-------------|-------------|
| MS-DOS | GDT | ASPI or GDT | ASPI | ASPI | ASPI | ASPI/GDT |
| NetWare | GDT | GDT | ASPI | ASPI | ASPI | ASPI/GDT |
| UNIX | GDT | GDT | UNIX | UNIX | UNIX | UNIX/GDT |
| Win. NT | GDT | Win.NT or GDT | Win.NT | Win.NT | Win.NT | Win.NT |
| OS/2 | GDT | OS/2 or GDT | ASPI | ASPI | ASPI | ASPI or GDT |

GDT: Configurable with GDTSETUP (some MODs are recognized as a hard disk (see your MOD manual). In this case, they too can be configured with GDTSETUP). **ASPI:** Integration by means of an ASPI interface. **UNIX, OS/2, Win.NT:** Supported by the operating system.

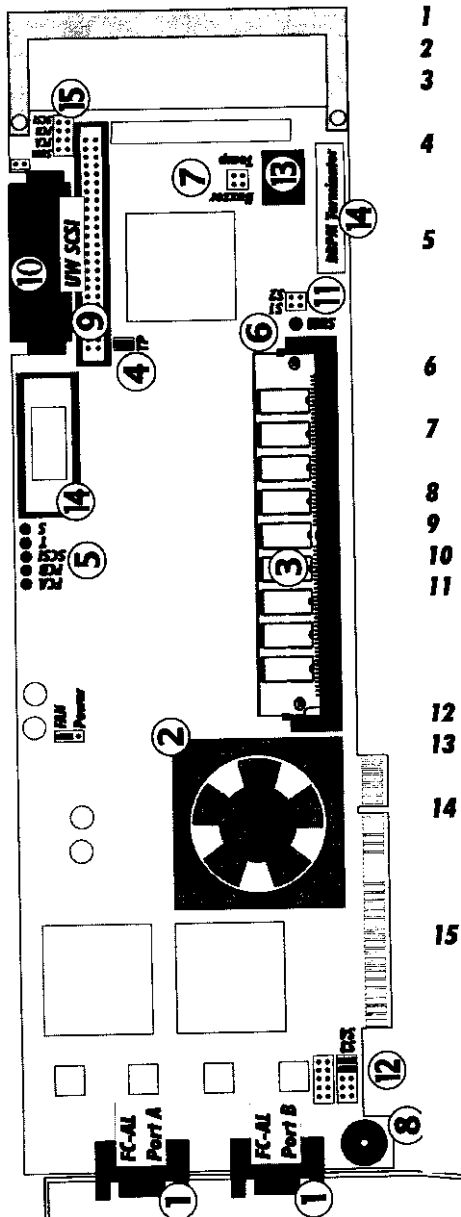
A.5.10 ICP Controller GDT RD Series Board Layout

The ICP Controller PCB (Printed Circuit Board) has several jumpers. In the following illustrations, all jumpers are shown in their factory setting. No other jumpers except the TP and S1 jumpers are user-serviceable and must remain in their displayed position. An installed TP jumper means that the ICP Controller supplies the termination power on the SCSI cable of the Wide/Ultra SCSI channel. The S1 jumper has to be installed if the ICP Controller is operated with an EDO SIMM. For operation with a Fast Page Mode SIMM, the jumper must not be set.



GDT6519RD Overall View

- 1** DB9 connector for FC-AL port A.
- 2** CPU cooler for i960RD.
- 3** 72-PIN EDO or FPM SIMM with 32 Bit or 36 Bit (not included).
- 4** Terminator Power Jumper for Ultra/Wide SCSI channel (normally closed).
- 5** LEDs. S(green)=Status.
T(green)=DMA transfer.
SCSI,FCA(yellow)=Activity on FC-AL and Ultra/Wide SCSI.
- 6** LED. SUM(yellow)=Activity of all FC-AL and Ultra/Wide SCSI accesses.
- 7** Connectors for secondary buzzer and temperature-alarm.
- 8** Loudspeaker.
- 9** Connector for 50 pin SCSI cable.
- 10** Connector for 68 pin SCSI cable.
- 11** Jumpers S1 and S2.
S1 = closed: EDO SIMM
S1 = open: FPM SIMM
S2 always open.
- 12** Jumpers S3 and S4. Always closed.
- 13** Feature Socket A (PLCC32 for additional Flash-RAM).
- 14** Terminator key if DRAM Battery Power Module not installed. Key can be also installed 180 degrees clockwise rotated).
- 15** Connector for external LEDs.
Sum: All FC-AL and Ultra/Wide activities.
FC-A: Activity on FC-AL port A
SCSI: Activity on Ultra/Wide SCSI channel.

GDT6529RD Overall View


- 1** DB9 connector for FC-AL ports A & B.
- 2** CPU cooler for i960RD.
- 3** 72-PIN EDO or FPM SIMM with 32 Bit or 36 Bit (not included).
- 4** Terminator Power Jumper for Ultra/Wide SCSI channel (normally closed).
- 5** LEDs. S(green)=Status.
T(green)=DMA transfer. SCSI,FCA, FCB(yellow)=Activity on FC-AL and Ultra/Wide SCSI.
- 6** LED. SUM(yellow)=Activity of all FC-AL and Ultra/Wide SCSI accesses.
- 7** Connectors for secondary buzzer and temperature-alarm.
- 8** Loudspeaker.
- 9** Connector for 50 pin SCSI cable.
- 10** Connector for 68 pin SCSI cable.
- 11** Jumpers S1 and S2.
S1=closed: EDO SIMM
S1=open: FPM SIMM
S2 always open.
- 12** Jumpers S3 and S4. Always closed.
- 13** Feature Socket A (PLCC32 for additional Flash-RAM).
- 14** Terminator key if DRAM Battery Power Module not installed. Key can be also installed 180 degrees clockwise rotated).
- 15** Connector for external LEDs.
Sum: All FC-AL and Ultra/Wide activities.
FC-A: Activity on FC-AL port A
FC-B: Activity on FC-AL port B
SCSI: Activity on Ultra/Wide SCSI channel.

Chapter B

Hardware

Installation



B. Hardware Installation

B.1 Before Installation

The ICP Controller is designed for minimum power consumption and maximum operational security. It therefore contains delicate electrical components (CMOS). In order to avoid damages caused by electrostatic charges, the following warning must be observed during installation:

Never take the ICP Controller out of the anti-static bag unless this is done at an anti-static work place and the person handling the ICP Controller is secured against electrostatic charge through wrist bands. If these instructions are not observed, the user risks damage or destruction of the CMOS components of the ICP Controller !

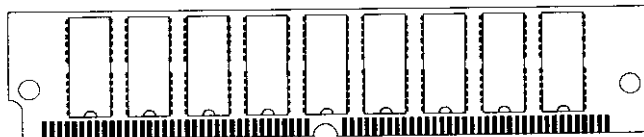
B.2 Tools

Before installing, please switch off the complete computer system and remove all cables including the power cable. Open the case of the host computer with an appropriate screwdriver (usually a medium sized Philips screwdriver).

B.3 Installing the Cache RAM SIMM

***It is not possible to operate the ICP Controller without Cache-RAM.
The ICP Controller is delivered without RAM (0MB).***

If the ICP Controller is not yet equipped with cache RAM, or if another SIMM is to be installed, we recommend adding it before you install the ICP Controller in your computer system. As mentioned before, the ICP Controller can be run with different cache RAM sizes.



The minimum cache RAM size is 8MB. The maximum cache RAM size is 128MB. The ICP Controller provides one socket for a standard 72 PIN SIMM (Single Inline Memory Module). The SIMM can either have parity (=36 Bit), or non-parity (=32 Bit). The ICP Controller's memory controller can use a **Fast Page Mode (FPM)** SIMM with 60ns (or less) or an **Extended Data Out (EDO)** SIMM with 50ns. The use of an EDO SIMM increases the performance of the ICP Controller. The SIMM is correctly plugged into the SIMM socket if it is engaged correctly into the socket's metal hooks and if all contacts of the SIMM are equally contacting the corresponding pins of the socket.

Automatic Cache RAM Recognition

Each time you switch on the computer system, the ICP Controller automatically recognizes how much cache RAM is available and configures itself accordingly.



Recommended SIMM Manufacturers

SIMMs from Goldstar, Motorola, Micron, NEC, Samsung, Siemens, Texas Instruments, and Toshiba have been successfully tested with the ICP Controllers. This recommendation does not imply an evaluation of quality. SIMMs from other manufacturers may be equally suitable. You can use single- and double-sided SIMMs. When using double-sided SIMMs with high power consumption special care should be taken that both, the ICP Controller and SIMM are properly cooled.

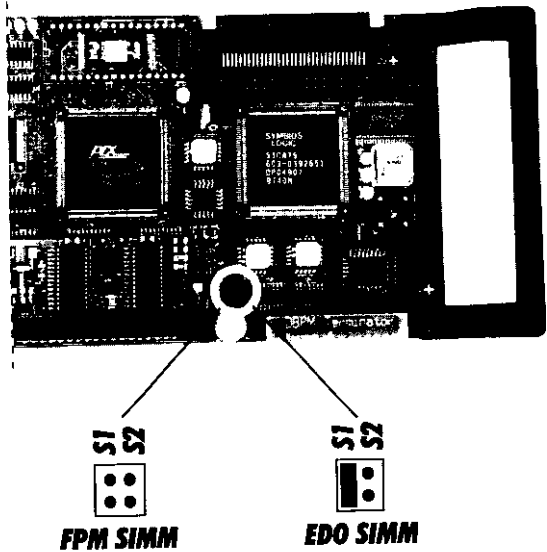
SIMM sizes and types which can be used on the ICP Controller :

| Fast Page Mode (FPM) SIMM, 60ns (or less), Jumper S1 not set | Extended Data Out (EDO) SIMM, 50ns ^(*) , Jumper S1 set | RAM Size |
|---|--|----------|
| 2M*32 and 2M*36 | 2M*32 and 2M*36 | 8MB |
| 4M*32 and 4M*36 | 4M*32 and 4M*36 | 16MB |
| 8M*32 and 8M*36 | 8M*32 and 8M*36 | 32MB |
| 16M*32 and 16M*36 | 16M*32 and 16M*36 | 64MB |
| 32M*32 and 32M*36 | 32M*32 and 32M*36 | 128MB |

^(*) When using an EDO SIMM on the ICP Controller, jumper S1 has to be set (see next page). For the operation of a Fast Page Mode SIMM S1 must remain open. We have tested several EDO SIMMs with 60ns without any problems, but according to the specification of the ICP Controller's Intel i960RD CPU, 50ns are necessary to comply with the timing requirements.

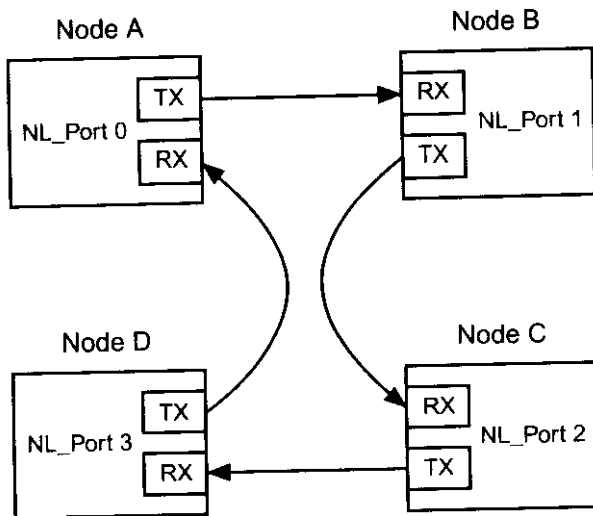
Obviously, the question arising at this point is: "**How much cache RAM do I need ?**" In the following table, we made RAM equipment suggestions for the minimum, typical and optimum RAM size (Note: Naturally, all ICP Controllers work flawless with the smallest RAM size stated in column 2 of this table).

| Controller | Usable Sizes in [MB] | Suggested RAM equipment | | |
|------------|-------------------------|-------------------------|---------|---------|
| | | Minimum | Typical | Optimum |
| GDT6519RD | 8,16,32,64,128 | 8 | 32-EDO | 64-EDO |
| GDT6529RD | | | | |



B.4 Fibre Channel Arbitrated Loop Topology - Facts

The GDT6519RD and GDT6529RD support the Arbitrated Loop Topology. The Arbitrated Loop (AL) allows up to 127 ports to be connected in a circular daisy chain. Data is transferred from one device to its neighbor in the chain. The ports in an AL are designated as NL_Ports, and two ports can be active simultaneously. The other ports func-

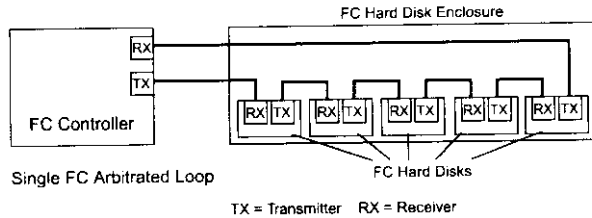


tion as repeaters and simply pass the signal along. This means, of course, that the bandwidth of 100MB/sec is shared among all devices. Just as in a token ring, each device on the

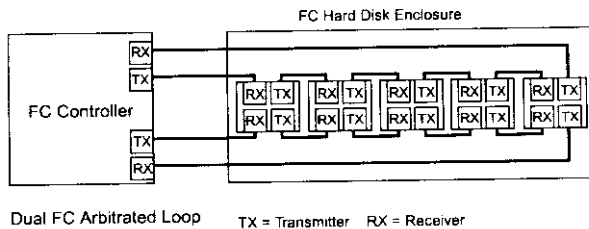
Arbitrated Loop sees every message, keeps those meant for it, and passes all others along. Fibre Channel Arbitrated Loop (FC-AL) is a subset of a Switched Fabric.

ICP controllers are available either as single port controller (GDT6519RD), with one FC channel, or dual port controller (GDT6529RD), with two independent channels.

Single channel systems cost less, but they have the disadvantage that if the cable itself, or



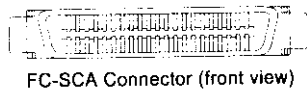
some other connecting component fails, the controller can no longer communicate with the FC devices. A dual port controller allows a system to be constructed with each device attached to both cables, so that if one cable fails, the other takes over all IO operations.



B.4.1 Fibre Channel Hard Drives

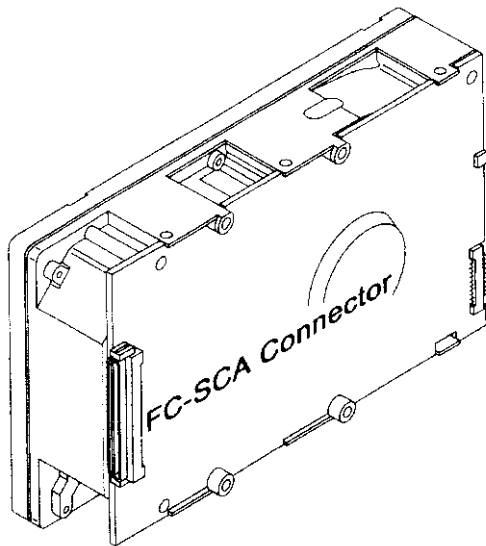
FC hard drives are built with a 40 pin SCA connector (Single Connector Attachment), which provides all necessary signal connections and electricity to the hard drives. This SCA connector enables hard drives to be easily built into an external enclosure with an SCA backplane. The drawback of the SCA connector, however, is that the hard drive can no longer be connected directly to the controller with a simple cable, but needs a specific FC-SCA to DB 9 adapter. This adapter converts the SCA connection on the hard drive into one or, in the case of a dual port hard drive, into two DB 9 female connectors, so the appropriate DB 9 male connector can be attached. The adapter also has a connector for the electrical current to the hard disk. When using such adapters, a loop back connector must be used to complete the communication loop.

If the hard drives are used in a dual loop configuration, they must have two NL_Ports.



When choosing FC hard drives, those with the shortest seek times and highest RPMs usually provide best performance. The seek time refers to the amount of time the drive read/write head needs to access specific data sectors on the disk. The shorter the seek time, the less time spent waiting during random reads/writes. Higher RPMs translate into better sequential data transfer rates and better read/write times.

B.4.2 FC Hard Drive Enclosures



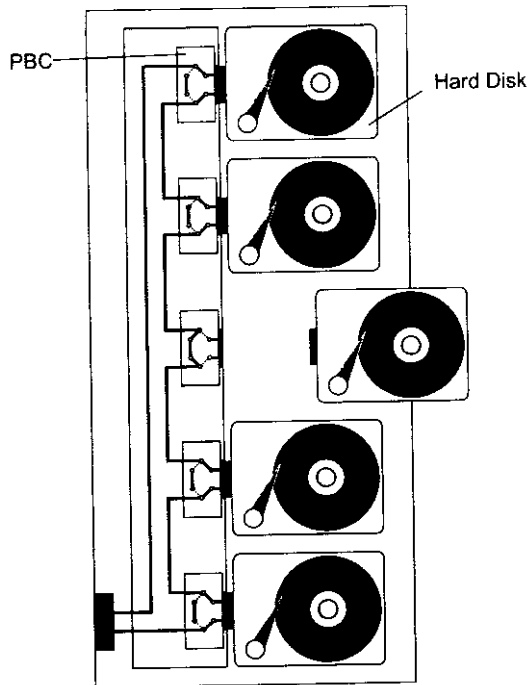
A FC hard drive enclosure functions not only to physically house the drives, but must also control electrical current and temperature. In choosing an enclosure, important features to consider are redundant and hot-swappable power supplies and fans. These components have a relatively high failure rate and, if they are not redundant, their failure can lead to hard drive failures.

The FC hard drive enclosure assigns to each hard drive a unique ID in the Loop.

Enclosures for RAID systems must also support the interactive change-out of a hard disk during system operation (Hot-Plug). To achieve this, the enclosure must have Port Bypass Circuits (PBC), which are located on the backplane and redirect data paths while the failed hard drive is exchanged. This prevents disruption of the Arbitrated Loop. While using a system with PBCs, one must take care that the allowable cable lengths between devices specified for FC-AL are not exceeded. In addition, pay attention to whether the enclosure can support a dual loop configuration. In order to provide the highest level of fault tolerance, some FC enclosures have two completely independent, redundant loops. If the hard drives and controller also provide two FC ports, the system can be completely redundant, with redundant cabling. If one loop fails completely, the second can still carry all communications between controller and hard drives.

Another consideration is whether the enclosure supports Media Interface Adapters (MIA). These adapters transform the electrical signals from hard drives into optical signals. In order for these adapters to function, however, the DB 9 connectors must provide the necessary electrical support. MIAs allow a controller with copper cabling to be used with a fiber optic system.

A modern enclosure should also provide a management interface, through which a RAID controller can communicate information regarding the status of the system. For example, the enclosure would communicate information about fan or power supply failure to the



controller, which would then notify the system administrator. Similarly, the controller communicates with the enclosure, indicating which hard disk has failed, so that the system administrator can see on the enclosure display (Fault LEDs or LCDs) which disk needs to be swapped.

B.4.3 FC Connectors and Cables

A net data transfer rate of 100 MB/sec corresponds to a signal frequency on the FC cable of 1 GHz. This extremely high frequency necessitates the highest quality connectors and cables, which means only those from reputable manufacturers should be used.

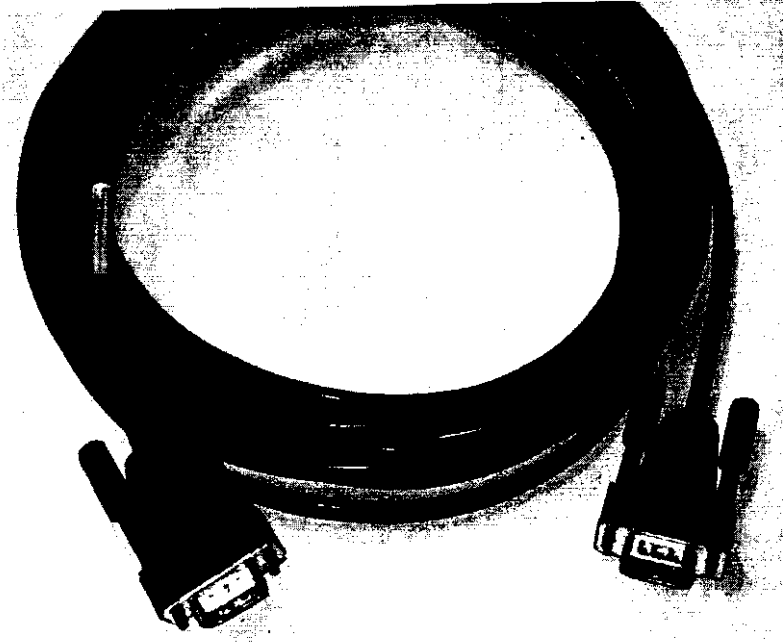
Because the distances between individual FC devices (RAID controllers and hard drives) in mass storage systems are not great, the less expensive copper cabling is most often used. Three different kinds of copper cabling with DB 9 connectors (similar to serial PC interface)

are defined for FC: Video Coaxial, Miniature Coaxial and Shielded Twisted Pair. This cabling enables the 100 MB/sec transfer rate for distances up to 25 meters.

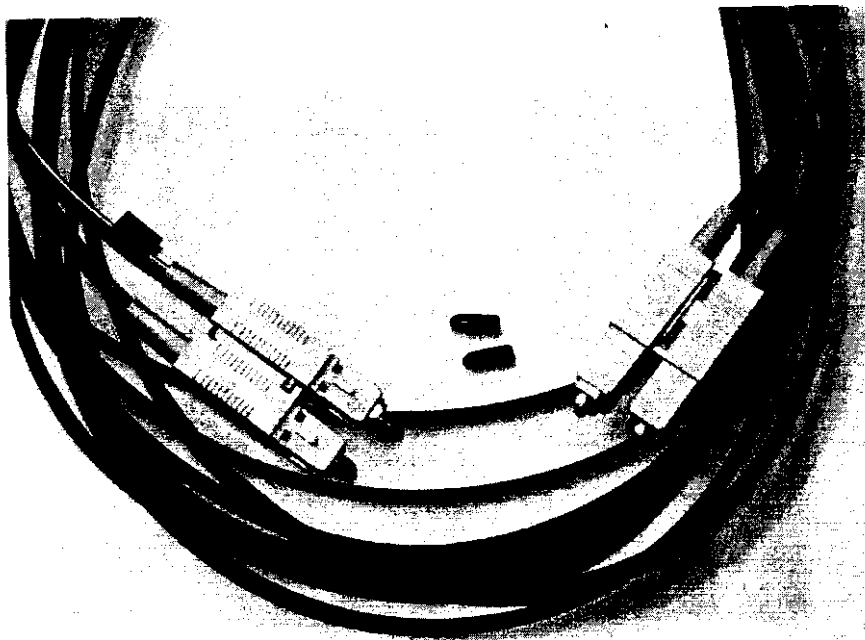
If the FC devices or device groups (such as a complete FC enclosure) have to be further than 25 meters apart, the signal transmission can be carried via optical fiber. The 50 μm multi mode optical fibers with shortwave lasers can handle cable lengths up to 500 meters, and the 62.5 μm multi Mode optical fibers up to 175 meters. SC duplex connectors should be used in these situations. 9 μm single mode optical fiber with longwave lasers can travel up to 10 km. (The distances discussed here refer to the distance between devices, not the length of the entire cable, as is the case with SCSI.)

Because the laser power necessary for the extremely long distances poses a threat to the human eye, a protective system called Open Fiber Control (OFC) has been defined. The receiver normally sends continual acknowledgments of receipt of the laser signals. If the transmitter does not receive this acknowledgement, the laser signals are immediately stopped.

There is also a non-OFC system, used when the power of the laser is not dangerous to the eye, so no receipt acknowledgements are sent. OFC and non-OFC systems are not compatible.



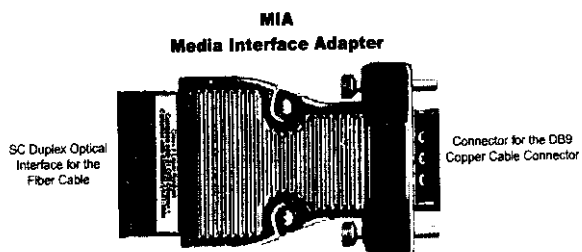
Example for a copper cable.



Example for a fibre optics cable.

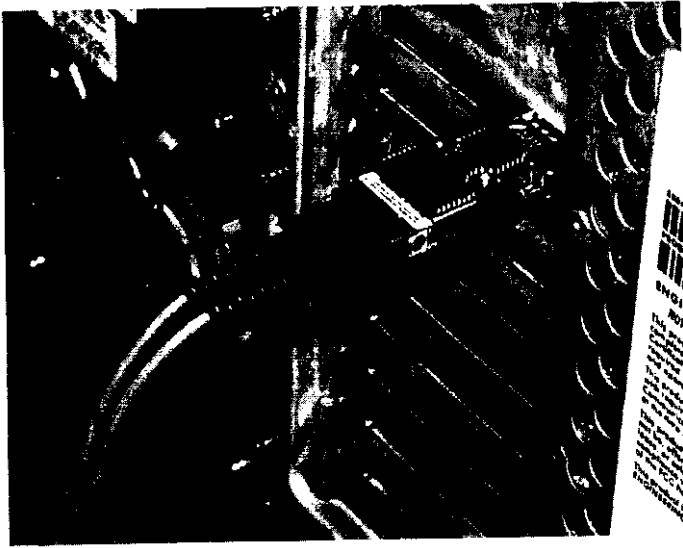
B.4.4 Media Interface Adapter (MIA)

MIA adapters transform the electrical signals used by copper cables into optical signals transmitted by optical fibers. One end of the adapter has an FC DB 9 male connector and the other end has an SC duplex female connector for the optical fiber. The adapter uses a laser diode to transform electrical signals into light signals and an optical sensor to perform the reverse function. The necessary electricity for the adapter must be delivered by the DB 9 connector. Compatibility with MIAs is an important point to consider when choosing FC devices. These adapters provide a very cost-effective method to connect FC devices which are located far from one another.

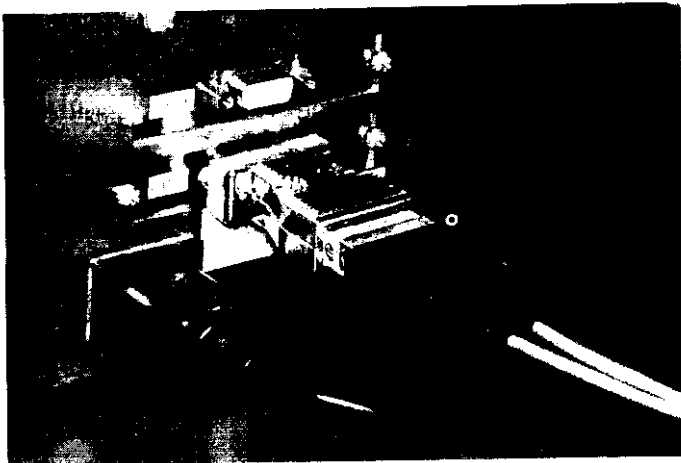


Example for a MIA and a SC fiber optics cable with a GDT6519RD

(MIA and fiber optics cable plugged into the female DB9 connector of the GDT6519RD)

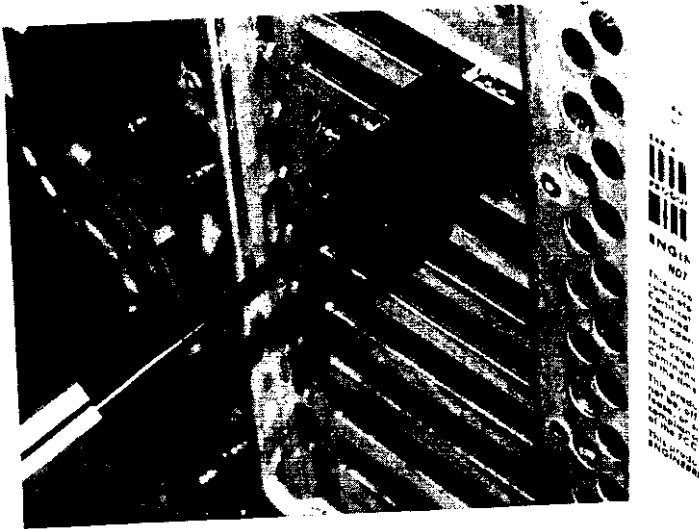


(MIA and fiber optics cable plugged into the female DB9 connector of the subsystem)

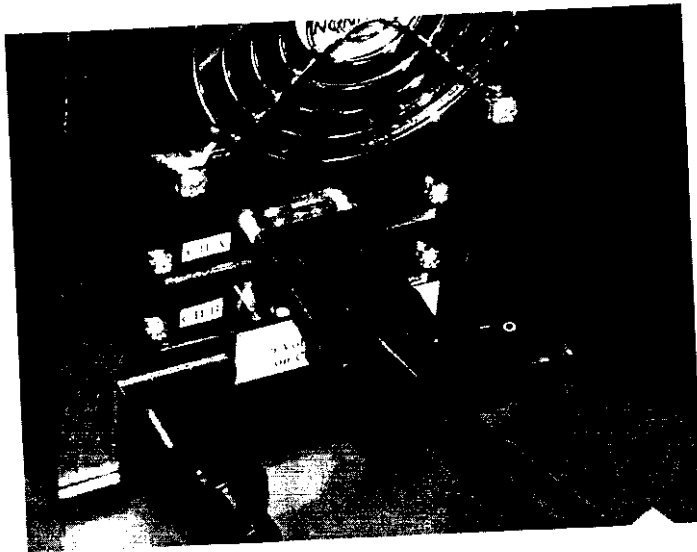


Example for a copper cable between a GDT6519RD and a FC-AL subsystem

(DB9 connector of copper FC-AL cable plugged into the female DB9 connector of the GDT6519RD)

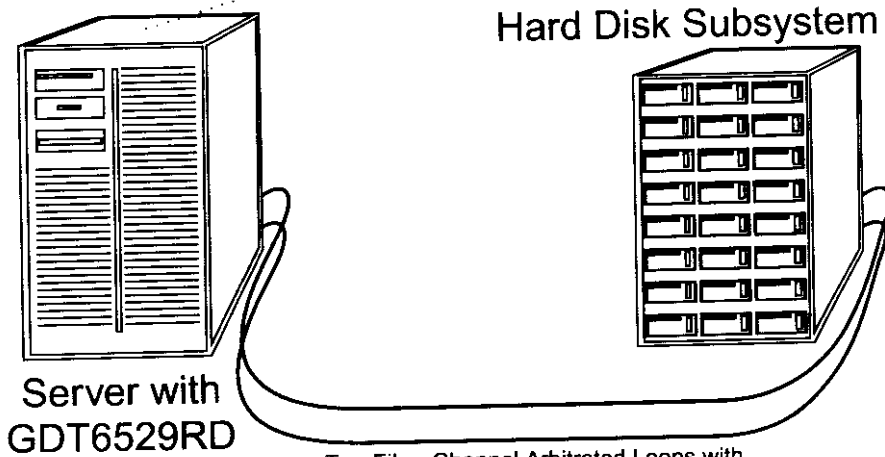
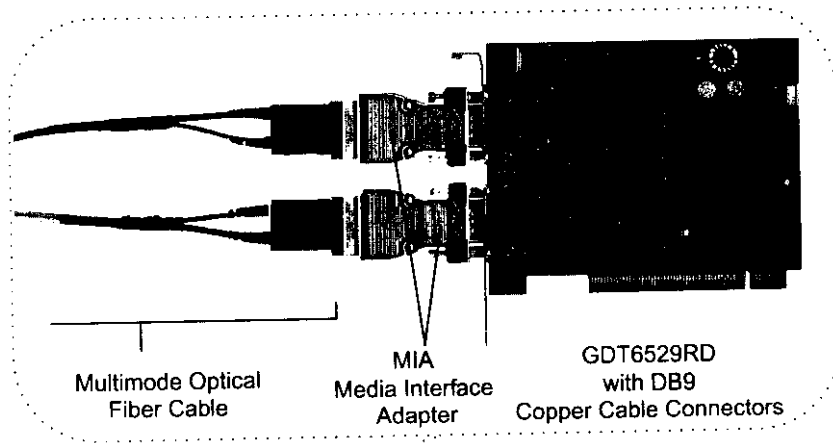


(DB9 connector of copper FC-AL cable plugged into the female DB9 connector of the subsystem)



ICP
Intelligent Computer Peripherals

Example for a Dual Loop Configuration with a GDT6529RD



Two Fibre Channel Arbitrated Loops with
Multi mode optical fiber cables.
Up to 500 meters and 100MB/sec.
One loop can fail and the system continues to operate.

B.5 The Basics of SCSI

It is very important for you to observe the information and notes given in this section of the User's Manual because it helps to ensure that the SCSI devices that are used in connection with the ICP Controllers are operated in a successful, long-lasting and trouble-free manner. In many cases, this information is not only applicable to ICP Controllers, but in general to all those SCSI systems which, like the ICP Controllers, use *Single Ended* SCSI bus channels. According to its definition, the SCSI bus provides access to several participants that are physically connected through an appropriate SCSI bus cable. To achieve a sufficiently good with the ICP Controllers are operated in a successful, long-lasting and trouble-free manner. In many cases, this information is not only applicable to ICP Controllers, but in general to all those SCSI systems which, like the ICP Controllers, use *Single Ended* SCSI bus channels. According to its definition, the SCSI bus provides access to several participants that are physically connected through an appropriate SCSI bus cable. To achieve a sufficiently good signal quality, it is not only recommended to use very good cables and connectors, but also to terminate both ends of the cable properly. For an unambiguous identification on the bus, all participants have a unique number – the so-called SCSI-ID. Further details on these topics can be found on the following pages.

Please note that **98% of all SCSI-related problems are caused by bad SCSI cables, wrong SCSI bus termination and duplicate SCSI-IDs.**

Recently, strong efforts have been made to automate the setting of the SCSI bus termination and SCSI-ID on the SCSI bus. An appendix to the SCSI-3 specification with the title SCAM (SCSI Configured AutoMatically) has been created. It includes a description of all the functions necessary for building a SCAM compatible SCSI device or controller. Unfortunately, in real life SCAM is rather a definition than a useful help. Even worse, SCAM has added other problems and more confusion to the already difficult SCSI topic. As long as it is possible to buy and operate SCSI devices without the SCAM feature (99.9% of all currently available devices do not support SCAM), massive problems are very likely to occur. Therefore, the ICP Controllers only rely on the well proven and standard method of setting SCSI-IDs and SCSI bus terminations and do not expect any further capabilities of the SCSI devices.

B.5.1 SCSI Cables

The quality and overall length of the cable, as well as the number and quality of the SCSI connectors is very important for both internal and external SCSI cables. Generally, internal SCSI cables are 50 or 68 conductor flat ribbon cables. To connect external SCSI devices, round and shielded cables with appropriate connectors are typically used. The minimum cross section per line has been defined in the SCSI-3 specification as follows:

- 50 conductor cables: minimum 28 AWG conductors and with
- 68 conductor cables: minimum 30 AWG conductors.

The typical impedance of a SCSI cable is 84 Ohm +/- 12 Ohms. The maximum difference in impedance between two conductors of a SCSI cable must not exceed 12 Ohms. External round cables should have a SCSI-compliant placement of the inside conductors. Besides the cables, the right connectors for a cable are also very important. It is highly recommend to use highest quality connectors, only. The following table shows the maximum cable lengths allowed for a given transfer rate. Based on many years of SCSI experience, the lengths we recommend are in some cases shorter than theoretically possible. The information in the table refers to one SCSI channel and represent the overall length of the cable, including internal and external parts.



| SCSI Bus Width | SCSI Mode | Synchronous Data transfer Rate | Number of Participants | Maximum Length |
|----------------|----------------|--------------------------------|------------------------|----------------|
| 8 Bit, narrow | Fast | 10 MB/sec. | 8 | 2.0 m |
| 8 Bit, narrow | Fast-20, Ultra | 20 MB/sec. | 4 | 1.5 m |
| 16 Bit, narrow | Fast | 10 MB/sec. | 8 | 2.0 m |
| 16 Bit, wide | Fast | 20 MB/sec. | 8 | 2.0 m |
| 16 Bit, wide | Fast-20, Ultra | 40 MB/sec. | 4 | 1.5 m |

With regard to Fast-20 devices, the maximum number of participants and the maximum cable length have to be strictly observed when a Fast-20 device (even if it is only one) is running in Fast-20 mode. In each case, the minimum cable length is 0.5 m. In addition to specifications mentioned above, the following should be kept in mind when selecting and installing SCSI cables:

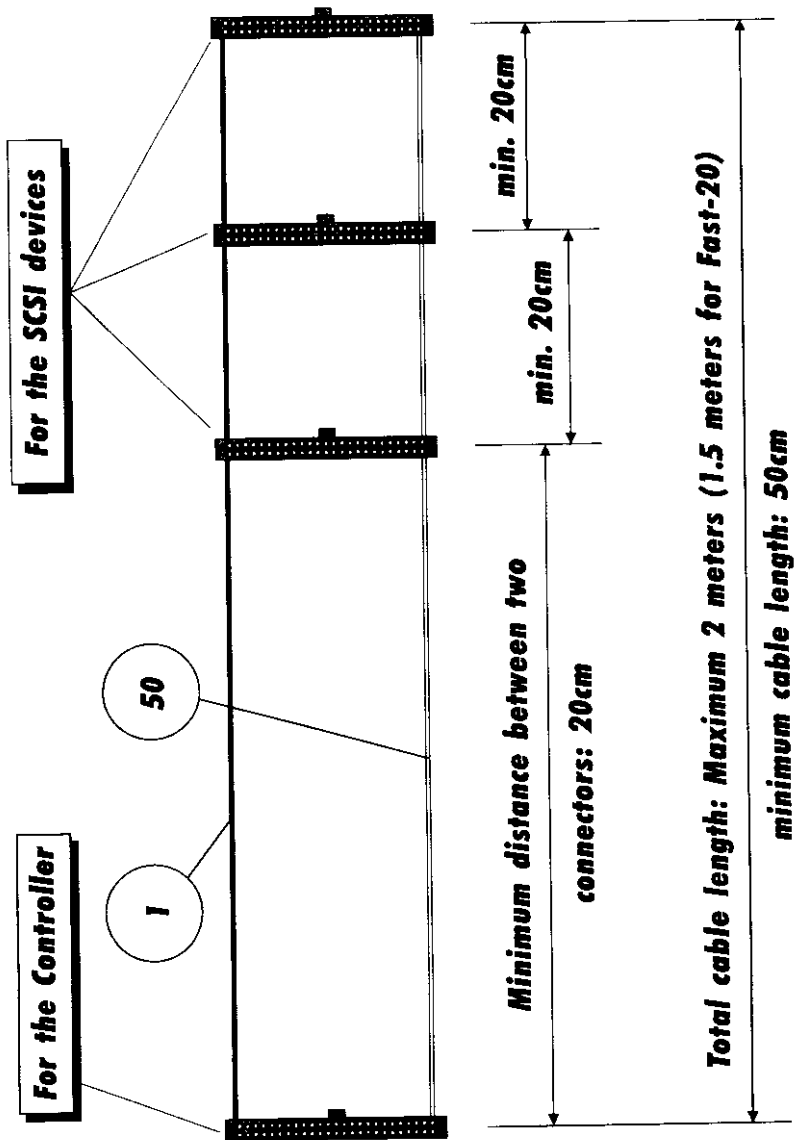
- Always install SCSI cables that are as short as possible. The lengths in the table above are absolute maximum lengths. (Total length of internal and external cables per channel).
- Avoid using SCSI cables with more connectors than actually needed. Never select a SCSI mode or operate a SCSI device with a cable that is not appropriate for this mode.
- The minimum distance between two connectors of a SCSI cable is 20 cm.
- Avoid cable stubs. If this is not possible, keep the stub length below 10 cm. "Star cablings" are not allowed.
- Keep the number of transitions from flat to round cables and vice versa as small as possible. It is usually best is to use flat or round cables, only.
- Check these points when routing SCSI cables:
 - Avoid kinks in the SCSI cable
 - Do not roll the SCSI cable up on itself
 - Avoid routing the cable next to other cables
 - Avoid routing the cable in the vicinity of noise sources such as power supplies
 - Avoid routing the cable over sharp edges and in areas where it could get caught up
 - Avoid routing/sticking the cable directly onto metal surfaces

Below is a list of some manufacturers of high quality SCSI connectors and cables: 3M, AMP, Amphenol, Fujitsu, Harting, Honda, Methode, Molex, Robinson Nugent, Yamaichi. When making home-made SCSI cables, make sure that the insulation displacement connectors are properly aligned and firmly pressed into the flat ribbon cable. Otherwise, the whole cable might turn out to be a big short-circuit. Furthermore, check carefully that PIN 1 of the cable connects to PIN 1 of the connectors. A simple short-circuit and continuity test before running the devices helps you to save time and money.

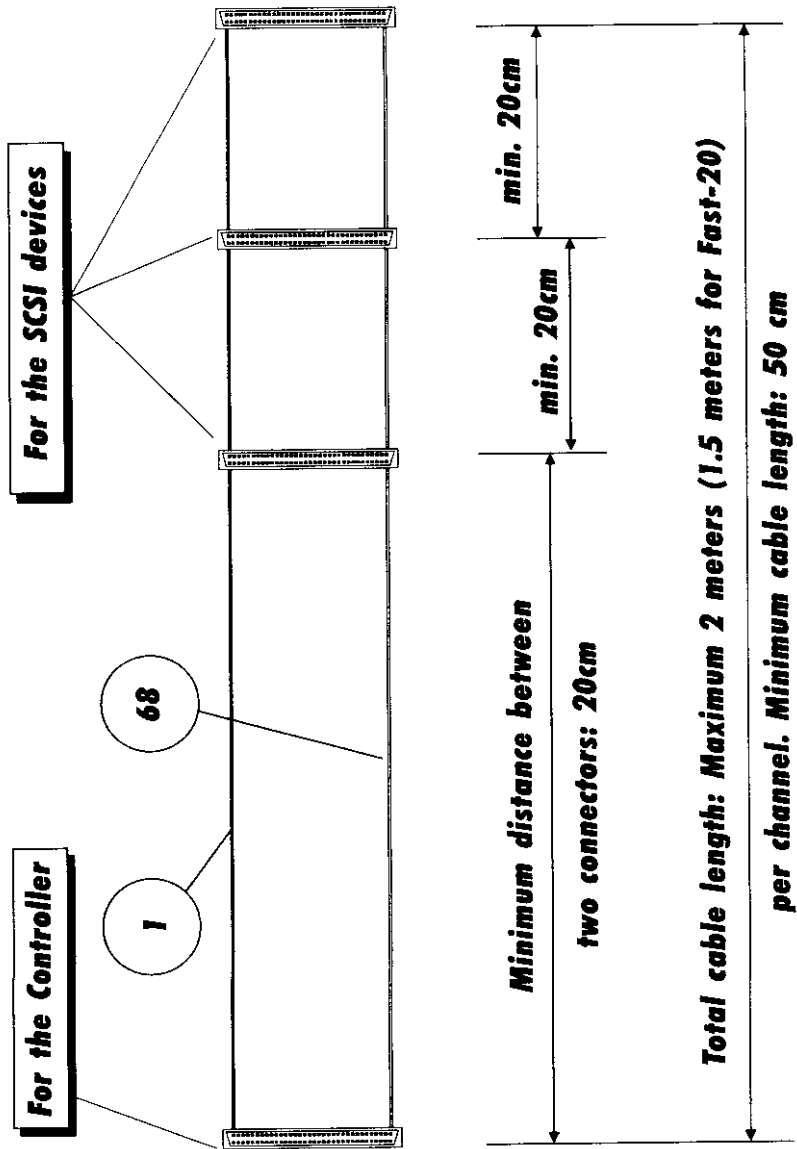
The same warnings as for home-made cables apply when you buy non-brand cables. If you plan to run Fast-20 devices, you should explicitly ask your dealer if these cables are appropriate for the Fast-20 mode. (Note: The ICP product range also includes some high quality SCSI accessories. Along with external SCSI brackets, there is a special FAST-20 Wide SCSI cable. Please see section B.5.4 of this User's Manual or check our Website: <http://www.icp-vortex.com>, for further details).



Example for a SCSI Flat Ribbon Cable for 8 Bit SCSI Devices (narrow)



Example for a SCSI Flat Ribbon Cable for 16 Bit SCSI Devices (wide)



B.5.2 SCSI Termination

In order to ensure a flawless and interference-free signal transmission on the SCSI bus and to minimize the detrimental effects of external noise generators, both ends of the SCSI cable have to be terminated. The SCSI specification prescribes two alternative termination modes for Single-Ended SCSI bus systems: the passive termination and the active termination, also known as Alternative-2 termination. The passive termination consists of a 220 Ohm pull-up and a 330 Ohm pull-down resistor for each signal. Today, the passive termination is mostly used in systems with synchronous data transfer rates not exceeding 5 MB/sec, which is rather slow. The active termination circuit consists of a 110 Ohm precision-resistor per signal and a common 2.85Volt voltage regulator. Thus, all signals are actively pulled up to a certain level. The active termination provides much better signal quality and significantly reduced liability to noise. All ICP Controllers are equipped with an active SCSI bus termination. The voltage for the termination circuitry (passive and active) is supplied either by the SCSI device itself, or by the TERMPWR line of the SCSI bus. Every SCSI device, regardless of whether it is a hard disk, a printer, or a ICP Controller, must have a SCSI bus termination. In addition, it must be possible to enable and disable the SCSI bus termination (on some devices, resistor array packs or a jumper have to be removed, on others, like the ICP Controllers, soft-switches allow a very comfortable setting of the SCSI bus termination). Furthermore, on each SCSI device it must be possible (for example through a jumper) to switch the voltage on the terminator power line (TERMPWR) of the SCSI cable on or off. For all configurations with ICP Controllers, we recommend that you use exclusively SCSI devices with an active SCSI bus termination.

- Always use active SCSI bus termination.
- Do not use SCSI devices with passive SCSI bus termination (e.g., CD-ROMs) for the termination of the SCSI cable.
- Always terminate only the two ends of a SCSI cable.

The TERMPWR jumper (TP) on the ICP Controller PCB should always be set. In this way, it is the ICP Controller which supplies the termination power on the SCSI cable and no other SCSI device may supply termination power on the cable.

The connections listed in the table below are **the only valid** connections allowed. Any other connection setup, even if physically possible, is not allowed as it will cause serious malfunctions or even the destruction of the SCSI device and/or the ICP Controller.

| Internal female connector, 68 pin | Internal male connector 50 pin | Termination Setting of the ICP Controller |
|---|---|--|
| Occupied and end terminated | Not occupied | On |
| Not occupied | Not occupied | On |
| Not occupied | Occupied and end terminated | On |
| Occupied and end terminated | Occupied and end terminated | Off |
| Not occupied | Occupied and both ends terminated, i.e., the connector is located between the both ends | Off |
| Occupied and both ends terminated, i.e., the connector is located between both ends | Not occupied | Off |

B.5.3 SCSI ID

All participants on the SCSI bus must have a unique identification number, that is, each number can only be used once on a given cable. Each SCSI device is uniquely addressed through its SCSI ID.



- All participants of a SCSI bus must have a different SCSI ID.
- The factory set SCSI ID of the ICP Controller SCSI channel is 7.
- Up to 7 SCSI devices can be connected to a single SCSI bus. SCSI IDs are 0 to 6.

On hard disks, CD-ROMs, tape streamers, etc., the SCSI ID is normally set through jumpers or small DIP switches. The ICP Controllers offer a far more comfortable method: software switches in the GDTSETUP program allow you to easily set the SCSI ID of a GDT SCSI channel. It is recommended to leave the default ID value at 7. Some operating systems require that the SCSI ID of certain SCSI device (e.g., tape streamer, CD-ROM) is set to a particular value (for more information, please refer to the appropriate chapter in this manual). (Note: More than 7 SCSI devices on a 16 Bit cable represent a performance bottle-neck for disk arrays. The SCSI bus utilization is too high).

B.5.4 ICP SCSI Accessories

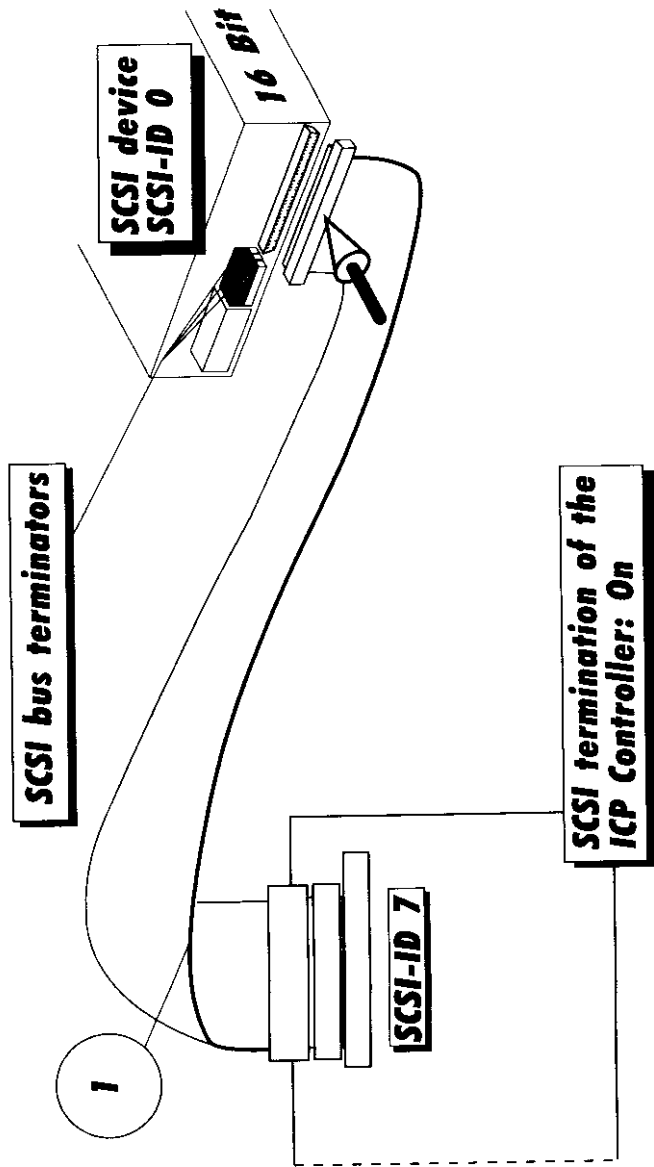
| Order # | Part Name | Description | Application |
|----------------|------------------------------|--|---|
| 8840 | Fast-SCSI Bracket | External SCSI connector with an internal 50 pin header and an external 50 pin HD SCSI connector (female) | Connection of an external Narrow/Ultra SCSI subsystem with an internal Narrow/Ultra channel |
| 8841 | Wide-SCSI Adapter | 16 Bit to 8 Bit SCSI adapter with a 50 pin header and a 68 pin HD SCSI connector (male) | Connection of Wide/Ultra SCSI devices with an 8 Bit 50 pin flat ribbon cable |
| 8842 | Wide-SCSI Bracket | External SCSI connector with an internal and an external 68 pin HD SCSI connector (female) | Connection of an external Wide/Ultra SCSI subsystem with an internal Wide/Ultra channel |
| 8843 | Wide/Ultra Flat Ribbon Cable | 80 cm Wide/Ultra SCSI cable with four 68 pin HD SCSI connectors (male) | Connection of up to 3 internal Wide/Ultra SCSI devices per SCSI channel |
| 8846 | Narrow-Wide Bracket | External SCSI connector with an internal 68 pin connector (female) and an external 50 pin HD SCSI connector (female) | Connection of an external Narrow/Ultra SCSI subsystem with an internal Wide/Ultra channel |

B.5.5 Examples

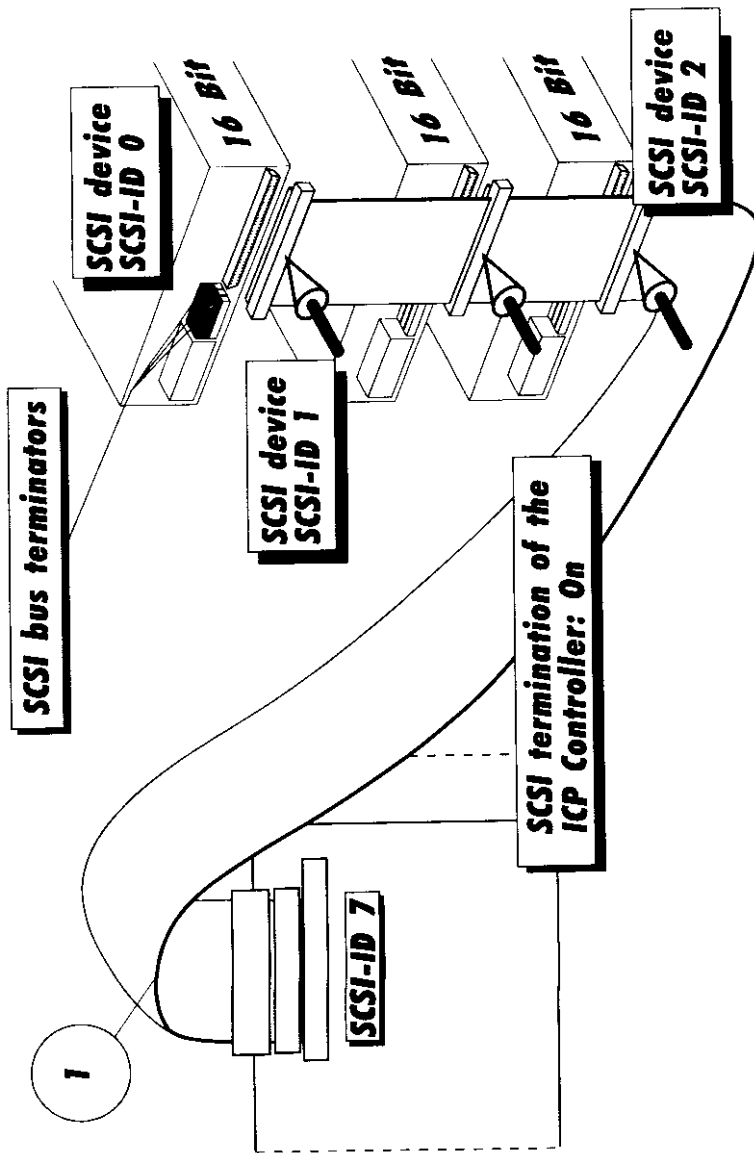
Below are some examples of correct SCSI cabling, SCSI terminations and SCSI-ID settings.

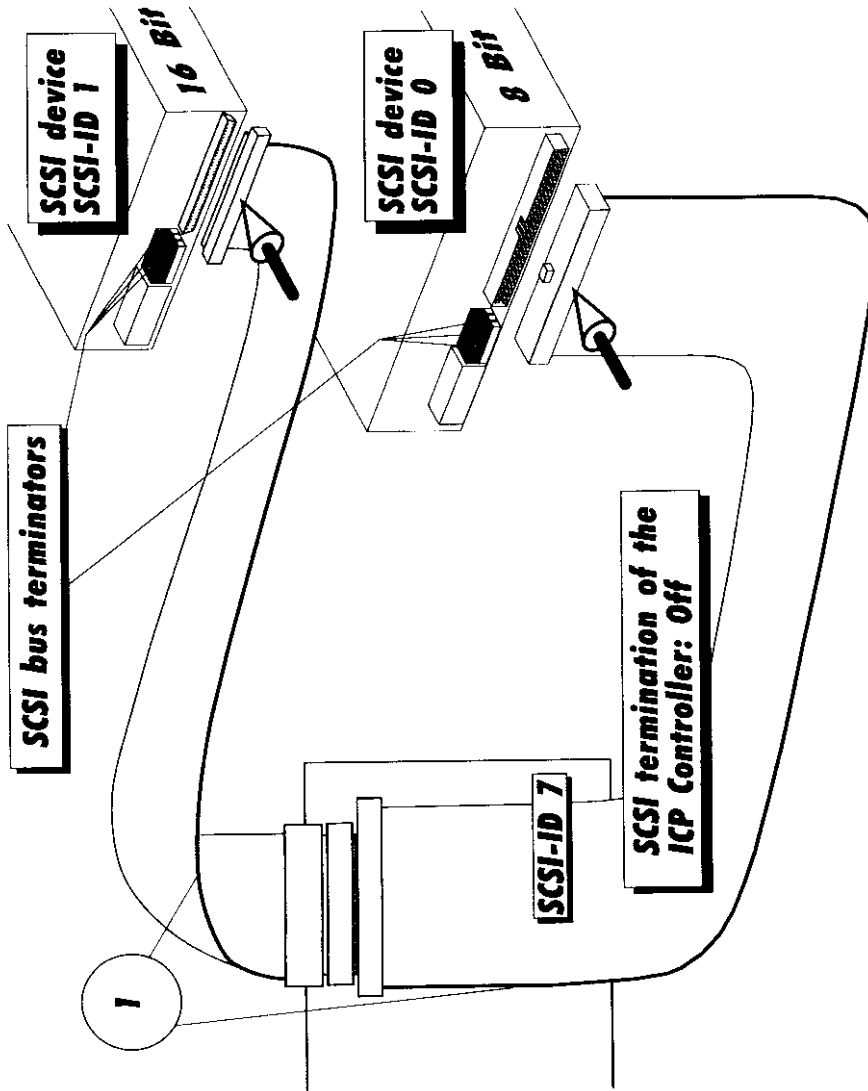


One Internal 16-Bit SCSI Device



Several Internal 16-Bit SCSI Devices



Two Internal SCSI Devices (16 Bit and 8 Bit)

B.6 ICP Controller Installation

Make sure that the ICP Controller is equipped with an appropriate SIMM (at least 8MB). As already mentioned in section B.3 of this User's Manual it is **not** possible to operate the ICP Controller without a SIMM.

Step 1

Switch off the PCI computer system and remove all cables (first of all the power supply).

Step 2

Following the instructions in the computer manual, open the case of the PCI computer, so that you have easy access to the PCI expansion slots.

Step 3

Select a free **PCI bus-master slot** and remove the metal bracket, following the instructions in your PCI computer manual. It is essential that the ICP Controller is plugged into a bus-master slot (it will NOT work in a slave or non-bus-master slot). Some motherboards have only 1 bus-master slot. Make sure that the selected slot has a sufficiently cooling airflow. Permanent overheating of electronic devices decreases their life time drastically.

Step 4

Push the ICP Controller firmly into the correct PCI bus-master slot. Make sure that the controller fits tightly into it, and that the external connectors stick out of the computer case. Now, fix the ICP Controller by tightening the screw of its bracket.

Step 5

To connect the Fibre Channel enclosure use either a copper round cable, or an optical fiber cable (with MIAs). Make sure that cables are fastened with the corresponding connectors. To connect internal SCSI devices, use the internal SCSI connectors of the ICP Controller. You need 50-pin or 68-pin SCSI flat ribbon cables with appropriate connectors. Please verify that the colored core of the SCSI flat ribbon cable connects PIN1 of the GDT SCSI connector to PIN1 of the SCSI device.

Step 6

If required, you can connect the HDD-front-LEDs of the PCI computer system to the LED connectors of the ICP Controller.

Step 7

Before the PCI computer system is switched on, check the following points over again:

- Is the SIMM plugged firmly into the SIMM socket ?
- Is the ICP Controller plugged firmly into one of the PCI bus-master slots ?
- Is the Fibre Channel enclosure properly connected with the ICP controller.
- Are the SCSI-IDs set correctly ?
Are the SCSI-bus terminators plugged/set correctly ?
Are the SCSI flat ribbon cables connected correctly ?

Step 8

After having checked all the points in "Step 7", reconnect the PCI computer system to the power supply. Do not close the computer case yet.



B.7 ICP Controller Function Check

Before we put the ICP Controller into operation for the first time, we would like to spend a few words on the PCI 2.x compatibility requirements a PCI computer system (especially the motherboard and the motherboard's BIOS) should meet.

B.7.1 PCI 2.x Compatibility Requirements

A **pre-condition** for a flawless installation of PCI bus-master expansion cards (the ICP Controllers belong to this group of expansion cards) in a PCI motherboard is a **100% PCI 2.x compatible System-BIOS**.

We have observed more than once that a motherboard declared fully PCI 2.x compatible was equipped with a System-BIOS (located in an EPROM or FLASH-RAM) which was not PCI 2.x compatible at all. To make up for this, many manufacturers of PCI motherboards or PCI computer systems offer their customers a BBS mailbox system from where the latest PCI-system-BIOS version can be downloaded by modem.

As PCI is a rapidly growing market and more and more bus-master expansion cards (high performance disk and LAN controllers) are becoming available, we have no doubt that such problems will be resolved very quickly by the respective system-BIOS manufacturer.

The System is fully PCI compatible.

If your PCI motherboard/computer is 100% PCI compatible, its PCI system-BIOS will, to a large extent automatically (*plug & play*), carry out the configuration (e.g., mapping of the ICP Controller's BIOS and DPMEM, assignment of a proper system IRQ to a PCI interrupt). This means that the PCI computer system (with its motherboard and PCI system-BIOS) must meet the following requirements:

1. The PCI computer system must automatically assign (map) the ICP Controller BIOS to an adequate address in the lower, 1MB area of the computer system's main memory.
2. The PCI computer system must map the ICP Controller's Dual Ported Memory (needed for high performance operation) to an adequate address in the lower, 1MB area of the computer system's main memory. In addition, it has to disable the shadowing of this address <SPACE>.
3. Assigning a system IRQ to a PCI interrupt.
The PCI 2.x specification prescribes 4 PCI interrupts, called INT A, INT B, INT C and INT D. A PCI interrupt must be assigned to a free (unused) IRQ of the PCI motherboard or computer. The ICP Controller is shipped with PCI INT A.

Depending on the manufacturer of the PCI computer system, there are several ways to carry out this task:

- automatically (automatic IRQ routing)
- with the PCI System-BIOS setup program
- with the PCI System-BIOS setup program *and* jumper settings on the system motherboard

Depending on the BIOS manufacturer (e.g., Award, Phoenix, AML etc.), the setup program is activated by pressing a certain key-combination shortly after the reset (cold boot or warm boot). For detailed information on the key-combination and the jumpers' locations and settings, please refer to the system manual of your PCI motherboard or computer.



The System is not fully PCI compatible.

Problems may occur if the motherboard and/or System-BIOS are not fully PCI 2.x compatible. The best remedy is to update the PCI system-BIOS to the latest version. Furthermore, we have integrated into our GDT BIOS various routines (*tricks*) which remedy the incompatibilities of some PCI system-BIOSes, at least with regard to the ICP Controller.

B.7.2 Switching On the PCI Computer System

Now, after having installed the ICP Controller and the devices, check whether the controller is working correctly. If the ICP Controller is the only controller in the computer system, set hard disks C: and D: to **not available** in the System-BIOS setup program of the computer. Normally, you can start the BIOS setup program by pressing a certain key-combination after switching on the computer. After switching on the PCI computer system, pay attention to the LEDs of the ICP Controller.

- If everything is installed correctly, the green LED "S" will light up when switching on the PCI computer system. The green LED "S" (S for status) shows that the ICP Controller is online. If this green LED does not react as described above, switch off the PCI computer and double-check the correct installation of the ICP Controller.
- The electronic loudspeaker of the ICP Controller gives forth a series of 4 signals with a pause between the first two).
- The other green LED "T" may flicker sometimes (it always lights up during BUS-Master DMA transfers; the brighter it lights, the more DMAs).
- The yellow LEDs indicate accesses to the devices. They also may flicker occasionally as GDT scans the I/Ochannels for existing devices.

The GDT boot message appears. In the following example, a GDT6519RD Controller has been detected in PCI slot 3, and it has 16MB of RAM ("16 MB RAM detected..."). On the SCSI channel is a Quantum drive and a DLT2000XT streamer. On the Fibre Channel port four Seagate Barracuda drives are detected. They form one RAID-5 host drive.



```

GDT - PCI      Disk Array Controller BIOS
Copyright (C) 1991-98 by ICP vortex Computersysteme GmbH
All rights reserved!
BIOS located at 0x000E0000 - 0x000E1FFF
1 Controller(s) found, Selftests OK, scanning I/O channels ...
[PCI 0/3] DPMEM at 0x000D0000 - 0x000D3FFF INTA = IRQ10
[PCI 0/3] GDT6519RD -- HWLO -- 16 MB RAM -- 1024kB/0kB Flash-RAM
[PCI 0/3] Serial-No. 00123412 -- RAIDYNE-FW-Version 2.21.00-RFFF -- Mar 17 1998
[PCI 0/3] SCSI-A ID:0 LUN:0 -- QUANTUM XP34300W
[PCI 0/3] SCSI-A ID:1 LUN:0 -- DLT2000XT
[PCI 0/3] Initializing Fibre Channel Link:
[PCI 0/3] FCAL-A: Fibre Channel Private Loop initialized
[PCI 0/3] FCAL-A ID:0 LUN:0 -- SEAGATE ST19171FC
[PCI 0/3] FCAL-A ID:1 LUN:0 -- SEAGATE ST19171FC
[PCI 0/3] FCAL-A ID:2 LUN:0 -- SEAGATE ST19171FC
[PCI 0/3] FCAL-A ID:124 LUN:0 -- SEAGATE ST19171FC
[PCI 0/3] RAID-5 Host Drive 1 installed (ready)

-->> Press <CTRL><G> to enter GDTSETUP <--<

```

The single messages have the following meaning:

BIOS located at 0x000E0000 - 0x000E1FFF

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 above reports the physical address occupied by the GDT BIOS.

[PCI 0/3]

PCI device, bus system **0**, slot **3**. The PCI 2.x specification allows several PCI bus systems to be present in one PCI computer. All ICP Controllers have been designed to support multiple PCI bus system computers. The slot number indicated in the message above does not refer to the 3rd PCI slot, but indicates that the ICP Controller is plugged into a slot which is the third one the PCI chipset of the PCI computer can access. To determine which physical PCI slot this corresponds to, consult the system manual of your PCI computer.

DPMEM at 0x000D0000 - 0x000D3FFF INTA = IRQ10

DPMEM stands for **D**ual **P**orted **M**EMory. The ICP Controller needs this 16KB address space of the PCI Computer for the command communication. In our example, the address space begins at D000:0000 and ends at D000:3FFF (D000 is the segment address). As with the ICP Controller 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 GDT DPMEM address space has to be excluded from the control of such a manager. (For more details, see chapter C of this manual). Furthermore, this messages tells us that the PCI **INTA** of the ICP Controller has been assigned to the system **IRQ10**. This assignment, is also carried out automatically if the PCI system-BIOS is 100% PCI 2.X compatible.



GDT6519RD -- HWL0 -- 16 MB RAM - 1024kB/0kB Flash-RAM

GDT6519RD -- HWL0 stands for the type of ICP Controller found by the GDT BIOS. **HWL** means Hardware level. **16 MB RAM** indicates that the installed SIMM is a 16MB, non-parity Fast Page Mode (FPM) SIMM. Depending on the type and size of the installed SIMM the following messages are possible (xx = 8, 16, 32, 64, 128):

| | |
|------------------------|---|
| xx MB RAM | xx MB Fast Page Mode (FPM) SIMM without parity (i.e. 32 bit) |
| xx MB RAM/P | xx MB Fast Page Mode (FPM) SIMM with parity (i.e. 36 bit) |
| xx MB EDO-RAM | xx MB Extended Data Out (EDO) SIMM without parity (i.e. 32 bit) |
| xx MB EDO-RAM/P | xx MB Extended Data Out (EDO) SIMM with parity (i.e. 36 bit) |

When a parity SIMM is installed this message is followed by: **ECC/Parity support enabled**. **1024kB/0kB Flash-RAM** indicates the size of the installed Flash-RAM. "1024kB" refers to the onboard Flash-RAM size. The "0kB" stands for an empty Flash-RAM expansion socket (Feature Socket).

SCSI-A indicates the SCSI devices connected with the controller's separate Ultra Wide SCSI channel. **FCAL-A or FCAL-B (with a GDT6529RD)** indicates the Fibre Channel devices connected with the controller's Fibre Channel Arbitrated Loops.

>>> Press <CTRL> <G> to enter GDTSETUP <<<

After pressing this hot-key, the message **Entering GDTSETUP. Please wait...** appears. The SCSI bus scan is completed and the built-in GDTSETUP configuration program is loaded. It allows you to configure RAID Array Drives.

B.7.3 Trouble Shooting

If these messages do not appear on the screen, or if other problems occur after switching on the computer system (screen remains dark etc.), you should check the entire installation over again:

- Are you using the correct SIM-module ?
(Minimum 8MB, 60ns or faster for FPM and 50ns for EDO)
Try another one.
- SIMM plugged firmly into the socket ?
Unplug it and plug it in again.
- Is the ICP Controller plugged into a PCI bus-master Slot ?
Check this. If necessary, try another slot.
- Is the Fibre Channel cable OK ?
Check length and connectors. Try another cable.
- Is the SCSI cable OK ?
Check the length and connectors. Try another cable..

If the **PCI System-BIOS is not PCI 2.x compatible** (see above), the ICP Controller BIOS may display one or more of the following messages:



(i) The DPMEM has not been installed correctly.

Error: **System-BIOS not PCI compliant (contact your mainboard supplier)**
Controller at x/y has invalid DPMEM address 012345.
Trying to allocate a free address.
Found free address at 678901, accept ? (Yes/No/Abort) Y
(Caution: this address must not be used by another expansion card !)

In this case, the system-BIOS has not installed the Dual Ported Memory of the ICP Controller correctly. Therefore, the ICP Controller will search for an adequate address. If you accept the suggested address (**Y**), the ICP Controller will install its DPMEM starting at this address. Since this 16KB address space which starts at **free address** must not be shadowed, you might have to disable the shadowing manually in the system-BIOS setup program. In addition, make sure that this address space is not used by another expansion card. (This is a work-around, not a solution. PCI 2.x is a well defined specification, and a fully compatible system-BIOS should have assigned the DPMEM automatically.)
 If the GDT BIOS could not find an appropriate address, the following message is displayed:

Cannot set DPMEM address, aborting

In this event, you can try to select a new address after resetting the computer. If this fails, too, there is no other way but to update the PCI system-BIOS.

(ii) The IRQ to PCI INT assignment doesn't work properly.

Warning: **controller at x/y, System BIOS configured IRQ Z, but uses U**

This warning indicates a bug in the PCI System-BIOS, too: It did not succeed in correctly assigning an IRQ to a PCI INT. The ICP Controller will function, but the GDT BIOS must not be disabled whatsoever.

(iii) The IRQ to PCI INT assignment doesn't work at all.

Error: **controller at x/y could not read IRQ setting**

If this error message is displayed, the ICP Controller will not work.

In all these cases you should - in case (iii) you have to - update your PCI system-BIOS as soon as possible.



B.8 Checking the ICP Controller Configuration

As mentioned before, these settings can be changed through soft-switches in the ICP Controller setup program GDTSETUP. All settings are permanently stored on the ICP Controller. The following table shows the various options and the possible settings.

| Function | Possible Settings | Factory Setting |
|---------------------------------|--|-----------------|
| Cache On ^{***} | On, Off | On |
| Delayed Write On ^{***} | On, Off | On |
| BIOS | Enabled, Disabled, Removed ^{****} | Enabled |
| BIOS Warning Level | All messages, Fatal errors | Fatal errors |
| Supported BIOS Drives | 2,7 | 7 |
| Memory Test | No Test, Standard, Double Scan, Intensive | Standard |
| SCSI-ID SCSI-A | 0,1,2,3,4,5,6,7 | 7 |
| SCSI Termination | On, Off, Auto | Auto |

^{***} Can also be changed with the GDTMON online utility. ^{****} Only with GDTSETUP under MS-DOS.

B.8.1 Loading GDTSETUP

As already mentioned before, there are two different possibilities to load GDTSETUP. Basically, these two possibilities are based on two different variants of the same program: One which is integrated into the FLASH-RAM of the ICP Controller and another which is simply an EXE program loadable under MS-DOS.

Loading GDTSETUP from the FLASH-RAM is very comfortable, since it requires nothing else, but pressing the <CTRL><G> key combination after switching on the PC.

Loading GDTSETUP under MS-DOS becomes necessary, when you want to use GDTSETUP's integrated partitioning functions, or when you have totally disabled the GDT's BIOS (which includes the GDTSETUP variant loadable from FLASH-RAM).

If you want to load GDTSETUP under MS-DOS you have to load the device driver GDTX000 first. This can be done in two ways:

1. Starting the device driver from the DOS-command level by typing GDTX000<ENTER>
2. Starting the device driver automatically by means of the CONFIG.SYS
(DEVICE=GDTX000.EXE)

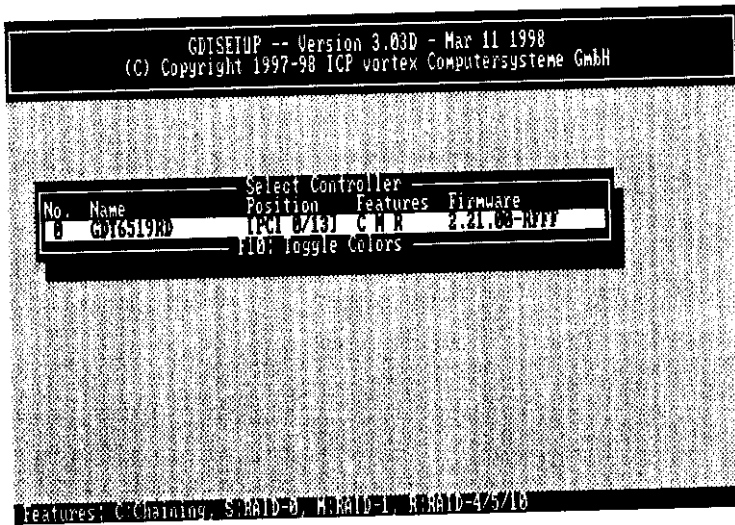
Note: GDTSETUP as well as GDTX000 are on the *System Disk* - DOS.

The header of the GDTSETUP program indicates with a letter after the version number, whether GDTSETUP was loaded from disk or from Flash-RAM:

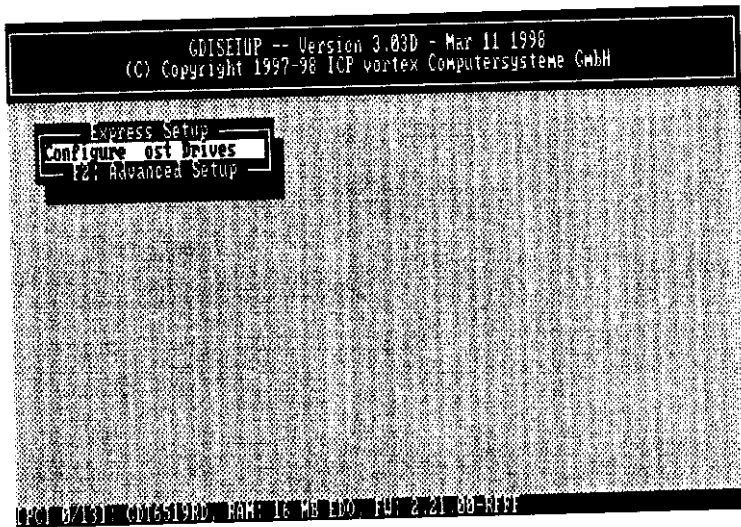
"R" for GDTSETUP loaded from the Flash-RAM after switching on the computer
"D" for GDTSETUP loaded from Disk, i.e., under MS-DOS.

The main menu appears. *Select Controller.*



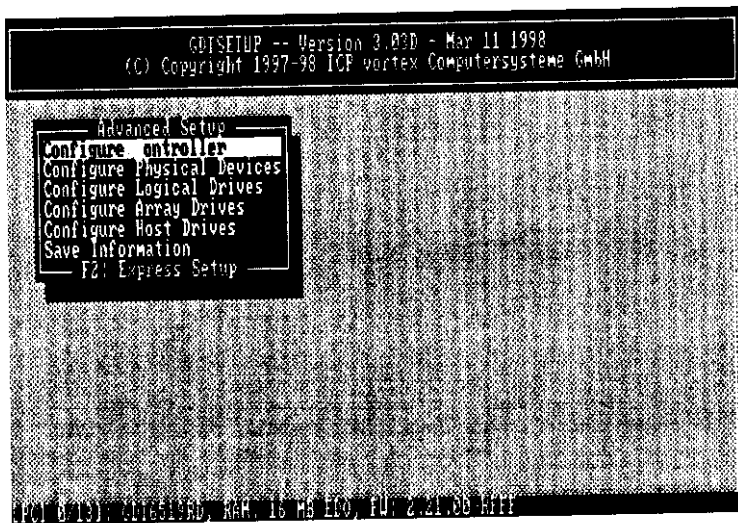


Select the ICP Controller and press <ENTER>.

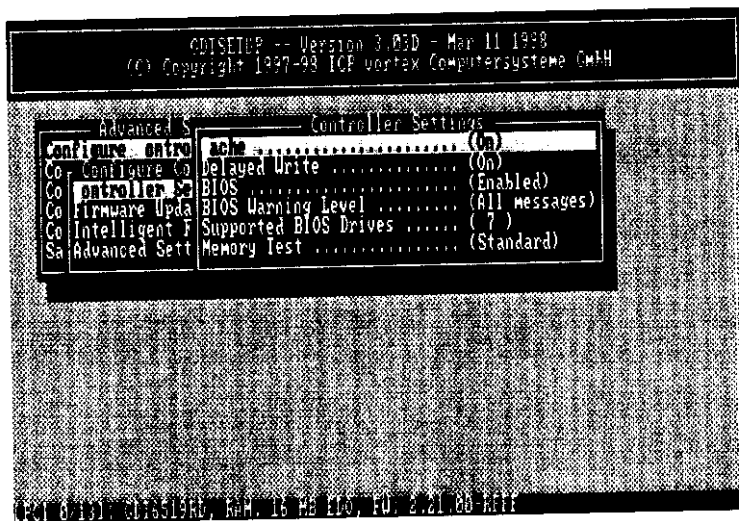


Press the <F2>-key for the Advanced Setup.





Select **Configure Controller** and press <ENTER>.



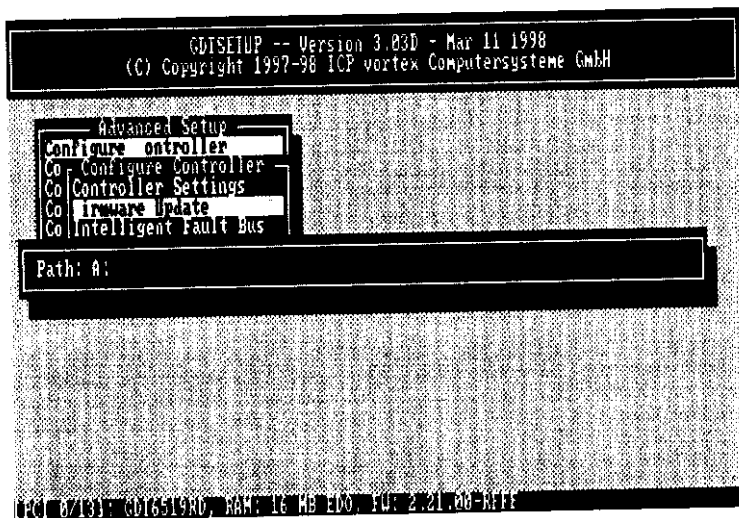
The fields can be selected by moving the cursor keys **↑** and **↓**. The values can be changed by pressing <ENTER> and selecting a new setting. Leave this menu by pressing the <ESC>-key. In order to obtain optimum performance from your ICP Controller, it is essential that the **Cache** and the **Delayed Write** options of the ICP Controller are set **ON**, too. If you should find different settings here, we recommend that they be changed now.



B.8.2 Updating the ICP Controller With New Firmware and BIOS Versions

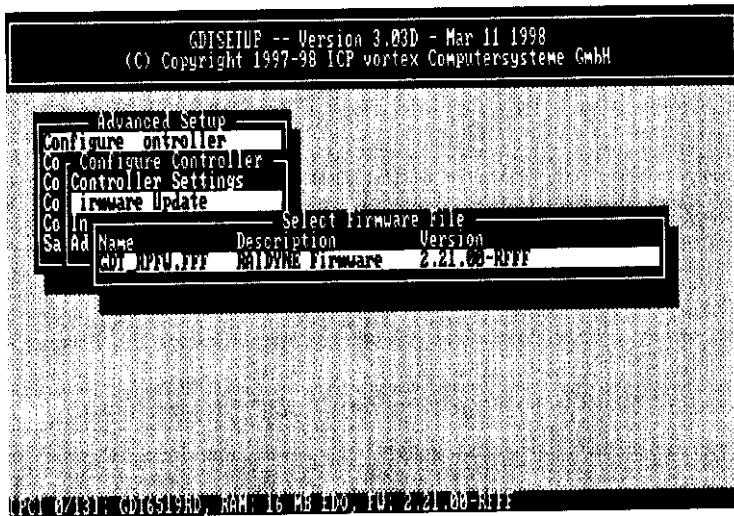
The firmware, the BIOS and the GDTSETUP program of the ICP Controller are stored in a Flash-RAM which is part of the ICP Controller hardware. In contrast to EPROMs, Flash-RAMs can be re-programmed many times and without the complicated UV-light erasing procedure. Thus, both software modules can be easily updated without having to remove the controller from its PCI slot. Firmware and BIOS are part of the **GDT_RPFW** file. The file has an extension (e.g., GDT_RPFW.009) which indicates the version stepping. The latest version of this file can be downloaded either from our 24h BBS (+49-(0)-7131-5972-15) or from our Website <http://www.icp-vortex.com>. We recommend that you also download the packed files which contain the latest programs/drivers for the operating system used on your system. Observe the following order when carrying out the updating procedure:

1. Get the latest GDT_RPFW file for the ICP Controller (download it from our BBS, or our Website, or ask for an upgrade disk if you do not have a modem). The file does NOT need to be expanded !
2. Format a 3.5" HD disk (1.44MB) and copy the GDT_RPFW file on this disk.
3. After loading GDTSETUP (from Flash-RAM or from disk under MS-DOS) select the desired ICP Controller for the firmware update and press the <F2>-key to enter the Advanced Setup.
4. Select *Configure Controller* and thereafter *Firmware Update*. Insert the disk with the firmware file into drive A. GDTSETUP loaded from the Flash-RAM will display a list of the valid files found on the disk. If you have loaded GDTSETUP from disk you have to enter the path "A:", first.



5. The update process starts as soon as the desired GDT_RPFW file has been selected. Strictly observe the messages and instructions of GDTSETUP. It is extremely important that the system is not switched off or reset during the update process. It is very likely that this would cause the ICP Controller to become inoperable.





The new versions of the GDT Firmware, the BIOS and GDTSETUP are available after the next cold-boot.

B.8.3 Additional Notes

Before the computer is switched off or a hard reset is carried out, the ICP Controller first has to write the current contents of its cache RAM back to the hard disk(s) (flush). The computer may only be switched off or reset after all hard disk accesses have been completed. If this is not observed there is a high risk of data corruption and data loss! A good indication for hard disk activity is the front HDD-LED of your computer system (presuming it is connected with the corresponding pin grid header of the GDT PCB). In addition, all GDT drivers (i.e. for all supported operating systems) are designed to perform a cache flush when a regular system shutdown is initiated (e.g., Under NetWare: Down and Exit; Under DOS: CTRL-ALT-DEL; Under UNIX: Shutdown). They will show a message similar to the following "Flushing Controller Cache". As long as this message is displayed you must not switch off or reset your PCI computer. For Windows 95, Windows NT and OS/2 you may switch off or reset the computer as soon as the operating system message is displayed, which indicates that it is safe, to turn off the computer now.

The RISC CPU of the ICP Controller is equipped with a cooler. The cooler keeps the operating temperature of the CPU within the specified limits. The air intake is on the top of the fan. The air flows through the fins of the heat sink and leaves it on the left and right side. In addition, it is necessary that the whole ICP Controller is positioned in a constant airflow. Normally, good server enclosures have extra fans for the motherboard expansion slot area. In case of over temperature, the ICP Controller sends a message to the operator.

The cooler on your ICP Controller may look different from the one on pages of this manual. Depending on the type of i960 Rx CPU installed on the ICP Controller, with some models, the cooler is completely missing. This is intended!
All variants fully comply to the specifications laid down in this User's Manual.



Chapter C

Quick-Setup



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C. Quick-Setup

C.1 What is the Aim of Quick-Setup ?

In the previous chapter we installed the ICP Controller in a PCI computer and connected the SCSI and FCAL devices. Now these devices must be prepared in order to run with your operating system. This **Quick-Setup** chapter should help you to get started quickly. Quick-Setup shows **four examples** on how a single hard disk, a Mirroring Array Drive (RAID 1), a RAID 5 Array Drive and a RAID 5 Array Drive with a Hot Fix drive are installed:

- Example 1** Installing a single hard disk.
- Example 2** Installing a Mirroring Array Drive (RAID 1), consisting of 2 hard disks.
- Example 3** Installing a RAID 5 Array Drive, consisting of 3 identical hard disks.
- Example 4** Installing a RAID 5 Array Drive, consisting of 3 identical hard disks, and adding one Hot Fix hard disk.

With examples 3 and 4 some essential issues having direct impact on the structure and configuration of an Array Drive will also be discussed:

1. How many physical hard disks are to be integrated in the Array Drive ?
2. Which redundancy level ought to be achieved ?
3. Should the ICP Controller automatically recover redundancy in the event of a disk failure ? Or, in other terms: Are Hot Fix drives needed ?

Before we go through these examples step by step, we would like to explain a few terms and relations important for the basic understanding of the ICP Controller firmware. At the end of example 4, we will try to answer the three questions above.

C.2 What is the ICP Controller Firmware ?

We refer to firmware (RAIDYNE) as the operating system which controls the ICP Controller with all its functions and capabilities. The firmware exclusively runs on the ICP Controller and is stored in the Flash-RAM on the ICP Controller PCB. The controlling function is entirely independent of the PCI computer and the host operating system installed (for example UNIX), and does not "drain" any computing power or time from the PCI computer. In addition to disk chaining, RAID 0 and RAID 1, RAIDYNE allows you to install and control Array Drives of the types RAID 4 (data striping with dedicated parity drive), RAID 5 (data striping with distributed parity) and RAID10 (a combination between RAID 0 and 1). All ICP Controllers are equipped with a hardware which is particularly well suited for disk arrays. RAIDYNE uses this hardware with extreme 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.).

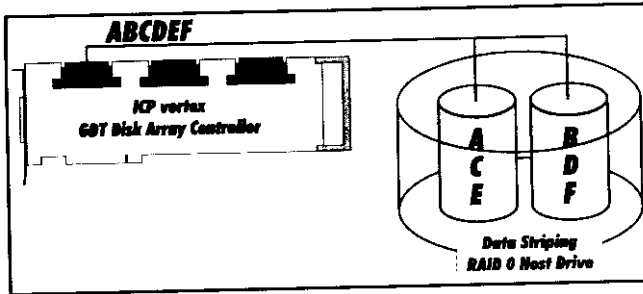
The basic concept of the RAIDYNE is strictly modular, and consequently, in its functioning it appears to the user as a unit construction system.



C.2.1 The Different RAID Levels

RAID 0 - Data Striping

According to the adjusted stripe size (e.g., 16 KB) and the number of hard disks, the data blocks are split into stripes. Each stripe is stored on a separate hard disk. Especially with sequential read and write operations, we can observe a significant improvement of the data throughput. RAID 0 includes no redundancy at all, i.e., when one hard disk fails, all data is lost.

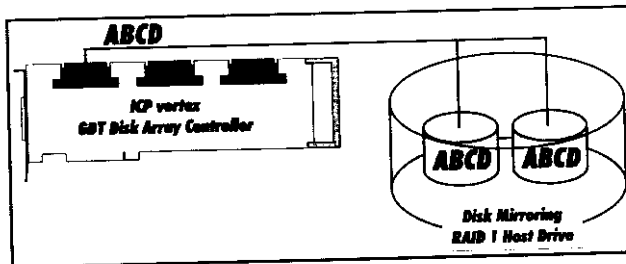


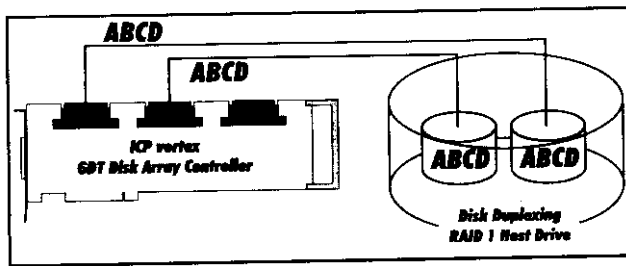
RAID 1 - Disk Mirroring/Disk Duplexing

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

We talk about "Disk Mirroring" when two hard disks are mirrored on one I/O channel. If each hard disk is connected with a separate I/O channel, this is called "Disk Duplexing" (additional security).

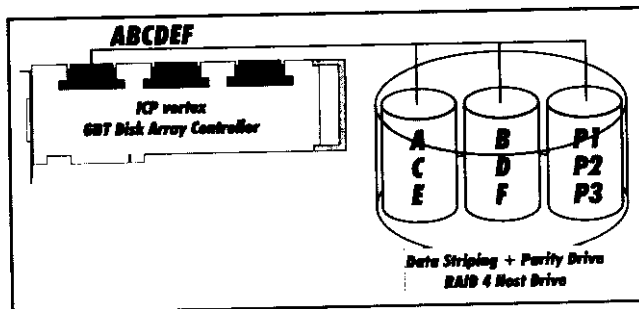
RAID 1 represents an easy and highly efficient solution for data security and system availability. It is especially suitable for installations which are not too large (the capacity available is only half of the installed capacity).





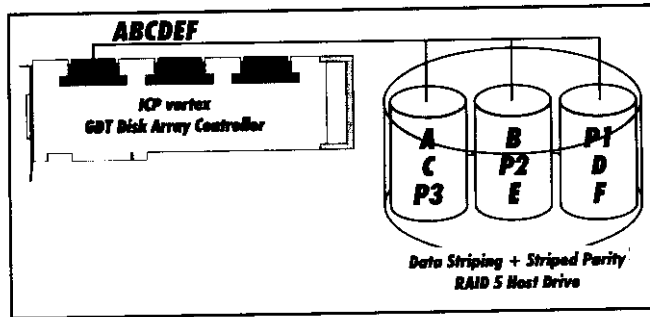
RAID 4 - Data Striping With a Dedicated Parity Drive

RAID 4 works in the same way as RAID 0. The data are striped amongst the hard disks. Additionally, the controller calculates redundancy data (parity information) which are stored on a separate hard disk (P1, P2, ...). Even when one hard disk fails, all data are still fully available. The missing data is recalculated from the data still available and the parity information. Unlike in RAID 1, only the capacity of one hard disk is needed for the redundancy. If we consider, for example, a RAID 4 disk array with 5 hard disks, 80% of the installed hard disk capacity is available as user capacity, only 20% is used for redundancy. In situations with many small data blocks, the parity hard disk becomes a throughput bottle-neck. With large data blocks, RAID 4 shows significantly improved performance.



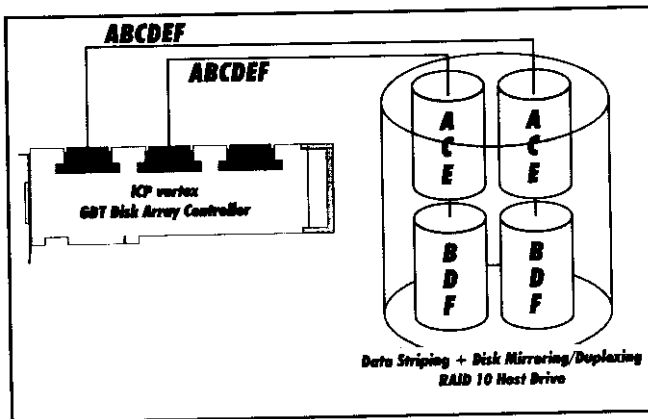
RAID 5 - Data Striping with Striped Parity

Unlike RAID 4, the parity data in a RAID 5 disk array are striped in all hard disks. 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 disk fails, all data are still fully available, the missing data are recalculated from the data still available and the parity information. RAID 4 and RAID 5 are particularly suitable for systems with medium to large capacity requirements, due to their efficient ratio of the installed and actually available capacity.



RAID 10 - Combination of RAID 1 and RAID 0

The idea behind RAID 10 is simply based on the 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. As in RAID 0, optimum performance is achieved in highly sequential load situations. Identical to RAID 1, 50% of the installed capacity is lost for redundancy.



C.3 How are the ICP Firmware Features Activated ?

Any installation or maintenance procedures regarding the ICP Controller are carried out with the configuration program **GDTSETUP**. The monitoring program **GDTMON** allows a continuous monitoring and maintenance of the ICP Controller and the connected disk arrays. The GDTMON utility also includes options to replace a defective drive with a new one (Hot Plug) and is available for most of the operating systems supported by the ICP Controllers. GDTSETUP allows you to set up single disks or complex disk arrays with simple and user-friendly installation procedures. Little previous knowledge is needed to be able to use GDTSETUP efficiently. It is only necessary to understand the hierarchy levels in the ICP Controller firmware.

For the user's convenience the GDTSETUP program is available in two different variants:

- GDTSETUP loaded from the ICP Controller's Flash-RAM after switching on the computer
- GDTSETUP loaded from disk under MS-DOS.

The header of the GDTSETUP program indicates with a letter after the version number whether GDTSETUP was loaded from disk or from Flash-RAM:

"**R**" for GDTSETUP loaded from the Flash-RAM after switching on the computer
 "**D**" for GDTSETUP loaded from Disk, i.e., under MS-DOS.

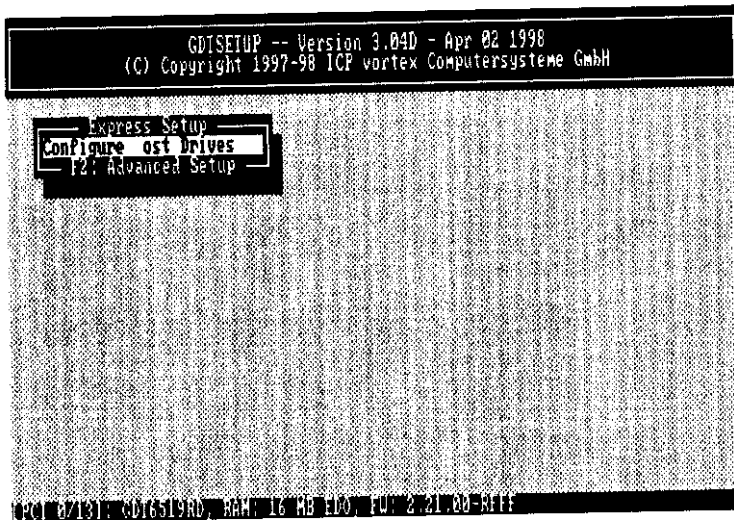
Loading GDTSETUP with <CTRL><G> from the Flash-RAM is very comfortable since no operating system is required to carry out the configuration and setup works.

On the other side, loading GDTSETUP from disk (i.e., under MS-DOS) becomes necessary for tasks like partitioning or enabling a totally disabled GDT BIOS (which includes GDTSETUP).

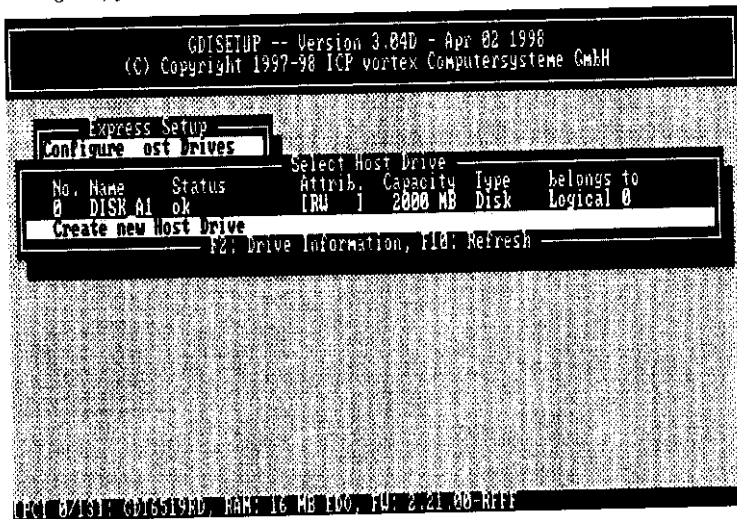
C.3.1 The Express Setup Function of GDTSETUP

Whenever you load GDTSETUP and select the desired ICP Controller, it comes up in its EXPRESS Setup mode. This mode does not require any previous knowledge. If you choose this function, GDTSETUP carries out the complete installation entirely on its own, providing you for example with a fully operational RAID 5 Array Drive with optimized settings (for instance, with all features of a given drive activated).

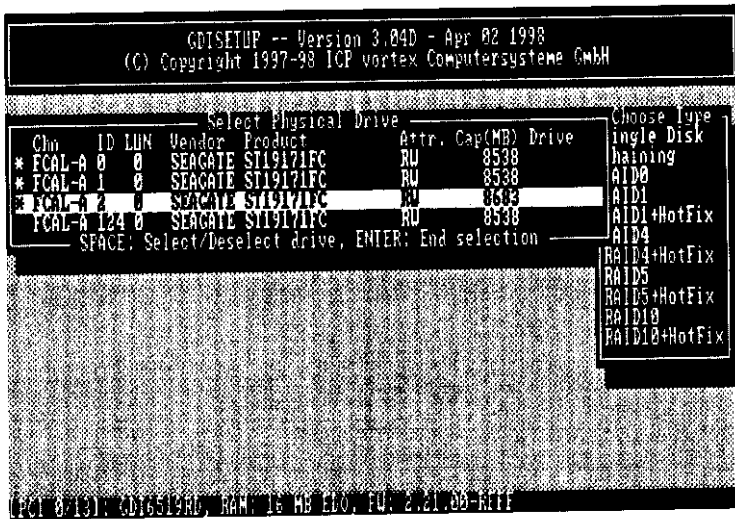




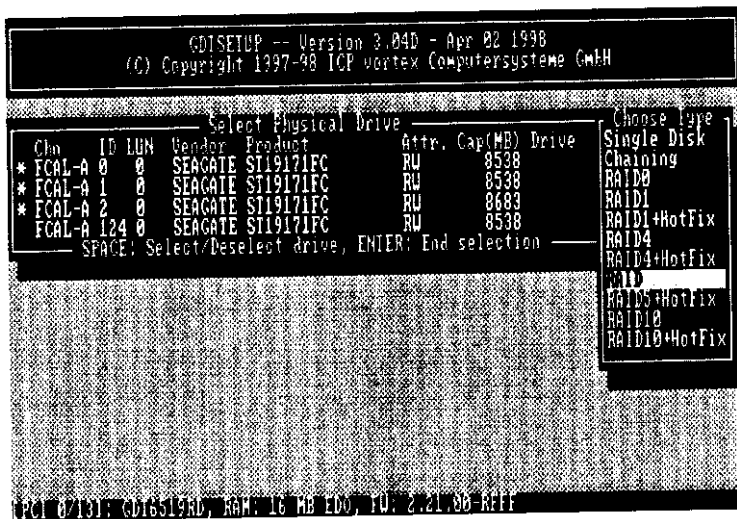
After selecting *Configure Host Drives*, select *Create new Host Drive*.



GDTSETUP scans the system for "free" hard disks (i.e., drives which are not yet part of other Host Drives). Use the <SPACE>-bar to select the desired hard disks (they are marked with an "**"). On the right side GDTSETUP offers highlighted the possible configurations with these drives.



Pressing <ENTER> ends the selection.



After choosing a configuration type for an Array Drive, GDTSETUP displays a security request.

```

GDISETP -- Version 3.04D - Apr 02 1998
(C) Copyright 1997-98 ICP vortex Computersysteme GmbH

```

| Select Physical Drive | | | | | | Choose Type | |
|-----------------------|----|-----|---------|-----------|---------------|-------------|-------------|
| Chn | ID | LUN | Vendor | Product | Attr. Cap(MB) | Drive | |
| * FCAL-A 0 | 0 | 0 | SEAGATE | ST19171FC | RW | 8538 | Single Disk |
| * FCAL-A 1 | 0 | 0 | SEAGATE | ST19171FC | RW | 8538 | Chaining |
| * FCAL-A 2 | 0 | 0 | SEAGATE | ST19171FC | RW | 8683 | RAID0 |
| FCAL- | | | | | | | RAID1 |

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

otFix
tFix
tFix
RAID10
RAID10+HotFix

PC: 0/13: GD16519RD, RAM: 16 MB EDO, PU: 2.21.00-R111

After this confirmation you can adjust the capacity per drive used for the disk array.

```

GDISETP -- Version 3.04D - Apr 02 1998
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```

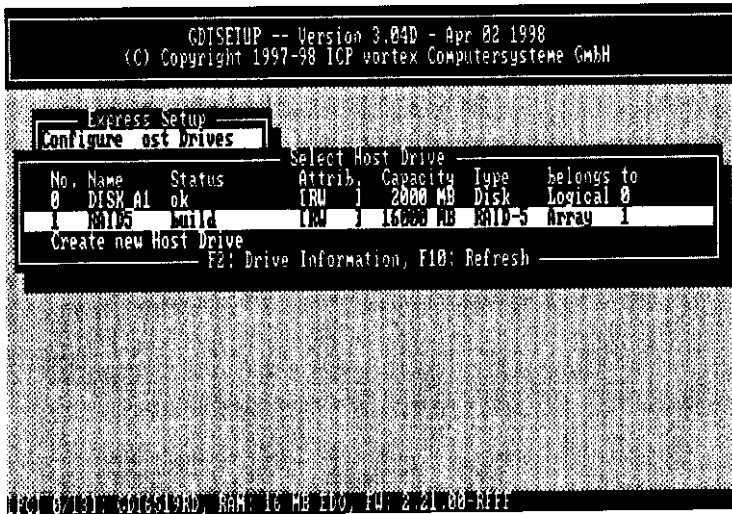
| Select Physical Drive | | | | | | Choose Type | |
|-----------------------|----|-----|---------|-----------|---------------|-------------|-------------|
| Chn | ID | LUN | Vendor | Product | Attr. Cap(MB) | Drive | |
| * FCAL-A 0 | 0 | 0 | SEAGATE | ST19171FC | RW | 8538 | Single Disk |
| * FCAL-A 1 | 0 | 0 | SEAGATE | ST19171FC | RW | 8538 | Chaining |
| * FCAL-A 2 | 0 | 0 | SEAGATE | ST19171FC | RW | 8683 | RAID0 |
| FCAL-A 124 | 0 | 0 | SEAGATE | ST19171FC | RW | 8538 | RAID1 |

SPACE: Select/Deselect

Used Capacity per Drive (1.,8538 MB): 8000

RAID10
RAID10+HotFix

PC: 0/13: GD16519RD, RAM: 16 MB EDO, PU: 2.21.00-R111



Express Setup delivers a fully operational RAID5 disk array. After leaving GDTSETUP the parity information is generated.

For chapter C, we do not use this function, but give detailed instructions on how to set up a single disk and disk arrays with GDTSETUP and its *Enhanced Setup*.

C.4 Levels of Hierarchy Within the GDT Firmware

RAIDYNE 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 = hard disks, removable hard disks, some MO drives¹¹ are located on the lowest level. This can be either devices with a SCSI interface, or devices with a Fibre Channel Arbitrated Loop (FCAL) port.

They are the basic components of all "drive constructions" you can set up. However, before they can be used by the firmware, these hard disks must be "prepared", a procedure we call *initialization*. During this initialization each hard disk receives information which allows a univocal identification even if the SCSI-ID, FCAL-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 whole ICP Controller and the channels, IDs, without losing the data and the information on a specific disk array.

¹¹ Also see section C.5.

Level 3:

On this level of hierarchy, the firmware forms the **Array Drives**. This can be:

- Single Disks (one hard disk, some vendors call it JBOD - Just A Bunch Of Drives)
- Chaining Sets (concatenation of several hard disks)
- RAID 0 Array Drives
- RAID 1 Array Drives, RAID 1 Array Drives plus hot fix drive
- RAID 4 Array Drives, RAID 4 Array Drives plus hot fix drive
- RAID 5 Array Drives, RAID 5 Array Drives plus hot fix drive
- RAID 10 Array Drives, RAID 10 Array Drives plus hot fix drive

Level 4:

On the highest level of hierarchy, the firmware forms the **Host Drives**. In the end, only these Host Drives can be accessed by the host operating system of the computer. Drives C, D, etc. under MS-DOS, Windows NT, NetWare, etc. are always referred to as Host Drives by the firmware. 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 Host Drives of the most various kinds at the same time. An example for MS-DOS: drive C is a RAID 5 type Host Drive (consisting of 5 hard disks), drive D is a single hard disk, and drive E is a CD-ROM communicating with RAIDYNE through corelSCSI and the GDT ASPI manager.

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 GDTSETUP, each level of hierarchy has its own special menu:

| | | |
|----------------|---|---|
| Level 1 | ⇒ | Menu: Configure Physical Devices |
| Level 2 | ⇒ | Menu: Configure Logical Drives |
| Level 3 | ⇒ | Menu: Configure Array Drives |
| Level 4 | ⇒ | Menu: Configure Host Drives |

Generally, each installation procedure passes through these 4 menus, starting with level 1.

Therefore:

- First initialize the Physical Drives.
- Then configure the Logical Drives.
- Then configure the Array Drives (e.g. Array Drives with RAID 0, 1, 4, 5 and 10).
- Finally, configure the Host Drives.

C.5 Using CD-ROMs, DATs, Tapes, etc.

A SCSI device that is not a SCSI hard disk or a removable hard disk, or that does not behave like one, is called a **Not Direct Access Device**.

Such a device is **not configured with GDTSETUP and does not form a Logical or Host Drive**. SCSI devices of this kind are either operated through the ASPI interface (Advanced SCSI programming Interface) (MS-DOS, Windows, Novell NetWare or OS/2), or are directly accessed from the operating system (UNIX, Windows NT). For more information on how to



use these devices, please refer to the corresponding chapters of this manual. Note: hard disks and removable hard disks are called *Direct Access Devices*. However, there are some *Not Direct Access Devices*, for instance certain MO drives, which can be operated just like removable hard disks if they have been appropriately configured before (for example by changing their jumper setting).

But enough on the dry theory. Now here are the examples which explain step by step all the necessary basics for setting up Host Drives with your ICP Controller

C.6 Example 1 - Installing a Single Hard Disk

We presume that the controller and the hard disks have been installed properly.

Step 1: Loading GDTSETUP

You can load GDTSETUP in two ways:

1. Press the <CTRL><G> key combination when the GDT BIOS message comes up (shortly after switching on the computer) and load GDTSETUP from the Flash-RAM of the ICP Controller. In this case no operating system is required.
If GDTSETUP was loaded this way, there is an "R" (ROM) behind the version number.
2. Load GDTSETUP from disk under MS-DOS. Boot the MS-DOS-operating system (either from a boot-floppy or from an already existing boot drive, i.e., IDE-hard disk etc.). In order for GDTSETUP to work properly, you have to load the device driver GDTX000 first. This can be done in two ways:
 - a.) Load GDTX000 from the DOS-command level by typing in GDTX000<ENTER>
 - b.) Load GDTX000 automatically through the CONFIG.SYS file (DEVICE=GDTX000.EXE)

Note: GDTSETUP.EXE as well as GDTX000.EXE are on the *System Disk* - DOS.

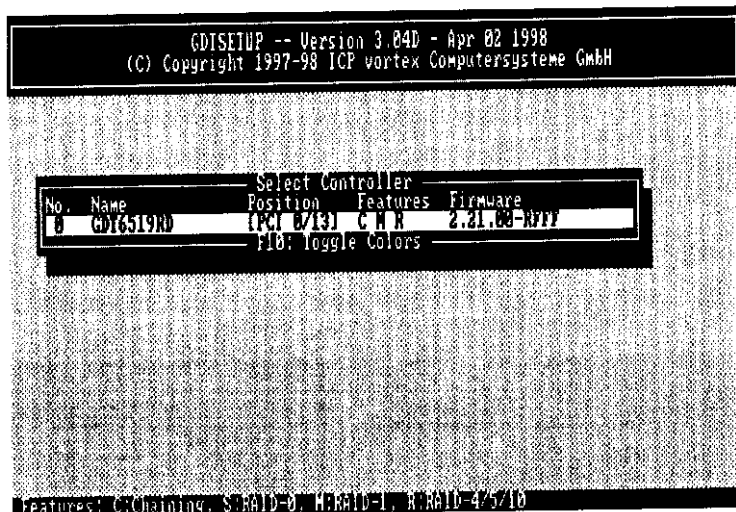
If GDTSETUP was loaded this way, there is a "D" (Disk) behind the version number.

You may now ask what are the differences between the two GDTSETUP variants? They are small. The GDTSETUP variant loadable from disk under MS-DOS also additionally allows the partitioning of Host Drives, which is not possible with GDTSETUP loaded from the Flash-RAM. Loading GDTSETUP from the Flash-RAM is pretty easy, since there is nothing more required to configure the disk arrays. User's, who have for instance, an NT installation without a DOS partition, will highly appreciate this Flash-RAM-resident GDTSETUP.

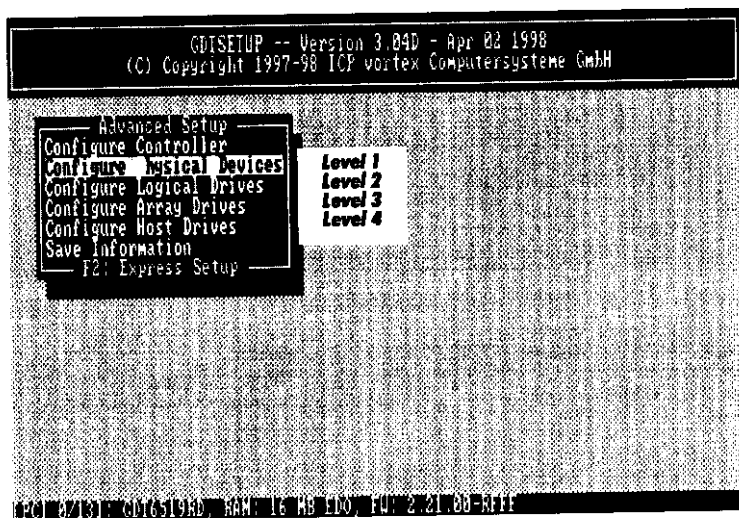
For our example, it is not relevant whether we load GDTSETUP from the Flash-RAM, or from disk.

Now load GDTSETUP. The first menu asks you to select the desired ICP Controller. In our example, there is only one ICP Controller installed in the system. Therefore, simply press <ENTER> and then <F2> to select the Advanced Setup.





The main menu gives you the following options. As mentioned before, we have to go through levels 1 to 4 to install the hard disk (with almost nothing to do on levels 3 and 4).



Step 2: Configure Physical Devices

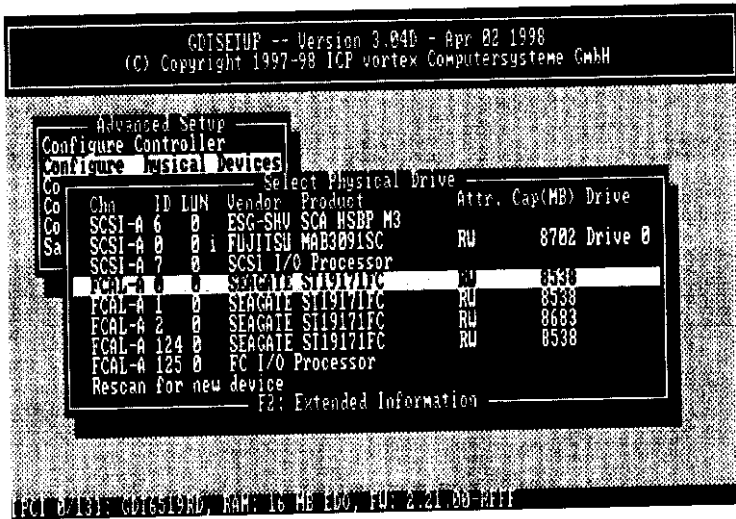
Now activate the menu *Configure Physical Devices* (level 1). A list appears showing all hard disks found on the ICP Controller's I/O channels. If you have an ICP Controller with a different number of I/O channels, the existing channels are displayed. Note: This screen will always report all devices that are found, even though GDTSETUP only allows you to work on *Direct Access Devices* (and therefore not on tape drives, DATs, CD ROMs etc.).

The screen shows you:



- the I/O channel to which a device is connected (this can be a SCSI or a FCAL channel)
- which ID the drive has (the entry I/O Processor stands for the corresponding I/O channel of the ICP Controller. It has the default ID setting 7 for SCSI and 125 for FCAL). The IDs of the FCAL drives are normally assigned through the backplane of the Fibre Channel Enclosure.
- the initialization status
- the names of the drives
- the Read-Write-Status. [RW] = Read + Write
- the gross capacity
- membership in a Logical, Array or Host Drive

Use the cursor keys ↑ and ↓ to select the drive you wish to initialize. We take the first drive of FCAL-A in the list. With this drive selected, press <ENTER>.

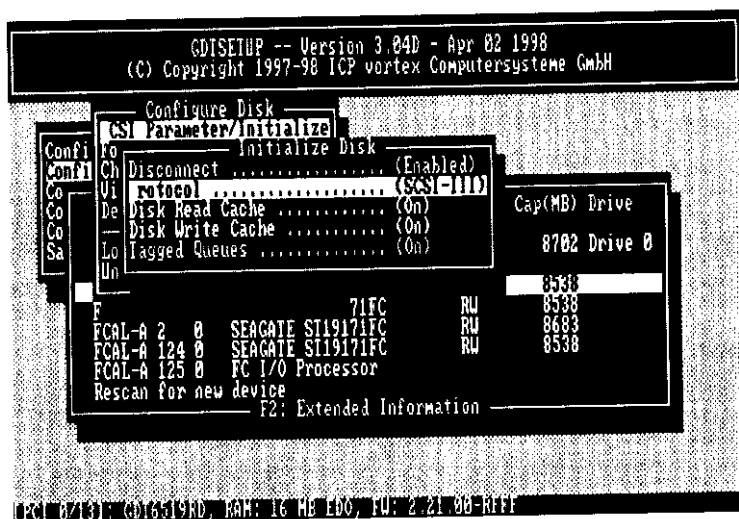


(Note: On SCSI-A, ID 0 and ID 6 are devices which are not relevant for our examples).

The *Configure Disk* menu appears which shows various options.

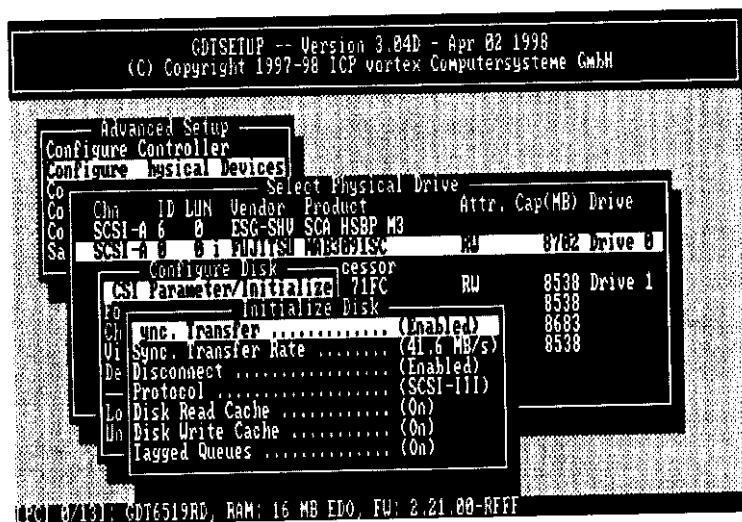
For our example we choose the *SCSI Parameter/Initialize* menu option and press <ENTER>.

The parameters within this menu can be changed by pressing <ENTER> and selecting the new setting.



With Fibre Channel devices, there are only view settings which are relevant. They should be "On" or "Enabled". (Note: Fibre Channel devices are also controlled by the SCSI protocol.)

With "real" SCSI devices, there are more parameters to describe the device.



1. Sync. Transfer: Enable

The SCSI-bus allows an asynchronous and a synchronous transfer. Every SCSI device must be able to perform the first type of transfer, the second one is optional. The advantage of the synchronous transfer lies in a higher data transfer rate as the signal transfer times on the possibly long SCSI-cable have no influence on the transfer rate anymore. Two SCSI-bus



participants wanting to exchange data between each other have to check if and how (i.e., with which parameters) a synchronous data transfer between them is possible. Therefore, the mere setting does not automatically enable synchronous data transfer; this mode is only effective if both devices support it and after they have checked their capability of communicating with each other in this mode.

2. Sync. Transfer Rate

The maximum synchronous transfer rate can be limited. This limitation may become necessary if a particular SCSI cabling does not allow the maximum rate the drive and the controller could achieve. In our example, we leave the rate at 20.0 MB/s (for Wide SCSI at 20.0 MB/s and Wide & Ultra SCSI at 40.0 MB/s).

Note: In order to select a transfer rate above 10.0 MB/s the Protocol has to be set to SCSI-III.

3. Disconnect: Enable

The concept of the SCSI-bus allows several participants (8 IDs with 8 LUNs each). All these participants should be able to use the bus in a manner that causes the least reciprocal disturbance or obstruction. A participant should therefore vacate the bus if he does not need it. For reasons of performance, it is particularly important to guarantee a high degree of overlapping of the actions on the SCSI-bus. This high degree of overlapping can be achieved if a SCSI device is allowed to disconnect, thus leaving the bus to be used by other participants. If there is only one SCSI device connected to the SCSI-bus, Disconnect should be disabled.

4. Protocol

This can be either SCSI-II or SCSI-III.

If you select SCSI-III make sure, that your hard disk supports this protocol. Most new multi-GB hard disks support SCSI-III. To enable Ultra (FAST-20) transfer rates (Narrow: 20 MB/s; Wide: 40 MB/s) SCSI-III protocol is required.

5. Disk Read Cache / Disk Write Cache / Tagged Queues

If a drive supports particular SCSI features you enable them (On).

Note: Most of the modern drives support disk caching (read and write). Some do not support Tagged Queues.

Press <ESC> to leave the SCSI Parameter/Initialize menu.

GDTSETUP displays a warning on the destruction of all data. This implies two different evaluations, according to the drive's current state and the options you have selected:

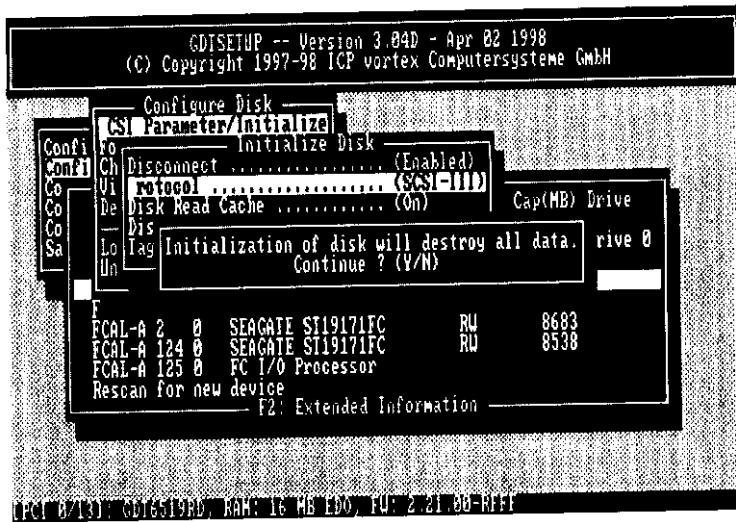
1. First Initialization of the device.

In this case the warning must be taken seriously. If the drive was previously connected to a different controller (e.g., NCR etc.) and still contains data, this data will be lost now.

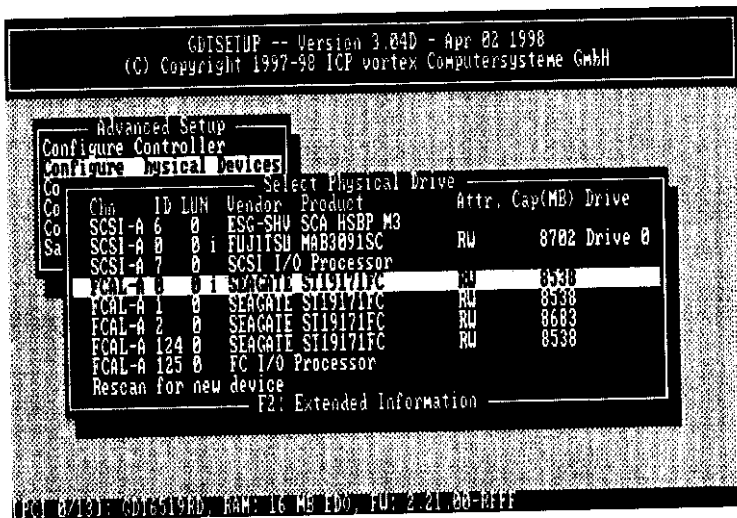
2. The device was already initialized.

If only internal parameters, such as Disconnect, Synchronous Transfer and SCSI-II options have been changed, the data on the drive remains intact. Only the function state of the device is changed.





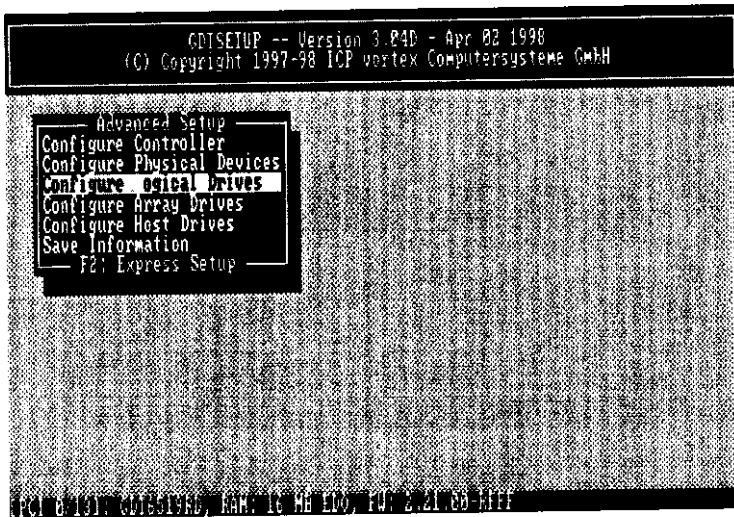
Press <Y> and we are back on the main screen of level 1 and see that the initialization-status of the device has changed.



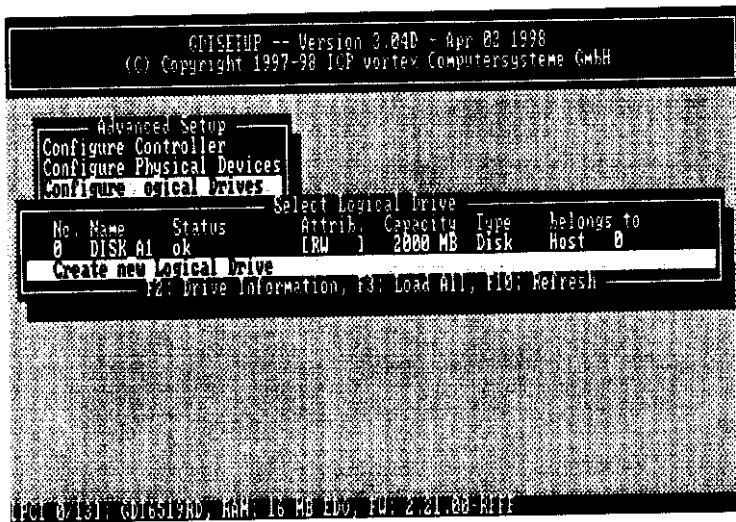
Step 3: Configure Logical Drives

We now leave level 1 (by pressing the <ESC>-key) and are back in the main menu. Now, with the cursor keys ↑ and ↓ select *Configure Logical Drives* and go to level 2 by pressing <ENTER>.

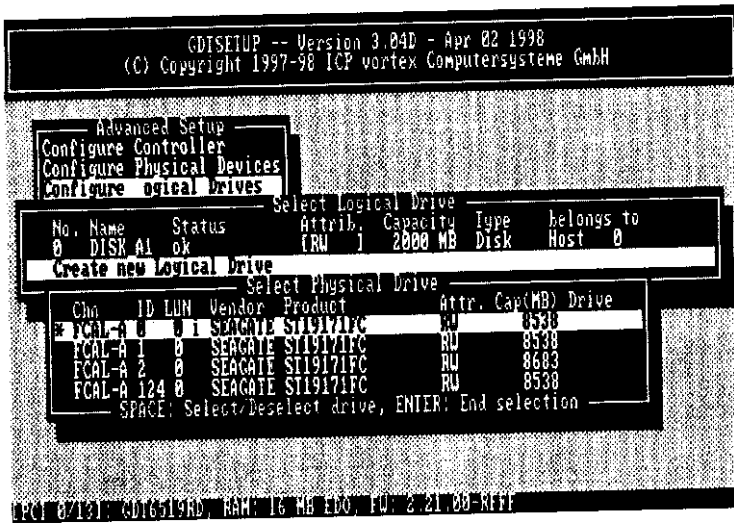




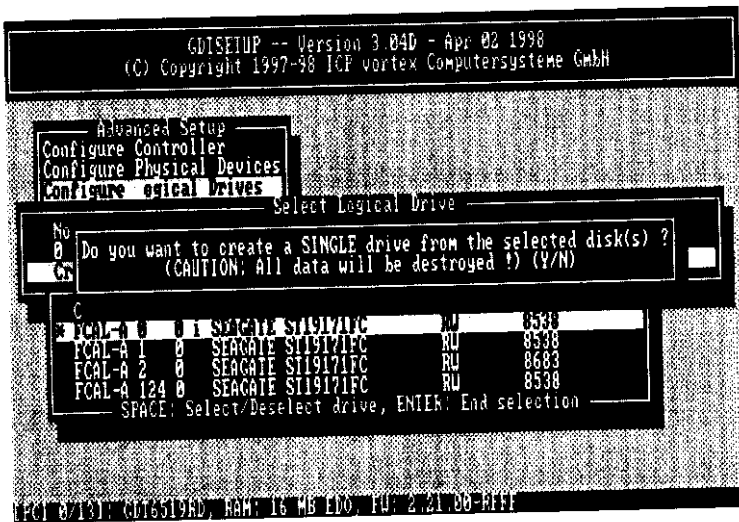
The main screen of level 2 appears. Move the selection bar to *Create new Logical Drive* and press <ENTER>.



Note: The already existing Logical Drive in this list has no relevance for our example.

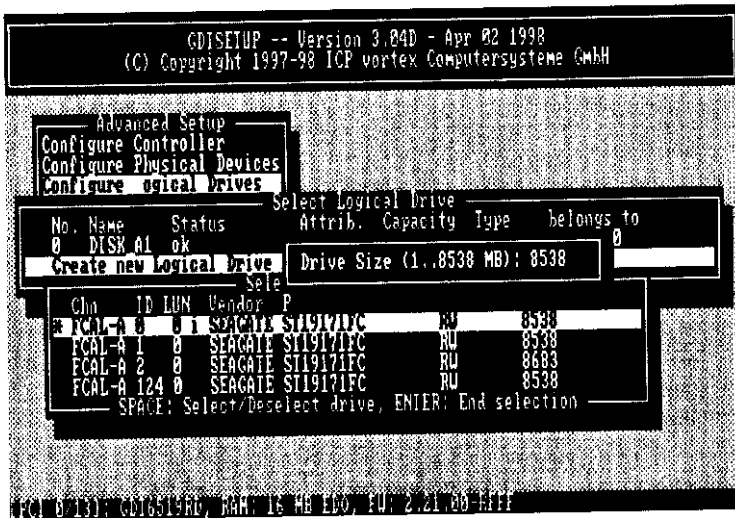


Select the initialized hard disk with the <SPACE>-bar (it becomes marked with an "**") and press <ENTER>.

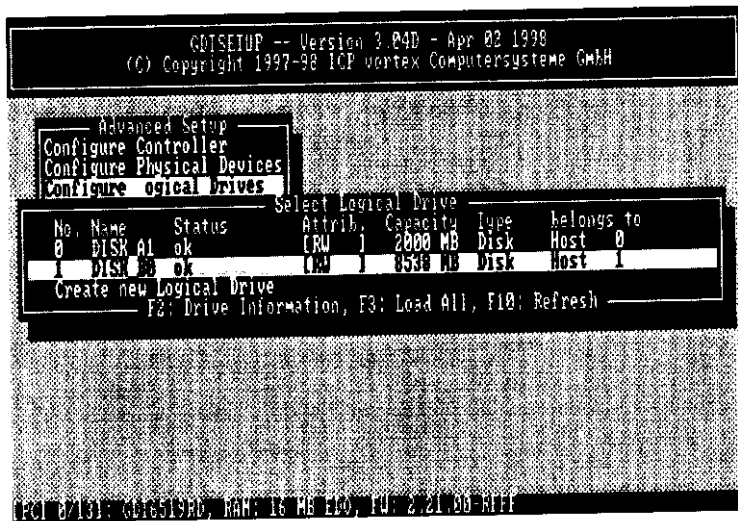


For security reasons, you will be asked again if you want to use the selected disk to create a Logical Drive.

As we are sure of our choice, we confirm with <Yes>. GDTSETUP allows you to limit the hard disk size for this Logical Drive. This becomes interesting when you configure disk arrays. For this example we use the full capacity and press <ENTER>.



The dialog box is closed and we are back in the main menu of level 2.



As you can see, we have already created a new Logical Drive of the type Disk. The name of the Logical Drive is assigned automatically and contains the channel description and the I/O channel ID after the "_". This can serve as a reminder when you install a complex system with many drives. (Naturally, you may change the name.) This concludes the installation on level 2. Now press the <ESC>-key to leave this screen.

Since we have only a single disk assigned to a Logical Drive, there is nothing to do in the *Configure Array Drives* menu, thus we go directly to the *Configure Host Drives* menu and have **no Step 4.**

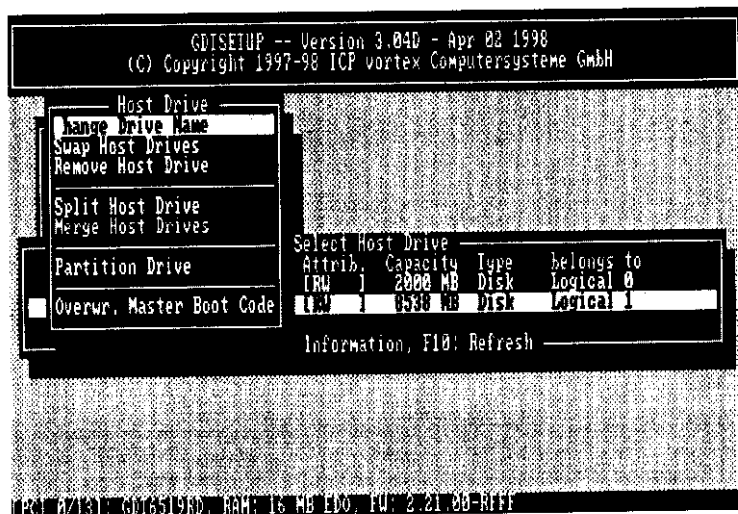


Step 5: Configure Host Drives

We are now back in the main menu of GDTSETUP and select *Configure Host Drive*.

The main screen of level 4 appears. Press <ENTER>. A list of available Host Drives is displayed. Again, the first entry is not relevant for our example.

At the second position we find our previously configured Logical Drive. It was automatically transformed into a Host Drive, thus for this example we have nothing to do in this menu. Press <ENTER> to get a list of possible menu options.



We should not forget to mention, that if you would have selected *Create new Host Drive*, this would have lead you to the same menu as the Express Setup mode.

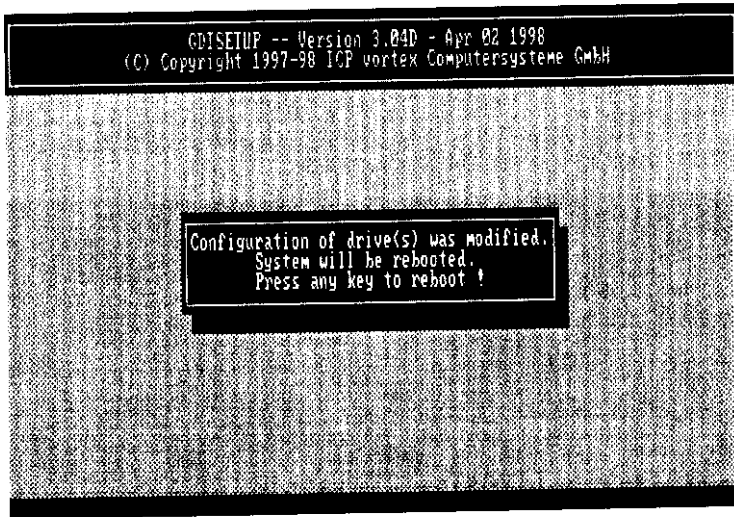
But this example is an exercise which should help you to gain a better understanding of how the ICP Controller and GDTSETUP work. So don't believe we let you do redundant homework.

By the way, if you have loaded GDTSETUP from the Flash-RAM (<CTRL><G>) the *Partition Drive* option will be missing in this menu. The reason is that partitioning makes no sense when there is not an operating system loaded and the INT13H extension of the ICP Controller has not yet been activated.

Step 6: Leaving GDTSETUP

We are now back in the main menu of GDTSETUP. The installation is completed, and we therefore leave GDTSETUP by pressing the <ESC>-key. The following message appears:





As we are done with the installation and therefore definitely want to leave GDTSETUP, we press any key.

IMPORTANT: Always end GDTSETUP by leaving the program in the regular way (do not warm-boot with CTRL-ALT-DEL or cold boot by pressing the RESET button). Certain information is only transferred to the controller when you leave GDTSETUP in the regular way.

The Host Drive we have configured in this example is now ready for the installation of the desired operating system.

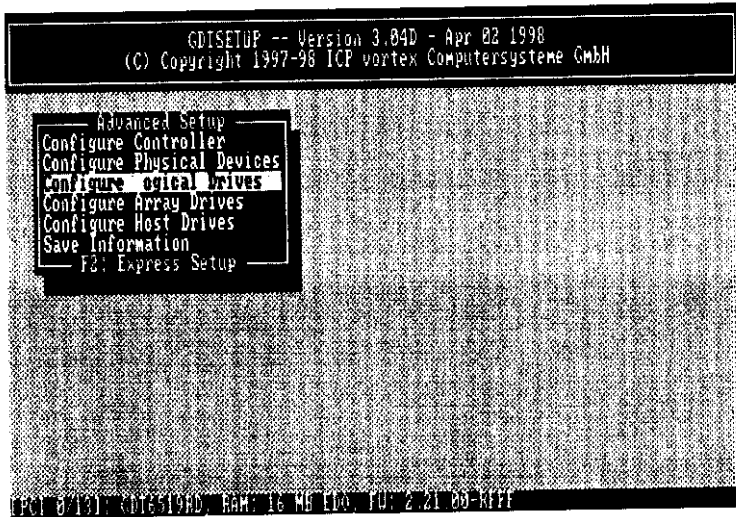


C.7 Example 2 - Installing a Mirroring Array - RAID 1

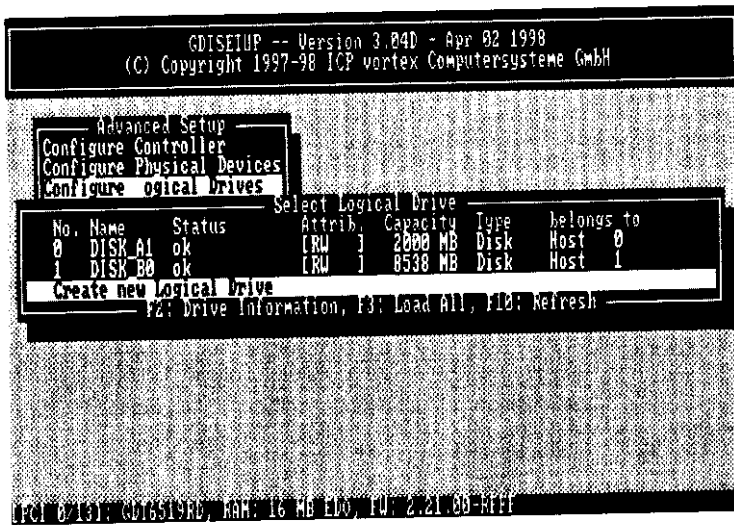
It is our intention to install a Mirroring Array consisting of two identical hard disks. In the classical terminology of the RAID levels this is called a RAID 1 disk array. We presume that the controller and the hard disks have been properly installed. **Step 1** of the installation is the same as in the first example, therefore we do not explain it again. **Step 2** regards the initialization of the second device. Proceed as described in the first example.

Step 3: Configure Logical Drives

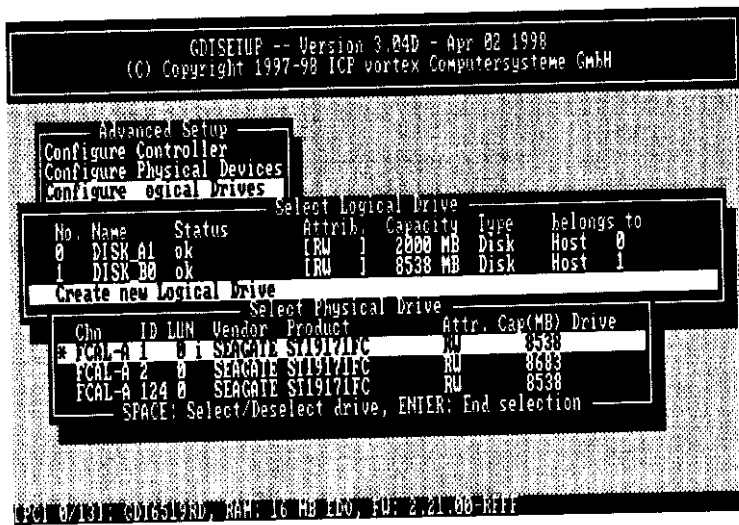
We now leave level 1 (by pressing the <ESC>-key) and are back in the main menu. Now, with the cursor keys ↑ and ↓ select *Configure Logical Drives* and go to level 2 by pressing <ENTER>.



The main screen of level 2 appears. Move the selection bar to *Create new Logical Drive* and press <ENTER>.

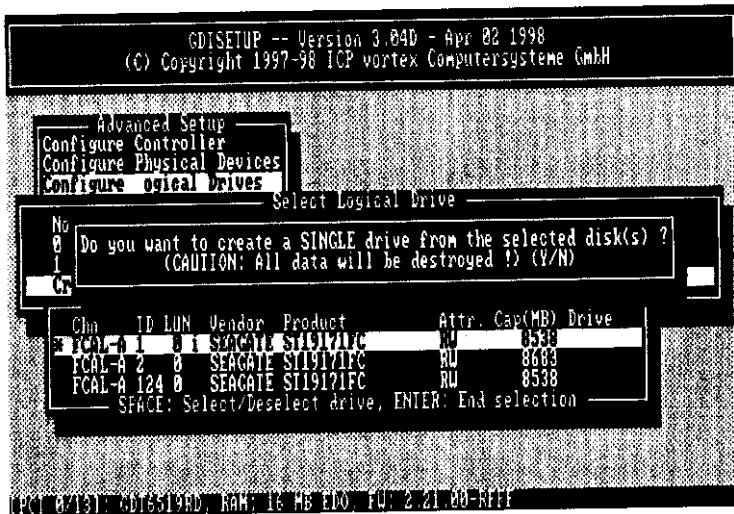


Note: The already existing Logical Drive in the first position of this list has no relevance for our example. The second entry was created before.



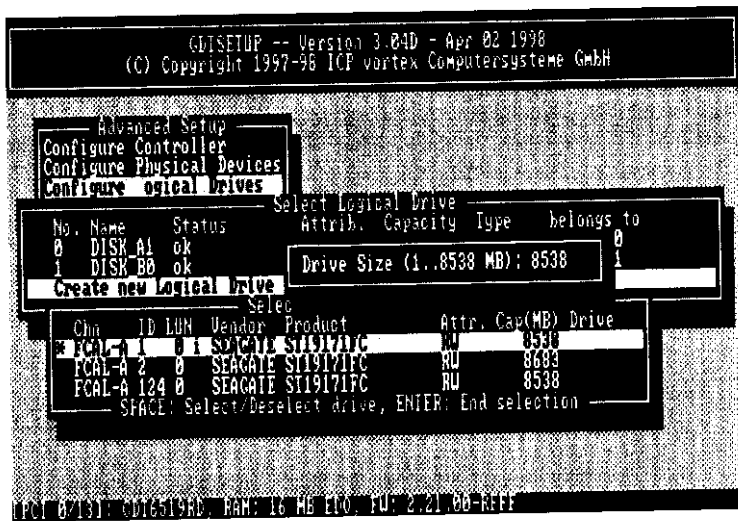
Select the initialized hard disk with the <SPACE>-bar (it becomes marked with an "*") and press <ENTER>.





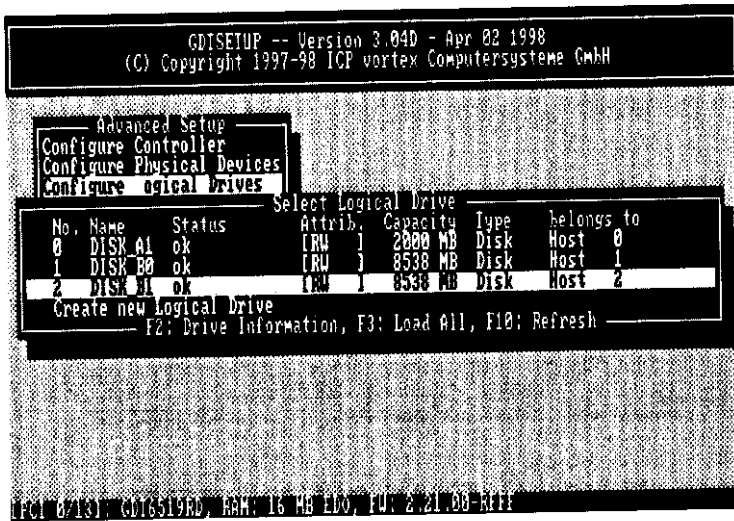
For security reasons, you will be asked again if you want to use the selected disk to create a Logical Drive.

As we are sure of our choice, we confirm with <Yes>. GDTSETUP allows you to limit the hard disk size for this Logical Drive. This becomes interesting when you configure disk arrays. For this example we use the full capacity and press <ENTER>.



The dialog box is closed and we are back in the main menu of level 2.



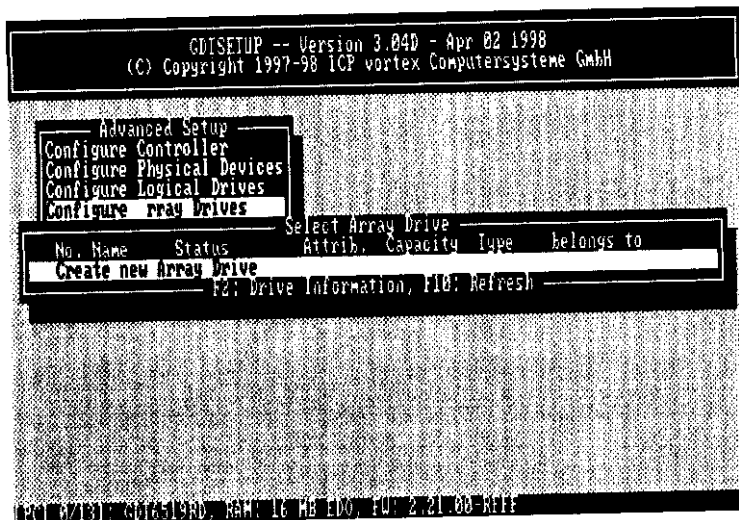


As you can see, we have created another Logical Drive of the type Disk. The name of the Logical Drive is assigned automatically and contains the channel description and the I/O channel ID after the "-". This can serve as a reminder when you install a complex system with many drives. (Naturally, you may change the name.) This concludes the installation on level 2. Now press the <ESC>-key to leave this screen.

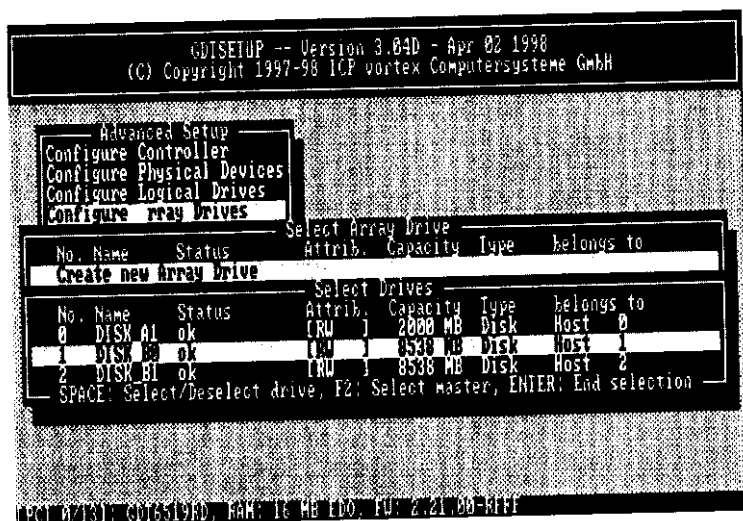
In the next step it is our objective to add the third Logical Drive in this list as a mirroring partner to the second Logical Drive of the list, thus configuring a RAID 1 disk array.

Step 4: Configure Array Drives

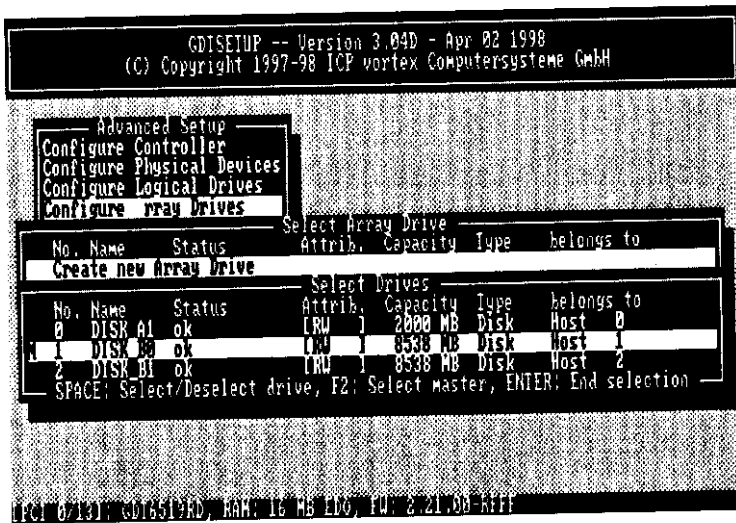
We now leave level 2 (by pressing the <ESC>-key) and are back in the main menu. Now, with the cursor keys ↑ and ↓ select *Configure Array Drives* and go to level 3 by pressing <ENTER>.



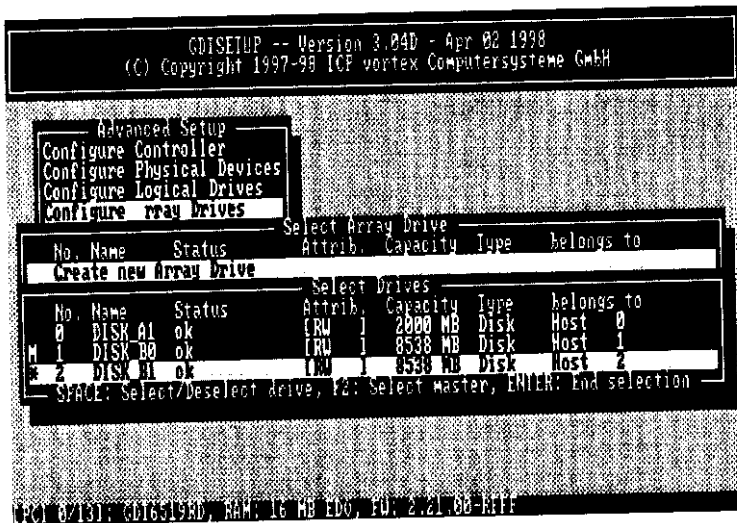
Since we want to create a new Array Drive press <ENTER>
 Note: The first entry in the following list has no relevance for our example.



Move the selection bar to the second entry and press the <SPACE>-bar. The entry is marked with an "M" for Master. This means that the data from this Logical Drive are copied to the second Logical Drive, which we will select next.

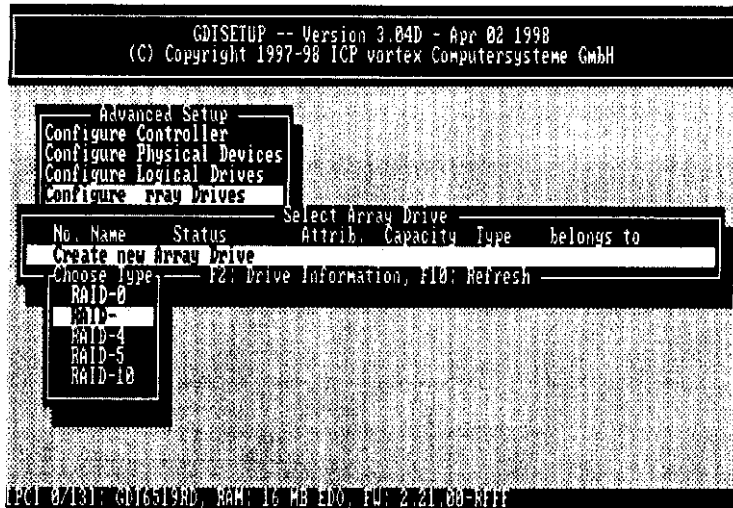


Move the selection bar with the cursor key ↓ to the next entry and press the <SPACE>-bar, again. It is marked with an "*" (pressing the <SPACE>-bar again undoes your choice).

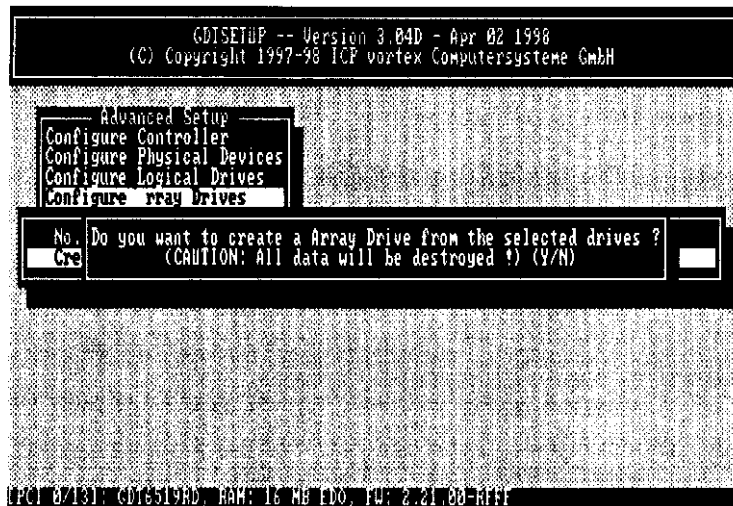


When the Logical Drive is selected, confirm with <ENTER>. GDISETUP displays now a list of possible RAID levels, available with the number of Logical Drives selected. In our case it is RAID 0 (data striping) and RAID 1. Move the selection bar to RAID-1 and press <ENTER>.





GDTSETUP displays a security request, which we answer with <Y>.

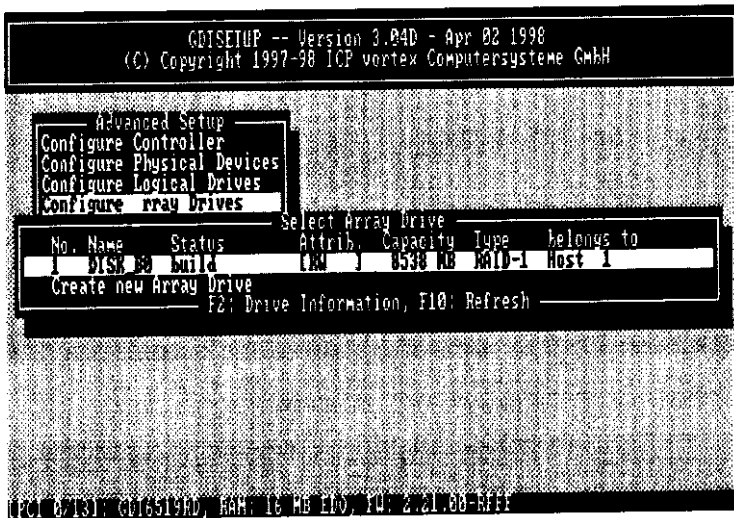


As you can easily recognize, we have created a new Array Drive of the Type RAID-1. Its state is build. When we leave GDTSETUP at the end of this example, you will see that the ICP Controller automatically copies the data of the first Logical Drive (our master) to the second Logical Drive. During this *synchronization* the RAID-1 array is fully operational. The functioning of a RAID-1, or mirroring, disk array, is easy to understand: On the ICP Controller, one write-access from the host computer is transformed into two write-accesses (to both Logical Drives forming the mirroring array). If the two Logical Drives are built of hard disks, which are connected with different I/O channels of the ICP Controller, both write-



accesses are performed simultaneously (this method is often called *Disk Duplexing*). During a read-access of the host computer the data will be read from the Logical Drive whose hard disk has the fastest access to the data requested.

If a hard disk should fail (for instance due to a mechanical defect), all data is still available on the other Logical Drive. In this event, the controller gives an acoustical alarm.



Steps 5 and 6 are the same as in example 1.

C.8 Example 3 - Installing a RAID 5 Disk Array

We presume that the controller and the hard disks have been installed properly.

Step 1: Loading GDTSETUP

You can load GDTSETUP in two ways:

1. Press the <CTRL><G> key combination when the GDT BIOS message comes up (shortly after switching on the computer) and load GDTSETUP from the Flash-RAM of the ICP Controller. In this case no operating system is required. If GDTSETUP was loaded this way, there is an "R" (ROM) behind the version number.
2. Load GDTSETUP from disk under MS-DOS. Boot the MS-DOS-operating system (either from a boot-floppy or from an already existing boot drive, i.e., IDE-hard disk etc.). In order for GDTSETUP to work properly, you have to load the device driver GDTX000 first. This can be done in two ways:

- a.) Load GDTX000 from the DOS-command level by typing in GDTX000<ENTER>
- b.) Load GDTX000 automatically through the CONFIG.SYS file (DEVICE=GDTX000.EXE)

Note: GDTSETUP.EXE as well as GDTX000.EXE are on the System Disk - DOS.
If GDTSETUP was loaded this way, there is a "D" (Disk) behind the version number.

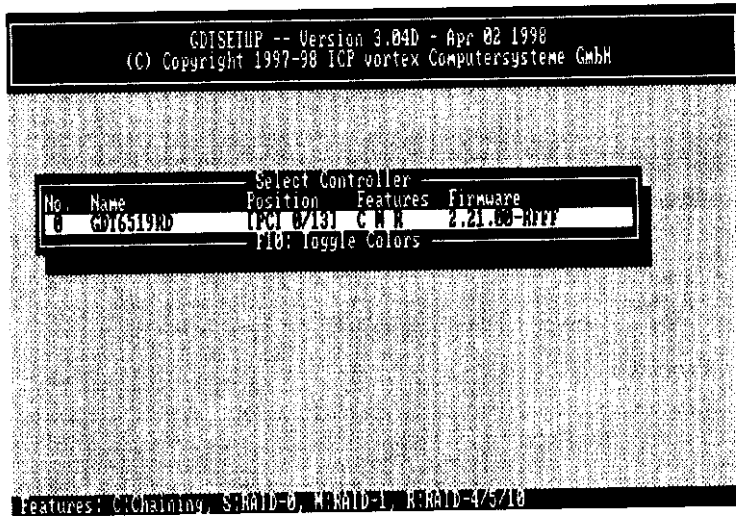
You may now ask what are the differences between the two GDTSETUP variants?



They are small. The GDTSETUP variant loadable from disk under MS-DOS also additionally allows the partitioning of Host Drives, which is not possible with GDTSETUP loaded from the Flash-RAM. Loading GDTSETUP from the Flash-RAM is pretty easy, since there is nothing more required to configure the disk arrays. User's, who have for instance, an NT installation without a DOS partition, will highly appreciate this Flash-RAM-resident GDTSETUP.

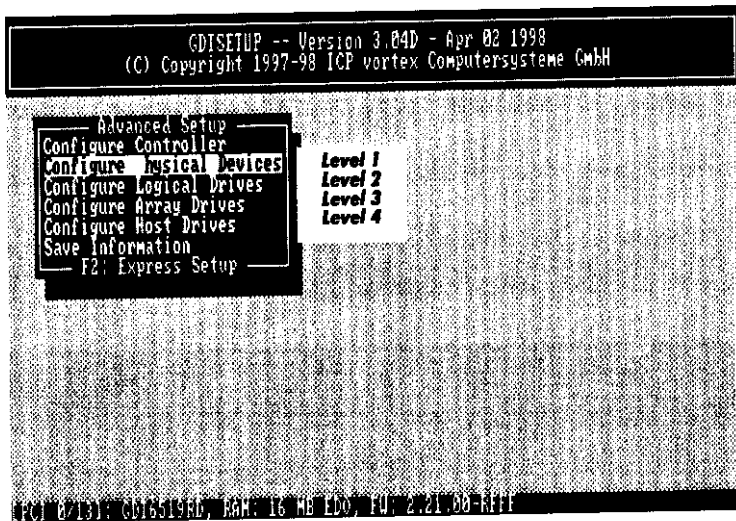
For our example, it is not relevant whether we load GDTSETUP from the Flash-RAM, or from disk.

Now load GDTSETUP. The first menu asks you to select the desired ICP Controller. In our example, there is only one ICP Controller installed in the system. Therefore, simply press <ENTER> and then <F2> to select the Advanced Setup.



The main menu gives you the following options. As mentioned before, we have to go through levels 1 to 4.





Step 2: Configure Physical Devices

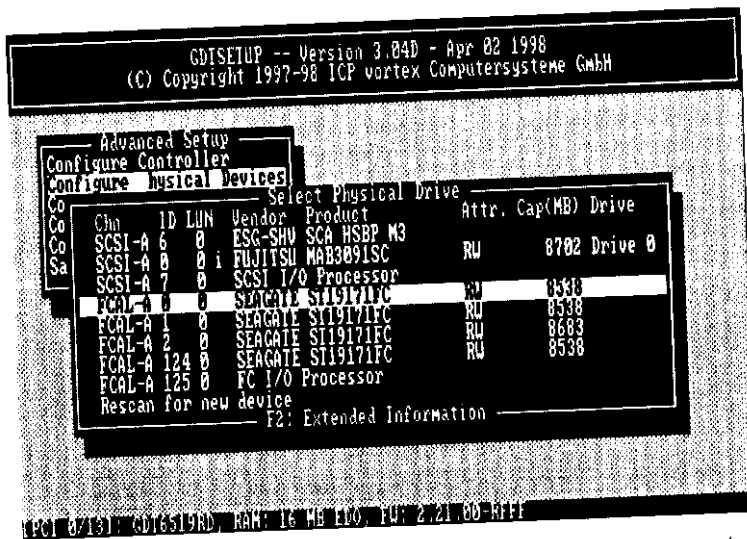
Now activate the menu *Configure Physical Devices* (level 1). A list appears showing all hard disks found on the ICP Controller's I/O channels. If you have an ICP Controller with a different number of I/O channels, the existing channels are displayed. Note: This screen will always report all devices that are found, even though GDTSETUP only allows you to work on *Direct Access Devices* (and therefore not on tape drives, DATs, CD ROMs etc.).

The screen shows you:

- the I/O channel to which a device is connected (this can be a SCSI or a FCAL channel)
- which ID the drive has (the entry I/O Processor stands for the corresponding I/O channel of the ICP Controller. It has the default ID setting 7 for SCSI and 125 for FCAL).
The IDs of the FCAL drives are normally assigned through the backplane of the Fibre Channel Enclosure.
- the initialization status
- the names of the drives
- the Read-Write-Status. [RW] = Read + Write
- the gross capacity
- membership in a Logical, Array or Host Drive

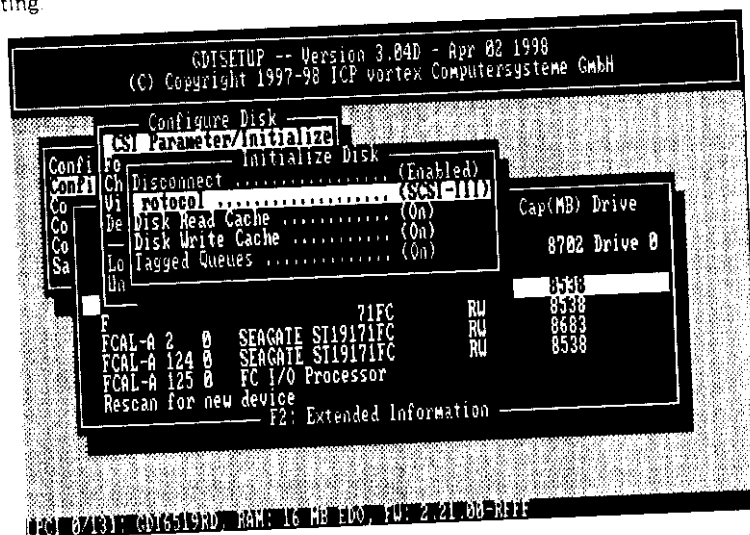
Use the cursor keys ↑ and ↓ to select the drive you wish to initialize. We take the first drive of FCAL-A in the list. With this drive selected, press <ENTER>.





(Note: On SCSI-A, ID 0 and ID 6 are devices which are not relevant for our examples).

The *Configure Disk* menu appears which shows various options. For our example we choose the *SCSI Parameter/Initialize* menu option and press <ENTER>. The parameters within this menu can be changed by pressing <ENTER> and selecting the new setting.

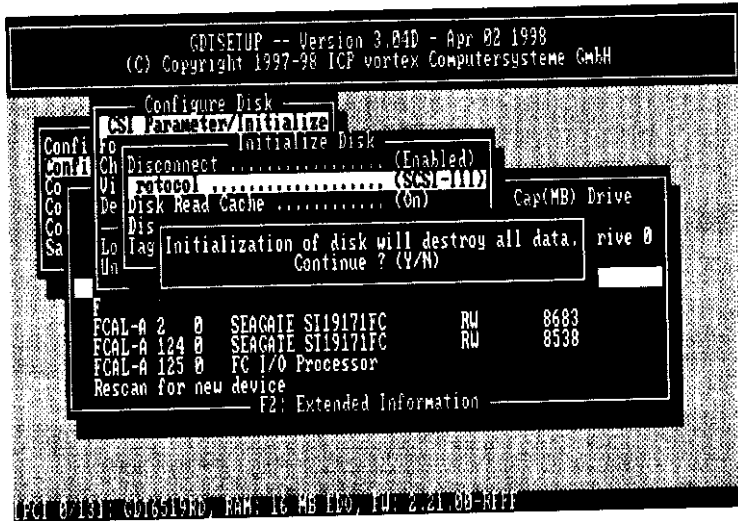


With Fibre Channel devices, there are only view settings which are relevant. They should be "On" or "Enabled". (Note: Fibre Channel devices are also controlled by the SCSI protocol.)

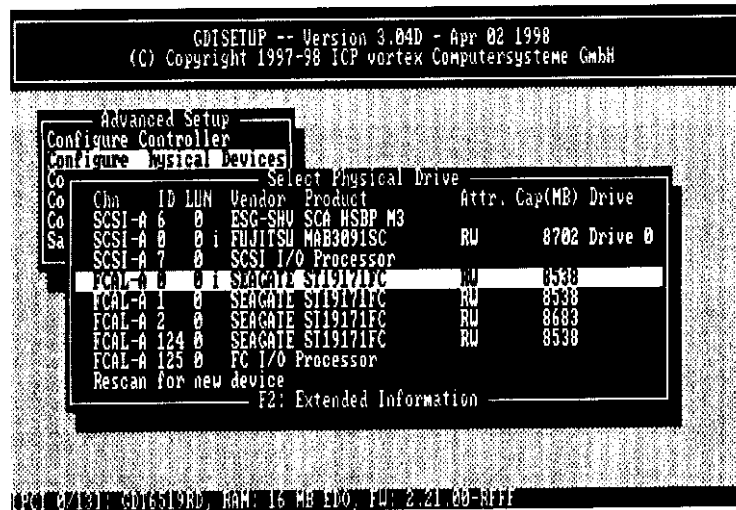
Press <ESC> to leave the SCSI Parameter/Initialize menu.

GDTSETUP displays a warning on the destruction of all data. This implies two different evaluations, according to the drive's current state and the options you have selected.

1. *First Initialization of the device.* In this case the warning must be taken seriously. If the drive was previously connected to a different controller (e.g., NCR etc.) and still contains data, this data will be lost now.
2. *The device was already initialized.* If only internal parameters, such as Disconnect, Synchronous Transfer and SCSI-II options have been changed, the data on the drive remains intact. Only the function state of the device is changed.



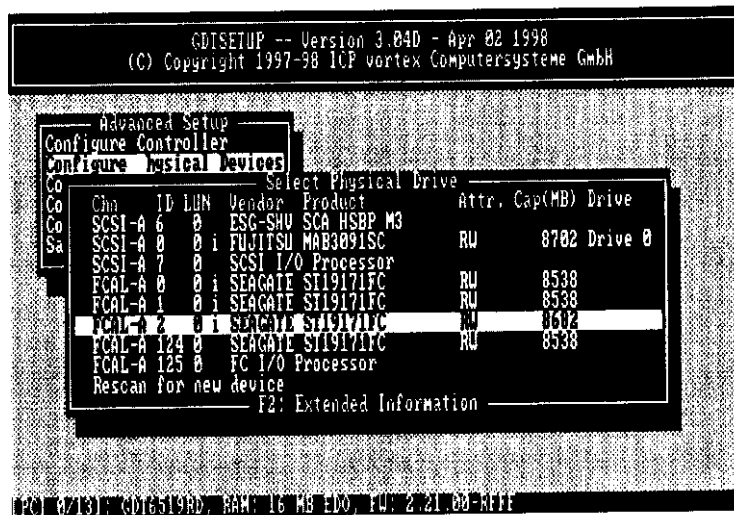
Press <Y> and we are back on the main screen of level 1 and see that the initialization-status of the device has changed.



Initialize the next two SEAGATE drives as described above, that is:

- Select the device with the cursor keys ↑ and ↓ and press the <ENTER>-key
- Choose the settings shown above
- Carry out the initialization

When the initialization completed, the screen should look as follows (a small **i** (i = initialized) must follow the ID of each hard disk):

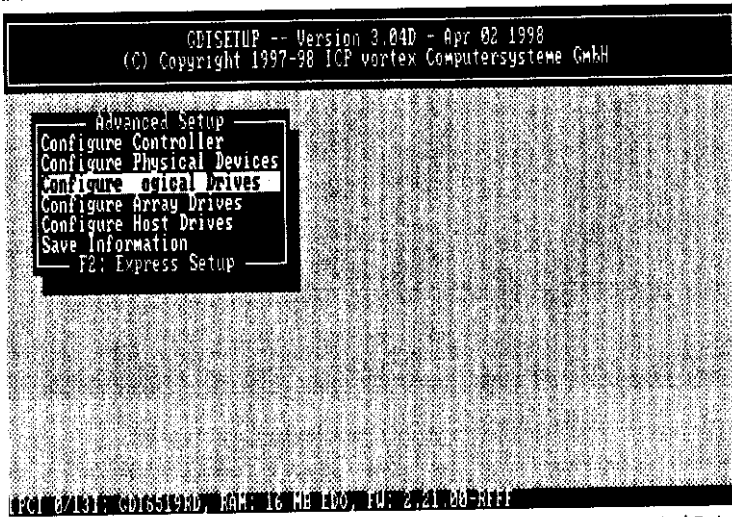


Important: Moving to the next level (Configure Logical Drives) only makes sense if all three devices you need there are initialized.

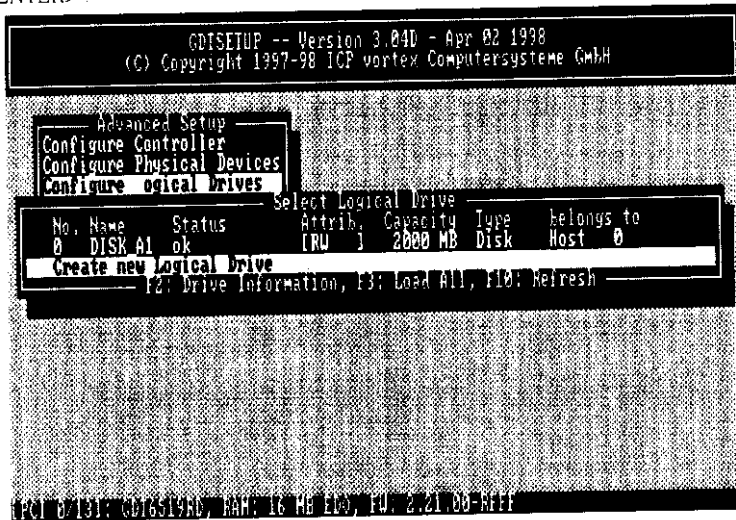


Step 3: Configure Logical Drives

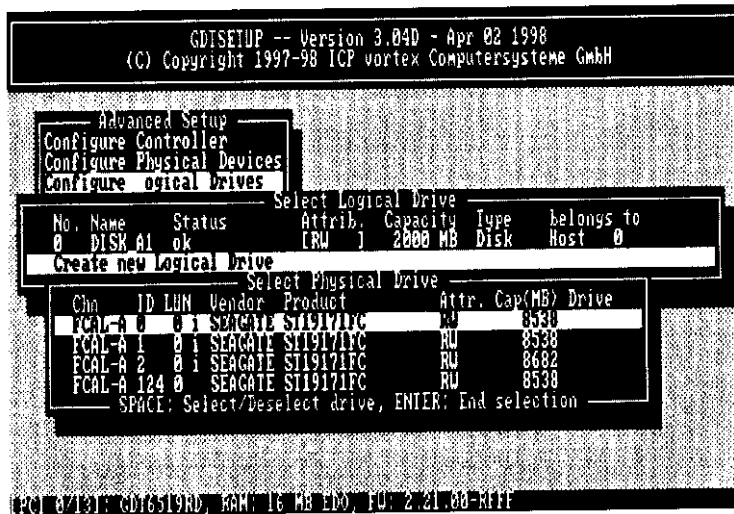
We now leave level 1 (by pressing the <ESC>-key) and are back in the main menu. Now, with the cursor keys ↑ and ↓ select *Configure Logical Drives* and go to level 2 by pressing <ENTER>.



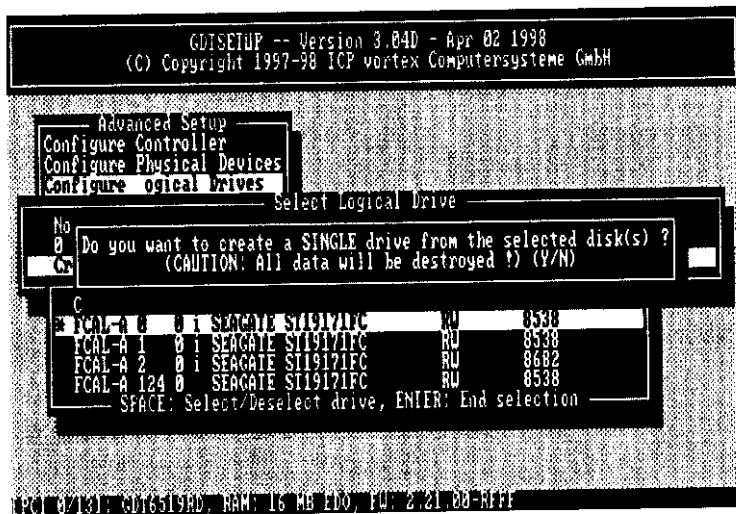
The main screen of level 2 appears. Move the selection bar to *Create new Logical Drives* and press <ENTER>.



Note: The already existing Logical Drive in this list has no relevance for our example.

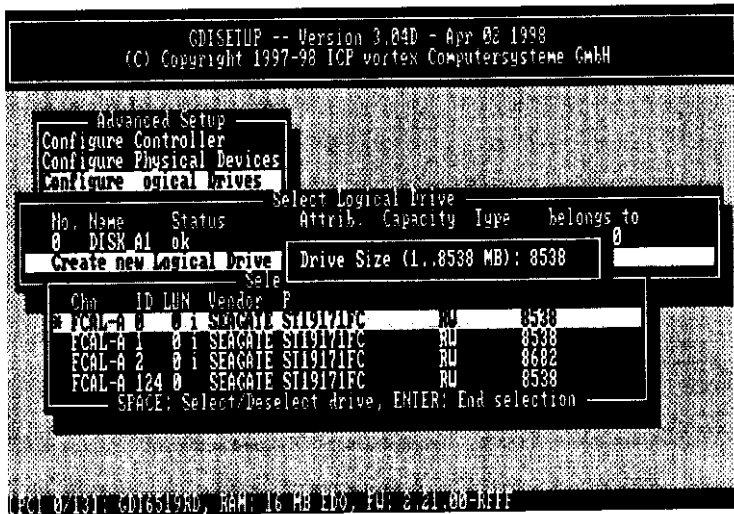


Select the initialized hard disk with the <SPACE>-bar (it becomes marked with an "**") and press <ENTER>.

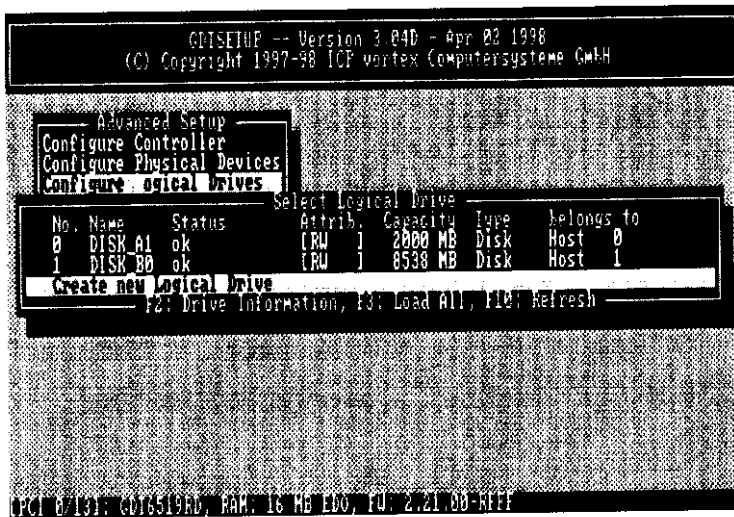


For security reasons, you will be asked again if you want to use the selected disk to create a Logical Drive. As we are sure of our choice, we confirm with <Yes>. GDTSETUP allows you to limit the hard disk size for this Logical Drive. This becomes interesting when you configure disk arrays and you want to make sure that future drives you want to bring into the disk array (e.g. for the capacity expansion or for replacement purposes) fit. It would be bad luck if the new drive only had 8537MB. GDTSETUP couldn't accept it. To avoid this occurring, you could limit the capacity of each drive to 8000 MB. Any new 9 GB drive must have at least

this capacity. The difference in our example would be lost. For this example we use the full capacity and press <ENTER>.

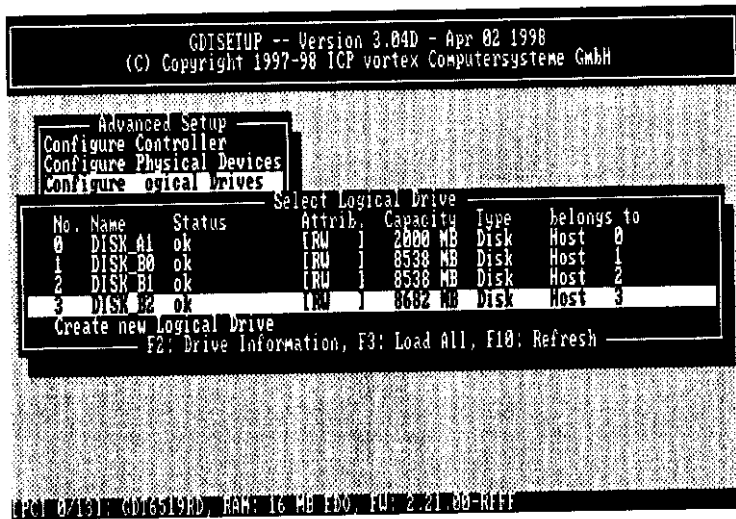


The dialog box is closed and we are back in the main menu of level 2.



As you can see, we have already created a new Logical Drive of the type Disk. The name of the Logical Drive is assigned automatically and contains the I/O channel description and the FCAL-ID after the "_". This can serve as a reminder when you install a complex system with many drives. (Naturally, you may change the name.). Now configure the remaining Logical Drives one by one. After having completed these procedures for all five Logical Drives, you will see the following screen:

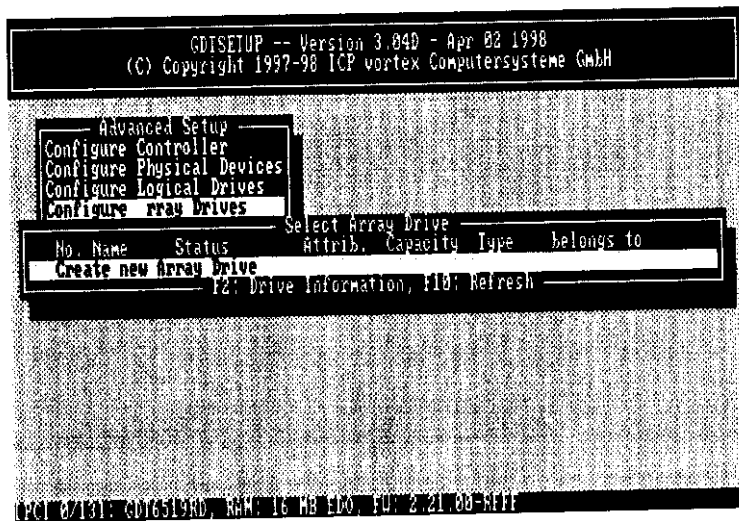




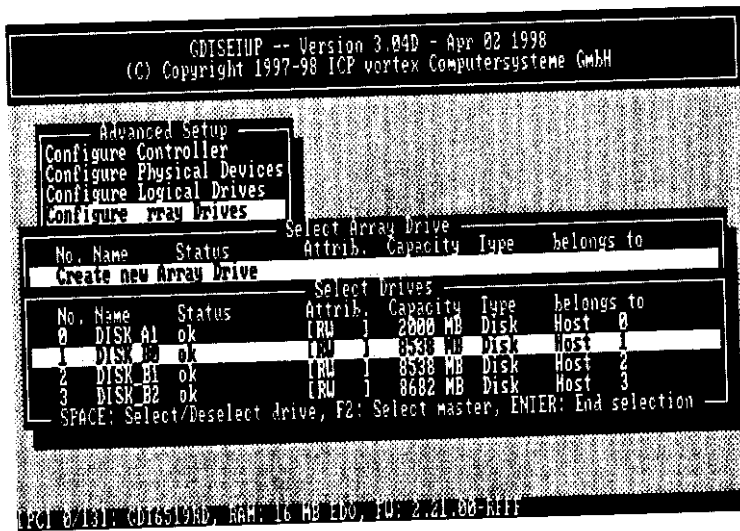
This concludes the installation on level 2. Now press the <ESC>-key to leave this screen.

Step 4: Configure Array Drives

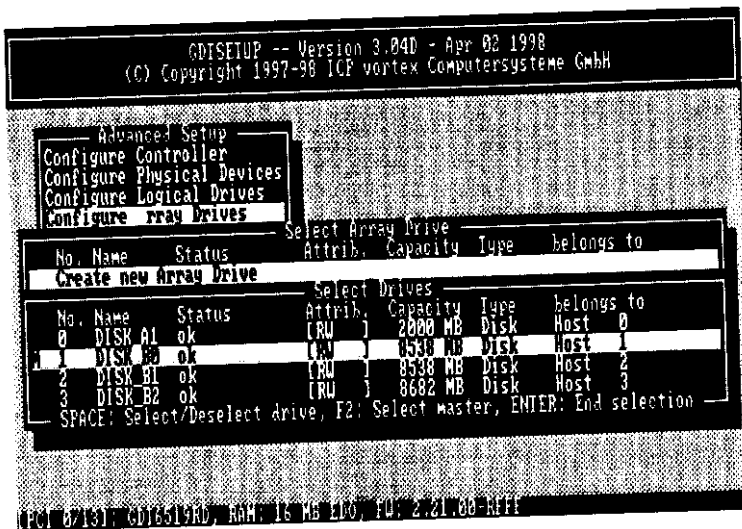
We now leave level 2 (by pressing the <ESC>-key) and are back in the main menu. Now, with the cursor keys ↑ and ↓ select *Configure Array Drives* and go to level 3 by pressing <ENTER>.



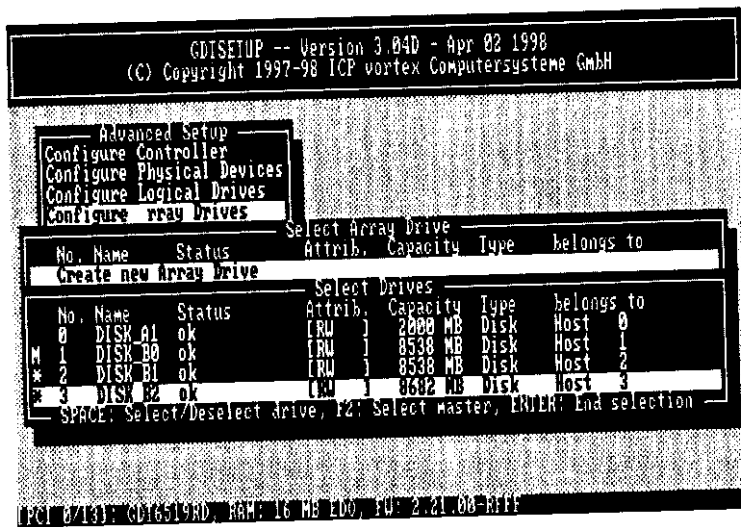
Since we want to create a new Array Drive press <ENTER>.
Note: The first entry in the next list has no relevance for our example.



Move the selection bar to the second entry and press the <SPACE>-bar. The entry is marked with an "M" for Master. This means that the disk array "begins" with this Logical Drive.

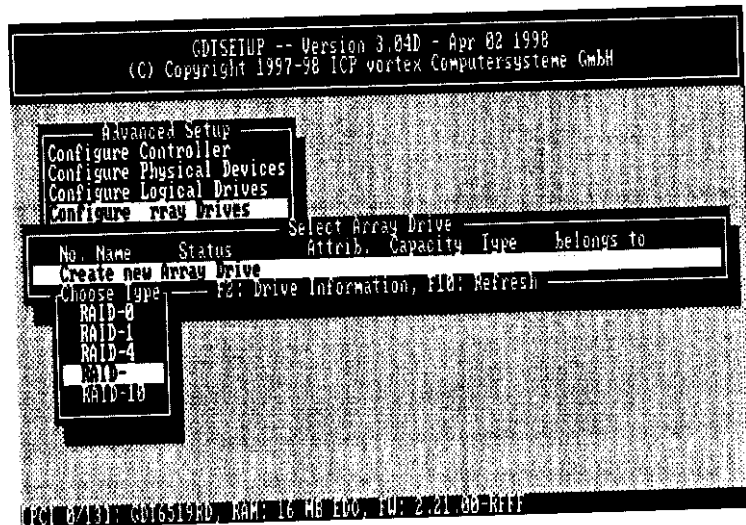


Move the selection bar with the cursor key ↓ to the next entry and press the <SPACE>-bar, again. It is marked with an "*" (pressing the <SPACE>-bar again undoes your choice). Repeat this selection until all three Logical Drives are marked.



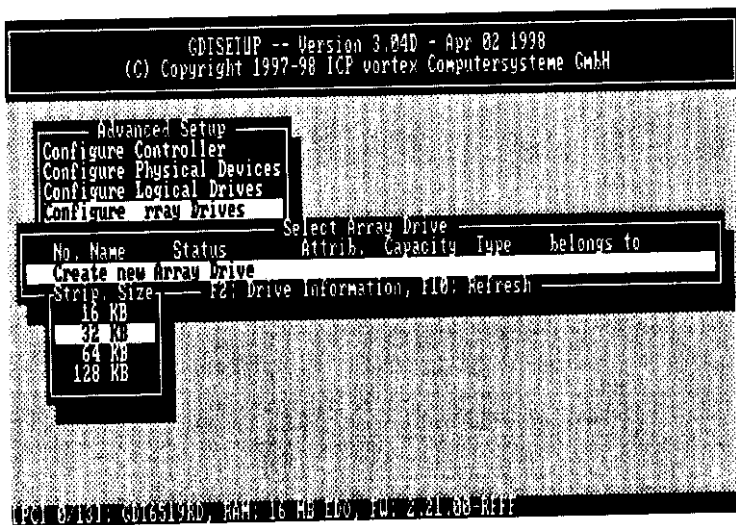
When the last Logical Drive is selected, confirm with <ENTER>. GDTSETUP now displays a list of possible RAID levels available with the number of Logical Drives selected.

- 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

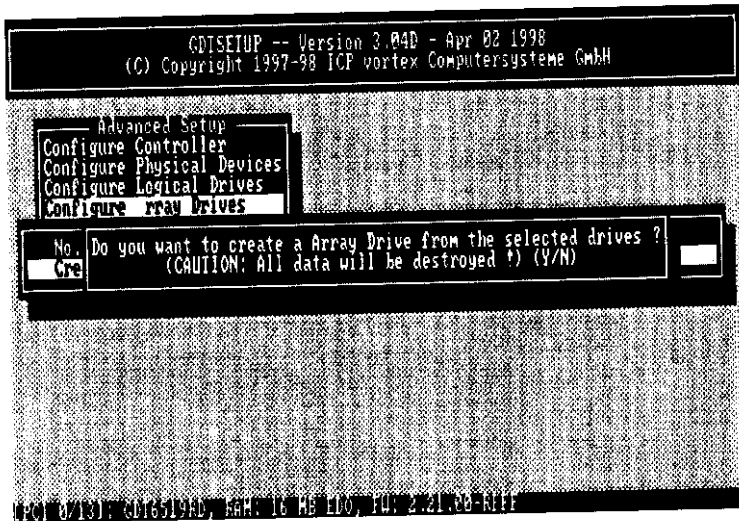


In our case we take RAID-5 and press <ENTER>.



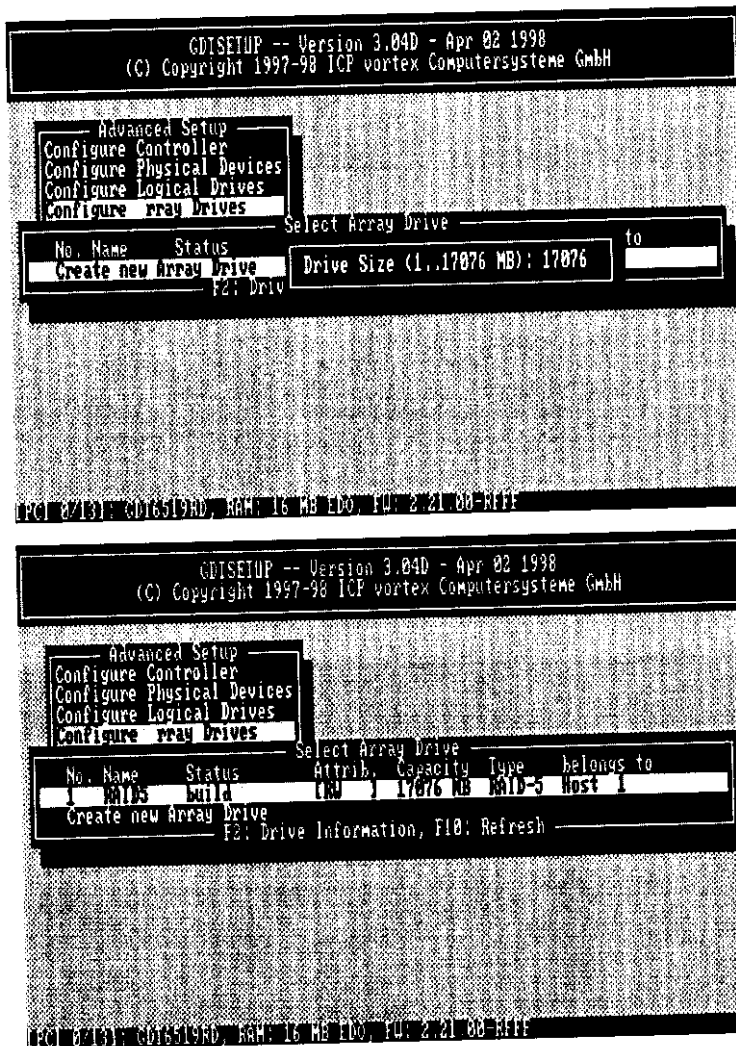


GDTSETUP asks for the *Stripe Size*. This is the size of the stripes into which the data is divided. The default is 32KB which we leave for this example and therefore press <ENTER>. (Note: 32KB stripe size is suggested because in various performance tests it has proved to be the best value.) GDTSETUP displays a security request, which we confirm with <Y>.



GDTSETUP allows you to limit the capacity of the disk array. This may be of interest if your installation requires an exact size for a disk array. Normally, the full capacity is used. In our example we press <ENTER>.





It's done !

We succeeded in setting up a RAID 5 disk array. The screen shows that the disk array is currently in an *build* state. Later in this chapter, we shall explain the different states a RAIDYNE disk array can assume.

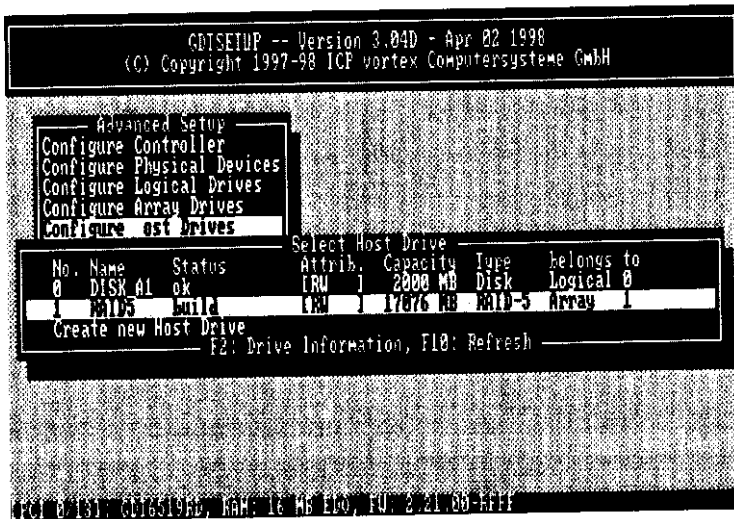
We are now back in the main menu of GDTSETUP.

Step 5: Configure Host Drives

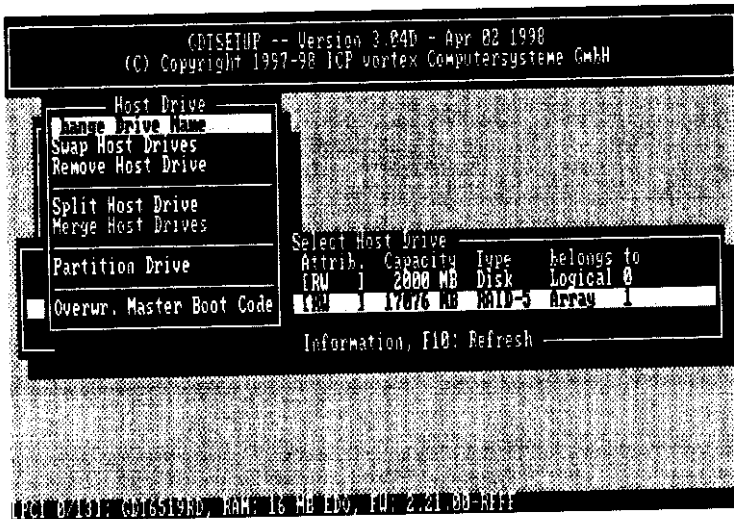
We are now back in the main menu of GDTSETUP and select *Configure Host Drives*. The main screen of level 4 appears. Press <ENTER>. A list of available Host Drives is displayed. Again, the first entry is not relevant for our example.



At position 1 we find our previously configured RAID-5 disk array. It was automatically transformed into a Host Drive, thus for this example we have nothing to do in this menu.



Press <ENTER> to get a list of possible menu options.

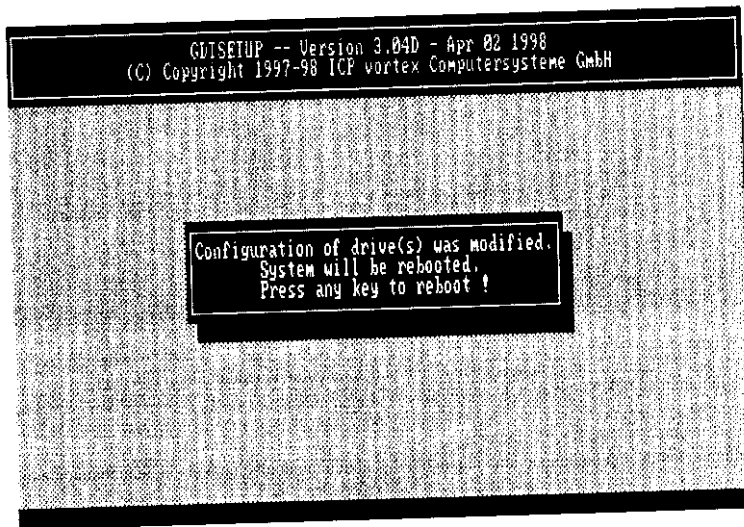


We should not forget to mention that if you would have selected *Create new Host Drive*, this would have lead you to exactly the same menu as the Express Setup mode. But this example is an exercise which should help you to gain a better understanding of how the ICP Controller and GDTSETUP work.

By the way, if you have loaded GDTSETUP from the Flash-RAM (<CTRL><G>) the *Partition Drive* option will be missing in this menu. The reason is that partitioning makes no sense, when there is no operating system loaded and the INT13H extension of the ICP Controller has not yet been activated.

Step 6: Leaving GDTSETUP

We are now back in the main menu of GDTSETUP. The installation is completed, and we therefore leave GDTSETUP by pressing the <ESC>-key. The following message appears:

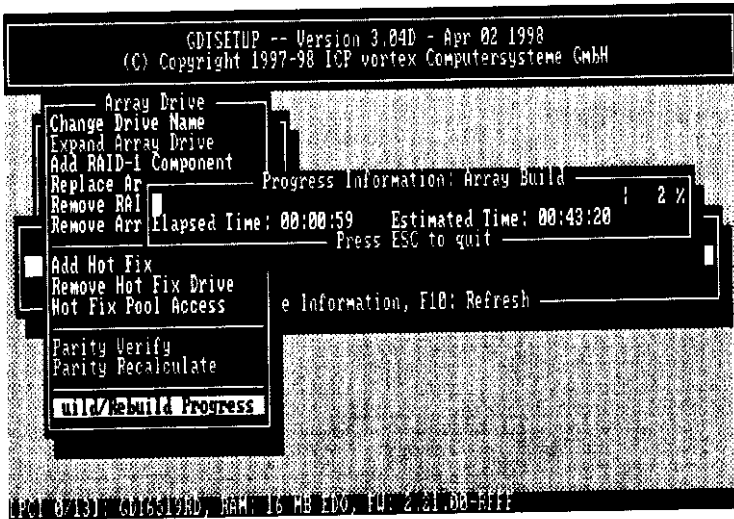


As we are done with the installation and therefore definitely want to leave GDTSETUP, we press any key.

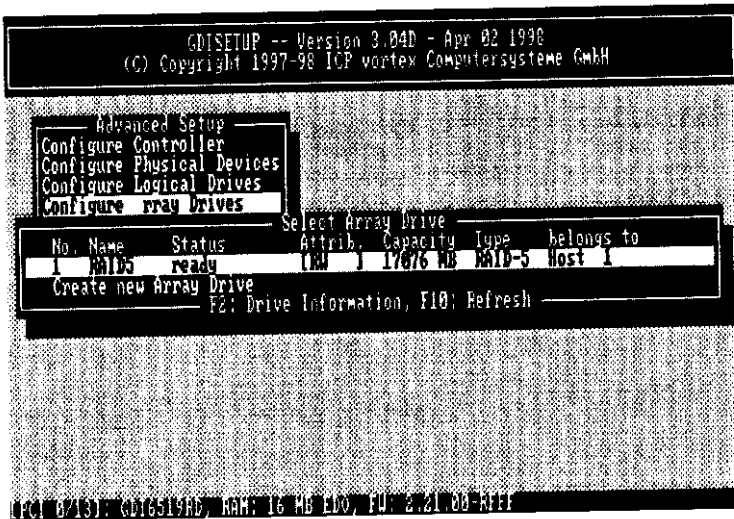
IMPORTANT: Always end GDTSETUP by leaving the program in the regular way (do not warm-boot with CTRL-ALT-DEL or cold boot by pressing the RESET button). Certain information is only transferred to the controller when you leave GDTSETUP in the regular way.

After rebooting the system, load GDTSETUP anew. Change to the Advanced Setup menu, select *Configure Array Drives*, and press <ENTER>. Select the Array Drive, press <ENTER> and move the selection bar to the *Build/Rebuild progress* menu. Press <ENTER>.



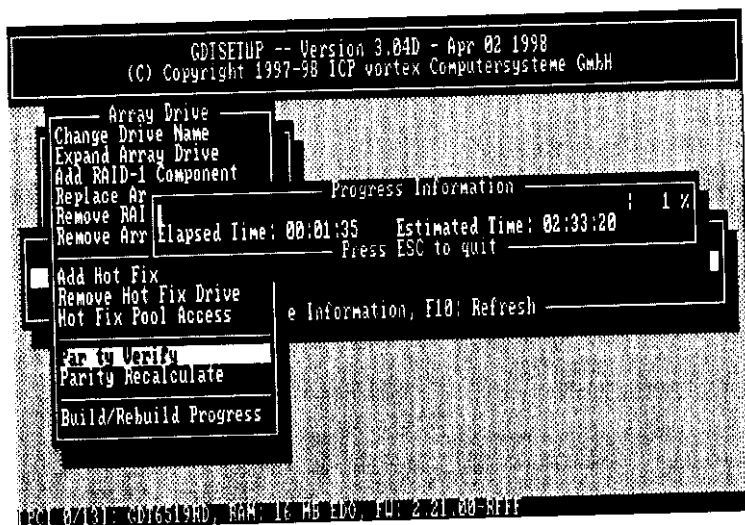


From the progress information slider, we can easily see, that the 17 GB disk array is already built up 2% and that the estimated time for the build process is 43 minutes.
 Note: During the build process the disk array is fully operational, but not yet redundant.
 I.e., you could immediately start installing your desired operating system, without having to wait until this process has finished.
 At the end of this build process the disk arrays state becomes *ready* (fully redundant).



Now press <ENTER> and move the selection bar to the *Parity Verify* menu. Press <ENTER>.





RAIDYNE now checks the correctness of the redundancy information (i.e., calculates the redundancy information anew and compares it with the already existing information). Depending on how large the disk array is, this check may take quite a long time, however, it can be aborted by pressing <ESC>. *Parity Verify* is a diagnosis function which enables you to verify the consistency of a disk array every now and then. We interrupt the verification by pressing <ESC>. Note: The GDT monitor program **GDTMON** also includes the parity verify function. Unlike in GDISETUP, the disk array's parity can be checked while the disk array is fully operational (e.g., in a NetWare file server). Further information on GDTMON is given in a separate chapter of this manual.

Step 7: Simulating a Drive Failure

This part of our example is optional. Nevertheless, we recommend that you go through it. It gives you a better understanding of how RAIDYNE reacts in the event of a drive failure and what you have to do in such a case.

Important: To carry out the drive failure simulation, the disk array must be in the *ready* state. Only in this state, has the disk array redundancy.

In order to make the simulation as realistic as possible, we suggest creating an MS-DOS-partition on the disk array with FDISK. To create disk activity, write a small batch program which copies data from one directory of this partition to another. While the copy process is going on, we simulate a drive failure of drive DISK_B1 by removing the drive's DC power supply cable. Now we can observe how RAIDYNE reacts:

1. After a short time, the acoustical alarm of the GDT is activated. (Note: this alarm is only activated when the RAID 5 Array Drive is being accessed).
2. RAIDYNE activates the so-called *fail* operation state during which the disk array remains fully operational. The data of the failed drive is calculated by means of the redundant data stored on the other drives.

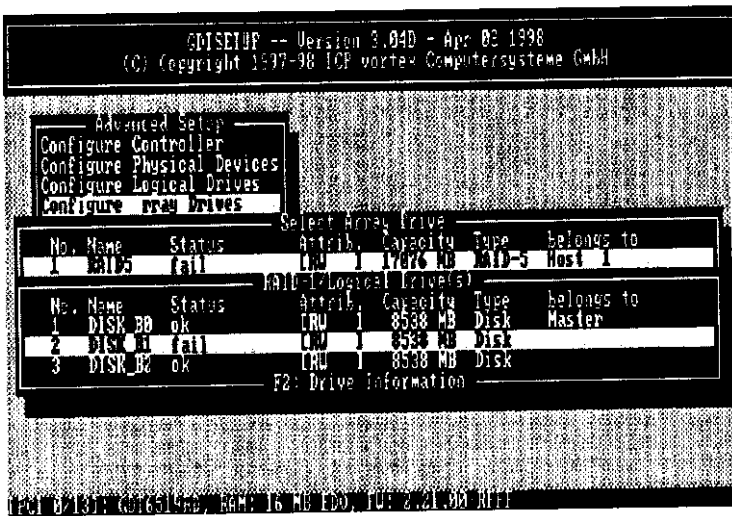
The alarm signal does not switch off because the disk array, although operational, is found in a state without redundancy, that is, a state which should be eliminated as soon as

possible. The alarm signal turns off when GDTSETUP is loaded.

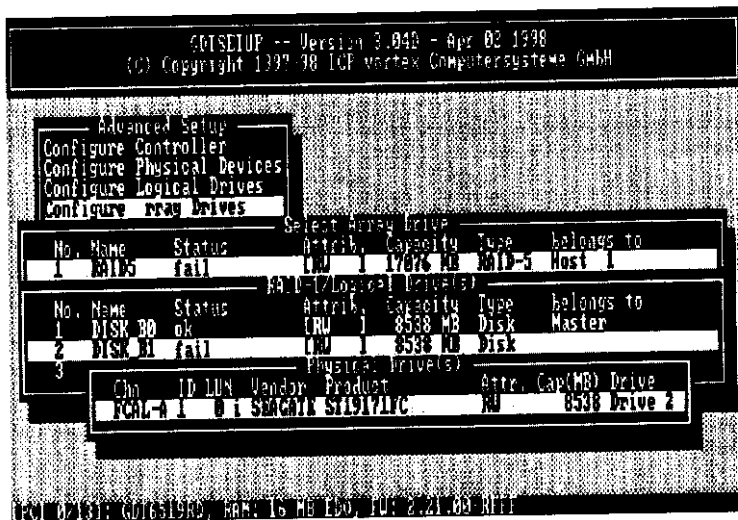
How is this situation reflected in GDTSETUP?

What has happened to the failed hard disk?

To answer these questions, we load GDTSETUP and check. We go to the menu *Configure Array Drives* menu and select our RAID-5 disk array which entered the *fail* state. Press <F2> to get further information on the failure.

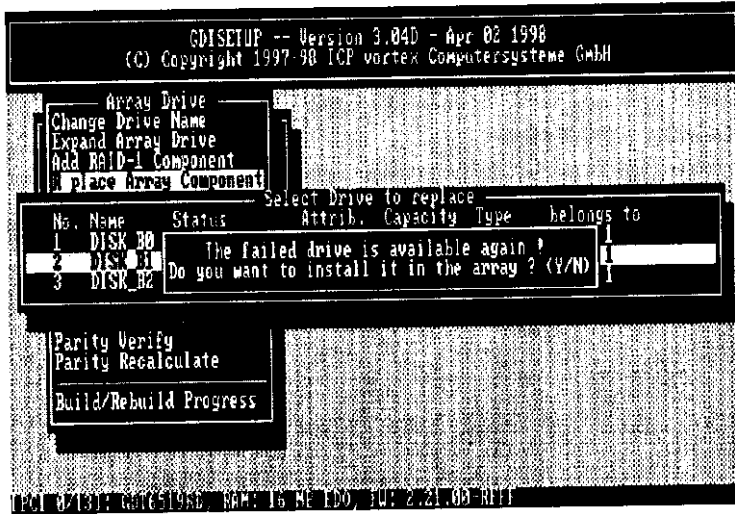


After selecting the failed Logical Drive, press again <F2> to obtain detailed information on the physical drive which has actually failed.



Important: Even if we reconnected the power supply to DISK_B1 before loading GDTSETUP, DISK_B1 would not be included in the disk array again. If you decide to use the failed hard disk again, it is best if you reconnect the drive to the power supply and do a cold boot. After loading GDTSETUP select the *Configure Array Drives* menu. Select the *Replace Array Component* menu

Press <ENTER>. GDTSETUP recognises the previously failed drive again (it was not really defective) and asks if it should be integrated into the disk array again.



Answer <Yes> and the disk array changes its state into *rebuild*. After leaving GDTSETUP the controller begins the reconstruction of the data of the failed drive. After the completion of this process, the disk array's state changes into *ready* again.

A few words on the replacement of a defective hard disk of a disk array.

If a hard disk belonging to a disk array for which no Hot Fix drive had been assigned should fail, you should replace this defective hard disk with a new one *as soon as possible*. Always be aware of the fact that this disk array does not have any redundancy until the defective hard disk has been substituted. This means that if another hard disk should fail while the disk array is without redundancy, all data is irretrievably lost. RAIDYNE offers two possibilities of replacing a failed drive of an array for which no Hot Fix drive has been designated:

1. Replacement with GDTSETUP (we have just demonstrated this method)
2. Replacement by using the **Hot Plug function of GDTMON**

The Hot Plug method allows you to replace a defective drive while the disk array continues to work and without having to load GDTSETUP. When this method is used, the I/O channel to which the defective drive is connected, is temporarily halted (that is, for the time necessary for replacement). After the replacement RAIDYNE automatically begins to rebuild the new drive. The halting and release of the I/O channel is controlled by GDTMON, which is available for most operating systems supported by the ICP Controller. The above mentioned halt of the I/O channel serves to avoid that interferences impair the functioning of still intact drives on this channel.



We would like to stress that the **Hot Fix** method is by far the most secure method of replacing a defective drive while the disk array is operational (see next example). First of all, because it is completely automatic, and secondly because it does not imply any mechanical or electrical interventions on the disk array as the Hot Plug method does. We shall explain GDTMON and the Hot Plug method more thoroughly later in this manual.

C.9 Example 4 - RAID 5 Disk Arrays With a Hot Fix Drive

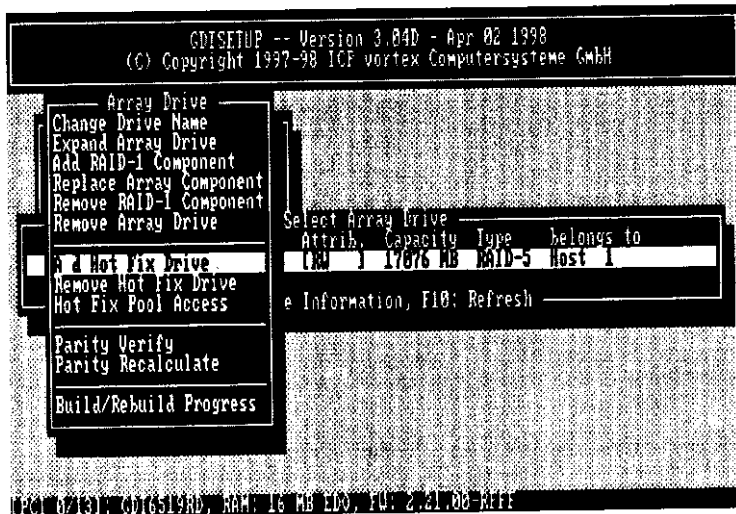
What we call **Hot Fix** drives is referred to as **Host Spare** drives in some literature. Most part of the installation is carried out as in our third example, so we do not repeat the explanation.

Do Step 1, Step 2, Step 3 and Step 4 as described in example no. 3.

In addition, initialize the fourth Seagate drive and make a Logical Drive out of it.

Step 5: Creating a Hot Fix Drive

Select the Array Drive in the **Configure Array Drives** menu and press <ENTER>. Move the selection bar to the **Add Hot Fix Drive** menu.



Press <ENTER>. GDTSETUP now displays a new dialog-box containing all the Logical Drives apt to serve as a Hot Fix drive (one criterion for this suitability is the drive's capacity, i.e., it has to be large enough). So do not be surprised if you do not find all the drives you would have expected during later installations. GDTSETUP knows which drives are suited to be used as Hot Fix drives.

```

GDTSETUP -- Version 3.04D - Apr 02 1998
(C) Copyright 1997-98 ICP vortex Computersysteme GmbH

  Array Drive
Change Drive Name
Expand Array Drive
Add RAID-1 Component
Replace Array Component
Remove RAID-1 Component
Remove Array Drive
  Select Array Drive
  Attrib. Capacity Type belongs to
  LUN 1 17876 MB RAID-5 Host 1

  Add Hot Fix Drive
  Select Drive for Hot Fix
  No. Name Status Attrib. Capacity Type belongs to
  4 DISK B3 ok LUN 1 8538 MB Disk Host 1

Build/Rebuild Progress

PCI 0/13: GD16519RD, RAM: 16 MB EDO, FPU: 2.21 80-Riff

```

Press <ENTER>.

```

GDTSETUP -- Version 3.04D - Apr 02 1998
(C) Copyright 1997-98 ICP vortex Computersysteme GmbH

  Array Drive
Change Drive Name
Expand Array Drive
Add RAID-1 Component
Replace Array Component
Remove RAID-1 Component
Remove Array Drive
  Select Array Drive
  Attrib. Capacity Type belongs to
  LUN 1 17876 MB RAID-5 Host 1

  Add Hot Fix Drive
  Select Drive for Hot Fix
  No. Name Status Attrib. Capacity Type belongs to
  4 DISK B3 ok LUN 1 8538 MB Disk Host 1

  Choose Type
  Private Hot Fix
  Pool Hot Fix
  ess

PCI 0/13: GD16519RD, RAM: 16 MB EDO, FPU: 2.21 80-Riff

```

GDTSETUP offers two different Hot Fix types: A *private* Hot Fix drive is only available for one specific disk array. A Hot Fix drive in a Hot Fix Pool can be made available to several disk arrays (presuming that the capacity fits). In our example we choose the *Private* Hot Fix drive and press <ENTER>.



```

GDTSETUP -- Version 3.04D - Apr 02 1998
(C) Copyright 1997-98 ICP vortex Computersysteme GmbH

  Array Drive
Change Drive Name
Expand Array Drive
Add RAID-1 Component
Replace Array Component
Remove RAID-1 Component
Remove Array Drive
Select Array Drive
s to
1. Hot 1 Do you want to add the drive to the array ? (Y/N)
No. Name      Status      Attrib. Capacity Type belongs to
4 DISK_B3 ok      LRW 1 8538 MB Disk Host 1

Build/Rebuild Progress

(Pci 0/13): GDT6519AD, RAM: 16 MB EDO, FPU: 2.21.00-MHz

```

Attention: By turning a Logical Drive into a Hot Fix drive, all its data is irretrievably lost.

```

GDTSETUP -- Version 3.04D - Apr 02 1998
(C) Copyright 1997-98 ICP vortex Computersysteme GmbH

  Advanced Setup
Configure Controller
Configure Physical Devices
Configure Logical Drives
Configure Array Drives
Select Array Drive
s to
No. Name      Status      Attrib. Capacity Type belongs to
1 RAID5 ready  LRW 1 17676 MB RAID-5 Host 1

RAID-1/Logical Drive(s)
No. Name      Status      Attrib. Capacity Type belongs to
1 DISK_B3 ok      LRW 1 8538 MB Disk Master
2 DISK_B1 ok      LRW 1 8538 MB Disk
3 DISK_B2 ok      LRW 1 8538 MB Disk
4 DISK_B3 ok      LRW 1 8538 MB Disk Priv. Hot Fix

F2: Drive Information

(Pci 0/13): GDT6519AD, RAM: 16 MB EDO, FPU: 2.21.00-MHz

```

After pressing <F2> we get detailed information on the structure of the disk array. The last entry refers to the Priv. Hot Fix drive.

We have already seen this form before, with the only difference that DISK_B3 has been assigned to be the Hot Fix drive. We now leave GDTSETUP as described in example no. 3, in order to allow GDTSETUP to send all relevant information to the controller and let RAIDYNE create and store the redundant information.

The question that arises now is:



When and how does the Hot Fix mechanism work ?

Normally, RAIDYNE puts Hot Fix drives in a stand-by mode, that is, their motors are stopped. However, it may happen that certain operations such as loading drivers, starting GDTSETUP and so on, cause the Hot Fix drives to start their motors. This takes a little bit longer, but it is necessary in order to enable RAIDYNE to check the consistency of the setup. RAIDYNE substitutes a failed hard disk with a Hot Fix drive only if the array was in a *ready* state before the failure. Or, in other words, a Hot Fix drive can only be activated if the corresponding disk array was in a state of data redundancy at the moment of failure.

Important: The following partial step can only be performed if the disk array is in the *ready* state.

Step 6: Simulating a Hard Disk Failure When a Hot Fix Drive is Present.

This partial step is optional. However, we recommend that you carry it out in order for you to get an idea of how RAIDYNE reacts in such a situation and which steps need to be taken. To have a very realistic simulation, create a DOS-partition and generate load on your disk array by using a batch file with copy commands. During these copy operations we cause DISK_B2 to fail by plugging out its power supply.

We now observe how RAIDYNE reacts:

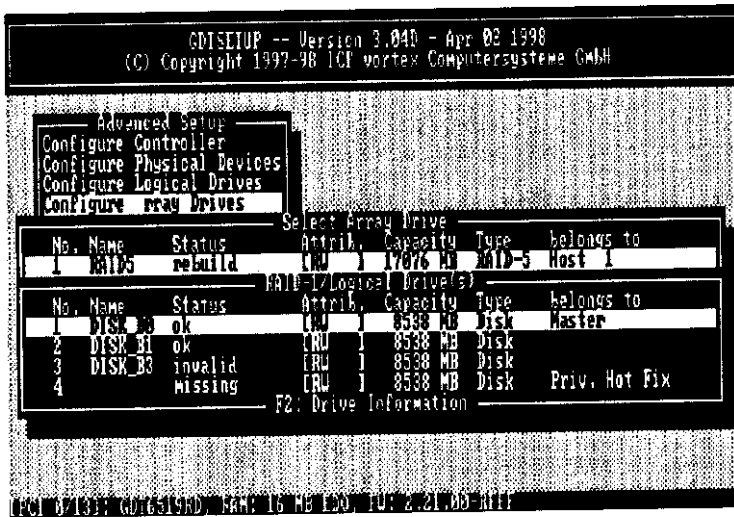
1. After a short while, GDT's alarm signal is heard.
(Note: the alarm only goes on when the RAID 5 Array Drive is accessed.)
2. RAIDYNE activates the so-called *fail* operation mode. In this mode, the disk array remains fully operational. The data of the failed drive is reconstructed by means of the redundancy information stored on the other drives.
3. RAIDYNE starts the motor of the Hot Fix drive.
4. RAIDYNE includes the Hot Fix drive into the disk array and starts to reconstruct the data and redundancy information. The disk array is now in the operation mode *rebuild*.
5. The alarm signal is not turned off until a new Hot Fix drive is added to the disk array, or until GDTSETUP (or GDTMON) is loaded and the missing Hot Fix drive is removed or replaced with a new one.

Obviously, no other hard disk may fail until all data is entirely reconstructed on the Hot Fix drive, because up to that moment the system operates without redundancy.

How is this situation reflected in GDTSETUP?
What has happened to the failed drive ?

To answer these we load GDTSETUP and check. We go directly to the menu *Configure Array Drive* menu. As expected, the disk array is in the *rebuild* state. Request the drive information regarding the RAID5 disk array with <F2>.





Two changes have occurred. The Hot Fix drive DISK_B3 has the state *invalid* and has jumped into the position of DISK_B2 (it will change its status from *invalid* to *OK* as soon as the Array Drive is becoming *ready* again). DISK_B2 is missing (this is the drive we let fail (disconnected it from the DC power)). Since this disk array was configured to have a hot fix drive, this position is still in the list, with the attribute *missing*.

C.10 Trying to Answer The Initial Questions

Now, after having demonstrated with examples 3 and 4 how RAID disk arrays are created with RAIDYNE (we hope you enjoyed it), we would like to return to the questions set down at the beginning of this chapter. When planning a disk array it is essential that you have precise ideas on how you intend to configure the disk array.

C.10.1 How Many Hard Disks Should be Integrated Into the Disk Array ?

To answer this question let us have a look at the delimiting parameters, that is, the maximum and minimum number of drives. The **maximum number** of physical drives in a disk array is determined by the number of physical drives the ICP Controller can control. In this context, we cannot analyze the many various factors which influence the decision of whether to integrate all Host Drives into one single RAID Host Drive, or rather create a number of smaller RAID Host Drives instead. The **minimum number** of necessary hard disks depends on the RAID level you wish to realize.

| RAID Level | Type of Disk Array | Minimum number of hard disks |
|------------|-----------------------------------|------------------------------|
| 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 |

The desired usable disk space of the disk array as well as the following two issues have a direct impact on the number of physical hard disks needed.



C.10.2 Which Level of Redundancy is Needed ?

To come straight to the point, **RAID 0** (data striping) does not imply any redundancy at all (the **R** in front of the **AID** is rather misleading). On the other hand, a RAID 0 disk array is pretty fast, since no parity information is required. With **RAID 1** (disk mirroring), the data is 100% redundant because it is mirrored. This is definitely the highest level of redundancy, but the most expensive one, too. An interesting combination of RAID levels 0 and 1 is **RAID 10**. Two RAID 0 stripe sets are simply mirrored. If one drive fails, the data are still available on the mirrored drive. With **RAID 4** (data striping with dedicated drive) and **RAID 5** (data striping with striped parity), parity information is calculated from the present data with a simple mathematical operation (eXclusive OR, XOR), and stored either to one dedicated drive (RAID 4) or to all drives (RAID 5). If one drive should fail, the data of the defective drive can be reconstructed on the basis of the normal 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, but in comparison to the latter, RAID 4, RAID 5 or RAID 10 are less expensive. As already mentioned before, the entire disk array controlling function is carried out at controller level and therefore does not load the host computer. Let us have a look at the following table which explains the correlations between the RAID level, usable disk capacity and number of physical hard disks. To make things easier, we consider identical 1 GB hard disks:

| RAID Level | 2 hard disks | 3 hard disks | 4 hard disks | 5 hard disks |
|----------------|--------------|--------------|--------------|--------------|
| RAID 0 | 2GB | 3GB | 4GB | 5GB |
| RAID 1 | 1GB | 1GB | 1GB | 1GB |
| RAID 4 | - | 2GB | 3GB | 4GB |
| RAID 5 | - | 2GB | 3GB | 4GB |
| RAID 10 | - | - | 2GB | - |

It is quite obvious that the redundancy of level RAID 1 soon becomes very expensive when more than 2 hard disks are used. Only with RAID 4 and RAID 5 have you a reasonable relation between storage capacity and expenses for the disk array.

C.10.3 Do we Need Hot Fix drives ?

In other words: Should RAIDYNE automatically reconstruct the lost data after a hard disk failure ?

One of the reasons that have led you to choose **RAID** disk arrays definitely lies with the redundancy, that is, the data security you still preserve even in the event of disk failure, thus resting assured against loss of data and time. Hot Fix drives are possible with all RAID 1, 4, 5 and 10 disk arrays. In order to assist the following considerations, we define the term **time without redundancy, TWR**. Set apart the time needed to set up the disk array (state *build*), the time without redundancy should be kept as short as possible. Let us assume that one of the hard disks of the RAID 5 disk array we set up with example 1 fails. The disk array is without redundancy. TWR starts to run. Any superfluous prolongation of the TWR (because you have to get a replacement drive, or because you did not realize the failure immediately since you didn't hear the ICP Controller's alarm signal, or because nobody checked the file server) increases the risk of data loss which will occur if a second drive should fail. Therefore, new redundancy should be created as soon as possible and in an entirely automated manner. Integrating a Hot Fix drive as an immediately available and auto-replacing drive is the only way to keep the TWR as short as possible. Only a Hot Fix drive can ensure optimal disk array security and constant data availability. Of course 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 do without a Hot Fix drive.



C.11 States of a RAIDYNE Disk Array

An Array Drive under the RAIDYNE operating system can assume seven different operational modes: **Idle, Ready, Fail, Build, Rebuild, Expand and Error.**

C.11.1 "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 GDTSETUP. If an error should 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 RAID 4 fails, the mode changes to *fail*).

C.11.2 "Build" State

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

C.11.3 "Ready" State

The disk array is fully operational when in the *ready* state. All redundant information is present, that is, a hard disk 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.

C.11.4 "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 disks to continue working. This state should be eliminated as soon as possible by replacing the defective hard disk. If a so-called Hot Fix drive has previously been assigned to a disk array with GDTSETUP, 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.

C.11.5 "Rebuild" State

The disk array will assume this state after the automatic activation of a Hot Fix drive or after a manual replacement carried out with GDTSETUP. The data and the redundant information are reconstructed and stored to the new drive.

C.11.6 "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*.

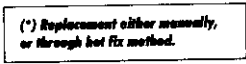
C.11.7 "Error" State

If a second hard disk should 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. The following state diagram of the disk array summarizes the states described above and the transitions from one state to another.



Some of these states may become the addendum **patch** (e.g. *build/patch*, *ready/patch*). This word indicates that the original Array Drive went through a significant procedure, i.e., the parity information was recalculated anew. Or, the Array Drive has been patched from the error state into the fail state. This may become extremely 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. RAIDYNE and GDTSETUP include some functions, which allow the patch of this Array Drive from the error state into the fail state. Before the actual patch, the defective drive has to be physically removed from the Array Drive. Such a patch-procedure is a real sheet-anchor and should only be used, after a detailed consultation with a trained support person (a printout of the *Save Information* file, is extremely helpful).





Chapter D

Using MS-DOS



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D. Using Microsoft MS-DOS

After having explained the installation of the ICP Controller and the host-drives in chapters B and C, we now explain how to install the operating system MS-DOS. By using some examples, we shall demonstrate how to partition a host-drive, transfer MS-DOS to the host-drive, install Windows 3.x and use a CD-ROM drive (standing for any other *Not Direct Access Device*) under MS-DOS. In addition, we will give you further information on how to install **Windows 95**.

D.1 Transparency of Host Drives

The structure of the Host Drives, which have been installed with GDTSETUP (in chapter C), is not known to DOS, i.e., the operating system does not recognize that a given Host Drive consists of a number of hard disks forming a disk array. To DOS this Host Drive simply appears as one single hard disk with the capacity of the disk array. This complete transparency represents the easiest way to operate disk arrays under DOS; neither DOS nor the PCI computer need to be involved in the administration of these complex disk array configurations.

D.2 Partitioning a Host-Drive and Transferring MS-DOS

You can partition the host-drives installed in chapter C with GDTSETUP as well as with the MS-DOS program FDISK. However, in our explanation we shall only use GDTSETUP. For further information on FDISK, please refer to your MS-DOS manual. During the following installation instructions we assume that there is not yet a boot disk in the computer system. Therefore, the following steps aim at installing a *primary* DOS partition on the host-drive previously installed with GDTSETUP (see chapter C), activating this partition, and transferring MS-DOS to this partition. Our objective is to be able to boot MS-DOS directly from this partition at the end of the installation. First of all, we would like to draw your attention to a common operating error which is often made when Host Drives are partitioned. Many users ignore that an MS-DOS boot partition has to have the state "**active**". If the partition is not active, the system will attempt to boot MS-DOS, but will "hang" straight away. Very often, the system message "ROM BASIC NOT FOUND, SYSTEM HALTED" is displayed (in the 40 lines of text mode). You can easily remedy this problem by booting the system from an MS-DOS floppy disk, and then activating the partition with GDTSETUP (more information later in this manual) or FDISK (for more information on FDISK please refer to the MSDOS user's manual).

(A) As already mentioned before, you can load GDTSETUP in two ways. For the partitioning, GDTSETUP has to be loaded from disk under MS-DOS:

Boot the MS-DOS-operating system (either from a boot-floppy or from an already existing boot drive, i.e., IDE-hard disk etc.).

(B) In order for GDTSETUP to work properly, you have to load the device driver GDTX000 first. This can be done in two ways:

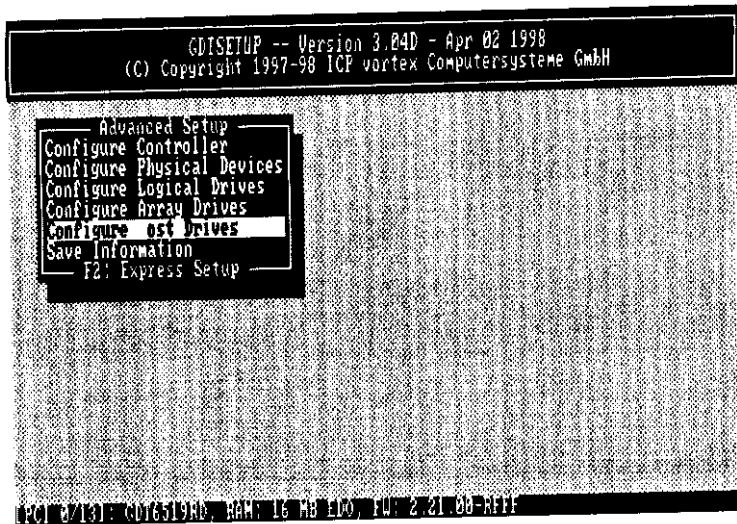
Load GDTX000 from the MS-DOS command level by typing in GDTX000<ENTER>, or load GDTX000 automatically through the CONFIG.SYS file (DEVICE=GDTX000.EXE).

Load GDTSETUP from the MS-DOS command level by typing GDTSETUP<ENTER>.

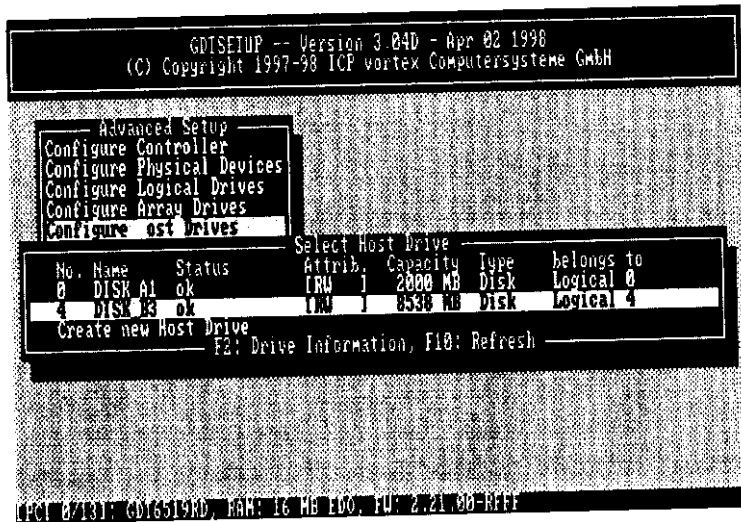
Note: GDTSETUP.EXE as well as GDTX000.EXE are on the *System Disk* - DOS.



(C) Now, in the program GDTSETUP, select the menu *Configure Host Drives*.

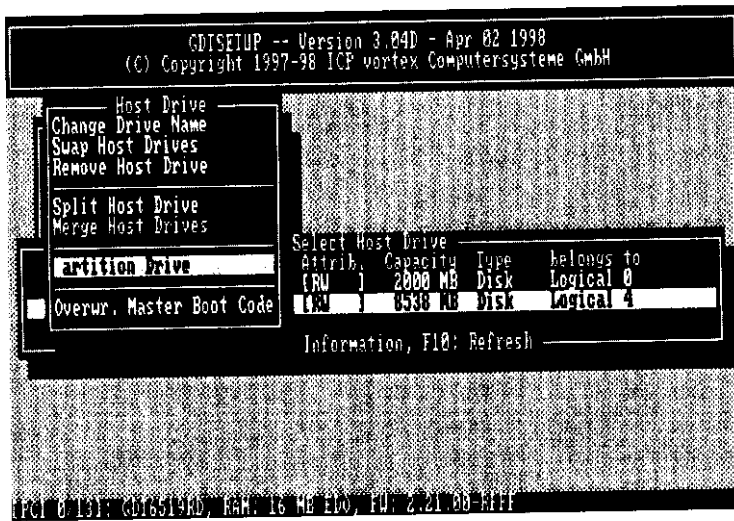


Pressing <ENTER> leads you to the following sub-menu. In our example, the Host Drive list contains two Host Drives. The first drive in the list is not relevant for our example.

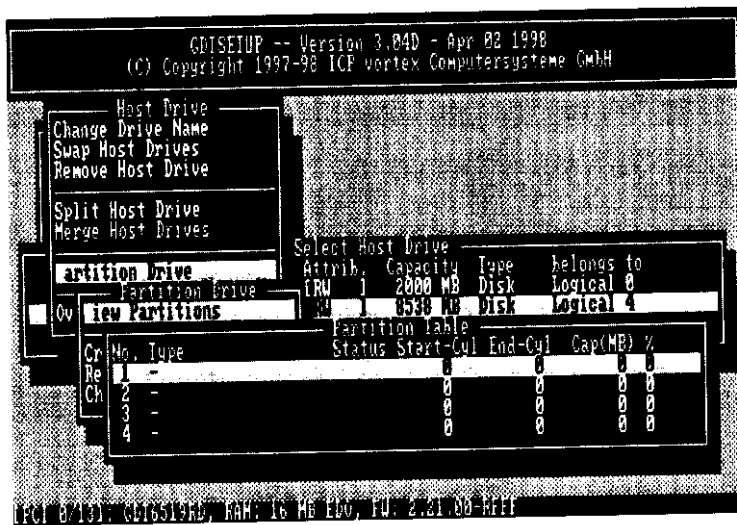


We select this Host Drive (by moving the selection line with the cursor keys ↑ and ↓) and confirm our choice with <ENTER>. Then the following screen comes up:

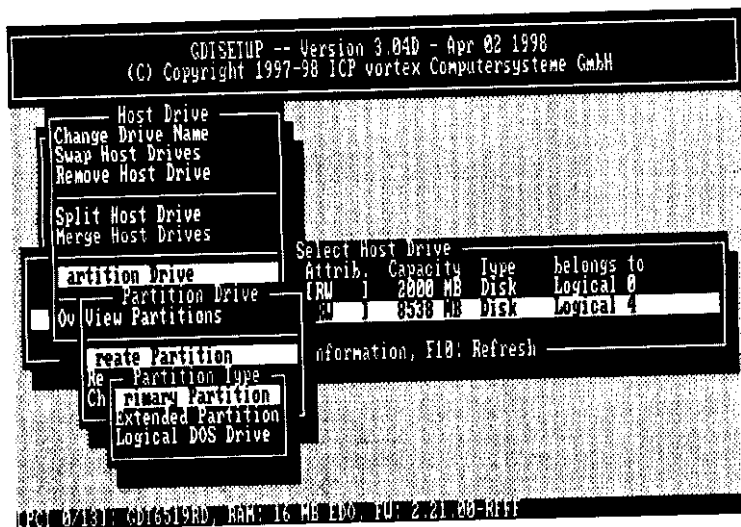




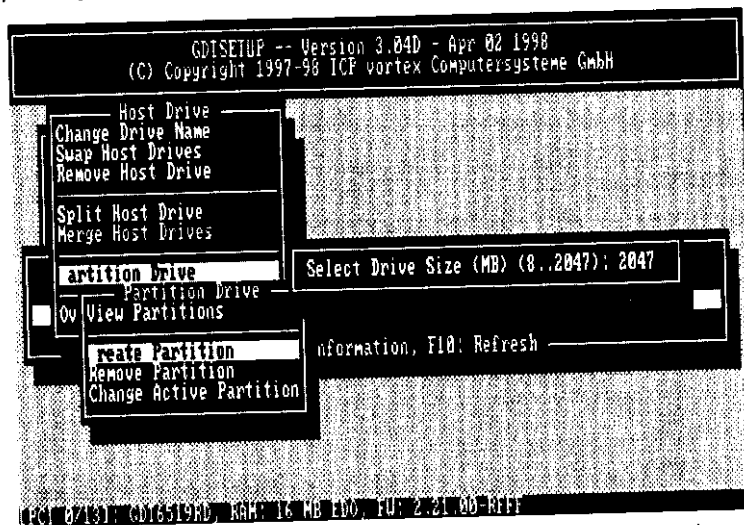
We now select Partition Drive and then View Partitions. The following screen appears. In our example, there is no entry yet.



Press <ESC>, select Create Partition and press <ENTER>.



In the upcoming window, select Primary Partition and confirm with <ENTER>.



Now you can determine the size of the primary partition. In our example, we choose to use 2047MB of the disk capacity for the primary partition and therefore enter 2047 and simply confirm with <ENTER>. Now select View Partitions again. You can see that the primary partition has been successfully installed and has the active state (A), which is necessary to boot MS-DOS from this partition.

(D) Now leave GDTSETUP by pressing <ESC>. After a few requests and messages from GDTSETUP, the system reboots.



(E) Now use the MS-DOS program FORMAT to transfer MS-DOS to the primary partition you have just created.
To do so, enter

A:\> FORMAT C: /S <ENTER>

(F) To complete the installation of MS-DOS, use the MS-DOS commands COPY or XCOPY to transfer the desired MS-DOS files.

A different and maybe even more elegant method of installing MS-DOS is to use the SETUP program of MS-DOS versions 5 and 6. In this case, you only have to create and activate a partition with GDTSETUP or FDISK. Then boot the system from the first floppy disk delivered with MS-DOS. MS-DOS SETUP will take care of all the rest.

D.3 CONFIG.SYS and the Driver GDTX000.EXE

GDTX000.EXE is the high performance MS-DOS driver for all ICP Controllers. In order to obtain the best performance of the ICP Controller under MS-DOS, this driver should be listed in the first line following the HIMEM.SYS device command in the CONFIG.SYS file. When loaded, GDTX000.EXE replaces the BIOS EPROM (the so-called INT13H interface) of the ICP Controller, and also offers a VDS (Virtual DMA Services) interface. This is of particular importance for Windows 3.x. When using GDTX000.EXE please observe the following:

- GDTX000.EXE must be loaded from the first line following the HIMEM SYS device command in the CONFIG.SYS file. If HIMEM SYS is not loaded, it must be loaded from the very first line of the CONFIG.SYS file.
- GDTX000.EXE can be loaded in the UMA.
- GDTX000.EXE is needed for an optimal use of Windows 3.x.
- The ICP Controller unfolds its full capacity under MS-DOS or Windows 3.x only when GDTX000.EXE is installed.
- In order to load GDTSETUP under MS-DOS from disk, you need GDTX000.EXE.
- In the CONFIG.SYS file, GDTX000.EXE must be loaded before GDTASPI.EXE.

Below is an example of a CONFIG.SYS file which is essential for the MS-DOS configuration

```
device=c:\windows\himem.sys
device=gdtx000.exe
files=30
buffers=30
stacks=9,256
dos=high,umb
install=\dos\keyb.com GR,\dos\keyboard.sys
device=gdtx000.exe
device=mouse.sys
device=\dos\setver.exe
device=\gdt\gdtaspi.exe
device=\aspi\aswcdnec.sys /D:CD-ROM
lastdrive=h
```

In this example, besides the GDTX000 driver, the GDTXDOS.EXE driver, the GDT ASPI Manager and an ASPI Module for an NEC CD-ROM drive are loaded.



D.4 Expanded Memory Managers

When using Expanded Memory Managers, a certain address area has to be excluded from being controlled by these programs. This area is the GDT Dual Ported Memory address space (sized 16KB). If the ICP Controller is not run with the GDTX000.EXE driver (that is, the driver has not been loaded from the CONFIG.SYS file), the address space of the GDT BIOS must also be excluded (the size of the GDT BIOS is 8KB). If the GDTX000.EXE driver is loaded from the CONFIG.SYS file in a line **before** the Expanded Memory Manager (EMM), it is not necessary to exclude the address space of the GDT BIOS. Unlike ISA or EISA computer systems where the controller's BIOS address space is set manually (through jumpers or the configuration file), PCI computers automatically map the address space of a peripheral PCI device (e.g., the ICP Controller with its BIOS and Dual Ported Memory) to a suitable location during a warm or cold boot. If the system configuration does not change (no new PCI expansion cards are being added etc.), the PCI System BIOS will always map these two spaces to the same addresses. To help you find out where these addresses have been mapped to, the GDT BIOS indicates the physical address locations of the GDT BIOS and the GDT DPMEM during the cold boot (also see chapter B in this manual):

BIOS located at 0x000E0000 - 0x000E1FFF

In this example, the GDT BIOS occupies E000:0000 to E000:1FFF (E000 is the segment address).

DPMEM at 0x000D0000 - 0x000D3FFF

Here the DPMEM starts at D000:0000 and ends at D000:3FFF (D000 is the segment address).

You may also use other utility programs such as *Georg Schnurer's (c't magazine) CTPCI* program in order to obtain the requested address locations. On this occasion we would like to thank Mr. *Georg Schnurer* and the *c't magazine* for allowing us to use this very helpful utility on our system disks.

Example 1: The Microsoft EMM386.EXE Manager is used. The GDT driver GDTX000.EXE has not been loaded from the CONFIG.SYS:

```
DEVICE=EMM386.EXE X=D000-D3FF X=E000-E1FF
```

Example 2: The Microsoft EMM386.EXE Manager is used. The GDT driver GDTX000.EXE has been loaded from the CONFIG.SYS:

```
DEVICE=EMM386.EXE X=D000-D3FF
```

(Note: You may have to add the path for "EMM386.EXE". Other parameters may follow the excluded areas).

D.5 Using Windows 3.x

In order to be able to install Windows 3.x, a fully operational MS-DOS operating system has to be present on the chosen partition. Furthermore, the first entry in the CONFIG.SYS file behind the HIMEM.SYS line has to be:

```
DEVICE=GDTX000.EXE
```

(if necessary, add the correct path name after the "=" symbol and before GDTX000.EXE).

(A) Now install Windows according to the instructions given in the Windows manual. Generally, you start with *Disk 1 - Setup* from which you load the setup program. This Setup program guides you through the entire installation and prompts you to insert further floppy disks.



(B) After the installation is completed, the Setup program will ask you if you want to reset the system. This reset must be performed.

(C) If you change to the directory WINDOWS after the reset and type in WIN<ENTER>, Windows will be loaded. Although thanks to its high computing power, the ICP Controller is just right for disk intensive operating systems such as Windows, it will not show its full capacity yet. The reason for this is that the "communication" between Windows and the ICP Controller is not yet carried out by GDTX000.EXE, but by Windows' SMARTDRV driver.

(D) The steps in this section aim at removing SMARTDRV from the CONFIG.SYS and AUTOEXEC.BAT files, and at adding a few entries to the Windows initialization file SYSTEM.INI. Now, delete those lines from the CONFIG.SYS and AUTOEXEC.BAT files which contain SMARTDRV.EXE (one line in each file) using an editor such as EDIT for instance which is part of MS-DOS 5 and 6, or deactivate these lines by entering REM at their beginning. Then save and exit the files. Next, load the SYSTEM.INI file located in the WINDOWS directory into the editor and look for the entry [386Enh]. The following lines have to be inserted after this entry:

```
[386Enh]
EMMExclude=D000-D1FF (or according GDT DPMEM area)
VirtualHDIRq=off
DMABufferSize=128
```

Now save the file. In the line "EMMExclude=..." you have to enter the address area occupied by the GDT DPMEM.

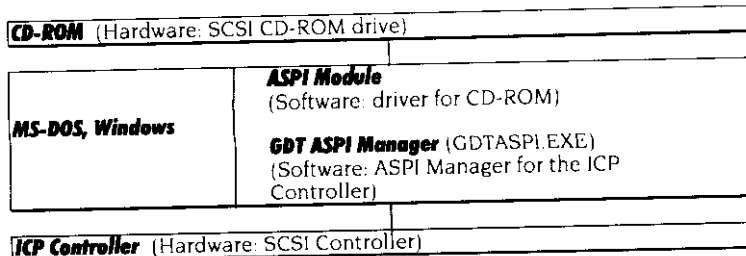
(E) Now do a warm reboot in order for the changes in the CONFIG.SYS the AUTOEXEC.BAT file to take effect.

(F) Now, change to the WINDOWS directory and type in WIN<ENTER>; Windows is loaded again and the installation is completed.

D.6 Using a CD-ROM Drive under MS-DOS or Windows 3.x

CD-ROM drives (as well as tape streamers, WORM drives and most MOD drives, too) belong to the category of the so-called **Not Direct Access Devices**. They **cannot** be installed with GDTSETUP or FDISK and FORMAT and they are not directly supported by MS-DOS or Windows - unlike, for example, hard disks and removable hard disks. To install and access these devices, a special standard, the so-called ASPI Standard (Advanced SCSI programming Interface), has been created. While the manufacturer of the controller (in this case ICP) has to offer the ASPI Manager, the manufacturer of the SCSI device (CD-ROMs etc.) has to provide an ASPI Module (note: there are some companies which have specialized in the development of ASPI modules, for example Core! Corp. with its product **core!SCSI**; the ICP Controller is certified by Core!). Both units, the SCSI controller and the SCSI device, communicate through this ASPI interface. It is not a hardware interface (like, for example, Centronics, SCSI or RS232), but a pure software interface. The following illustration explains this interface:





With the following two examples we demonstrate how to install a CD-ROM drive for use with the ICP Controller under MS-DOS and Windows. The installation differs slightly, depending on whether you use the corelSCSI software or the ASW software. Regardless of which software you choose to use, the ASPI manager of the ICP Controller (located on the *GDT System Disk - DOS*) has to be loaded from the CONFIG SYS file. The objective of both installations is to make the CD-ROM drive accessible as a drive (for example drive E) under MS-DOS or Windows, and to be able to access this drive just as if it were a (write-protected) floppy disk in drive A or B.

At this point we presume that the CD-ROM drive has been properly connected to the ICP Controller. This includes that the SCSI-ID and the SCSI bus terminators are set in accordance with the settings of the already existing SCSI devices (i. e., the SCSI-ID chosen for the CD-ROM drive is not occupied by another device; resistor terminators are located only at the two ends of the SCSI bus).

D.6.1 Example: Using the ASW Software for the CD-ROM

The important lines in both files are printed bold.

CONFIG.SYS

```
device=c:\windows\himem.sys
device=gdtx000.exe
files=30
buffers=30
stacks=9,256
dos=high,umb
shell=\COMMAND.COM /E:512 /P
device=\dos\setver.exe
device=\gdt\gdtaspi.exe
device=\aspi\aspicd.sys /D:CD-ROM
lastdrive=h
```

AUTOEXEC.BAT

```
path=c:\c\dos;c:\gdt;c:\aspi;
prompt $P -$G
doskey
c:\aspi\mscdex /D:CD-ROM
```

The GDTX000.EXE driver is loaded from the first line following the HIMEM.SYS command of the CONFIG.SYS file. Loading the SETVER driver (part of MS-DOS) allows older versions of Microsoft's CD-ROM translation program MSCDEX (loaded from AUTOEXEC.BAT) to run trouble-free with the MS-DOS version currently installed. The next line loads the GDT ASPI Manager GDTASPI.EXE. Next, the ASPICD module for the CD-ROM drive is loaded. The parameter "/D:CD-ROM" has nothing to do with a drive name, it only serves as a recognition



information for MSCDEX. As mentioned before, it is our objective to be able to access the CD-ROM drive with a drive name (i.e. E). Naturally, this drive name has to be "free", and there have to be enough drive names available. For example, the DOS command LASTDRIVE=H would enable the user to use drive names from A to H. In the AUTOEXEC.BAT file, the Microsoft translation program for CD-ROMs (MSCDEX - Microsoft CD-ROM Extension) is loaded. It is not part of MS-DOS (except for version 6). The parameter /D:CD-ROM set here has to be identical to the parameter set after the ASPICD module in the CONFIG.SYS file. After a warm reboot which serves to activate the changes made in the CONFIG.SYS and AUTOEXEC.BAT files, the CD-ROM drive can be accessed as drive E (in our example there are two SCSI hard disks in the PCI computer, and under MS-DOS they are accessed as C and D). Drive E can be accessed under Windows, too, now (the icon next to "E" indicates that it is a CD-ROM drive).

D.6.2 Example: Using corelSCSI for the CD-ROM

When using the corelSCSI software, the installation is carried out by a program (*install*) so that the changes in the files CONFIG.SYS and AUTOEXEC.BAT mentioned below are, to a large extent, made automatically. Under corelSCSI the SCSI/FAST-SCSI channels of the ICP Controller are available as independent host adapters. The important lines in both files are printed bold.

CONFIG.SYS

```
device=c:\windows\himem.sys
device=gdtx000.exe
files=30
buffers=30
stacks=9,256
dos=high,umb
shell=\COMMAND.COM /E:512 /P
device=\dos\setver.exe
device=\gdt\gdtaspi.exe
device=c:\corel\cuni_asp.sys /ID:6 /HAN:0 /N:1 /D:MSCD000
lastdrive=h
```

AUTOEXEC.BAT

```
path=c:\;c:\dos;c:\gdt;c:\aspi;
prompt SP -$G
c:\corel\corelcdx /M:8 /D:MSCD000
```

The first line following the HIMEM.SYS command of the CONFIG.SYS file loads the GDTX000.EXE. The next line loads the GDT ASPI Manager GDTASPI.EXE. Next, the corel ASPI Module for the CD-ROM drive is loaded. The parameter "/D:MSCD000" has nothing to do with a drive name, it only serves as recognition information for CORELCDX. As mentioned before, it is our objective to be able to access the CD-ROM drive with a drive name (i.e., E). Naturally, this drive name has to be "free", and there has to be enough drive names available. For example, the command LASTDRIVE=H would enable the user to use drive names from A to H under DOS. In the AUTOEXEC.BAT file, the corel translation program for CD-ROMs, CORELCDX, is loaded. The parameter /D:MSCD000 set here has to be identical to the parameter set after the ASPI Module in the CONFIG.SYS file. After a warm reboot which serves to activate the changes made in the CONFIG.SYS and AUTOEXEC.BAT files, the CD-ROM drive can be accessed as drive E (in our example there are two SCSI hard disks in the PCI computer, and under MS-DOS they are accessed as C and D). Drive E can be accessed under Windows, too, now (the icon next to "E" indicates that it is a CD-ROM drive). Information on the various CD-ROM drives which can be used can be obtained directly from Corel.



D.7 The GDT ASPI Manager GDTASPI.EXE

The GDT ASPI Manager GDTASPI.EXE allows you not only to run *Not Direct Access Devices* (e.g., CD-ROMs, tapes, MODs etc.), but to control hard disks and removable hard disks, too (the so-called *Direct Access Devices*). These devices are then no longer controlled by GDTSETUP but exclusively by the ASPI interface. The advantage is evident, in particular with regard to removable hard disks (for example SyQuest). When using an appropriate ASPI module to access these removable hard disks, for example ASPIDISK.SYS or UNI_ASP.SYS from Core!, you can exchange the media of these drives under DOS without having to use GDTSETUP. To the ASPI interface, the ICP Controller appears as one host-adapter. If there are more SCSI controllers (even if from various manufacturers) in the system and corresponding ASPI managers have been installed in the CONFIG.SYS file, you can determine a controller's host adapter number by using the GDT program **ASPISCAN.EXE**. In order to exclude that a *Direct Access Device* is run directly from the ICP Controller, it has to be reserved for the ASPI interface control. To do so, certain parameters have to be specified when the GDT ASPI manager is loaded.

DEVICE=GDTASPI.EXE /R:Hx1ly1[:Hx2ly2:Hx3ly3 ...]

| | |
|---------|---|
| H: | host adapter number |
| l: | SCSI ID of the SCSI device to be reserved |
| x1, y1: | host adapter number, SCSI ID of the first SCSI device to be reserved (in decimal form) |
| x2, y2: | host adapter number, SCSI ID of the second SCSI device to be reserved (in decimal form) |

Example: We assume that there is only one ICP Controller in the system. Two *direct access devices*, the SyQuest removable hard disk connected to channel A, ID 2, and the Quantum hard disk connected to channel B, ID 4, have to be reserved for the ASPI manager. The corresponding entry in the CONFIG.SYS is:

DEVICE=GDTASPI.EXE /R:H0I2:H1I4

Important note: SCSI devices reserved for the ASPI manager must not have been initialized with GDTSETUP. Neither must they pertain to a GDT Logical or Host Drive. If necessary, these devices can be de-initialized with GDTSETUP.

As already mentioned in paragraph 6 of this chapter, in addition to the ASPI manager an ASPI module has to be present in order to be able to access the SCSI device under MS-DOS with a drive name (e.g., D, E, etc.). In the following description you find how to install ASPI interface-reserved *direct access devices* with the ASW ASPI module ASPIDISK.SYS and the core!SCSI ASPI module UNI_ASP.SYS.

D.7.1 Using ASW ASPIDISK.SYS

Step 1: Include GDTX0000.EXE, GDTASPI.EXE with appropriate reservations (./R...), and ASPIDISK.SYS in the CONFIG.SYS file, then do a warm reboot (Ctrl+Alt+Del).

Step 2: Use the ASW program AFDISK.EXE to initialize the drive to be run through the ASPI interface.

Step 3: After the successful initialization, do a warm reboot (Ctrl+Alt+Del). The CONFIG.SYS will be similar to the following (the relevant entries are printed bold):

```
device=gdtx000.exe
files=30
buffers=30
stacks=9,256
```



```

shell=\COMMAND.COM /E:512 /P
device=\gdt\gdtxdos.exe
device=\gdt\gdtaspi.exe /R:H114
device=aspidisk.sys

```

Note: Drives run with ASPIDISK.SYS are not compatible with drives run with GDTSETUP.

D.7.2 Using corelSCSI

- Step 1:** Include GDTX0000.EXE, GDTASPI.EXE with appropriate reservations (./R:...) in the CONFIG.SYS file, then do a warm reboot (Ctrl+Alt+Del).
- Step 2:** Load corel's *Install* program and follow the instructions. Preferably, use *Express-Setup*.
- Step 3:** After the successful installation, do a warm reboot (Ctrl+Alt+Del).
- Step 4:** Using the corelSCSI program CFORMAT, format the drive to be run through the ASPI interface.

The CONFIG.SYS will be similar to the file below (the relevant entries are printed bold). The parameters following the corelSCSI driver refer to a particular configuration, they have automatically been added by the corelSCSI INSTALL program.

```

device=gdtx000.exe
files=30
buffers=30
stacks=9,256
shell=\COMMAND.COM /E:512 /P
device=\gdt\gdtxdos.exe
device=\gdt\gdtaspi.exe /R:H114
device=\coreldr\UNI_ASP.SYS /C:4 /D:4;;;1 /VOL:1 /DOS4 /SS:512 /@4:-98

```

Note: Drives run with corelSCSI and the UNI_ASP.SYS driver are neither compatible with drives run with GDTSETUP and the GDT cache nor with those run with the above mentioned ASPIDISK.SYS driver.



D.8 Installing Windows 95

This guide will take you through the process to install the files necessary to allow the controller to operate under Windows 95.

We differentiate three cases: The ICP controller is the primary controller, the ICP controller is the secondary controller, and the ICP controller is already installed under Windows 95 and its driver should be updated.

D.8.1 The ICP controller is the primary controller

You must create an **MS-DOS partition** on and **format** the drive to which Windows 95 is to be installed. You also need a **CD-ROM** that is fully accessible under MS-DOS.

1. Transfer the WIN95 files from the **ICP System CD** to a 3.5" floppy disk. The files are located in the directory, (your CD-ROM drive letter)\DRIVERS\WIN95. You will need this disk later in the Windows 95 Setup.
2. Power-on the system. Press **Ctrl+G** to enter the **GDTSETUP** program.
3. Select the controller - **<ENTER>**. Press **F2** to enter **Advanced Setup**.
4. Highlight **Configure Controller** - **<ENTER>**. Highlight **Controller Settings** - **<ENTER>**.
5. Highlight **Delayed Write** - **<ENTER>**. Highlight **OFF** - **<ENTER>**. Delayed write is now disabled. This is done to ensure all files are written immediately to the Host Drive during the Windows installation.
6. Press **Esc**. A message appears: "Do you want to save changes?" Press **<Y>**.
7. Install Windows 95 per instructions provided with the program.
8. After installation: double click **My Computer** icon. Double click the **Control Panel** icon.
9. Double click the **System** icon. Click the **Device Manager** tab.
10. Double click **Other Devices**. Double click **PCI SCSI Bus Controller**.
11. Click **Driver**. Click **Change Driver**. Double click **SCSI Controllers**.
12. Click **Have Disk**. Insert the ICP Windows 95 driver disk you created in step 1.
13. Click **OK**. Click **OK** again. Click **OK** again.
14. Click **Cancel**. **Never click Test. Windows 95 is unable to determine if the ICP BIOS can be removed. Using the Test option may cause the system to freeze.**
15. **Remove** the ICP Windows 95 driver disk. Restart the system.



Upon completion of the Windows 95 installation you will need to load the GDTMON program to Windows 95. The following steps will take you through this process.

1. Find the GDTMON.EXE file in the DRIVERS\WIN95 directory on the ICP System CD.
2. Copy GDTMON EXE to your Host Drive. Start the GDTMON program.
3. Press <ENTER> to select the Controller. Press <ENTER> to select the Protocol.
4. Press <ENTER> to select the Controller installed.
5. Highlight **View/Change Settings** and press <ENTER>.
6. Highlight **Cache Settings** and press <ENTER>.
7. Highlight **Delayed Write**. Use the space bar to toggle setting to **ON**.
8. Press <ENTER> two times. Delayed Write is now enabled.
9. Highlight **Save Information** and press <ENTER>.
10. Type the file name **ICP001** and press <ENTER>. *NOTE: This creates a "snapshot" of your system configuration. Anytime the configuration changes (i.e. add a new hard drive, hard drive failure, change system parameters, etc.) save the information again, using the ICP header for the file and the next higher number (i.e. ICP001, ICP002, ICP003, etc.). This information will be needed by ICP Technical Support personnel to assist you in troubleshooting problems with the controller.
11. Press **Esc** two times to exit the GDTMON program.

D.8.2 The ICP controller is the secondary controller

1. Transfer the WIN95 files from the **ICP System CD** to a 3.5" floppy disk. The files are located in the directory, (your CD-ROM drive letter)\DRIVERS\WIN95. You will need this disk later in the Windows 95 Setup.
2. In Windows 95 double click on **My Computer** icon. Double click **Control Panel** icon.
3. Double click the **System** icon. Click the **Device Manager** tab.
4. Double click **Other Devices**. Double click **PCI SCSI Bus Controller**.
5. Click **Driver**. Click **Change Driver**. Double click **SCSI Controllers**.
6. Click **Have Disk**. Insert the ICP Windows 95 driver disk you created in step 1.
7. Click **OK**. Click **OK** again. Click **OK** again.
8. Click **Cancel**. **Never click Test. Windows 95 is unable to determine if the ICP BIOS can be removed. Using the Test option may cause the system to freeze.**
12. Remove the ICP Windows 95 driver disk. Restart the system.



D.8.3 Update the ICP Windows 95 Driver

1. Download the **WIN95.EXE** file from the ICP web site (<http://www.icp-vortex.com>). This self-extracting file contains all the Windows 95 files you need.
2. Run **WIN95.EXE** to get the update files.
3. Format a 3.5" HD disk (1.44MB). **Copy** all Windows 95 files to this disk.
4. In Windows 95 double click on **My Computer** icon. Double click **Control Panel**.
5. Double click **System** icon. Click **Device Manager** tab.
6. Double click **SCSI controller** icon. Double click the **ICP Controller** shown.
7. Click **Driver** tab. Click **Change Driver**.
8. Click **Have Disk**. Insert the Windows 95 driver disk created in step 3.
9. Click **OK** until you reach a prompt to specify the location of the update files.
10. Select the drive where the update disk is located. Click **OK**.
11. When file copy is done, remove the update disk and click Yes.
12. After installation of the new driver, the system needs to **reboot** before the new settings will take effect.



Chapter E

Using OS/2



E. Using IBM OS/2 Version 2.x and Warp

After having exposed the installation of the ICP Controller in chapters B and C as well as that of the host-drives, we would now like to give you some hints and pieces of advice on how to install IBM's operating system OS/2 Versions 2.x and Warp. Furthermore, we explain how to install a CD-ROM drive (representatively standing for any other *Not Direct Access Device*) under OS/2.

E.1 Transparency of Host Drives

The structure of the Host Drives, which have been installed with GDTSETUP (in chapter C), is not known to OS/2. I.e., the operating system does not recognize that a given Host Drive consists of a number of hard disks forming a disk array. To OS/2, this Host Drive simply appears as one single hard disk with the capacity of the disk array. This complete transparency represents the easiest way to operate disk arrays under OS/2; neither OS/2 nor the PCI computer need to be involved in the administration of these complex disk array configurations.

E.2 Preparing the Installation

Under OS/2, the ICP Controller can be operated in two different ways. It is either run by GDT's BIOS (INT13H interface), or, alternatively, by the high performance driver GDTX000.ADD (located on the GDT OS/2 disk). Correspondingly, there are two different ways of installing OS/2 with the ICP Controller. At this point we would like to stress that only by using the high performance GDTX000.ADD driver can the ICP Controller unfold its full capacity under OS/2. We therefore recommend this operating mode. In order to be able to use the GDTX000.ADD from the very beginning of the installation it has to be copied to the OS/2 diskette #1. We recommend the following procedure:

Step 1: With MS-DOS (using DISKCOPY for example), create a copy of the OS/2 diskette #1.

Step 2: Copy GDTX000.ADD (using the COPY command) into the root directory of this new floppy disk. To get sufficient free space on OS/2 diskette #1, it may be necessary to erase some files which are not needed for the installation procedure (for example not needed *.ADD files)

Step 3: Insert the following line into the OS/2 CONFIG.SYS file of your DISK 1 copy:

```
BASEDEV=GDTX000.ADD /V
```

The position of the entry is irrelevant.

E.3 Carrying out the Installation

As the OS/2 installation takes quite a long time, we suggest having a closer look at the **OS/2 installation manual**. During the installation you will be prompted to answer several questions, for example whether you want to copy OS/2 on an already existing MS-DOS partition, or whether you want OS/2 to have its own partition, or whether you want to install the OS/2 Boot-Manager, etc. . After having decided on these options, you can start the installation beginning with DISK 1 of the copy set you have previously created. The OS/2 installation itself is carried out according to the OS/2 installation program. After having completed the installation, you should check that the OS/2 CONFIG.SYS file created during the OS/2 installation contains the following line:



```
BASEDEV=GDTX000.ADD /V
```

and that the driver GDTX000.ADD is either in the OS/2 or the root directory:

```
GDTX000.ADD          or
\OS2\GDTX000.ADD
```

If this line is missing you have to add it to your CONFIG.SYS file. If the GDT driver GDTX000.ADD is not in the OS/2 or root directory, copy it there.

E.4 Using a CD-ROM Drive under OS/2

If OS/2 has been installed from an OS/2 CD, you may skip this chapter as well as chapters E.4.1 and E.4.2. A CD-ROM drive (standing for any other Not Direct Access Device) can be accessed under OS/2 either directly through the OS/2 driver **OS2SCSI.DMD**, or the OS/2 ASPI Manager **OS2ASPI.DMD**, or, for example, through corelSCSI for OS/2. We presume that the CD-ROM drive has been properly connected to the ICP Controller. This includes that the SCSI-ID and the SCSI bus terminators are set in accordance with the settings of the already present SCSI devices (i. e., the SCSI-ID set for the CD-ROM drive is not occupied by another device; resistor terminators are located at the two ends of the SCSI bus only).

E.4.1 Installation with OS2SCSI.DMD

Step 1: Click the OS/2 *System* icon on the OS/2 Presentation Manager. Then select "System Setup" and then "Selective Install".

Step 2: Confirm the system configuration with "OK".

Step 3: Now click "CD-ROM Device Support" in the window opening and select the CD-ROM drive. Hereafter click "OK".

Step 4: Click *Install* now and the installation begins. The system will ask you to insert further OS/2 system disks or select an appropriate path on the hard disk.

Step 5: After the installation is completed and OS/2 is started again, the CD-ROM drive can be accessed.

E.4.2 Installation with OS2ASPI.DMD

Step 1: Add the following line to the CONFIG.SYS file, using, for example, the OS/2 system editor:

```
BASEDEV=OS2ASPI.DMD
```

Step 2: Now the driver GDTX000.ADD has to be configured in a manner that allows only the ASPI Manager to access the CD-ROM drive (identified by its SCSI-ID, which in our example is SCSI-ID 6):

```
BASEDEV=GDTX0000.ADD /V /A:0 /AM:(0,6)
```

(an exact description of the command line switches can be found in the next chapter, E.5).

Step 3: Now install the corelSCSI software from the corelSCSI OS/2 floppy disk.

Step 4: After the restart of OS/2, the CD-ROM drive can be accessed.



E.5 Command Line Switches of GDTX000.ADD

The GDTX000.ADD driver can be configured with the following command line switches. The names of the switches are IBM OS/2 compliant. The descriptions given in brackets ([,]) are optional. The "!" inverts the following function.

BASEDEV=GDTX000.ADD [/V] [/A:d] [/(!)DM...] [/(!)SM...] [/(!)AM...] [/NOSCAN] [/(!)UT] [R:...]

| | |
|------------------|---|
| /V | Verbose (only possible as first parameter) Display logo/error messages on screen. |
| /A:d | All the following options until the next /A:d are valid for adapter d. All adapters are numbered starting with 0. |
| /(!)DM... | Switch for supporting a Direct Access (SCSI) Device-Manager (i.e.: OS2DASD.DMD) |
| /DM | Support Host-Drives (Standard) |
| /DM:d | Support Host-Drive d as a hard disk (default if no CD-ROM is present) |
| /DM:(d,e) | Support SCSI device (Bus d, SCSI-ID e) as a hard disk (default for SCSI type 0: DASD) |
| /(!)SM... | Switch for supporting a SCSI-Manager (i.e.: OS2SCSI.DMD) |
| /SM | Support SCSI devices (default) |
| /SM:d | Support Host-Drive d as SCSI device (default if d is a cached CD-ROM) |
| /SM:(d,e) | Support SCSI device (Bus d, SCSI-ID e) as SCSI device (default for all SCSI types except 0: DASD) |
| /(!)AM... | Switch for supporting an ASPI-Manager (i.e.: OS2ASPI.DMD) |
| /AM | Support SCSI devices (OS2ASPI.DMD) |
| /AM:d | Support Host-Drive d as ASPI-Device |
| /AM:(d,e) | Support SCSI device (Bus d, SCSI-ID e) as ASPI-Device |
| /NOSCAN | Scans the SCSI channels only for these devices, which are configured through the "/DM", "/SM", "/AM" or "/R" switches. |
| /(!)UT | Ignores special time-out values of a certain application, but always uses the GDTX000.ADD settings. Some backup programs use time-out values that are too short. |
| /R:(d,e) | Reserve a SCSI device (channel d, SCSI-ID e) as a raw device, which is directly operated through OS/2 (the data are not cached by the GDT cache). This SCSI- device must not be initialized with GDTSETUP (it may need to be de-initialized). |

If reciprocally exclusive options have been selected, the one set last is effective.



Chapter F

Using NetWare



F. Using Novell NetWare

After having explained in chapters B and C the installation of the ICP Controller as well as that of the host-drives, we would now like to give you some hints and pieces of advice on how to install Novell's operating system Novell NetWare. We shall mainly focus on NetWare 3.x and NetWare 4.x. For successful installation, it is essential to study the NetWare system manuals thoroughly. The information given in this chapter refers to the loading of the GDT NetWare driver only.

F.1 Transparency of Host Drives

The structure of the Host Drives, which have been installed with GDTSETUP (in chapter C), is not known to NetWare. I.e., the operating system does not recognize that a given Host Drive consists of a number of hard disks forming a disk array. To NetWare, this Host Drive simply appears as one single hard disk with the capacity of the disk array. This complete transparency represents the easiest way to operate disk arrays under NetWare; neither NetWare nor the PCI computer need to be involved in the administration of these complex disk array configurations.

F.2 Novell NetWare 3.10, 3.11 and 3.12

The ICP Controller and the Host Drives previously configured with GDTSETUP are integrated by means of GDT's driver software located on the GDT *Novell NetWare* disk. The driver belongs to the category of so-called NLMs (NetWare Loadable Module).

| | |
|--------------|-------------------|
| GDTRP310.DSK | for NetWare 3.10 |
| GDTRP311.DSK | for NetWare 3.11 |
| GDTRP312.DSK | for NetWare 3.12 |
| ASPITRAN.DSK | ASPI manager |
| CTRLTRAN.DSK | Module for GDTMON |

(Note: More information about the GDTMON diagnosis tool can be found in a separate chapter of this manual.). The installation of the fileserver itself is carried out following the Novell NetWare documentation. According to your NetWare version, copy the appropriate driver, the GDT ASPI Manager ASPITRAN.DSK and the GDT CTRLTRAN.DSK module to the boot disk or the DOS boot partition. During installation type in,

```
:LOAD GDTRP310 <ENTER>      (NetWare 3.10)      or
:LOAD GDTRP311 <ENTER>      (NetWare 3.11)      or
:LOAD GDTRP312 <ENTER>      (NetWare 3.12)
```

The GDT ASPI Manager ASPITRAN.DSK and the CTRLTRAN.DSK module will then be automatically loaded by the GDT driver (GDTRP310, GDTRP311 or GDTRP312). If more ICP Controllers are installed in the fileserver (i.e., for controller duplexing), the above mentioned driver has to be called upon several times. But as it is re-entrant, it is only loaded once. A single ICP Controller can be chosen by selecting its PCI slot number.

F.3 Novell NetWare 4.x

The ICP Controller and the Host Drives previously configured with GDTSETUP are integrated by means of GDT's driver software located on the GDT *Novell NetWare* disk. The driver belongs to the category of the so-called NLMs (NetWare Loadable Module).



GDTRP400.DSK
 ASPITRAN.DSK
 CTRLTRAN.DSK

for NetWare 4.x
 ASPI manager
 Module for GDTMON

(Note: More information about the GDTMON diagnosis tool may be found in a separate chapter in this manual.)

The official release for ICP HAM-drivers is scheduled for Q2/98. There is already a beta-package available on our Website.

if you wish to install NetWare 4.x from a CD-ROM, you first have to set up the CD-ROM drive under MS-DOS, following the instructions given in chapter D, section D.6. Then install NetWare following the instructions in the NetWare documentation. During the installation, the NetWare installation program asks you which hard disk driver you want to load, showing a list of available drivers. As the GDT driver is not part of this list yet, you have to boot it from the floppy disk: insert the GDT Novell NetWare disk into the floppy drive. Now, select the drivers GDTRP400, ASPITRAN and CTRLTRAN. Complete the installation according to the instructions given by the NetWare installation program. Naturally you can also load the GDT driver directly from the system console, just as with NetWare 3.x:

```
:LOAD GDTRP400 <ENTER>
```

(ASPITRAN.DSK and CTRLTRAN.DSK will be loaded automatically). If more ICP Controllers are installed in the fileserver (i.e., for controller duplexing), the above mentioned driver has to be called upon several times. But as it is re-entrant, it is only loaded once. A single ICP Controller can be chosen by selecting its PCI slot number.

F.4 Tips and Tricks

F.4.1 Optimize Data Throughput

High performance RAID controllers are designed for multi-I/O operations and are capable of processing several I/Os simultaneously. Especially cache controllers with powerful on-board RISC CPUs can handle several hundred I/Os per second. NetWare offers the option of adjusting the number of write I/Os which are loaded on the mass storage subsystem. In order 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, this 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 disks. The ICP Controllers 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.



F.4.2 '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 MByte. The command 'Register Memory' allows the registration of memory above 16 MByte.

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. In order to carry out this process, the disk driver has to be removed from the startup.ncf and inserted into the autoexec.ncf in the DOS partition. In this case, the disk driver has to be loaded directly after the Register Memory command. An example of an autoexec.ncf file:

```
register memory 1000000 1000000
LOAD C:GDTRP312
```

In addition, a further start file can be loaded on the SYS volume for differentiation, e.g., with the name 'autonet.ncf'.

F.4.3 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 - forever. This problem only occurs when the CD-ROM drive's name under MS-DOS is 'cdrom', i.e., the config.sys/autoexec.bat contains the following files:

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

To avoid this problem, simply change the CDROM's name in DOS to another name, i.e., use '/D:scsicc' instead of '/D:cdrom'.

F.4.4 NetWare-Server Not Stable When High Utilization

High server utilization, combined with a large number of applications running on the server often leads to the following problem: The number of 'Dirty Cache Buffers' increases tremendously and the server is then not stable. In order to avoid this situation, the following parameters should be modified:

1. 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 disks.

2. Decrease the delayed write standard parameter:

```
set dirty disk cache delay time
```



This parameter sets the time whereafter 'dirty buffers' are written (flushed) from the cache of NetWare to the hard disk. The minimum value is 0.8 seconds which influences the server performance substantially. Therefore, care should be taken not to go below 0.8 seconds.

F.4.5 ICP Controller and Non-ASPI Compatible Controllers

If an ICP Controller is operated under NetWare together with a further controller / host-adaptor 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 (GDT, 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 file ASPITRAN.DSK can be deactivated via a modification.

Please note: After this modification, no other Raw Devices (tapes, CD-Roms) are recognized on the GDT (Adaptec,...).

In order to deactivate ASPITRAN.DSK, the string 'ASPI_Entry' has to be found by using a Disk-Monitor in ASPITRAN.DSK (please pay attention to capitals etc). This string is then modified, e.g., by replacing 'A' with an 'X' (i.e., 'XSPI_Entry').

This modified ASPITRAN.DSK enables the operation of Raw Devices on the non-ASPI-compatible Controllers.

F.4.6 Last Status Information

All ICP Controllers temporarily store the status information from all hard disks which are connected. This information can be very 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 GDTMONitor or can be saved in a SAVE INFORMATION ASCII file. The information is temporarily available in the ICP Controller'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. The most important Last-Status codes are described in this manual, a more detailed description can be found in the files LASTSTAT.PDF (Adobe Acrobat format) or LASTSTAT.TXT (ASCII format) at the ICP vortex Website (<http://www.icp-vortex.com>).

F.4.7 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. In order 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.

F.5 Notes on ARCserve

Please make sure that you always have the latest version of your ARCserve software. The back-up program ARCserve can be used in connection with the ICP Controller. The communication between the tape device (for example DAT, DLT) and the ICP Controller takes place through the ASPI interface. For this purpose, the GDT ASPI Manager ASPITRAN.DSK is needed. When loading the regular GDT NetWare driver (for example GDTRP311.DSK), the ASPI Manager is automatically loaded, too. During the installation of ARCserve, choose **Adaptec ASPI Manager** as interface.



Chapter G

Using SCO UNIX



G. Using SCO UNIX V/386

After having explained in chapters B and C the installation of the ICP Controller as well as that of the Host Drives, we would now like to give you a few hints regarding the installation of the operating systems

SCO UNIX V/386 3.2v4.x, 3.2v5.x (Open Server)

For successful installation, it is essential to read the SCO system manuals thoroughly.

G.1 Transparency of Host Drives

The structure of the Host Drives, which have been installed with GDTSETUP (in chapter C), is not known to UNIX. I.e., the operating system does not recognize that a given Host Drive consists of a number of hard disks forming a disk array. To UNIX this Host Drive simply appears as one single hard disk with the capacity of the disk array. This complete transparency represents the easiest way to operate disk arrays under UNIX; neither UNIX nor the PCI computer need to be involved in the administration of these complex disk array configurations.

G.2 General Tips for Installation

In the following description, we shall explain the installation of SCO UNIX V/386 3.2v4.x and 3.2v5.x step by step in connection with the ICP Controller. Apart from the SCO UNIX floppy disks and the SCO UNIX documentation, you also need the GDT floppy disks

GDT SCO UNIX BTLD-Disks for 3.2v4.x, 3.2v5.x

for the installation. In the following discussion, when we speak of a *boot drive* we refer to the drive which is first integrated upon system power up. For the ICP Controller this drive is the first Host Drive in the list of GDT Host Drives, i. e., the Host Drive number 0 (see GDTSETUP menu *Configure Host-Drives*). During the installation you will have to decide whether you want the ICP Controller to make the boot drive available, or whether you want to operate the ICP Controller as an additional controller in the computer system. If the ICP Controller is the only hard disk controller in the computer system, it will automatically make the boot drive available. If there are more hard disk controllers, the controller which makes the first drive available (the drive containing the MS-DOS partition C:) will be the boot controller.

In principle, SCO UNIX is always installed on the hard disk with Target ID 0 and LUN 0 on host adapter 0, that is on Host Drive 0 of this controller. If SCO UNIX is installed from tape (streamer) the streamer must have SCSI ID 2 and be connected to SCSI channel A of host adapter 0. For an installation from CD-ROM, the CD-ROM device must have SCSI-ID 5 and has to be connected with channel A of the ICP Controller.



When using 3.2v4.x or 3.2v5.x, you have the option to link the driver to the kernel before starting the kernel (*btld* (ADM)). This will allow you to use the ICP Controller as the only controller in the system. Use the GDT BTLD Disk. During the installation, whenever the N1 floppy disk is inserted and the message

Boot

is displayed, do not press <ENTER> immediately, but type in *link* <ENTER>. The system will then prompt you for the name of the BTLD driver. Now type in *gdth*. It may be necessary to type in the complete boot string. In this case, you have to add the following command:

```
link=gdth btld=fd(xx)
```

where *xx* is the "Minor Device Number" of the corresponding device file: *xx* = 60 for fd0135ds18, 3.5" floppy as A.; or *xx* = 61 for fd1135ds18, 3.5" floppy as B: (see SCO UNIX system Administrator's Reference, Hardware Dependence, floppy devices). When requested, enter the IRQ which has been assigned to the PCI INT of the ICP Controller (see chapter B, Hardware Installation). In addition, the GDT BIOS must not be disabled and the boot drive must be connected with the ICP Controller having the lowest PCI slot number. When the UNIX installation has been completed, the driver is installed, too, and you may install further devices with *mkdev hd* (ADM).

If the ICP Controller is an additional controller, the installation of the driver is carried out with *installpkg*.

6.3 Instructions on *mkdev* (ADM) for 3.2v4.x

Whenever the program *mkdev hd* (ADM) is started, you will be asked for the coordinates of the device you wish to install. The driver does not automatically display all devices connected, so after the installation you will find a tool named **GDTSCAN** in the directory */etc*. The scanning can take up to several seconds, especially when there is more than one controller in the system. The devices are displayed together with their host adapter number, target-ID and LUN. These values are to be used in *mkdev* (ADM). Let's have a brief look at how the HA-no., target-ID and LUN are determined. Please note that the UNIX driver always maps the first detected Host Drive with target-ID 0, LUN 0. Exactly this drive would be used as a boot drive when the ICP Controller is to make the boot drive available.

Host adapter Number (HA)

The host adapter number assigned to the ICP Controller is derived from the PCI slot number of the ICP Controller. Therefore, if there is only one ICP Controller installed in the PCI bus computer system, the host adapter number=0. If there are two ICP Controllers installed, the ICP Controller with the lower PCI Slot number is assigned host adapter number 0 and the ICP Controller with the higher PCI slot number is assigned host adapter 1. (Note: After a cold boot, the GDT BIOS displays a couple of messages, each beginning with the controller's PCI slot number, e.g. "[PCI 0/3] 4 MB RAM detected". The number after the */* is the slot number of the controller. This helps you to determine which is the order of the ICP Controllers and which host adapter number is assigned to them by UNIX. See also chapter B, Hardware Installation).

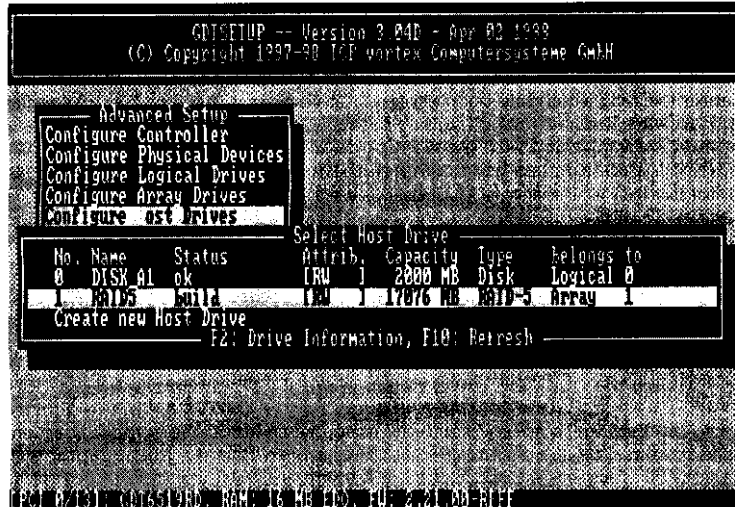


UNIX Target-ID and LUN

Target-IDs 0 and 1 with LUN 0 to 7 are reserved for "Direct Access Devices" (devices behaving like a hard disk or a removable hard and therefore configurable with GDTSETUP). There is a correlation between the Host Drive number GDTSETUP assigns (menu *Configure Host Drives*), and the assigned target-ID and LUN:

$$\text{Host-Drive Number} = 8 * \text{Target-ID} + \text{LUN}$$

The Host Drive number is the number the drive is given in the list of available Host Drives in the GDTSETUP program. The following exemplary screen shows a list of Host Drives. In this example, there are two Host Drives installed.



Therefore, the first Host Drive has target-ID 0 / LUN 0 and the second target-ID 0 / LUN 1. The formula for determining target ID and LUN from the existing Host Drive numbers yields the following possible combinations for "Direct Access Devices":

| Host Drive number | Target ID | LUN | Host Drive number | Target ID | LUN |
|----------------------|-----------|-----|----------------------|-----------|-----|
| 0 | 0 | 0 | 8 | 1 | 0 |
| 1 | 0 | 1 | 9 | 1 | 1 |
| 2 | 0 | 2 | 10 | 1 | 2 |
| 3 | 0 | 3 | 11 | 1 | 3 |
| 4 | 0 | 4 | 12 | 1 | 4 |
| 5 | 0 | 5 | 13 | 1 | 5 |
| 6 | 0 | 6 | 14 | 1 | 6 |
| 7 | 0 | 7 | 15 | 1 | 7 |

This conversion is necessary because the single SCSI devices are not declared to the host operating system in the order of their SCSI-IDs anymore, but according to the Host Drive numbers they have in GDTSETUP. Host Drives are a prerequisite for the ICP Controller to be able to link several SCSI devices to form a higher structure (i.e., RAID 5).

The sequence of the single Host Drives can be changed very easily by having GDTSETUP sort them in its *Configure Host Drives* menu. In this way, it is also possible to change the boot



drive (it had previously been selected as boot drive because it has the lowest drive number, that is, 0, and is therefore the first drive to be communicated to the system).

Target ID and LUN of **"Not Direct Access Devices"** (devices such as streamers, tapes, CD-ROMS, etc., not configurable with GDTSETUP) are determined on the basis of the SCSI-ID and the SCSI channel used by the ICP Controller. These devices can only be configured with SCSI-IDs 2 to 6. SCSI-ID 0 and 1 are reserved for hard disks, SCSI-ID 7 for the ICP Controller. If "Not Direct Access Devices" are configured on SCSI-ID 0 or 1, they are not recognized during the scanning process and can therefore not be used. The Target IDs of *Not Direct Access Devices* are identical to their SCSI-ID, the LUN depends on the SCSI channel used (LUN 0 for SCSI channel A and LUN 4 for SCSI channel B). Note: After a cold boot the GDT BIOS displays all connected devices with their physical coordinates, i. e. their SCSI-ID and SCSI-LUN, (see "Chapter B, ICP Controller Function Check").

| SCSI-ID of Not Direct Access Devices | Used GDT SCSI channel | UNIX Target ID | UNIX LUN |
|---|------------------------------|-----------------------|-----------------|
| 2 | A | 2 | 0 |
| 3 | A | 3 | 0 |
| 4 | A | 4 | 0 |
| 5 | A | 5 | 0 |
| 6 | A | 6 | 0 |
| 2 | B | 2 | 4 |
| 3 | B | 3 | 4 |
| 4 | B | 4 | 4 |
| 5 | B | 5 | 4 |
| 6 | B | 6 | 4 |

Having to determine the Target ID and LUN in such a complicated manner might seem rather awkward. However, it is necessary to do so because the ICP Controllers have more than one SCSI channel, whereas UNIX can only manage host adapters with one SCSI channel. Therefore, the GDT UNIX driver has to make the appropriate transformations.

Configuration Example:

In the PCI computer are two ICP Controllers (HA 0 = 1st GDT, HA 1 = 2nd GDT), each with two SCSI channels.

1 hard disk as Host Drive no. 0 on HA0
 1 hard disk as Host Drive no. 0 on HA1
 1 hard disk 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 A of HA0
 1 DAT SCSI-ID 2, LUN 0 on SCSI channel B of HA1

Result:

| HA | Target-ID | LUN | Device |
|----|-----------|-----|--|
| 0 | 0 | 0 | 1 st hard disk, Host Drive no. 0 (boot- and installation drive) |
| 0 | 2 | 0 | Streamer |
| 0 | 3 | 0 | CD-ROM |
| 1 | 0 | 0 | hard disk, Host Drive no. 0 |
| 1 | 0 | 1 | hard disk, Host Drive no. 1 |
| 1 | 2 | 4 | DAT |



G.4 Instructions on *mkdev* (ADM) for 3.2v5.x (Open Server)

Whenever the program *mkdev hd* (ADM) is started, you will be asked for the coordinates of the device you wish to install. The driver does not automatically display all devices connected, so after the installation you will find a tool named **GDTSCAN** in the directory '/etc'. The scanning can take up to several seconds, especially when there is more than one controller in the system. The devices are displayed together with their host adapter number, target-ID and LUN. These values are to be used in *mkdev* (ADM). Let's have a brief look at how the HA-no., target-ID and LUN are determined. Please note that the UNIX driver always maps the first detected Host Drive with target-ID 0, LUN 0. Exactly this drive would be used as a boot drive when the ICP Controller is to make the boot drive available. As an alternative for the following "new" mapping method of SCO UNIX V/386 3.2v5.x, you may also use the mapping as described in section G.3 (for 3.2v2.0 & 3.2v4.x). To enable this ("old") mapping, change in the

```
/etc/conf/pack.d/gdth/space.c
gdth_mapping=1          into
gdth_mapping=0
```

Host adapter Number (HA)

The host adapter number assigned to the ICP Controller is derived from the PCI slot number of the ICP Controller. Therefore, if there is only one ICP Controller installed in the PCI bus computer system, the host adapter number=0. If there are two ICP Controllers installed, the ICP Controller with the lower PCI Slot number is assigned host adapter number 0 and the ICP Controller with the higher PCI slot number is assigned host adapter 1. (Note: After a cold boot, the GDT BIOS displays a couple of messages, each beginning with the controller's PCI slot number, e.g. "[PCI 0/3] 4 MB RAM detected". The number after the '/' is the slot number of the controller. This helps you to determine which is the order of the ICP Controllers and which host adapter number is assigned to them by UNIX. See also chapter B, Hardware Installation).

UNIX Target-ID and LUN

Target-IDs and LUNs for "Not Direct Access Devices" (devices like streamers, tapes and CD-ROMs and therefore not configurable via GDTSETUP), are directly assigned to the SCSI-ID and the channel of the ICP Controller. 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 ICP Controllers (HA 0 = 1st GDT, HA 1 = 2nd GDT), each with two SCSI channels.

| | |
|-------------|---|
| 1 hard disk | as Host Drive no. 0 on HA0 |
| 1 hard disk | as Host Drive no. 0 on HA1 |
| 1 hard disk | 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 |



Result:

| HA | Bus | Target-ID | LUN | Device |
|----|-----|-----------|-----|---|
| 0 | 0 | 0 | 0 | 1 st hard disk, Host Drive no. 0 (boot drive) |
| 0 | 0 | 2 | 0 | Streamer |
| 0 | 1 | 3 | 0 | CD-ROM |
| 1 | 0 | 0 | 0 | hard disk, Host Drive no. 0 |
| 1 | 0 | 1 | 0 | hard disk, Host Drive no. 1 |
| 1 | 0 | 2 | 0 | DAT |
| 1 | 0 | 3 | 0 | hard disk, Host Drive no. 2 |

Important Note: 'Not Direct Access Devices' must not be connected to Bus 0, Target-ID 0, LUN 0. This is reserved for the boot device under SCO Unix 3.2V5.0

6.5 Further Information

- From version 4.x of SCO UNIX V/386 3.2, a media change can be made with the UNIX commands **MOUNT** and **UNMOUNT**. Please make sure that the removable hard disk keeps its GDTSETUP drive number when changing the media, otherwise a separate ID/LUN entry is necessary for each single media (since the drive number depends on the media and not the device containing it).
- SCO UNIX V/386 3.2v4.x and later versions support a maximum of 4 ICP Controllers in one computer system.
- The tool **GDTSYNC** in the directory '/etc' carries out a UNIX SYNC command (update super block) and causes all buffers still present in GDT's cache to be written to the Logical Drives. It is advisable to use this tool before shutting down the system.
- When using *Direct Access Devices* with **exchangeable media** (e.g., removable hard disks), a media has to be inserted when the system is booted, otherwise the device is not available under UNIX.
- "Not Direct Access Devices" (streamer, tapes, CD-ROMs, etc) can be switched on even after system power up, they will still be recognised by **GDTSCAN** afterwards.



Chapter H

Using Interactive UNIX



H. Using Interactive UNIX

After having explained the installation of the GDT Host Drive in chapters B and C as well as that of the Host Drives, we would now like to give you a few hints regarding the installation of the operating systems

Interactive UNIX V/386 3.2v3 and 3.2v4.

For successful installation, it is essential to read the Interactive system manuals thoroughly. Besides the Interactive UNIX disks and documentation, the following GDT disks are needed (they may be downloaded from our BBS or Website):

GDT Interactive UNIX 3.2v3&4 for sysadm
GDT Interactive UNIX 3.2v4 - for boot installation
 (only for Interactive UNIX 3.2v4 and the boot installation)

H.1 Transparency of Host Drives

The structure of the Host Drives, which have been installed with GDTSETUP (in chapter C), is not known to UNIX. I.e., the operating system does not recognize that a given Host Drive consists of a number of hard disks forming a disk array. To UNIX, this Host Drive simply appears as one single hard disk with the capacity of the disk array. This complete transparency represents the easiest way to operate disk arrays under UNIX; neither UNIX nor the PCI computer need to be involved in the administration of these complex disk array configurations.

H.2 Installation as an additional Controller

Install the driver software with the help of *sysadm*, using the menu options *Software, Install a package*. (The driver software for Interactive UNIX is on the **GDT Interactive UNIX floppy disk**). Now specify the drive containing the driver disk and select the floppy disk type (720KB) (reading the floppy disk can take some time). During installation, a GDT driver corresponding to the IRQ used by the ICP Controller has to be selected. As discussed in chapter B of this user's manual, the PCI System BIOS automatically assigns an IRQ to a PCI INT. The IRQ used by a ICP Controller is displayed by the GDT BIOS after a cold boot. After having successfully completed the installation of the GDT driver, you may introduce another GDT Host Drive into the system by using *kconfig* and its menu options *Configure, HPDD, Reconfigure HPDD*. In the next menu you enter the connected SCSI devices (type of device, SCSI-ID and LUN). After this, link a new kernel in *kconfig* by using *Build, Build a kernel*, then install with *Install*. At the next system reboot, the GDT displays a screen listing all its connected devices. Connected tapes are instantly ready for use, they can be accessed immediately with programs such as *mt* for rewinding, deletion etc. Host Drives have to be prepared with *sysadm* first, using the options *Disk, Fixed Disk Management, Add a Fixed Disk to the system* (Partition Disk and Create UNIX Partitions), and *mount* to connect the file systems. Please note that the hard disks must have been prepared (initialized) before with GDTSETUP (the DOS configuration-program on the System Disk - DOS), and the Host Drives must have been defined.

H.3 Installation as Boot Controller

First initialize a hard disk connected to the ICP Controller (using GDTSETUP under DOS), and install it as a Host Drive (see chapters C and I "Configure Host Drives"). The Host Drive



on which you wish to install the interactive UNIX system must be assigned number 0 (GDTSETUP menu option *Configure Host Drives*). Now you can start the installation procedure. During installation, a GDT driver corresponding to the IRQ used by the ICP Controller has to be selected. As discussed in chapter B of this user's manual, the PCI System BIOS automatically assigns an IRQ to a PCI INT. The IRQ used by a ICP Controller is displayed by the GDT BIOS after a cold boot. After having successfully installed the basic interactive system, use *InstallPkg* to install the software package *OS File Management*, *kernel Configuration*, and afterwards the GDT driver software. After having installed other desired software, choose the menu option *kconfig* to configure the ICP Controller as boot controller and to enter any other device connected to it. Then, a new kernel must be linked and installed (see above). After *Exit* and a system reboot, you can partition and mount Host Drives with *sysadm* (see above). You can integrate the GDT driver into the kernel of the copy of the boot disks in two different ways:

a) There is already a bootable system on another computer

In this case, the easiest method is to install the driver software for the ICP Controller on this system and to link a kernel containing the ICP Controller as boot controller (see above). Then copy this kernel to the Interactive boot disk copy. This can be easily done since this floppy disk contains a mountable file system. You can then start the installation with this boot disk. Make sure that the controller's IRQ is set according to the entry in *kconfig*.

b) There is no bootable system available.

For interactive UNIX 3.2v4, only.

When using this UNIX version, you have to use the GDT Interactive disk called GDT Interactive UNIX 3.2v4 - for boot installation. The installation is carried out according to the Interactive UNIX 3.2v4 documentation.

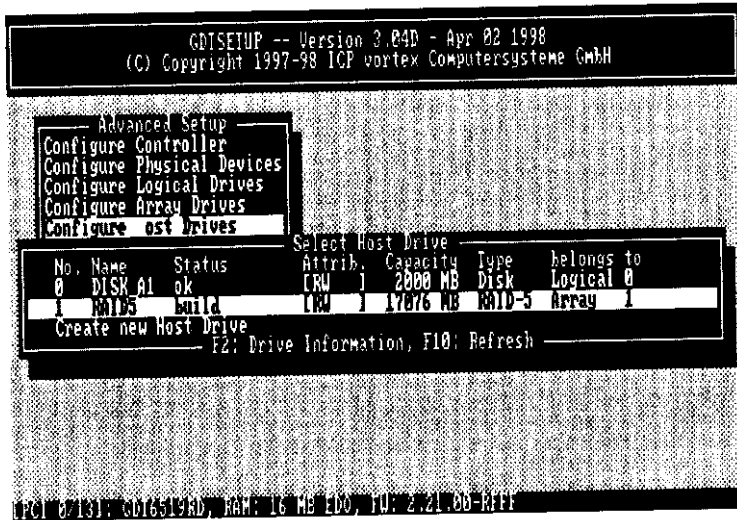
H.4 UNIX Target-ID/LUN of a Host Drive Number

Target-IDs 0 and 1 with LUN 0 to 7 are reserved for "**Direct Access Devices**" (devices behaving like a hard disk or a removable hard disk and therefore configurable with GDT-SETUP). There is a fixed correlation between the Host Drive number in GDTSETUP (menu "Configure Host Drives") and the target-ID and LUN. When a host-drive has been installed with GDTSETUP, it has to be communicated to the UNIX system (in *kconfig*) by assigning a target-ID and LUN which are determined with the following formula:

$$\text{Host-Drive Number} = 8 * \text{Target-ID} + \text{LUN}$$

The host-drive number is the number the drive has in the list of available host drives in the GDTSETUP program. The following exemplary screen shows a list of host drives in which two host drives are installed.





Therefore, the first Host Drive has target-ID 0 / LUN 0 and the second target-ID 0 / LUN 1. The formula for determining target ID and LUN from the existing host-drive numbers yields the following possible combinations for "Direct Access Devices":

| Host Drive number | Target ID | LUN | Host Drive No. | Target ID | LUN |
|----------------------|-----------|-----|-------------------|-----------|-----|
| 0 | 0 | 0 | 8 | 1 | 0 |
| 1 | 0 | 1 | 9 | 1 | 1 |
| 2 | 0 | 2 | 10 | 1 | 2 |
| 3 | 0 | 3 | 11 | 1 | 3 |
| 4 | 0 | 4 | 12 | 1 | 4 |
| 5 | 0 | 5 | 13 | 1 | 5 |
| 6 | 0 | 6 | 14 | 1 | 6 |
| 7 | 0 | 7 | 15 | 1 | 7 |

This conversion is necessary because the single SCSI devices are not declared to the host operating system in the order of their SCSI-IDs, but according to the host-drive numbers of GDTSETUP. The ICP Controller needs host-drives in order to be able to link several SCSI devices to form a higher structure (i.e., RAID 5). The sequence of the single host-drives can be changed very easily by having GDTSETUP sort them in its "Configure Host Drives" menu. In this way, it is also possible to change the boot drive (it had previously been selected as boot drive because it has the lowest drive number, that is, 0, and is therefore the first drive to be communicated to the system). There is one restriction that has to be observed with Interactive UNIX. Even though gaps are allowed when numbering the host-drives, if there are several Host Drives, a certain number for a device having a LUN greater than 0 may only be selected if this number already exists for another device with LUN 0. In other words, a certain number can only be assigned to a LUN >0 position if the LUN 0 position has also been assigned.

Example: If a host-drive no. 13 exists (target-ID=1, LUN=5), there also has to be a host-drive with number 8 (target-ID=1, LUN=0). Please keep this in mind when assigning the



numbers in GDTSETUP. Target ID and LUN of "Not Direct Access Devices" (devices such as streamers, tapes, CD-ROMS, etc., not configurable with GDTSETUP) must be determined on the basis of the SCSI-ID and the SCSI channel used by the ICP Controller. These devices can only be configured with SCSI-IDs 2 to 6. SCSI-ID 0 and 1 are reserved for hard disks, SCSI-ID 7 for the ICP Controller. If "Not Direct Access Devices" are configured on SCSI-ID 0 or 1, they are not recognized during the scanning process and can therefore not be used. The Target IDs of Not Direct Access Devices are identical to their SCSI-IDs, the LUN depends on the SCSI channel used (LUN 0 for SCSI channel A and LUN 4 for SCSI channel B). Note: After a cold boot, the GDT BIOS displays all connected devices with their physical coordinates, i.e., their SCSI-ID and SCSI-LUN, (see "Chapter B, ICP Controller Function Check").

| SCSI-ID of Not Direct Access Devices | Used GDT SCSI channel | UNIX Target ID | UNIX LUN |
|---|------------------------------|-----------------------|-----------------|
| 2 | A | 2 | 0 |
| 3 | A | 3 | 0 |
| 4 | A | 4 | 0 |
| 5 | A | 5 | 0 |
| 6 | A | 6 | 0 |
| 2 | B | 2 | 4 |
| 3 | B | 3 | 4 |
| 4 | B | 4 | 4 |
| 5 | B | 5 | 4 |
| 6 | B | 6 | 4 |

Having to determine the Target ID and LUN in such a complicated manner might seem rather awkward. However, it is necessary to do so because the ICP Controllers have more than one SCSI channel, whereas UNIX can only manage host adapters with one SCSI channel. Therefore, the GDT UNIX driver has to make the appropriate transformations.

Configuration Example:

In the PCI computer are two ICP Controllers (HA 0 = 1st GDT, HA 1 = 2nd GDT), each having two SCSI channels.

| | |
|-------------|---|
| 1 hard disk | as Host Drive no. 0 on HA0 |
| 1 hard disk | as Host Drive no. 0 on HA1 |
| 1 hard disk | 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 A of HA0 |
| 1 DAT | SCSI-ID 2, LUN 0 on SCSI channel B of HA1 |

Result:

| HA | Target-ID | LUN | Device |
|----|-----------|-----|--|
| 0 | 0 | 0 | 1st hard disk, Host Drive no. 0 (boot- and installation drive) |
| 0 | 2 | 0 | Streamer |
| 0 | 3 | 0 | CD-ROM |
| 1 | 0 | 0 | hard disk, Host Drive no. 0 |
| 1 | 0 | 1 | hard disk, Host Drive no. 1 |
| 1 | 2 | 4 | DAT |



H.5 Further Information

- During the installation of the GDT driver, additional tools are copied into the /etc directory. Before you can use them you have to create a special device file named /dev/rgdth by means of "link"; this device file has to be placed on a device of a GDT Host Drive.
For example, on ICP Controller 0 we have the Host Drive 1 which is HA 0, Target-ID 0, LUN 1 under Interactive Unix. The corresponding special device file is /dev/rdisk/c0t0d1s0 (c0 = HA, t0 = Target-ID 0, d0 = LUN 0, s0 = Unix partition).
By means of "ln /dev/rdisk/c0t0d1s0 /dev/rgdth", the required special device file is generated.
- A media change can be made with UNIX commands **MOUNT** and **UNMOUNT**. Please make sure that the removable hard disk keeps its GDTSETUP drive number when changing the media, otherwise a separate ID/LUN entry is necessary for each single media (since the drive number depends on the media and not the device containing it).
- If you change the hardware configuration of your PCI computer system, it may happen that the GDT is assigned to a different IRQ, as it was assigned during the installation and operation of UNIX. In this case you need to run the installation again with a GDT driver for the new IRQ, or change the hardware configuration so that the old IRQ is available for the GDT again.



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Chapter I

Using UNIXWARE



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I. Using UnixWare

After having exposed the installation of the ICP Controller as well as that of the Host Drives in chapters B and C, we would now like to give you some hints and pieces of advice on how to install the operating system UnixWare version 2.x.

I.1 Transparency of Host Drives

The structure of the Host Drives, which have been installed with GDTSETUP (in chapter C), is not known to UNIX. I.e., the operating system does not recognize that a given Host Drive consists of a number of hard disks forming a disk array. To UNIX, this Host Drive simply appears as one single hard disk with the capacity of the disk array. This complete transparency represents the easiest way to operate disk arrays under UNIX, neither UNIX nor the PCI computer need to be involved in the administration of these complex disk array configurations.

I.2 General Installation Notes

In the following description, we shall explain the installation of UnixWare in connection with the ICP Controller step by step. Apart from the UnixWare floppy disks, the CD-ROM and the UnixWare documentation, you also need the GDT floppy disk:

UnixWare BTLD-Disk

In the following discussion, when we speak of a *boot drive* we refer to the drive which is first integrated upon system power up. For the ICP Controller, this drive is the first Host Drive in the list of GDT Host Drives, i.e. the Host Drive with number 0 (see GDTSETUP menu *Configure Host-Drives*). During the installation you will have to decide whether you want the ICP Controller to make the boot drive available, or whether you want to operate the ICP Controller as an additional controller in the computer system. If the ICP Controller is the only hard disk controller in the computer system, it will automatically make the boot drive available.

If there are more hard disk controllers, the controller which makes the first drive (the drive containing the MS-DOS partition C:) available will be the boot controller. If the ICP Controller does not make the boot drive, you can skip the following paragraph.

I.3 GDT as Boot Controller

First initialize a hard disk connected to the ICP Controller (using GDTSETUP under DOS) and install it as a Host Drive (see chapters C and M "Configure Host Drives"). If there are several ICP Controllers in the system, this Host Drive must be connected to the first ICP Controller found during a cold boot. In addition, the GDT BIOS must be enabled and the SCSI-ID of the corresponding GDT SCSI channel must be set to 7.

Now you can begin the installation. Boot the system with the first UnixWare boot disk. UnixWare scans the system for host adapters. When requested insert the GDT UnixWare BTLD-Disk. The installation procedure which follows then has to be carried out as described in the UnixWare documentation.

Important note: As already mentioned in chapter B "Hardware Installation", the assignment of an IRQ to an INT is made by the PCI System BIOS. The UnixWare versions 2.xy and higher automatically recognize the IRQ of a PCI expansion card.



1.4 GDT as an additional Controller

We distinguish two cases.

a.) No ICP Controller has been configured for UnixWare yet.

In this case, the GDT driver must be installed from the GDT *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"` (GDT driver disk in drive 0).

b.) A ICP Controller has already been configured for UnixWare.

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

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

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

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

After that, a reboot of the UnixWare system is necessary. No kernel link is required because the driver will be dynamically loaded.

1.5 Coordinates of SCSI devices

a.) Host adapter Number (HA)

The host adapter number assigned to the ICP Controller is derived from the PCI slot number of the ICP Controller. Therefore, if there is only one ICP Controller installed in the PCI bus computer system, the host adapter number=0. If there are two ICP Controllers installed, the ICP Controller with the lower PCI Slot number is assigned host adapter number 0 and the ICP Controller with the higher PCI slot number is assigned host adapter 1. (Note: After a cold boot, the GDT BIOS displays a couple of messages, each beginning with the controller's PCI slot number, e.g. "[PCI 0/3] 4 MB RAM detected". The number after the "/" is the slot number of the controller. This helps you to determine which is the order of the ICP Controllers and which host adapter number is assigned to them by UNIX. See also chapter B, Hardware Installation).

b.) UnixWare Bus number, Target-ID and LUN

Target-IDs and LUNs for "Not Direct Access Devices" (devices like streamers, tapes and CD-ROMs and therefore not configurable via GDTSETUP), are directly assigned to the SCSI-ID and the channel of the ICP Controller. 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 ICP Controllers (HA 0 = 1st GDT, HA 1 = 2nd GDT), each with two SCSI channels.

| | |
|-------------|---|
| 1 hard disk | as Host Drive no. 0 on HA0 |
| 1 hard disk | as Host Drive no. 0 on HA1 |
| 1 hard disk | 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 |



Result:

| HA | Bus | Target-ID | LUN | Device |
|----|-----|-----------|-----|---|
| 0 | 0 | 0 | 0 | 1st hard disk, Host Drive no. 0 (boot drive) |
| 0 | 0 | 2 | 0 | Streamer |
| 0 | 1 | 3 | 0 | CD-ROM |
| 1 | 0 | 0 | 0 | hard disk, Host Drive no. 0 |
| 1 | 0 | 1 | 0 | hard disk, Host Drive no. 1 |
| 1 | 0 | 2 | 0 | DAT |
| 1 | 0 | 3 | 0 | hard disk, Host Drive no. 2 |

1.6 Further Information

- During the installation of the GDT driver, additional tools are copied into the /etc directory. Before you can use them you have to create a special device file named /dev/rgdth by means of "link"; this device file has to be placed on a device of a GDT Host Drive. With 'gdtsync' from the /etc directory, you can determine the coordinates of a GDT Host Drive. Usually the first Host Drive has the coordinates c0b0t0d0. A special device file (character device) is '/dev/rdisk/c0b0t0d0s0'. In this case, /dev/rgdth can be generated with: `ln /dev/rdisk/c0b0t0d0s0 /dev/rgdth`. (c0 = HA, b0 = Bus number, t0 = Target-ID 0, d0 = LUN 0, s0 = UnixWare partition).
- All new SCSI devices will be automatically recognized and a corresponding special-device-file will be generated
- Host Drives must be partitioned and a file system/file system(s) must be created. You can do this with `diskadd cCbBtDd`.
- When using *Direct Access Devices* with **exchangeable media** (e.g., removable hard disks) that are not reserved for the raw service, a media has to be inserted either when the system is booted, or with GDTSETUP (mount/unmount), otherwise the device is not available under UnixWare.
- The GDT UnixWare driver supports *Direct Access Devices* (e.g., hard disks, removable hard-disks) as SCSI-raw devices. This is especially important if you use removable hard disks which you want to exchange with other controllers. How to reserve a device for the SCSI-raw service is described in the file `space.c` on the GDT BTLD disk (example and documentation).
- Multi-processor support: The GDT device drivers for UnixWare 2.01 and UnixWare 2.1 support multi-processor systems.

Chapter J

Using Windows NT



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J. Using Microsoft Windows NT

After having explained the installation of the ICP Controller and the host drives in chapters B and C, we now explain how to install the operating system Microsoft Windows NT. For a successful installation, we recommend that you take a close look at the manuals which came with your Windows NT package.

J.1 Transparency of Host Drives

The structure of the Host Drives, which have been installed with GDTSETUP (in chapter C), is not known to Windows NT. I.e., the operating system does not recognize that a given Host Drive consists of a number of hard disks forming a disk array. To Windows NT, this Host Drive simply appears as one single hard disk with the capacity of the disk array. This complete transparency represents the easiest way to operate disk arrays under Windows NT; neither Windows NT nor the PCI computer need to be involved in the administration of these complex disk array configurations.

J.2 General Information on Windows NT

Your ICP Controller may be operated in both operating system variants, the Windows NT *Workstation* variant and the Windows NT *Advanced Server* variant. The ICP Controller is integrated into the Windows NT operating system through the GDTX.SYS driver which is the same for both Windows NT variants. Therefore, in this chapter we shall not distinguish between these two variants. All the information refers both to the Workstation and the Advanced Server variant. Note: At the time this manual was printed, Windows NT 3.5, Windows NT 3.51 and Windows NT 4.0 had been successfully tested.

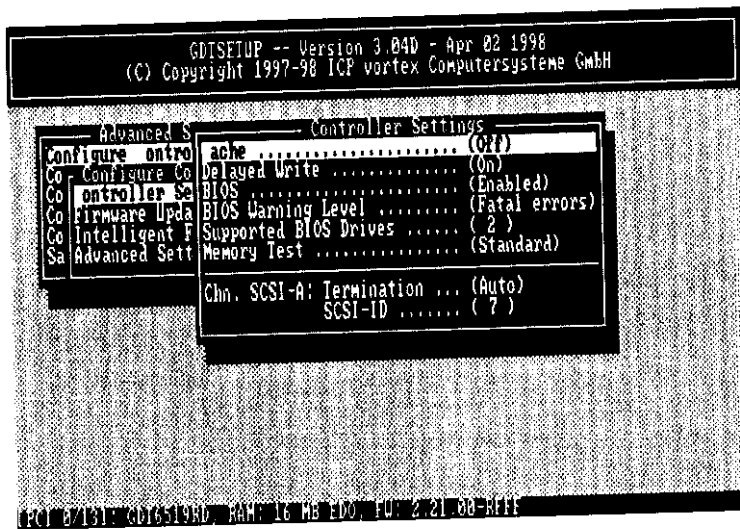
J.3 Preparing the Installation

The following steps have to be carried out and/or checked before you can begin with the installation of Windows NT:

Step 1: If you want to install Windows NT 3.51 or NT 4.0, skip this step. If you intend to install Windows NT 3.50 on your system, please observe the following. The GDT driver for NT 3.50 is located in the subdirectory DRIVERS of the GDT Windows NT disk. Its name is GDTX350.SYS. This file has to be renamed into GDTX.SYS and copied into the root-directory of the GDT Windows NT disk.

Step 2: When you do a warm boot by simultaneously pressing the CTRL+ALT+DEL keys, some PCI motherboards 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 ICP Controller, are reset. During the installation procedure of Windows NT this anomaly can cause the contents of the GDT 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 an NTFS partition at the end of the Windows NT installation procedure. In order to avoid this problem and prevent the risk of data corruption, **it is advisable to disable the Delayed Write function of the GDT cache during complete installation.** To do so, use the GDTSETUP 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.





Step 3: The size of a Windows NT boot partition is limited to a maximum capacity of 2GB (this is a Windows NT restriction).

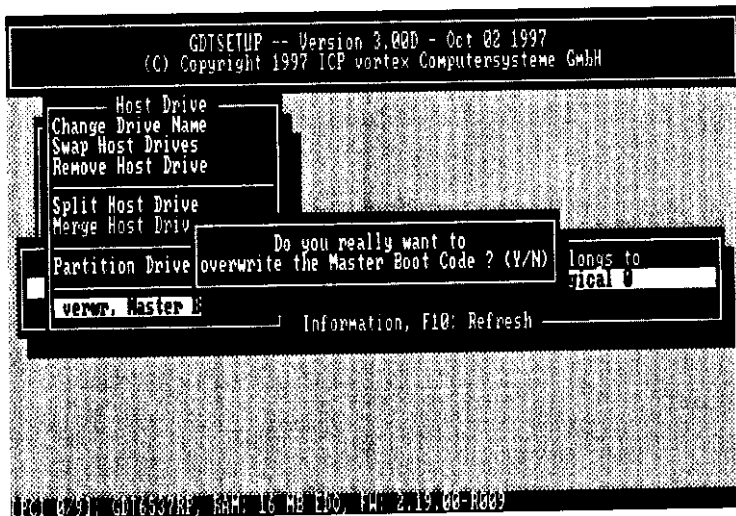
Step 4: In some cases Windows NT checks the virtual geometric parameters (heads, sectors) of the ICP Controller BIOS Host Drives during the installation process. This can cause Windows NT to calculate wrong parameters. In this case, the first part of the installation procedure (text mode) seems to work fine, but after the first warm boot the installation terminates irregularly because the Windows NT boot loader is no longer available. To avoid this problem (which will inevitably occur with Host Drives larger than or equal to 1GB), we recommend that you first re-create the so-called *master boot record* (MBR) of the given Host Drive, and secondly, to prepare the Host Drive with a little program named NTPREP for the Windows NT installation. NTPREP.EXE is part of the GDT Windows NT disk.

FDISK /MBR <ENTER> and NTPREP <ENTER>

GDTSETUP includes an option that makes both, FDISK /MBR and NTPREP. Select the *Configure Host Drives* menu and then *Overwr. Master Boot Code*.

You should never use *Overwr. Master Boot Code* or FDISK /MBR and NTRPEP when the Host Drives already contain valid data.





Step 5: When connecting the various SCSI devices to the SCSI channel of the ICP Controller, please ensure that the SCSI-ID of all *Not-Direct-Access* devices (e.g., CD-ROM, DAT-Streamer, MO-drive, etc.) are adjusted to a value greater than or equal to 2. This applies as well for the CD-ROM drive from which Windows NT is installed.

J.4 The Installation

First of all, make sure that you have verified or carried out all steps described in section J.3.

J.4.1 The ICP Controller is the only Controller in the System

The following instructions 1.) to 12.) assume that the ICP Controller is the only controller in the system and that the operating system is booted from its first Host Drive.

1. Insert the first Windows NT setup disk (Disk #1) into the boot floppy disk drive and reset the system. After a while you are asked to insert Disk #2.
2. Select: **S=Skip Detection**
3. Select: **S=Specify Additional Device**
4. Choose **Other (Requires disk provided by hardware manufacturer)** and press <ENTER>
5. Insert the GDT Windows NT Disk.
6. Select the **GDT SCSI Disk Array Controller** and press <ENTER>.
7. Setup tells you that it has recognized the ICP Controller. Press <ENTER> to continue.
8. Insert Disk #3 and press <ENTER>.
9. Now you can adjust the other system configuration parameters of your Windows NT system (graphics adapter, mouse, etc.).



10. Afterwards, the installation program scans the system for existing hard disks (which are identical to the Host Drives of the GDT). Choose the drive on which to install Windows NT and which you want to partition.
11. Now the actual installation of the Windows NT operating system begins. Follow the instructions of the Windows NT installation program.
12. After successful installation, switch the *Delayed Write* function of the ICP Controller ON again by using the GDTSETUP program or the GDTMON program.

J.4.2 The ICP Controller is the Secondary Controller in the System

If you wish to use the ICP Controller as a secondary controller in your Windows NT system (e.g. Windows NT is installed on an IDE hard disk), follow the instructions a.) to h.) below:

- a) Double click the **My Computer** icon.
- b) Double click **Control Panel**.
- c) Double click **SCSI Adapters**.
- d) Click on **Drivers**.
- e) Click on **Add**.
- f) Click on **Have Disk**.
- g) Insert the GDT Windows NT driver disk and click **OK**.
- h) Select **GDT SCSI Disk Array Controller**.

At the next system boot the GDT driver is loaded and the existing Host Drives are ready to be partitioned under Windows NT.

J.4.3 Using the Hot Plug Function with RAID Host Drives

In order to be able to use the Hot Plug function under Windows NT, it is necessary to load GDTMON, the monitoring utility program. (Note: GDTMON.EXE is part of the GDT Windows NT Disk).

J.4.4 Installation of a new GDTX.SYS Driver Version

If it should become necessary to install a new version of the GDTX.SYS driver, the procedure is as follows:

- a) Double click the **My Computer** icon.
- b) Double click **Control Panel**.
- c) Double click **SCSI Adapters**.
- d) Click on **Drivers**.
- e) Select **GDT SCSI Disk Array Controller**.
- f) Click on **Add**.



- g) Click on **OK**.
Windows NT informs you that this driver is already on the system and asks if you want to use the currently installed driver or a new one.
- h) Click on **New** and insert the GDT Windows NT driver disk.
- i) Click on **Continue** and NT copies the new driver to the disk.

At the next system boot the GDT driver is loaded.

J.5 Installation of a Removable Hard Disk

Removable hard disks (e.g., SyQuest, IOMEGA or magneto optical devices, MODs) are controlled by the ICP Controller in two fundamentally different modes:

Mode 1: The removable hard disk is treated like a normal hard disk. The data passes through the cache of the ICP Controller and the media needs to be initialized with GDTSETUP.

Mode 2: The removable hard disk is handled as a *Raw Device*. This means that the removable device is directly controlled by Windows NT without any further interaction of the controller. Consequently, the data is not cached by the GDT cache and the media does not need to be initialized with GDTSETUP. The advantage of mode 1 lies in a decisively better performance due to caching. On the other hand, the relatively complicated procedure of media changing presents a disadvantage. The opposite is true when adopting mode 2: The media change is easy and the media are compatible with other disk controllers (e.g., NCR). The performance is rather low since the data cannot be cached on the ICP Controller. To install a removable hard disk as a Raw Device, the media must not be initialized with GDTSETUP and the device must be set to a SCSI-ID equal to or greater than 2. In addition, the parameters of the GDT driver GDTX.SYS need to be configured differently in the Windows NT Registry

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\gdtx\Parameters\Device

To do so, follow these instructions:

1. Load the Registry Editor **regedt32.exe** in **...system32**
2. Select the window **HKEY_LOCAL_MACHINE on Local Machine**
3. Choose the Key **gdtx** in the directory **SYSTEM\CurrentControlSet\Services**
4. Enter by means of Edit, function Add Key, the name **Parameters**.
Select **Parameters**
5. Enter by means of Edit, function Add Key, the name **Device**.
Select **Device**
6. Enter by means of Edit, function Add Value, the name **DriverParameter**
7. Use data type **REG_SZ**.
Now enter the parameter string (e.g.): **/reserve:0,0,4,0**.
(This string causes the SCSI device connected with ICP Controller 0, SCSI channel 0, SCSI ID 4, LUN 0 to be reserved as a Raw Device. ICP Controller 0 is the ICP Controller which is detected and configured first after switching on your computer system).
8. The reservation of the SCSI device becomes active after completing regedt32, exiting and rebooting the system.



J.6 Tips & Tricks

J.6.1 ICP Controller not Found During Windows NT Installation

We have observed situations where Windows NT can not find the ICP Controller when installing the GDT driver. This problem is usually caused by one of the standard drivers which Windows NT loads automatically during the first installation phase.

If this is the case, we recommend that Windows NT Setup be started again and carried out in the mode 'user defined'. If this process is carried out correctly, the scan for hard disk controllers carried out by Windows NT can then be omitted. Instead of carrying out a scan, the GDT driver will be installed manually immediately. The ICP Controller should then be easily found. If other disk controllers are in the system, they can also be specified manually after the ICP Controller.

J.6.2 Installation and Upgrade of Windows NT 3.5x / 4.x

Windows NT in the latest Versions 3.51 and 4.0 offers various methods for the installation and the upgrade.

Method 1: The corresponding Setup - Disks 1 to 3 are generated and Windows NT (the Upgrade) is installed by booting the disks. In general, it is recommended to use method 1 for installing Windows NT, as the operating system always enables the user to insert an OEM disk (e.g., the driver disk of the ICP Controllers). In addition, installation is much faster if method 1 is used as not all Windows NT raw files have to be copied to a temporary directory. Installation according to method 1 affords that 3 setup disks are generated. This is carried out via the program Winnt.exe on the Windows NT CD, i.e., by entering the command line:

```
WINNT /OX
```

The switch '/OX' ensures that the Setup disks are generated.

Method 2: Windows NT generates a temporary directory on an existing partition and installs the operating system (i.e., the upgrade) from there. This installation is only possible if there is already a partition with enough free disk space (around 150 MByte). Depending on whether it is an upgrade or a new installation, either WINNT.EXE has to be started with the corresponding command line option (e.g., 'WINNT /B' during a new installation via a temporary directory on a DOS Partition), or the Upgrade icon on the CD-ROM symbol of the inserted Windows NT CD-ROM can be clicked on. In any of these circumstances, Windows NT does not automatically enable the user to be able to insert an OEM disk. With all hard disk controllers, where the driver is not on the Windows NT CD-ROM, the following problem occurs: The access to the hard disk is not possible after the first reboot of the computer during the installation procedure. Normally, the error message 'Inaccessible Boot Device' appears and the installation is stopped. To avoid this error message, a 'hidden key' of Windows NT should be used. As soon as the NT operating system has restarted the computer (reset), and the setup program starts, the key F6 has to be pressed and held down when the Setup screen appears. The Setup screen appears before the symbol for the Windows NT-Version and the system RAM is displayed in the upper corner of the screen. This is easily recognizable by a blue background color. In contrast to the 'Boot-Screen' with the version message and RAM message, the setup screen uses the large screen font. After pressing F6, a window is opened and Windows NT offers the opportunity of specifying an additional device driver. Now insert the floppy disks with the Windows NT driver for the ICP Controller. If the whole process described above has been carried out correctly, a



window is displayed in the middle of the screen with the message 'GDT Disk Array Controller'.

If the function key F6 was not pressed at the correct point, the procedure can be easily repeated by rebooting the computer (hard reset).

Otherwise, Windows NT restarts the driver of the ICP Controllers after confirming by pressing the <ENTER>-key. Installation can be carried out in the usual way. The GDT driver disk will be needed again later to allow Windows NT to copy the gdtx.sys to the boot partition.

J.6.3 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. In order to be able to make use of the new capacity without having to down the server, use the *Disk Administrator*. When loading, it detects the new Host Drive.



Chapter K

GDTMON



K. The Diagnosis Program GDTMON

GDTMON (GDT monitor) is a helpful and flexible diagnosis tool for the monitoring, maintenance and tuning of mass storage subsystems which are based on one or more ICP Controllers. The key features of GDTMON:

- Diagnosis program with a graphical user interface. Clear performance representation with variable horizontal bars
- Available under MS-DOS, NetWare 3.x & 4.x, Windows 95, Windows NT, OS/2 and SCO UNIX
- Loadable locally (on the server) or remotely from an authorized workstation (NCPE and NETBIOS protocol support)
- Indicates the performance, expressed in [KB/sec] and [IO/sec], of:
 - Host Drives (Disk, Chain, RAID 0, 1, 4, 5, 10)
 - Logical Drives
 - SCSI Drives and FCAL Drives
- Indicates the GDT cache utilization
 - Read-Hits
 - Write-Hits
 - Separate indication for data- and parity-cache (RAID 4/5)
- Allows online changing of the GDT cache parameters:
 - Cache ON/OFF
 - Delayed Write ON/OFF
- Allows online changing of the devices' parameters:
 - SCSI protocol
 - Synchronous or Asynchronous data transfer
 - Setting of the synchronous data transfer rate
 - Disconnect/Reconnect
 - Disk Cache ON/OFF
 - Tagged Queues ON/OFF
- Indicates the structure of Logical, Array and Host Drives
- Performs online parity checking of RAID 4 and RAID 5 Host Drives
- Allows the online RAID Level migration and capacity expansion of existing Array Drives
- Saves all relevant configuration data to floppy disk or hard disk
- Sets up or removes RAID 1 Disk Arrays while maintaining full operational conditions
- Performs Hot Plugs on RAID 4 / RAID 5 disk arrays
- Allows to add or remove a dedicated or pool Hot Fix drive while maintaining full operational conditions



K.1 Loading GDTMON

As mentioned before, the GDTMON program is available for various operating systems. It can be used either locally or remotely. This means that all ICP Controllers in a network can be monitored and serviced from one (or several) workstation(s). The communication between the ICP Controller(s) and the GDTMON program is based on the NETBIOS or NCPE protocols. Thus, for example, it is possible to monitor the ICP Controller in an OS/2 workstation or the ICP Controller in the Novell NetWare fileserver from a Windows 95 workstation.

In order to be able to access a certain computer system with its ICP Controller remotely on the network, a special communication module has to be loaded first, which routes the information through the network. For a Novell NetWare fileserver this is the CTRLSRV.NLM module (NCPE). For Windows NT (server and workstation), Windows 95 and OS/2 (server and workstation) this is the NBSERVX.EXE module (NETBIOS). While the module is loaded it searches for a CTRLSRV.CFG (Novell NetWare) or NBSERV.CFG (Windows NT, Windows 95 and OS/2) file, which includes the definition of the access rights of the different users and their passwords. The CFG file assigns every user to two different access levels. Access level 0 gives the user all functions to view and change the controller-, disk-drive and disk-array-settings. Access level 1 entitles the user only to view the various settings and performance data.

The Windows NT, Windows 95 and OS/2 driver diskettes include so-called DLLs for the supported protocols. Example: If the MON4NETB.DLL file is located in the same directory as GDTMON.EXE file for Windows NT, the NETBIOS protocol is automatically used for the GDTMON on this system. As soon as the NETBIOS support of this operating system is installed during the network configuration, the GDTMON on this system can communicate through this protocol with another system in the network which has a ICP Controller. The following drivers for the 'remote' GDTMONitor are currently available:

OS/2

| | |
|--------------|---------------------------------------|
| GDTMON32.EXE | GDTMONitor for OS/2 |
| MON2NETB.DLL | NETBIOS DLL for OS/2 |
| MON2NCPE.DLL | NCPE DLL for OS/2 |
| NBSRV2.EXE | NETBIOS Server for OS/2 |
| NBSRV.CFG | Configuration file for NetBios Server |
| NBCLEAN2.EXE | NETBIOS analysis program |

Windows NT

| | |
|--------------|---------------------------------------|
| GDTMON.EXE | GDTMONitor for Windows NT |
| MON4NETB.DLL | NETBIOS DLL for Windows NT |
| NBSRV4.EXE | NETBIOS Server for Windows NT |
| NBSRV.CFG | Configuration file for NETBIOS Server |
| NBCLEAN4.EXE | NETBIOS analysis program |

Windows 95

| | |
|--------------|---------------------------------------|
| GDTMON.EXE | GDTMONitor for Windows 95 |
| MON5NETB.DLL | NETBIOS DLL for Windows 95 |
| NBSRV5.EXE | NETBIOS Server for Windows 95 |
| NBSRV.CFG | Configuration file for NETBIOS Server |
| NBCLEAN5.EXE | NETBIOS analysis program |

The MS-DOS GDTMON also allows remote access. The DLLs are integrated into the GDTMON.EXE file, thus there is no NETBIOS server available for MS-DOS. Since there is no NETBIOS support within MS-DOS, it is necessary to load the NETBIOS program to access from a MS-DOS workstation through the network a ICP Controller in a Windows NT and OS/2 workstation or server, or a Windows 95 workstation. NETBIOS is part of the Novell NetWare operating system. For the remote access of a Novell NetWare fileserver the NETBIOS program is not needed.



K.1.1 Loading the GDTMON Program Under NetWare

The GDTMON program for NetWare is part of the GDT Novell NetWare disk. GDTMON can be used either under NetWare 3.1x or under NetWare 4.x. There are two different methods of loading GDTMON:

- loading GDTMON on the fileserver
- loading GDTMON on an authorized workstation (remote)

Loading GDTMON on the fileserver. Beforehand, the GDT NetWare driver (GDTRP311.DSK for NetWare 3.11, GDTRP312.DSK for NetWare 3.12 and GDTRP400.DSK for NetWare 4.x) and the auto-loading module CTRLTRAN.DSK must have been loaded on the fileserver.

LOAD GDTMON <ENTER>

on the fileserver.

Loading GDTMON on a workstation. In this case, too, the GDT NetWare driver and the auto-loading module CTRLTRAN.DSK must have been previously loaded on the fileserver console. In addition, the module CTRLSRV.NLM has to be loaded. This module searches for a file named CTRLSRV.CFG. This file must be located in the same directory as CTRLSRV.NLM. The system administrator has to set up a user group named GDT_OPERATOR. All users belonging to this group are given access (through GDTMON) to the ICP Controller(s) in this specific fileserver (Access level 0). Now, the GDTMON program can be loaded from one (or more) workstation(s):

GDTMON <ENTER>

By selecting the menu *Select Controller* of the GDTMON main menu, you can now choose either a fileserver (equipped with a ICP Controller), or a ICP Controller in your workstation.

K.1.2 Loading the GDTMON Program Under OS/2

The GDTMON program for OS/2 is part of the GDT OS/2 disk. To load the program under OS/2, enter:

GDTMON32 <ENTER>

K.1.3 Loading the GDTMON Program Under Windows NT

The GDTMON program for Windows NT is part of the GDT Windows NT disk. To load the program under Windows NT, enter:

GDTMON <ENTER>

K.1.4 Loading the GDTMON Program Under Windows 95

The GDTMON program for Windows 95 is part of the GDT Windows 95 disk. To load the program under Windows 95, enter:

GDTMON <ENTER>



K.1.5 Loading gdtmon under SCO UNIX

In order to be able to use the gdtmon program under SCO UNIX (2.x, 4.x and 5.x), it becomes necessary to substitute the standard terminal entry by a new one:

```
cd /usr/lib/terminfo <ENTER>
tic gdt386.src <ENTER>
```

Before each loading of gdtmon, this terminal has to be activated by:

```
TERM = gdt386 <ENTER>
export TERM <ENTER>
```

These two lines can also be inserted in the **.profile** file and will then be automatically processed during each login. The gdtmon program itself is copied during the SCO UNIX installation (chapter G of this User's Manual) into the */etc* directory. gdtmon is loaded by entering:

```
gdtmon <ENTER>
```

K.2 The GDTMON Program

As mentioned before, the GDTMON program appears identical for all operating systems, so we can demonstrate the use and functioning of this program regardless of the operating system used. In previous chapters we have already described the hierarchical structure of the GDT firmware. We have defined 4 different levels of hierarchy: Level 1 where the physical devices named **Physical Drives** are found, level 2 containing the **Logical Drives** (made up of one or several **Physical Drives**), level 3 where we have the **Array Drives**, and finally, level 4 where the **Host Drives** are. Only the latter ones are known to the operating system. The drive of a given level of hierarchy is always set up by using the drives of the next lower level as components. Accordingly, GDTMON has various menu options, each referring to one level of hierarchy

| | | |
|------------------------|-----|---------|
| Host Drives | --- | Level 4 |
| Logical Drives | --- | Level 2 |
| Physical Drives | --- | Level 1 |

Each menu option displays the performance of the drives belonging to the corresponding level. (Note: The performance of Array Drives and Host Drives is identical). The performance is measured in KB/s (kilobyte per second, transfer rate) and IO/s (I/Os per second, number of simultaneously processed I/Os on the ICP Controller). The performance is displayed numerically as well as graphically in the form of variable horizontal bars, with separate indications for each drive and its write and read accesses.

K.2.1 Select Controller

This menu option yields a list of available ICP Controllers. By selecting a protocol, you have either access to the ICP Controller(s) in your local computer (e.g., MS-DOS, Windows NT, Windows 95 or OS/2 protocol), or to a ICP Controller in another computer (server or workstation) in the network (NetWare NCPE or IBM NETBIOS protocol). All diagnosis and maintenance functions of GDTMON refer to the ICP Controller you have selected here (and the hard disks connected with this controller).



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Main Menu
Select Controller
 Host Drives
 Logical Drives
 Physical Drives
 Cache Statistics
 Sampling Rate
 View/Change Settings
 F10: Toggle Colors

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Select Protocol
 (MS-DOS)
 NetWare NCPE

Main Menu
Select Controller
 Host Drives
 Logical Drives
 Physical Drives
 Cache Statistics
 Sampling Rate
 View/Change Settings

(MS-DOS) in the Select Protocol menu indicates that the GDTMON program was loaded on a MS-DOS computer. I.e.: If GDTMON had been loaded under Windows NT, we would see there (Windows NT).



| Main Menu | | | | | |
|-------------------|-----------|----------|----------|---------|------------------|
| Select Controller | | | | | |
| Host Drives | | | | | |
| Select Controller | | | | | |
| Ctr. Type | Position | Features | Firmware | Driver | Serial-No. |
| 0 | GD16537HP | PCI 0/9 | C H R | 2.19.00 | 1.12 0x080C0127F |

K.2.2 Host Drives

This menu option leads to the list of available Host Drives (level 4). We would like to recall that the operating system (e.g., NetWare) only recognizes these Host Drives and not their possibly complex structures. This means that it is of no importance for the operating system if a Host Drive consists of one single hard disk (of the type *disk*), or of 5 hard disks configured to form a RAID 4 Array Drive. Apart from the performance, the name, type, state and capacity (1024KB = 1MB) of a Host Drive is displayed. The figures shown at *Total* represent the overall performance of the Host Drives as a whole. With the ← and → keys you may change the scale of the graphical KB/s indication. With the ↑ and ↓ keys you can scroll the screen to see further Host Drives (if available).

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```

Main Menu-
Select Controller

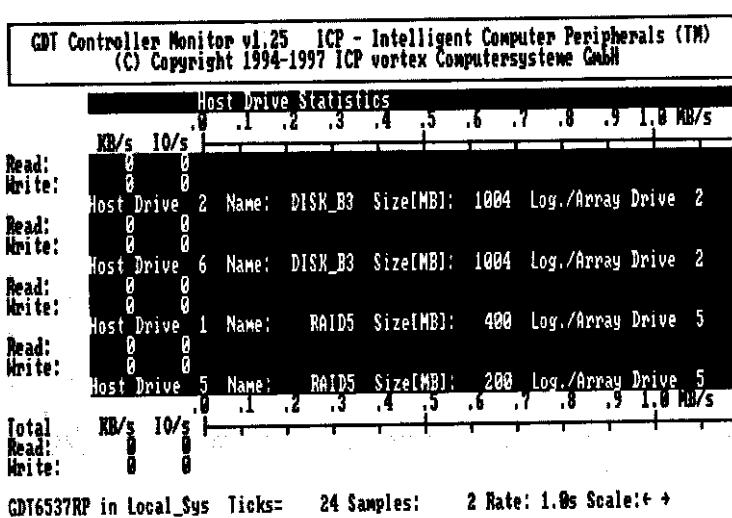
Host Drives
Logical Drives
Physical Drives
Cache Statistics
Sampling Rate

View/Change Settings
F10: Toggle Colors

```

GD16537RP in Local_Sys Sampling Rate= 1.0 sec





(Note: All Host Drives on the screen shown above are idle.)

K.2.3 Logical Drives

This menu option yields a list of available Logical Drives (level 2). Logical Drives are the components for Array Drives and Host Drives. In its most simple form, a Host Drive consists of one Logical Drive which is made up of a single hard disk (type *disk*). In case of RAID Host Drives, the performance of the Logical Drives forming a RAID Host Drive are shown in the menu *Logical Drives*. The performance data displayed here gives immediate information on the quality of a given Host Drive. When judging the indicated performance of Logical Drives belonging to a RAID Host Drive, the following considerations should be taken into account:

(a) RAID 0, RAID 1, RAID 10 and RAID 5 Host Drives

If a certain Logical Drive shows poor performance for a longer period (when compared to the other Logical Drives), this Logical Drive impairs the overall performance, making it the *bottle neck* of the entire RAID Host Drive.

(b) RAID 4 Host Drives

In principle, the same as in (a) applies to RAID 4 Host Drives, with the exception made for the parity Logical Drive. The poor performance can have various reasons: the hard disk forming the Logical Drive

- is too slow (different from the other hard disks with regard to type or manufacturer)
- has wrong parameters (SCSI II, disk cache, tagged queues etc.)
- has too many defects, causing the read/write actuator to have to move to *alternate tracks* very often

When setting up RAID 4/5 Host Drives, please observe the notes on RAID 4/5 Host Drives exposed in the chapter **GDTSETUP in Detail**.



```

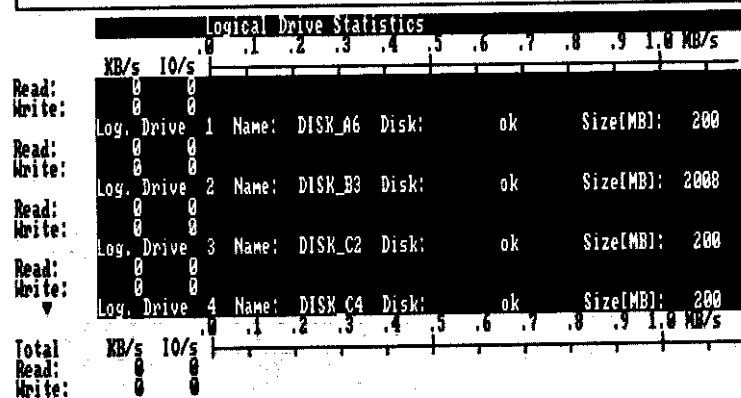
Main Menu
Select Controller
-----
Host Drives
Logical Drives
Physical Drives
Cache Statistics
Sampling Rate

View/Change Settings
F10: Toggle Colors

```

GD16537RP in Local_Sys Sampling Rate= 1.0 sec

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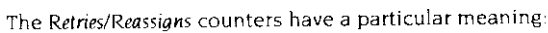


GD16537NP in Local_Sys Ticks= 33 Samples: 3 Rate: 1.0s Scale:4 +

The figures under *Total* represent the total performance of all Logical Drives. With the ← and → keys you may change the scale of the graphical KB/s indication. With the ↑ and ↓ keys you can scroll the screen to see more Logical Drives (if available).

Main Menu
 Select Controller
 Host Drives
 Logical Drives
 Physical Drives
 Cache Statistics
 Sampling Rate
 View/Change Settings
 F10: Toggle Colors

- the GDT I/O channel the hard disk is connected to
- which ID the hard disk has
- the name of the hard disk
- the gross capacity (1MB = 1024KB)



(1) The *Retries* counter is incremented by one unit whenever the ICP Controller retries to access a hard disk. If this counter continues to increase (possibly on other hard disks, too) it is very likely that the cable is not *good* enough for the selected data transfer rate (cable too long, poor quality of cable and connectors), or that the SCSI bus is not properly terminated (too many terminators on the cable, or missing terminator). In very few cases is the hard disk concerned defective. The retry counter also increases when the SCSI parameters of a hard disk are changed (see further ahead). Obviously, retries due to this do not imply bad cabling.

(2) The *reassign* counter reflects the number of media defects which occur on the hard disk drive. Defective blocks of the hard disk are assigned substitute blocks (spare blocks) which 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 disk through according reassignment tables. Note: If a hard disk 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.

If you observe that the number of reassigns is constantly increasing, you may suspect that something is wrong with this drive.

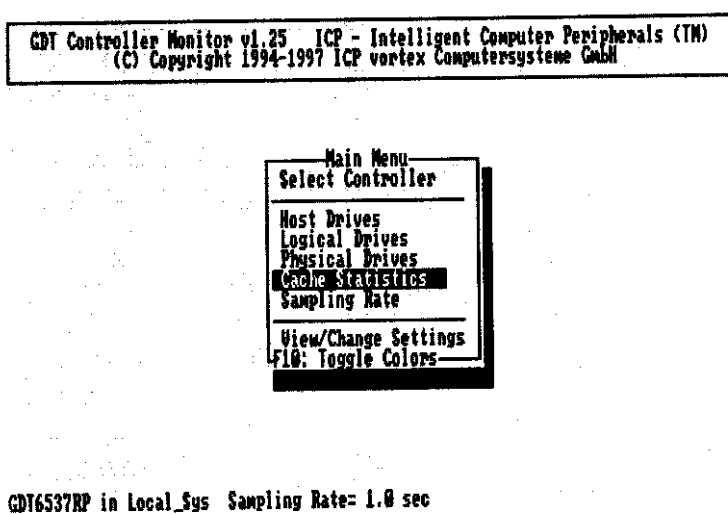
With the ← and → keys, you can change the scale of the graphical KB/s indication.

With the ↑ and ↓ keys, you can scroll the screen to see more hard disks (if available).

K.2.5 Cache Statistics

This menu option gives information on the utilization of the GDT cache. For RAID 4/5 Host Drives, the data cache and parity cache are displayed separately.

Note: The GDT firmware only allocates cache RAM to the GDT parity cache if RAID4/5 Host Drives have been set up.



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Cache Statistics

```
Cache: on    Delayed Write: on    Cache Size: 16384 KB
Dirty Buffers: 07 11111111111111111111111111111111 0%
Read Hits: 0 00000000000000000000000000000000 0%
Read Hits: (average) 00000000000000000000000000000000 0%
Write Hits: 0 00000000000000000000000000000000 0%
Write Hits: (average) 00000000000000000000000000000000 0%
Replacements: 0 Flush Writes: 0 Cache Writes: 0
```

CDT6537RP in Local_Sys Ticks= 14 Samples: 2 Rate: 1.0s F10: Reset

K.2.6 Sampling Rate

By setting the sampling rate, you can choose the interval at which the ICP Controller delivers new measurements. According to the operating system used, the sampling rate can be set to a maximum of 60 seconds. The default setting is 1 second.

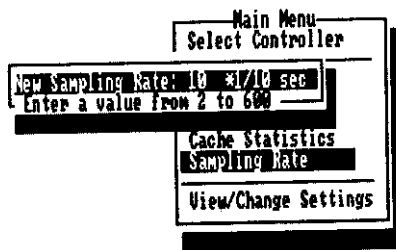
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```
Main Menu
Select Controller
-----
Host Drives
Logical Drives
Physical Drives
Cache Statistics
Sampling Rate
View/Change Settings
F10: Toggle Colors
```

CDT6537RP in Local_Sys Sampling Rate= 1.0 sec



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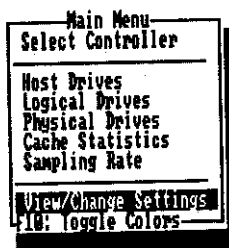


GD16537RP in Local_Sys Sampling Rate= 1.0 sec

K.3 The Menu: View/Change Settings

This menu includes a set of very powerful options and functions for the online maintenance and diagnosis of RAID 1/4/5/10 Host Drives.

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GD16537RP in Local_Sys Sampling Rate= 1.0 sec

From this menu you can select further submenus:

Controller

- View the ICP Controller configuration
- View Last Events
- View/Change the Intelligent Fault Bus settings



- Cache Settings** - View/Change the GDT cache parameters
- Physical Drives** - View/Change the SCSI parameters
- Logical Drives**
 - Display the structure of Logical Drives
 - Add/Remove Mirror Drives to/from Host Drives
 - Perform a Hot Plug on a RAID 1 Host Drive
 - Add/Remove Private Hot Fix and Pool Hot Fix drives to/from a RAID 1 Host Drive
- Array Drives**
 - Display the structure of RAID 4/5/10 Host Drives
 - Perform a Parity Verify on RAID 4/5 Host Drives
 - Perform a Parity Recalculation on RAID 4/5 Host Drives
 - Perform online capacity expansion and/or RAID level migration
 - Perform a Hot Plug on RAID 4/5/10 Host Drives
 - Add/Remove Private Hot Fix and Pool Hot Fix drives to/from RAID 4/5/10 Host Drives
- Save Information** - Save all relevant configuration data to disk

Before going into detail, some information on the so-called Hot Plug of fault tolerant disk arrays (RAID 1/4/5/10) is given below.

K.3.1 Notes and Information on the Hot Plug function of GDTMON

Fault tolerant means that a hard disk which is part of a RAID 1/4/5/10 Array Drive can fail without causing data loss on the Array Drive. At the same time, the Array Drive remains fully accessible. Obviously, the Array Drive then lacks the redundant data, therefore the defective disk should be replaced by an intact one as soon as possible. In chapters C (RAIDYNE Quick-Setup) and L (GDTSETUP in Detail), we have shown with various examples how to exchange a defective drive with GDTSETUP. Moreover, we described the functioning of the so-called Hot Fix drive. This "constantly available spare part when needed" automatically integrates itself into the Array Drive and is therefore the quickest means of regaining a redundant Array Drive.

The Hot Plug function enables the replacement of a drive of an Array Drive (either in the *ready* or *fail* state) while the system continues to run, that is, without having to shut down the NetWare fileservers for instance. A drive replacement may not only become necessary when the drive has already failed, but also when there are signs that a failure could occur soon (strong whistling of the hard disk, or constant retries of the read/write head). Only those users with thorough knowledge of RAID and the ICP Controller should use the Hot Plug function. Improper use can lead to data loss. (Naturally, we have integrated all kinds of security provisions into the ICP Controller and GDTMON. But how can we prevent a user from plugging out the wrong drive?). We recommend that you document each Array Drive immediately after its configuration with GDTSETUP. This record should at least comprise the following information:

- To which ICP Controller has the Array Drive been connected ?
- Which hard disks are part of the Array Drive ?
- To which SCSI ID have they been set ?
- Which SCSI devices terminate a SCSI channel ?

In addition, the hard disks themselves should be labeled with the above information. The following is an example of such a label.

C xy z t



C: controller number **x**: channel
y: ID **z**: Logical Drive number
!: + = terminated, - = not terminated (with SCSI hard disks)

Example:

1 SCSI-A 6 3 +

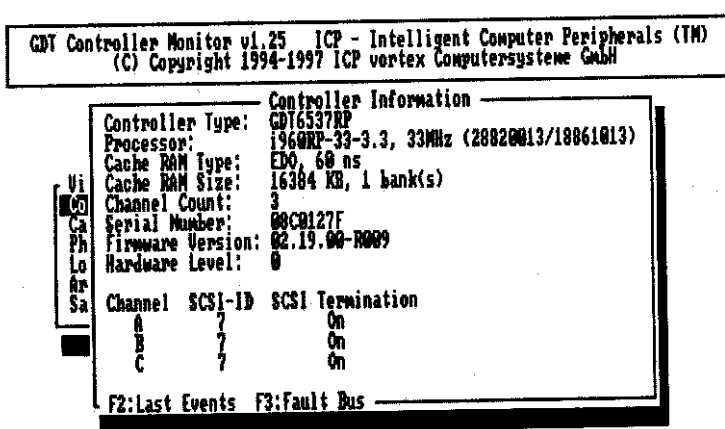
controller number 1, SCSI channel A, SCSI-ID 6, Logical Drive number 3, terminated. The menu option *Save Information* of GDTSETUP, GDTMON program can be of help when setting up the documentation.

How does the Hot Plug mechanism work ?

During the Hot Plug, the I/O channel of the ICP Controller to which the drive to be exchanged is connected, is temporarily "halted" (for the time needed for the exchange), so that the drive can be disconnected from the I/O channel and replaced without any risk. After the replacement, the I/O channel halt is lifted and the firmware automatically begins to rebuild the new drive. The halting and the halt-lifting of the I/O channel is controlled by the Hot Plug function. The Hot Plug should be carried out as quick as possible.

K.3.2 Controller

This option displays details on the ICP Controller. For example, how much Cache RAM the ICP Controller has and what the current termination setting of the SCSI channel is.



GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

Press <F3> to get detailed information on the configuration of the Intelligent Fault Bus (IFB). Changing and enabling these features requires the existence of an IFB-compatible subsystem.



| Intelligent Fault Bus | | | | | | | | | | | |
|--|-----------|-------------|-------------|-------------------------------|-----|------|------|------|------|------|------|
| Controller/Channel Settings: | | | | | | | | | | | |
| Auto Hot Plug: Enabled SHELf Monitoring: On SHELf Error: audible Alarm | | | | | | | | | | | |
| Channel | Fault Bus | Swap Detect | SHELf State | Actual LED code number per ID | | | | | | | |
| | | | | ID0 | ID1 | ID2 | ID3 | ID4 | ID5 | ID6 | ID7 |
| A | Disabled | 0 | NA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| B | Disabled | -266 | Not OK | 10 | 70 | 19 | 20 | 3060 | -100 | 2950 | 2816 |
| C | Enabled | -100 | Not OK | 2816 | 20 | 0 | 40 | -996 | 1109 | 1133 | -306 |
| D | Disabled | 1130 | Not OK | 112 | 30 | 1109 | -266 | 0 | 10 | 70 | 19 |
| E | Disabled | -964 | Not OK | 10 | 20 | 1130 | -266 | 0 | 112 | 30 | 1109 |

| LED Code Table: | | |
|-----------------|--------------------|---|
| LED Code No. | Description | Disk/Array State |
| 0 | LED off | Disk OK |
| 1 | LED on | Remove Disk or Insert Disk |
| 2 | LED slow blinking | Build or Rebuild in progress |
| 3 | LED quick blinking | Array Idle/Error or Auto Hot Plug aborted |

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

K.3.3 Cache Settings

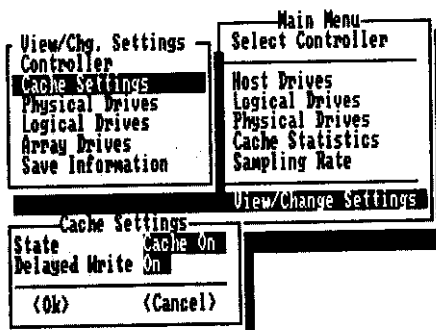
This submenu displays the current GDT cache settings which can be changed here. The various settings are:

- Cache ON** the GDT cache is enabled, that is, all accesses to the Host Drives pass through the GDT cache
- Cache OFF** the GDT cache is disabled
- Delayed Write ON** Write accesses are delayed, i.e., the write-back cache algorithm is active
- Delayed Write OFF** All write accesses are directly transmitted to the Host Drives. If delayed-write is off and the Cache is ON, the GDT cache works exclusively as a read cache.

Note: Best performance is achieved with *Cache ON* and *Delayed Write ON*.



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GDT6537NP in Local_Sys Sampling Rate: 1.0 sec

K.3.4 Physical Drives

This option gives a list of all hard disks connected to the ICP Controller. Besides information on the GDT I/O channel, the ID, the name/vendor and the gross capacity (1MB = 1024KB), it also shows which hard disk(s) belong to a given Logical Drive. When you select a hard disk in this list and then press <ENTER>, GDTMON gives you further information on the Drive Settings of this device. These settings may be changed.

The Last Status information should always be 0x00000000. After a device failure or other significant events, a different value may be displayed here. Chapter L.7.4 of this manual gives an excerpt of the SCSI specification with all relevant device Last Status information. This information may be of assistance in further analysis of the problem.

The Grown Defects counter shows the number of media defects which have occurred since the first time the device was operated with a ICP Controller. A specific hard disk is in a good condition when it has 0 grown defects. When this counter increases, there is definitely something wrong with the device.



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Physical Devices

| Ch | ID | Model | Size(MB) | Log. Drive |
|-------|-------|------------------|----------------|--------------|
| Ch: A | ID: 0 | SEAGATE ST52160N | Size(MB): 2068 | Log. Drive 5 |
| Ch: A | ID: 6 | SEAGATE ST52160N | Size(MB): 2068 | Log. Drive 1 |
| Ch: B | ID: 0 | QUANTUM P1055 91 | Size(MB): 99 | |
| Ch: B | ID: 3 | SEAGATE ST52160N | Size(MB): 2068 | Log. Drive 2 |
| Ch: C | ID: 2 | SEAGATE ST52160N | Size(MB): 2068 | Log. Drive 3 |
| Ch: C | ID: 4 | SEAGATE ST52160N | Size(MB): 2068 | Log. Drive 4 |

View/Chg. Controller
Cache Sett
Physical Dr
Logical Dr
Array Drive
Save Information

Sampling Rate

View/Change Settings

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

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Physical Devices

| Ch | ID | Model | Size(MB) | Log. Drive |
|-------|-------|------------------|----------------|--------------|
| Ch: A | ID: 0 | SEAGATE ST52160N | Size(MB): 2068 | Log. Drive 5 |
| Ch: A | ID: 6 | SEAGATE ST52160N | Size(MB): 2068 | Log. Drive 1 |
| Ch: B | ID: 0 | QUANTUM P1055 91 | Size(MB): 99 | |
| Ch: B | ID: 3 | SEAGATE ST52160N | Size(MB): 2068 | Log. Drive 2 |
| Ch: C | ID: 2 | SEAGATE ST52160N | Size(MB): 2068 | Log. Drive 3 |
| Ch: C | ID: 4 | SEAGATE ST52160N | Size(MB): 2068 | Log. Drive 4 |

View/Chg. Controller
Cache Sett
Physical Dr
Logical Dr
Array Drive
Save Information

Sampling Rate

View/Change Settings

Drive Settings

Sync. Transfer Enabled 20.8 MB/s

Disconnect Enabled

SCSI Features

Protocol SCSI-III

Disk Read Cache On

Disk Write Cache On

Tagged Queues On

Last Status: 0x00000000

Grown Defects: 0

<Ok> <Cancel>

GDT6537RP in Local_Sys Sampling Rate= 1.

If you select the SEP of a SAF-TE subsystem, GDTMON displays a list of the installed and configured slots in the subsystem



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Physical Devices

| | | | | |
|-------------|--------|----------|----------------|--------------|
| Ch: B ID: 0 | CONNER | CFP2105E | Size(MB): 2047 | Log. Drive 5 |
| Ch: B ID: 1 | CONNER | CFP2105E | Size(MB): 2047 | Log. Drive 5 |
| Ch: B ID: 2 | CONNER | CFP2105E | Size(MB): 2047 | Log. Drive 5 |
| Ch: B ID: 3 | nstor | CMB SA | | |

View/Chg. SAF-TE Configuration

| Slot | Installed Disk |
|------|--|
| 0 | Ch: B ID: 0 CONNER CFP2105E Size(MB): 2047 |
| 1 | Ch: B ID: 1 CONNER CFP2105E Size(MB): 2047 |
| 2 | No hard disk installed in this slot |
| 3 | No hard disk installed in this slot |
| 4 | Slot not present |
| 5 | Slot not present |
| 6 | Slot not present |
| 7 | Slot not present |

< Ok > < Cancel >

F2: Enclosure Status

GDY6127RP in Local_Sys Sampling Rate= 1.0 sec

Press <F2> to get the status of the SAF-TE enclosure.

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SAF-TE Enclosure Status

| | |
|------------------------|-------------------------|
| Audible Alarm Status: | Off |
| Door Lock Status: | Not available |
| Power Supply 0 Status: | Operational and on |
| Power Supply 1 Status: | Not present |
| Power Supply 2 Status: | Operational and on |
| Fan 0 Status: | Operational |
| Fan 1 Status: | Not installed |
| Fan 2 Status: | Operational |
| Fan 3 Status: | Operational |
| Fan 4 Status: | Operational |
| Enclosure Temperature: | OK |
| Temperature Sensor 0: | 23°C (73°F) Status: OK |
| F2: Audible Alarm on | |

F2: Enclosure Status

GDY6127RP in Local_Sys Sampling Rate= 1.0 sec

K.3.5 Logical Drives

This command yields a list of the existing Logical Drives. In addition to the Logical Drive numbers, information on the drives' type, state, net capacity and belonging to a given Array Drive / Host Drive is displayed. Press <F2> to obtain further information on a selected Logical Drive.



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Logical Drives

| Log. Drive | Disk | ok | Size(MB) | Array Drive |
|---------------|-------|----|---------------|---------------|
| Log. Drive 1: | Disk: | ok | Size(MB): 200 | Array Drive 5 |
| Log. Drive 2: | Disk: | ok | Size(MB): 200 | Array Drive 5 |
| Log. Drive 3: | Disk: | ok | Size(MB): 200 | Array Drive 5 |
| Log. Drive 4: | Disk: | ok | Size(MB): 200 | Array Drive 5 |
| Log. Drive 5: | Disk: | ok | Size(MB): 200 | Array Drive 5 |

View
 Cont
 Cach
 Phys
 Log1 F2: Drive Information
 Array
 Save Information
 Sampling Rate
 View/Change Settings

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

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Logical Drives

| Log. Drive | Disk | ok | Size(MB) | Array Drive |
|---------------|-------|----|---------------|---------------|
| Log. Drive 1: | Disk: | ok | Size(MB): 200 | Array Drive 5 |
| Log. Drive 2: | Disk: | ok | Size(MB): 200 | Array Drive 5 |
| Log. Drive 3: | Disk: | ok | Size(MB): 200 | Array Drive 5 |
| Log. Drive 4: | Disk: | ok | Size(MB): 200 | Array Drive 5 |

Physical Disks

Ch: A ID: 6 SEAGATE ST52160N Size(MB): 2068

View
 Cont
 Cach
 Phys
 Log1
 Array
 Save
 View/Change Settings

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

Press <ENTER> to select a Logical Drive. The following options become available:

K.3.5.1 Set Logical Drive Name

Change the name of the Logical Drive. This name was defined within GDTSETUP, either automatically, or manually.



K.3.5.2 Hot Plug: Replace Mirror Drive

If a RAID 1 or RAID 10 Host Drive has already been set up, a defective drive can be replaced (Hot Plug) while the system continues to be fully operational.

| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) (C) Copyright 1994-1997 ICP vortex Computersysteme GmbH | | | |
|---|-------|----|------------------------------|
| Logical Drives | | | |
| Log. Drive 1: | Disk: | ok | Size(MB): 200 Array Drive 5 |
| Log. Drive 2: | Disk: | ok | Size(MB): 200 Array Drive -- |
| Log. Drive 3: | Disk: | ok | Size(MB): 200 Array Drive 5 |
| Log. Drive 4: | Disk: | ok | Size(MB): 200 Array Drive 5 |
| Log. Drive 5: | Disk: | ok | Size(MB): 200 Array Drive 5 |
| <div> <div>View</div> <div>Cont</div> <div>Cach</div> <div>Phys</div> <div>Hot</div> <div>Array</div> <div>Save Information</div> <div>Sampling</div> <div>View/Chan</div> </div> | | | |
| Logical Drive Settings | | | |
| Set Log. Drive Name | | | |
| Hot Plug: Replace Mirror Drive | | | |
| Hot Plug: Add Mirror Drive | | | |
| Hot Plug: Remove Mirror Drive | | | |
| Hot Plug: Add Pool Hot Fix Drive | | | |
| Hot Plug: Remove Pool Hot Fix Drive | | | |
| Pool Hot Fix Access | | | |
| GDT6537RP in Local_Sys Sampling Rate= 1 | | | |

There are typically two different applications, where a Hot Plug becomes necessary.

Application 1. The RAID 1/10 Array Drive is in the fault tolerant (both drives are valid: w). It is likely that a drive will fail soon (for example when there is a loud operating noise). As a preventative measure, this drive ought to be exchanged now, that is, in a moment when the Array Drive is still in a ready state and still has redundancy.

Application 2. The Array Drive is no longer fault tolerant, because a drive of the Array Drive has actually failed. The Array Drive is still fully operational, but it does not have redundancy any more. If another drive should fail, too, the Array Drive's functionality is impaired.

Example Session for Application 1

We assume that there is a RAID 1 Array Drive which is fault tolerant. Its state is vv, both Logical Drives are valid. After selecting the Array Drive, we choose the Replace Mirror Drive option.

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Logical Drives

Log. Drive 0: Mirror: ok vv Size(MB): 200 Array Drive --

View
Cont
Cach
Phys
Log1
Array
Save Information

F2: Drive Information

Sampling Rate

View/Change Settings

GD16537RP in Local_Sys Sampling Rate: 1.0 sec

GD1 Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
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Logical Drives

Log. Drive 0: Mirror: ok vv Size(MB): 200 Array Drive --

View
Cont
Cach
Phys
Log1
Array
Save Information

Sampling

View/Chan

Logical Drive Settings

Set Log. Drive Name

Hot Plug: Replace Mirror Drive

Hot Plug: Add Mirror Drive

Hot Plug: Remove Mirror Drive

Hot Plug: Add Pool Not Fix Drive

Hot Plug: Remove Pool Not Fix Drive

Pool Not Fix Access

GD16537RP in Local_Sys Sampling Rate: 1

A list is displayed which shows the members of the RAID 1 Array Drive.



GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)

| Disk Drives | | | | | | | | | |
|-------------|----------|------|----|--------|---------|----------|-------|----------|-------|
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 0 | i | SEAGATE | ST52160N | RM | 2068 | valid |
| 1 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | valid |

Select one of the disk drives for Hot Plug

View/Chan

Hot Plug: Replace Mirror Drive
 Hot Plug: Add Mirror Drive
 Hot Plug: Remove Mirror Drive
 Hot Plug: Add Pool Hot Fix Drive
 Hot Plug: Remove Pool Hot Fix Drive
 Pool Hot Fix Access

GDT6537RP in Local_Sys Sampling Rate= 1

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)

| Disk Drives | | | | | | | | | |
|-------------|----------|------|----|--------|---------|----------|-------|----------|-------|
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | valid |
| 1 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RM | 2068 | valid |

Scanning SCSI channels / target ID's !
Please wait !

or Drive

Hot Plug: Add Mirror Drive
 Hot Plug: Remove Mirror Drive
 Hot Plug: Add Pool Hot Fix Drive
 Hot Plug: Remove Pool Hot Fix Drive
 Pool Hot Fix Access

GDT6537RP in Local_Sys Sampling Rate= 1

The Hot Plug function now displays a list of the positions available for the new drive. Each position is univocally determined by its coordinates (I/O channel, ID). Obviously, the new drive can only be assigned to a position which is not occupied by another device yet, exception made for the position still occupied by the drive to be exchanged.

We choose entry number 1 and press <ENTER>.



| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|-----------------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | valid |
| 1 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RM | 2068 | valid |
| Disk Drive Positions | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 0 | i | QUANTUM | PLUS 910-10-94x | RM | 99 | |
| 2 | PCI 0/9 | C | 4 | i | SEAGATE | ST52160N | RM | 2068 | |
| 3 | PCI 0/9 | A | 1 | | | | | | |
| 4 | PCI 0/9 | A | 2 | | | | | | |
| 5 | PCI 0/9 | A | 3 | | | | | | |
| 6 | PCI 0/9 | A | 4 | | | | | | |
| 7 | PCI 0/9 | A | 5 | | | | | | |
| 8 | PCI 0/9 | B | 1 | | | | | | |
| Select the position of the new disk drive | | | | | | | | | |

GD/6537RP in Local_Sys Sampling Rate= 1

For this example, we select the first position and receive the following message:

| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|-----------------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | valid |
| 1 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RM | 2068 | valid |
| Do you really want to replace this drive in the mirror union ? | | | | | | | | | |
| | | | | | | | | No | Yes |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | C | 4 | i | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 0 | i | QUANTUM | PLUS 910-10-94x | RM | 99 | |
| 2 | PCI 0/9 | C | 4 | i | SEAGATE | ST52160N | RM | 2068 | |
| 3 | PCI 0/9 | A | 1 | | | | | | |
| 4 | PCI 0/9 | A | 2 | | | | | | |
| 5 | PCI 0/9 | A | 3 | | | | | | |
| 6 | PCI 0/9 | A | 4 | | | | | | |
| 7 | PCI 0/9 | A | 5 | | | | | | |
| 8 | PCI 0/9 | B | 1 | | | | | | |

GD/6537RP in Local_Sys Sampling Rate= 1

The Hot Plug function now informs us that all devices on the I/O channel to which the drive to be exchanged is connected, have to be temporarily halted. In addition, it shows which Host Drives are affected by this brief halt. With regard to the new drive, we are given some important information: Required storage capacity, ID and possible SCSI bus termination. The <ENTER>-key may only be pressed when the new drive is ready at hand and after having checked its capacity, ID and SCSI termination (the latter two may have to be changed). In our example we presume that these preparations have been made, so we press <ENTER> in order to halt the I/O channel.



| CDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RW | 2068 | valid |
| 1 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RW | 2068 | valid |

| | | | | | | | | | |
|-----|---------|---|---|---|---|---|---|---|---|
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | PCI 0/9 | A | 3 | | | | | | |
| | PCI 0/9 | A | 4 | | | | | | |
| | PCI 0/9 | A | 5 | | | | | | |
| | PCI 0/9 | B | 1 | | | | | | |

All SCSI devices connected to channel(s) C
 have to be stopped temporarily until the Hot Plug is completed.
 This affects Host Drive(s) 0.
 Please configure the new disk drive with SCSI ID 4.
 Check if SCSI bus terminators have to be added or removed.
 The new disk drive must have at least 200 MB capacity.
 Press RETURN to stop the SCSI channel for unplugging/plugging.
 Press RETURN to confirm!

GD16537RP in Local_Sys Sampling Rate= 1

Now we have entered the actual Hot Plug procedure. Disconnect the drive to be exchanged by plugging it off from the I/O channel first, and then, from the power cable. We immediately connect the new drive to the plugs that are now free, first to the power supply and then to the I/O channel. After having reconnected the new drive properly, press <ENTER>.

| CDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RW | 2068 | valid |
| 1 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RW | 2068 | valid |

| | | | | | | | | | |
|-----|---------|---|---|---|---|---|---|---|---|
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | PCI 0/9 | A | 3 | | | | | | |
| | PCI 0/9 | A | 4 | | | | | | |
| | PCI 0/9 | A | 5 | | | | | | |
| | PCI 0/9 | B | 1 | | | | | | |

*** SCSI channel(s) C stopped ***
 Plug in the new disk drive at SCSI channel C, SCSI ID 4.
 YOU MUST NOT DO ANY UNPLUGGING OR PLUGGING ON OTHER SCSI CHANNELS
 DOING SO MIGHT CAUSE SERIOUS HARDWARE DAMAGE.
 All data on the new disk drive will be destroyed.
 After confirming, unplugging or plugging is not allowed.
 This may cause serious hardware damage.
 Press RETURN to confirm!

GD16537RP in Local_Sys Sampling Rate= 1



| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|---|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | valid |
| 1 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RM | 2068 | valid |
| No. The disk drive you have plugged in has already been initialized. This disk drive will be used for the Hot Plug if you confirm. All data on this disk drive will be destroyed! Press RETURN to confirm! | | | | | | | | | |
| 2 | PCI 0/9 | A | 1 | | | | | | |
| 3 | PCI 0/9 | A | 2 | | | | | | |
| 4 | PCI 0/9 | A | 3 | | | | | | |
| 5 | PCI 0/9 | A | 4 | | | | | | |
| 6 | PCI 0/9 | A | 5 | | | | | | |
| 7 | PCI 0/9 | A | 6 | | | | | | |
| 8 | PCI 0/9 | B | 1 | | | | | | |

GD16537RP in Local_Sys Sampling Rate= 1

GDTMON recognizes that the new hard disk was already initialized before.
Confirmation of this message destroys all data on the selected drive.

| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|---|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | valid |
| 1 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RM | 2068 | valid |
| No. Position Chn. ID Do you really want to add this drive to the mirror union? Size(MB) Drive | | | | | | | | | |
| 0 | PCI 0/9 | C | 2 | No | YES | | | 2068 | 0 |
| 1 | PCI 0/9 | B | 0 | | | | | 99 | |
| 2 | PCI 0/9 | C | 4 | | | | | 2068 | |
| 3 | PCI 0/9 | A | 1 | | | | | | |
| 4 | PCI 0/9 | A | 2 | | | | | | |
| 5 | PCI 0/9 | A | 3 | | | | | | |
| 6 | PCI 0/9 | A | 4 | | | | | | |
| 7 | PCI 0/9 | A | 5 | | | | | | |
| 8 | PCI 0/9 | B | 1 | | | | | | |

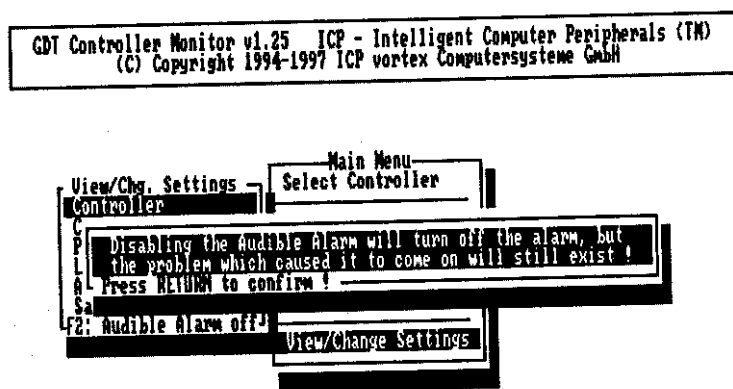
GD16537RP in Local_Sys Sampling Rate= 1

After this confirmation, the Hot Plug is finished successfully. It takes approximately 10 minutes to re-synchronize the data with this sample configuration.



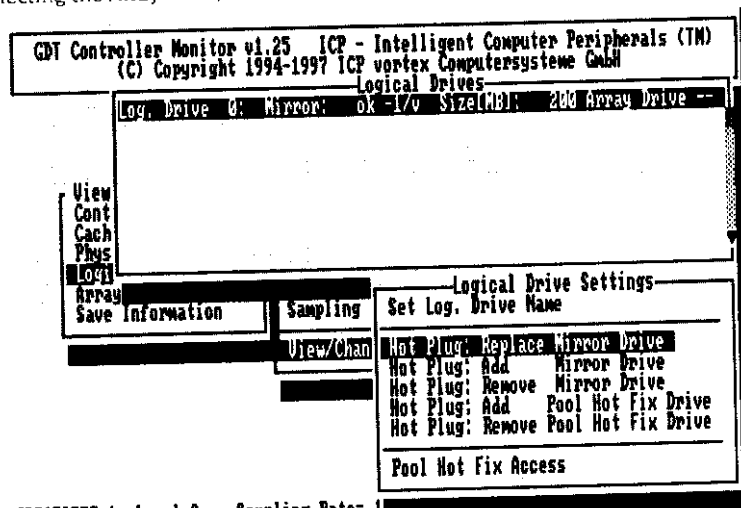
Example Session for Application 2

We assume that there is a RAID 1 Array Drive which is no longer fault tolerant. Its state is -1/v, one drive has failed and is therefore no longer accessible on the I/O channel. The ICP Controller started beeping. The audible alarm can be disabled within GDTMON by pressing <F2> as soon as the View/Change Settings menu is loaded:



GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

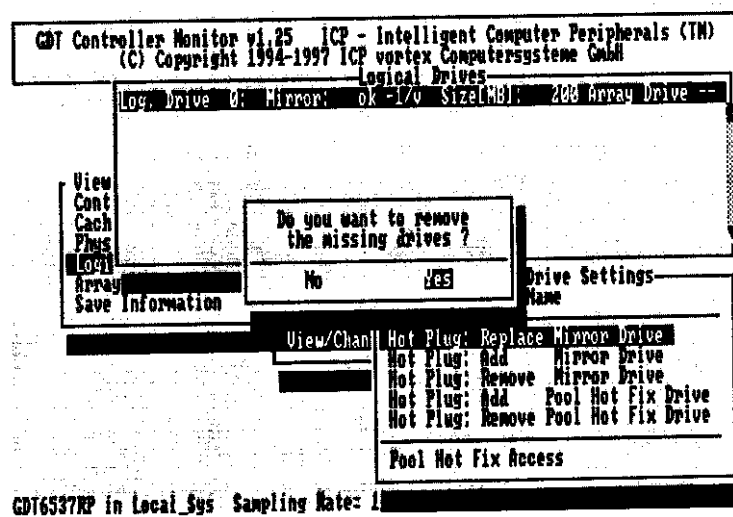
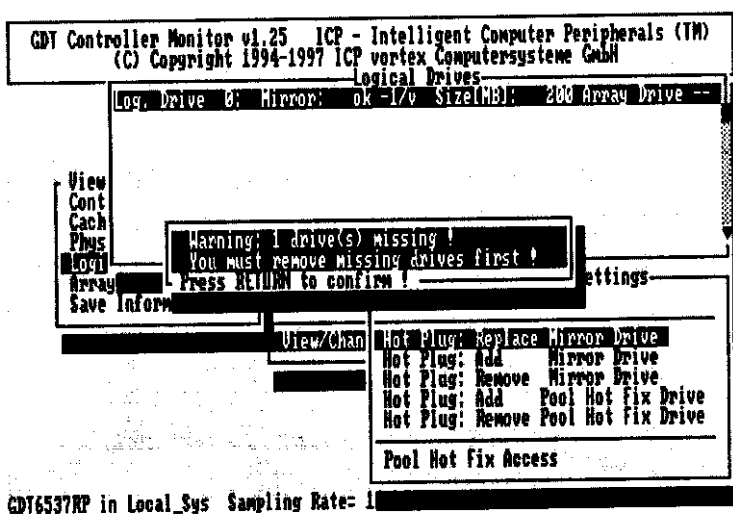
After selecting the Array Drive, we choose the Replace Mirror Drive option.



GDT6537RP in Local_Sys Sampling Rate= 1

Before the new drive can be added, the missing drive has to be deleted in the RAID 1 configuration.





After confirming here with "Yes", you can follow the next paragraph "K.3.5.3 Hot Plug: Add Mirror Drive", to add a new mirror drive to the remaining drive out of the previously failed RAID 1 Array Drive.

K.3.5.3 Hot Plug: Add Mirror Drive

This option allows you to add another Logical Drive as a mirroring drive to another Logical Drive. The new hard disk can be plugged onto the I/O channel while the system continues to be fully operational. If a spare and suitable hard disk is already connected and not yet

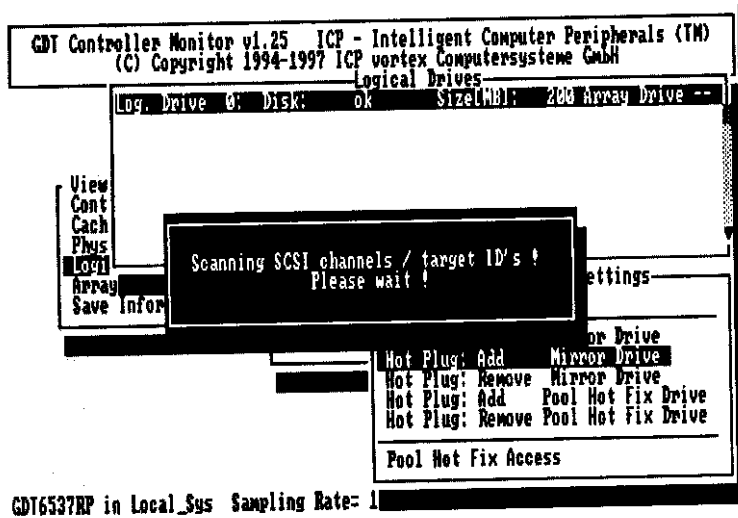


assigned to a Logical Drive or Host Drive, it will be displayed in the list of Disk Drive Positions.

There are two cases which make this function very interesting:

1. An existing hard disk should be given 100% redundancy, but there is no time to shut down the system and interrupt the normal operation
2. An existing hard disk has a high probability of failure, because it makes, for example, a strange noise or generates a lot of grown defects, but there is no time to shut down the system and interrupt the normal operation.

Once the new hard disk is added, the data synchronization (mirroring update) is automatically carried out in the background simultaneously with the normal operation.



In this example, there was already a spare hard disk available (on Channel B, SCSI ID 3). This drive must not be a Logical Drive. Otherwise it will not be available for this function.

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Logical Drives
Log. Drive 0: Disk: ok Size(MB): 200 Array Drive --

View
Cont

| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
|-----|----------|------|----|--------|---------|------------------|-------|----------|-------|
| 0 | PCI 0/9 | B | 0 | 1 | QUANTUM | PI05S 910-10-94x | RM | 99 | |
| 1 | PCI 0/9 | B | 3 | 1 | SEAGATE | S152160N | RM | 2068 | |
| 2 | PCI 0/9 | C | 2 | 1 | SEAGATE | S152160N | RM | 2068 | |
| 3 | PCI 0/9 | C | 4 | 1 | SEAGATE | S152160N | RM | 2068 | |
| 4 | PCI 0/9 | A | 0 | | | | | | |
| 5 | PCI 0/9 | A | 1 | | | | | | |
| 6 | PCI 0/9 | A | 2 | | | | | | |
| 7 | PCI 0/9 | A | 3 | | | | | | |
| 8 | PCI 0/9 | A | 4 | | | | | | |

Select the position of the new disk drive

GD16537RP in Local_Sys Sampling Rate= 1

After selecting the new hard disk, the following message appears:

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Logical Drives
Log. Drive 0: Disk: ok Size(MB): 200 Array Drive --

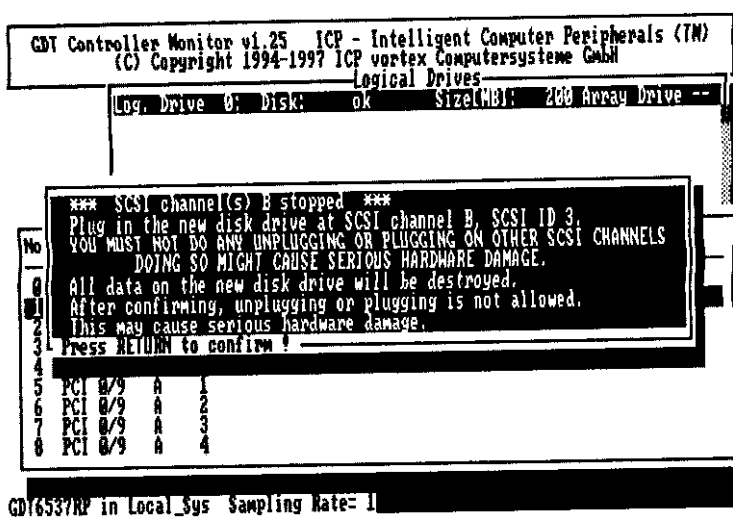
All SCSI devices connected to channel(s) B
have to be stopped temporarily until the Hot Plug is completed.
This affects Host Drive(s) -
Please configure the new disk drive with SCSI ID 3.
Check if SCSI bus terminators have to be added or removed.
The new disk drive must have at least 200 MB capacity.
Press RETURN to stop the SCSI channel for unplugging/plugging.
Press RETURN to confirm!

| | | | | |
|-----|---------|---|---|--|
| No. | | | | |
| 0 | | | | |
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | PCI 0/9 | A | 1 | |
| 6 | PCI 0/9 | A | 2 | |
| 7 | PCI 0/9 | A | 3 | |
| 8 | PCI 0/9 | A | 4 | |

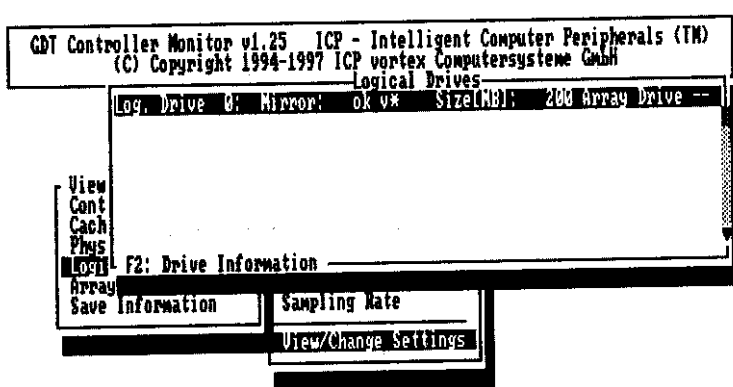
GD16537RP in Local_Sys Sampling Rate= 1

The following message indicates that channel B was stopped for the time of the actual Hot Plug





Now, the new hard disk is added as a mirror to the selected Logical Drive. The updated list of available Logical Drives shows the change. The Logical Drive changed its type to Mirror and the data on the new hard disk are currently synchronized, indicated through the "*" behind the "v".



GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

After pressing <F2>, the new structure is displayed.



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Logical Drives

Log. Drive 0: Mirror: ok v* Size(MB): 200 Array Drive --

Mirror Drive Components

Log. Drive: Name: DISK_00 Disk: valid Size(MB): 200
 Log. Drive: Name: DISK_01 Disk: invalid Size(MB): 200

View
 Cont
 Cache
 Plus
 Log1
 Array
 Save Info

F2: Drive Information

GDY6537RP in Local_Sys Sampling Rate= 1.0 sec

The entry "invalid" for the second drive means that the data have not yet been (completely) copied from the first drive. After the completion of the synchronization process, this entry changes into "valid".

K.3.5.4 Hot Plug: Remove Mirror Drive

This option allows the removal of a Mirror Drive from a RAID 1 or RAID 10 Array Drive. Once the drive has been removed, the data on the other drive are no longer redundant.

GDY Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)

Disk Drives

| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
|-----|----------|------|----|--------|---------|----------|-------|----------|-------|
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | valid |
| 1 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | RM | 2068 | valid |

Select one of the disk drives for Hot Plug

View/Chan

Hot Plug: Replace Mirror Drive
 Hot Plug: Add Mirror Drive
 Hot Plug: Remove Mirror Drive
 Hot Plug: Add Pool Hot Fix Drive
 Hot Plug: Remove Pool Hot Fix Drive

Pool Hot Fix Access

GDY6537RP in Local_Sys Sampling Rate= 1



K.3.5.5 Hot Plug: Add Pool Hot Fix Drive

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 RAID 1 and RAID 10 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.

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Logical Drives

Log. Drive 0: Mirror: ok uv Size(MB): 200 Array Drive --

View
Cont
Cach
Phys
Logic

Array
Save Information

Sampling

Logical Drive Settings

Set Log. Drive Name

Hot Plug: Replace Mirror Drive
Hot Plug: Add Mirror Drive
Hot Plug: Remove Mirror Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive

Pool Hot Fix Access

GDT6537RP in Local_Sys Sampling Rate: 1

After selecting this option, GDTMON scans the ICP Controller for drives which are suitable

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Logical Drives

Log. Drive 0: Mirror: ok uv Size(MB): 200 Array Drive --

View
Cont

Disk Drive Positions

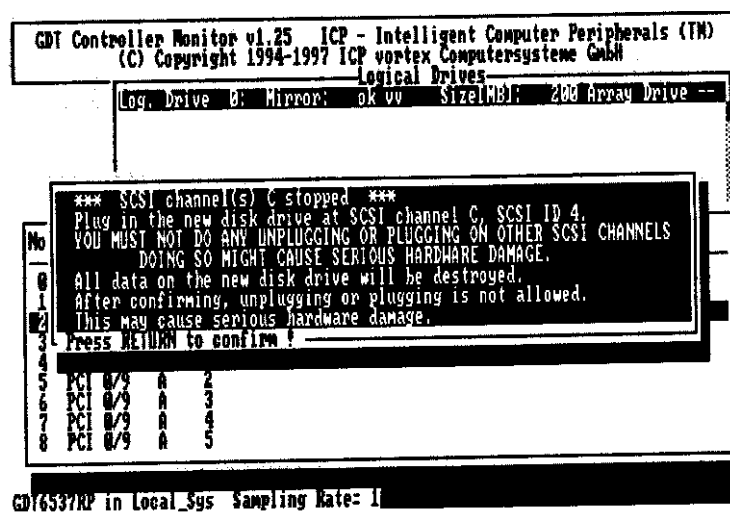
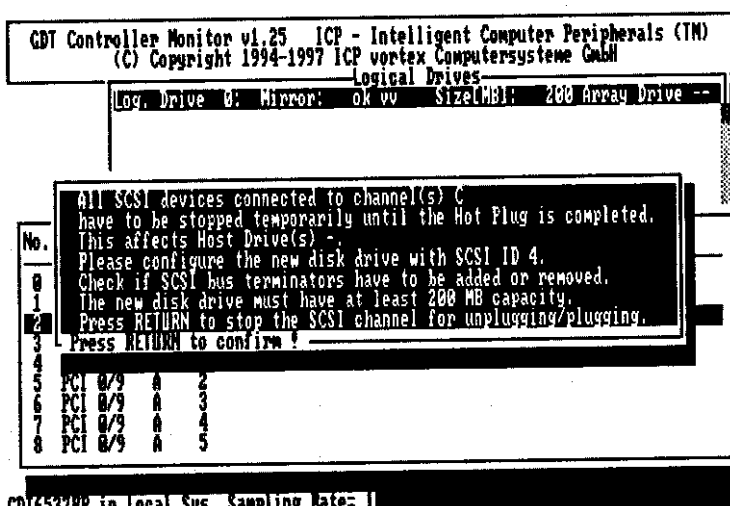
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
|-----|----------|------|----|--------|---------|------------------|-------|----------|-------|
| 0 | PCI 0/9 | B | 0 | 1 | QUANTUM | PI855 910-10-94x | RM | 99 | |
| 1 | PCI 0/9 | C | 2 | 1 | SEAGATE | S152160N | RM | 2068 | |
| 2 | PCI 0/9 | C | 4 | 1 | SEAGATE | S152160N | RM | 2068 | |
| 3 | PCI 0/9 | A | 0 | 1 | | | | | |
| 4 | PCI 0/9 | A | 1 | 1 | | | | | |
| 5 | PCI 0/9 | A | 2 | 1 | | | | | |
| 6 | PCI 0/9 | A | 3 | 1 | | | | | |
| 7 | PCI 0/9 | A | 4 | 1 | | | | | |
| 8 | PCI 0/9 | A | 5 | 1 | | | | | |

Select the position of the new disk drive

GDT6537RP in Local_Sys Sampling Rate: 1

for becoming a Pool Hot Fix drive (i.e. they belong to no Logical Drive), and for free coordinates (SCSI Channel / SCSI ID). We choose Channel C and SCSI ID 4 for the new Hot Fix Drive.





After the completion of this function, the Pool of Hot Fix drives contains a new drive (in our example here, it is the only drive).
To allow a RAID 1 or RAID 10 Array Drive access to the Hot Fix Pool, use the Pool Hot Fix Access menu (K.3.5.7).

K.3.5.6 Hot Plug: Remove Pool Hot Fix Drive

It may become necessary to remove a certain drive from the Hot Fix Pool.



GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)

Disk Drives

| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size[MB] | Drive |
|-----|----------|------|----|--------|---------|----------|-------|----------|-------|
| 0 | PCI 0/9 | C | 4 | i | SEAGATE | S152160N | RM | 2068 | 1 |

Select one of the disk drives for Hot Plug

View/Chan

Hot Plug: Replace Mirror Drive
 Hot Plug: Add Mirror Drive
 Hot Plug: Remove Mirror Drive
 Hot Plug: Add Pool Hot Fix Drive
 Hot Plug: Remove Pool Hot Fix Drive

Pool Hot Fix Access

GDT6537RP in Local_Sys Sampling Rate: 1

K.3.5.7 Pool Hot Fix Access

This function enables or disables the access of a certain RAID 1 or RAID 10 Array Drive to the Hot Fix Pool.

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Logical Drives

| | | | | |
|---------------|---------|-------|-----------|--------------------|
| Log. Drive 0: | Mirror: | 0x 00 | Size[MB]: | 200 Array Drive -- |
| Log. Drive 1: | Disk: | ok | Size[MB]: | 2068 Hot Fix Pool |

View
 Cont
 Cash
 Phys
 Log
 Array
 Save Inf

The access to the Hot Fix Pool is enabled !
 Do you want to disable it ?

No YES

View/Chan

Hot Plug: Replace Mirror Drive
 Hot Plug: Add Mirror Drive
 Hot Plug: Remove Mirror Drive
 Hot Plug: Add Pool Hot Fix Drive
 Hot Plug: Remove Pool Hot Fix Drive

Pool Hot Fix Access

GDT6537RP in Local_Sys Sampling Rate: 1

If the access had been enabled before, you could disable it now.

K.3.6 Array Drives

This command yields a list of the existing RAID 4 and RAID 5 Array Drives. In addition to the Array Drive number, information on the RAID level of the Array Drive: 4 or 5), the state



(error, idle, build, ready, fail, expand, rebuild) and the net capacity are displayed. Press <F2> to obtain further information on a selected Array Drive.

```

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Array Drives
Array Drive 0: RAID-5: ready  Size(MB): 400

View/Chg.
Controller
Cache Sett
Physical D
Logical Dr
Array Drive

F2: Drive Information

Array Drive Components
Log. Drive 0: Disk: ok  Size(MB): 200 Master
Log. Drive 1: Disk: ok  Size(MB): 200
Log. Drive 2: Disk: ok  Size(MB): 200

F2: Drive Information
GDT

```

If you press once more <F2>, you get detailed information on the physical hard disk.

```

GDT Controller Monitor v1.25  ICP - Intelligent Computer Peripherals (TM)
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Array Drives
Array Drive 0: RAID-5: ready  Size(MB): 400

Physical Disks
Ch: A ID: 6 SEAGATE ST52160N Size(MB): 2068

View/Chg.
Controller
Cache Sett
Physical D
Logical Dr
Array Drive

F2: Drive Information

Log. Drive 0: Disk: ok  Size(MB): 200 Master
Log. Drive 1: Disk: ok  Size(MB): 200
Log. Drive 2: Disk: ok  Size(MB): 200

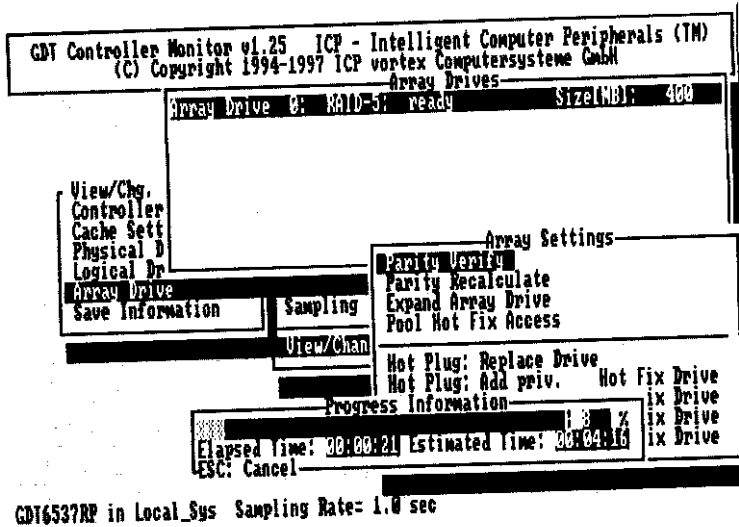
F2: Drive Information
GDT

```

K.3.6.1 Parity Verify

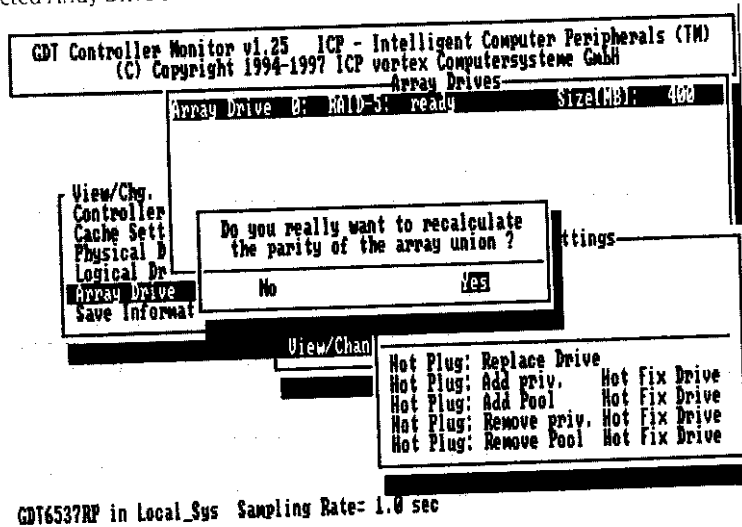
This option verifies online the parity information of the selected RAID 4 or RAID 5 Array Drive. Pressing <ESC> terminates this process. If this option is selected for several Array Drives, the processes are put into a queue and performed one after the other.





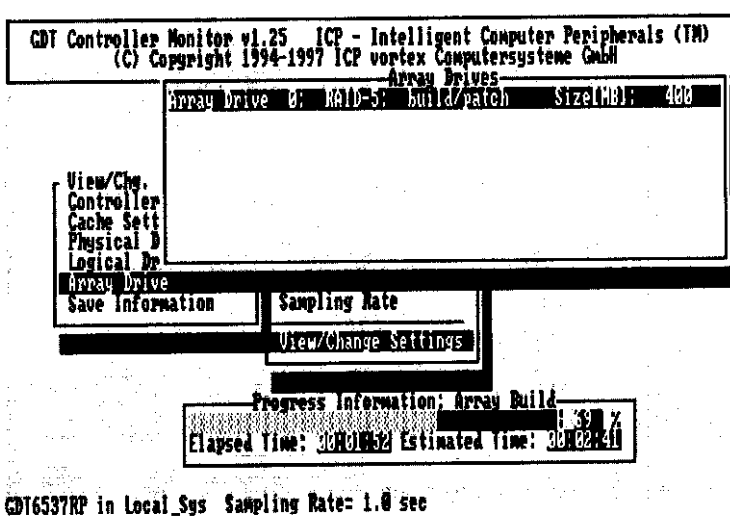
K.3.6.2 Parity Recalculate

If the parity verify option reports a parity problem, it is advisable to recalculate the parity of the selected Array Drive anew.



The state of the Array Drive changes into "build/patch", and the build process is started immediately. The word "patch" indicates that the parity of this Array Drive was calculated anew. After this procedure the Array Drive assumes the *ready/patch* state.





K.3.6.3 Expand Array Drive

There are two fundamental functions which 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)
- Expand the capacity of the selected Array Drive by adding one or several new hard disks

Both functions can be selected at the same time. E.g., 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 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 here, 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.



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Array Drives

Array Drive 0: RAID-5: ready Size(MB): 400

View/Chg.
Controller
Cache Sett
Physical Dr
Logical Dr
Array Drive
Save Information

Type
RAID-0
RAID-1
RAID-5

Array Settings

Verify
Recalculate
no Array Drive
Pool Not Fix Access

View/Chan

Hot Plug: Replace Drive
Hot Plug: Add priv. Hot Fix Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove priv. Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive

CDT6537RP in Local_Sys Sampling Rate= 1.0 sec

CDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
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Array Drives

Array Drive 0: RAID-5: ready Size(MB): 400

View/Chg.
Controller
Cache Sett
Physical Dr
Logical Dr
Array Drive
Save Information

Do you want to add a new drive
to the array?

No YES

View/Chan

Hot Plug: Replace Drive
Hot Plug: Add priv. Hot Fix Drive
Hot Plug: Add Pool Hot Fix Drive
Hot Plug: Remove priv. Hot Fix Drive
Hot Plug: Remove Pool Hot Fix Drive

CDT6537RP in Local_Sys Sampling Rate= 1.0 sec

After confirming this request, the I/O channels are scanned for free positions and already existing available (i.e., not yet assigned to a Logical Drive) hard disks.



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Array Drives

Array Drive 0: RAID-5; ready Size(MB): 400

View/Chg.
Controller
Cache Sett
Physical Dr
Logical Dr
Array Drive
Save Infor

Scanning SCSI channels / target ID's !
Please wait !

Hot Plug: Replace Drive
Hot Plug: Add priv. Not Fix Drive
Hot Plug: Add Pool Not Fix Drive
Hot Plug: Remove priv. Not Fix Drive
Hot Plug: Remove Pool Not Fix Drive

GD16537RP in Local_Sys Sampling Rate= 1.0 sec

For this demo, we select the hard disk on channel A and ID 0.

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Array Drives

Array Drive 0: RAID-5; ready Size(MB): 400

View/Chg.
Controller

| Disk Drive Positions | | | | | | | | | |
|----------------------|----------|------|----|--------|---------|------------------|-------|----------|----------|
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/0 | A | 0 | 1 | SEAGATE | ST52160N | RM | 2068 | |
| 1 | PCI 0/0 | B | 0 | 1 | QUANTUM | PI055 910-10-94x | RM | 99 | |
| 2 | PCI 0/0 | C | 4 | 1 | SEAGATE | ST52160N | RM | 2068 | Fragment |
| 3 | PCI 0/0 | A | 1 | 1 | | | | | |
| 4 | PCI 0/0 | A | 2 | 1 | | | | | |
| 5 | PCI 0/0 | A | 3 | 1 | | | | | |
| 6 | PCI 0/0 | A | 4 | 1 | | | | | |
| 7 | PCI 0/0 | A | 5 | 1 | | | | | |
| 8 | PCI 0/0 | A | 6 | 1 | | | | | |

Select the position of the new disk drive

GD16537RP in Local_Sys Sampling Rate= 1.0 sec



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Array Drives

Array Drive 0: RAID-5: ready Size(MB): 400

View/Chg. Controller

Do you really want to add this drive to the array union?

No Yes

Size(MB) Drive

2068 99

2068 Fragment

| No. | Position | Chn. | ID |
|-----|----------|------|----|
| 0 | PCI 0/9 | A | 0 |
| 1 | PCI 0/9 | A | 1 |
| 2 | PCI 0/9 | C | 4 |
| 3 | PCI 0/9 | A | 1 |
| 4 | PCI 0/9 | A | 2 |
| 5 | PCI 0/9 | A | 3 |
| 6 | PCI 0/9 | A | 4 |
| 7 | PCI 0/9 | A | 5 |
| 8 | PCI 0/9 | B | 1 |

GDY6537RP in Local_Sys Sampling Rate= 1.0 sec

The new drive is built into the Array Drive. According to the Expansion Progress Information this takes approximately 18 minutes. During the expansion the Array Drive's state is *ready/expand*.

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Array Drives

Array Drive 0: RAID-5: ready Size(MB): 400

View/Chg. Controller

Cache Sett

Physical Dr

Logical Dr

Array Drive

Save Information

Sampling

View/Chan

Array Settings

Parity Verify

Parity Recalculate

Expand Array Drive

Pool Not Fix Access

Hot Plug: Replace Drive

Hot Plug: Add priv. Hot Fix Drive

Progress Information: Expansion

Elapsed time: 20:00:54 Estimated time: 38:17:05

1x Drive

1x Drive

1x Drive

GDY6537RP in Local_Sys Sampling Rate= 1.0 sec

As expected the Array Drive's capacity is now 600MB.



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Array Drives

| | |
|------------------------------|---------------|
| Array Drive 0: RAID-5: ready | Size(MB): 600 |
|------------------------------|---------------|

View/Chg.
Controller
Cache Sett
Physical D
Logical Dr
F2: Drive Information

Array Drive
Save Information

Sampling Rate

View/Change Settings

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

K.3.6.4 Pool Hot Fix Access

This function enables or disables the access of a certain RAID 4 or RAID 5 Array Drive to the Hot Fix Pool.

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Array Drives

| | |
|------------------------------|---------------|
| Array Drive 0: RAID-5: ready | Size(MB): 400 |
|------------------------------|---------------|

View/Chg.
Controller
Cache Se
Physical
Logical
Array Dr
Save Inf

The access to the Hot Fix Pool is enabled !
Do you want to disable it ?

No YES

View/Chan

| | |
|-------------------------|---------------|
| Hot Plug: Replace Drive | |
| Hot Plug: Add priv. | Hot Fix Drive |
| Hot Plug: Add Pool | Hot Fix Drive |
| Hot Plug: Remove priv. | Hot Fix Drive |
| Hot Plug: Remove Pool | Hot Fix Drive |

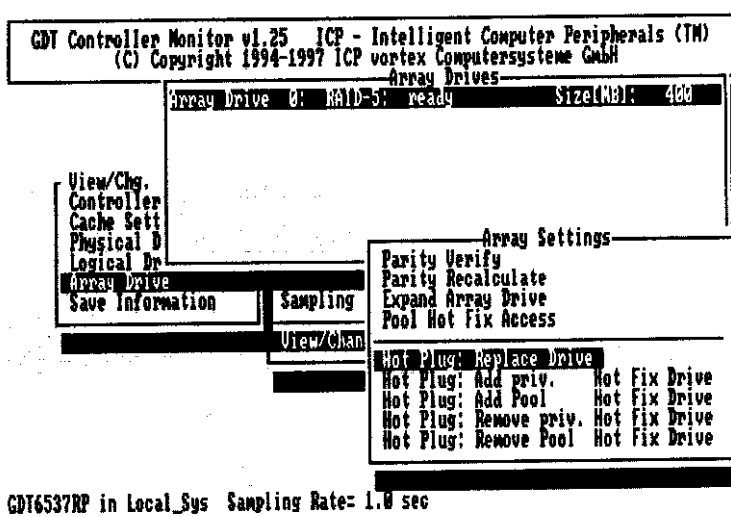
GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

If the access had been enabled before, you would be able to disable it now.



K.3.6.5 Hot Plug: Replace Drive

In a similar way as was described a few pages before with the RAID 1 Array Drives, this function is designed to replace a defective drive of a RAID 4 or RAID 5 Array Drive, while the system continues to be fully operational.



There are typically two different applications where a Hot Plug is necessary.

Application 1. The RAID 4/5 Array Drive is in the *ready* state. It is likely that a drive will soon fail (for example when there is a loud operating noise). As a preventative measure, this drive ought to be exchanged now, that is, in a moment when the Array Drive is still in a ready state and still has redundancy.

Application 2. The RAID 4/5 Array Drive is no longer fault tolerant (*fail* state), because a drive of the Array Drive has actually failed. The Array Drive is still fully operational, but it does not have redundancy any more. If another drive should also fail, the Array Drive's functionality is impaired.

Example Session for Application 1

We assume that there is a RAID 5 Array Drive which is fault tolerant. Its state is *ready*, all drives are valid. After selecting the Array Drive, we choose the Replace Drive option.



| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RW | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | RW | 2068 | 1 |
| 2 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RW | 2068 | 2 |

Select one of the disk drives for Hot Plug

View/Chan

Hot Plug: Replace Drive
 Hot Plug: Add priv. Hot Fix Drive
 Hot Plug: Add Pool Hot Fix Drive
 Hot Plug: Remove priv. Hot Fix Drive
 Hot Plug: Remove Pool Hot Fix Drive

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

A list of the Array Drive's components is displayed. For our example we choose No.1 for the Hot Plug.

GDTMON scans the ICP Controller's I/O channels for drives which are still free (not yet assigned to Logical Drives) and free (i.e., not occupied) I/O channels and IDs.

| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RW | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | RW | 2068 | 1 |
| 2 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RW | 2068 | 2 |

Scanning SCSI channels / target ID's !
Please wait !

Hot Plug: Replace Drive
 Hot Plug: Add priv. Hot Fix Drive
 Hot Plug: Add Pool Hot Fix Drive
 Hot Plug: Remove priv. Hot Fix Drive
 Hot Plug: Remove Pool Hot Fix Drive

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec



| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | RM | 2068 | 1 |
| 2 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RM | 2068 | 2 |

| Disk Drive Positions | | | | | | | | | |
|----------------------|----------|------|----|--------|---------|------------------|-------|----------|-------|
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | RM | 2068 | 1 |
| 1 | PCI 0/9 | A | 0 | i | SEAGATE | ST52160N | RM | 2068 | |
| 2 | PCI 0/9 | B | 0 | i | QUANTUM | PI855 910-10-94x | RM | 99 | |
| 3 | PCI 0/9 | C | 4 | i | SEAGATE | ST52160N | RM | 2068 | |
| 4 | PCI 0/9 | A | 1 | | | | | | |
| 5 | PCI 0/9 | A | 2 | | | | | | |
| 6 | PCI 0/9 | A | 3 | | | | | | |
| 7 | PCI 0/9 | A | 4 | | | | | | |
| 8 | PCI 0/9 | A | 5 | | | | | | |

Select the position of the new disk drive _____

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

The list of Disk Drive Positions shows us the following:

- No.0 This is the position of the drive which should be replaced. Since it is still there, the hard disk's state, vendor, type, attributes, size and Logical Drive number are displayed.
- No.1, 2, 3 Free available (i.e., not yet assigned to a Logical Drive) drives. 1 and 3 could also be used for the replacement.
- No.4 to No.17 These are free (i.e., not occupied) plugging positions for the new hard disk (On the above screen you can't see positions No.9 to No.17, but you can scroll the list with the Page-Down/Up keys).

| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | RM | 2068 | 1 |
| 2 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RM | 2068 | 2 |

All SCSI devices connected to channel(s) B have to be stopped temporarily until the Hot Plug is completed. This affects Host Drive(s) - . Please configure the new disk drive with SCSI ID 3. Check if SCSI bus terminators have to be added or removed. The new disk drive must have at least 200 MB capacity. Press RETURN to stop the SCSI channel for unplugging/plugging. Press RETURN to confirm !

| | | | | | | | | | |
|-----|----------|------|----|--------|---------|----------|-------|----------|-------|
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | RM | 2068 | 1 |
| 2 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RM | 2068 | 2 |
| 3 | PCI 0/9 | A | 0 | | | | | | |
| 4 | PCI 0/9 | A | 1 | | | | | | |
| 5 | PCI 0/9 | A | 2 | | | | | | |
| 6 | PCI 0/9 | A | 3 | | | | | | |
| 7 | PCI 0/9 | A | 4 | | | | | | |
| 8 | PCI 0/9 | A | 5 | | | | | | |

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec



For our example we now take the new hard disk (which must have a capacity equal or larger than 200MB) set it to SCSI ID 3 and observe the SCSI termination.

| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | RM | 2068 | 1 |
| 2 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RM | 2068 | 2 |

*** SCSI channel(s) B stopped ***
 Plug in the new disk drive at SCSI channel B, SCSI ID 3.
 YOU MUST NOT DO ANY UNPLUGGING OR PLUGGING ON OTHER SCSI CHANNELS
 DOING SO MIGHT CAUSE SERIOUS HARDWARE DAMAGE.
 All data on the new disk drive will be destroyed.
 After confirming, unplugging or plugging is not allowed.
 This may cause serious hardware damage.
 Press RETURN to confirm !

| | | | | | | | | | |
|-----|----------|------|----|--------|---------|----------|-------|----------|-------|
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | RM | 2068 | 1 |
| 2 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RM | 2068 | 2 |

GD16537RP in Local_Sys Sampling Rate= 1.0 sec

After this message we can unplug the old drive and plug in the new one again and confirm this procedure.

| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | RM | 2068 | 1 |
| 2 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RM | 2068 | 2 |

The new disk drive is built into the disk array !
 Please wait !

| | | | | | | | | | |
|-----|----------|------|----|--------|---------|----------|-------|----------|-------|
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | RM | 2068 | 1 |
| 2 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RM | 2068 | 2 |

GD16537RP in Local_Sys Sampling Rate= 1.0 sec

If everything was OK, GDTMON displays the following message:



| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|---|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size[MB] | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | RM | 2068 | 1 |
| 2 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RM | 2068 | 2 |
| The Hot Plug was finished successfully ! | | | | | | | | | |
| The disk array's status has changed to REBUILD. | | | | | | | | | |
| The time the disk array needs to assume the READY status depends on the controller's utilization and the disk array's capacity. | | | | | | | | | |
| Press RETURN to confirm ! | | | | | | | | | |
| 3 | PCI 0/9 | C | 4 | i | SEAGATE | ST52160N | RM | 2068 | |
| 4 | PCI 0/9 | A | 1 | | | | | | |
| 5 | PCI 0/9 | A | 2 | | | | | | |
| 6 | PCI 0/9 | A | 3 | | | | | | |
| 7 | PCI 0/9 | A | 4 | | | | | | |
| 8 | PCI 0/9 | A | 5 | | | | | | |

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

If the new drive, which we have plugged in just before, had contained data from a previous operation with a ICP Controller, GDTMON would have reported this.

| | |
|--|----------------------|
| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | |
| (C) Copyright 1994-1997 ICP vortex Computersysteme GmbH | |
| Array Drives | |
| Array Drive 0: RAID-5: rebuild | Size[MB]: 400 |
| View/Chg. Controller Cache Sett Physical D Logical Dr | |
| Array Drive | Sampling Rate |
| Save Information | View/Change Settings |
| Progress Information: Array Rebuild | |
| Elapsed time: 00:00:06 Estimated time: 00:03:09 | |

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

Example Session for Application 2

We assume that there is a RAID 5 Array Drive where one drive has failed. Its state is fail. After selecting the Array Drive, we choose the Replace Drive option.



GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
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Array Drives
 Array Drive 0: HD0-1: fail Size(MB): 400

View/Chg.
 Controller
 Cache Sett
 Physical D
 Logical Dr
 Array Drive
 Save Information
 Sampling
 View/Chan

Array Settings
 Parity Verify
 Parity Recalculate
 Expand Array Drive
 Pool Hot Fix Access

Hot Plug: Replace Drive
 Hot Plug: Add priv. Hot Fix Drive
 Hot Plug: Add Pool Hot Fix Drive
 Hot Plug: Remove priv. Hot Fix Drive
 Hot Plug: Remove Pool Hot Fix Drive

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

GDTMON shows the failed drive (No.1),

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
 Disk Drives

| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
|-----|----------|------|----|--------|---------|----------|-------|----------|-------|
| 0 | PCI 0/9 | A | 6 | 1 | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | 1 | SEAGATE | ST52160N | fail | 2068 | 3 |
| 2 | PCI 0/9 | C | 2 | 1 | SEAGATE | ST52160N | RM | 2068 | 2 |

The failed/missing drive(s) will be used for Hot Plug

View/Chan

Hot Plug: Replace Drive
 Hot Plug: Add priv. Hot Fix Drive
 Hot Plug: Add Pool Hot Fix Drive
 Hot Plug: Remove priv. Hot Fix Drive
 Hot Plug: Remove Pool Hot Fix Drive

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

After pressing the <ENTER>-key, GDTMON scans the ICP Controller for free plugging positions:



| CDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RW | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | fail | 2068 | 3 |
| 2 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RW | 2068 | 2 |

Scanning SCSI channels / target ID's !
Please wait !

| | |
|-------------------------|---------------|
| Hot Plug: Replace Drive | |
| Hot Plug: Add priv. | Hot Fix Drive |
| Hot Plug: Add Pool | Hot Fix Drive |
| Hot Plug: Remove priv. | Hot Fix Drive |
| Hot Plug: Remove Pool | Hot Fix Drive |

CDT6537RP in Local_Sys Sampling Rate= 1.0 sec

| CDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | i | SEAGATE | ST52160N | RW | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | fail | 2068 | 3 |
| 2 | PCI 0/9 | C | 2 | i | SEAGATE | ST52160N | RW | 2068 | 2 |

| Disk Drive Positions | | | | | | | | | |
|----------------------|----------|------|----|--------|---------|------------------|-------|----------|-------|
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | B | 3 | i | SEAGATE | ST52160N | fail | 2068 | 3 |
| 1 | PCI 0/9 | A | 0 | i | SEAGATE | ST52160N | RW | 2068 | |
| 2 | PCI 0/9 | B | 0 | i | QUANTUM | PI855 910-10-94x | RW | 99 | |
| 3 | PCI 0/9 | C | 4 | i | SEAGATE | ST52160N | RW | 2068 | |
| 4 | PCI 0/9 | A | 1 | | | | | | |
| 5 | PCI 0/9 | A | 2 | | | | | | |
| 6 | PCI 0/9 | A | 3 | | | | | | |
| 7 | PCI 0/9 | A | 4 | | | | | | |
| 8 | PCI 0/9 | A | 5 | | | | | | |

Select the position of the new disk drive

CDT6537RP in Local_Sys Sampling Rate= 1.0 sec

The list of Disk Drive Positions shows us the following:

- No.0 This is the position of the drive which should be replaced. Since it is still there, but defective, the hard disk's state, vendor, type, attributes, size and Logical Drive number are displayed.
- No.1, 2, 3 Free available (i.e., not yet assigned to a Logical Drive) drives. 1 and 3 could also be used for the replacement.
- No.4 to No.17 These are free (i.e., not occupied) plugging positions for the new hard disk (On the above screen you can't see positions No.9 to No.17, but you can scroll the list with the Page-Down/Up keys).



| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | 1 | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | 1 | SEAGATE | ST52160N | Fail | 2068 | 3 |
| 2 | PCI 0/9 | C | 2 | 1 | SEAGATE | ST52160N | RM | 2068 | 2 |

All SCSI devices connected to channel(s) B have to be stopped temporarily until the Hot Plug is completed. This affects Host Drives(s) -
Please configure the new disk drive with SCSI ID 3.
Check if SCSI bus terminators have to be added or removed.
The new disk drive must have at least 200 MB capacity.
Press RETURN to stop the SCSI channel for unplugging/plugging.
Press RETURN to confirm!

| | | | | | | | | | |
|---------|---|---|---|---|---|---|---|---|---|
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| PCI 0/9 | A | 2 | | | | | | | |
| PCI 0/9 | A | 3 | | | | | | | |
| PCI 0/9 | A | 4 | | | | | | | |
| PCI 0/9 | A | 5 | | | | | | | |

GD16537RP in Local_Sys Sampling Rate= 1.0 sec

For our example we now take the new hard disk (which must have a capacity equal to or larger than 200MB) set it to SCSI ID 3 and observe the SCSI termination.

| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | A | 6 | 1 | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | 1 | SEAGATE | ST52160N | Fail | 2068 | 3 |
| 2 | PCI 0/9 | C | 2 | 1 | SEAGATE | ST52160N | RM | 2068 | 2 |

*** SCSI channel(s) B stopped ***
Plug in the new disk drive at SCSI channel B, SCSI ID 3.
YOU MUST NOT DO ANY UNPLUGGING OR PLUGGING ON OTHER SCSI CHANNELS
DOING SO MIGHT CAUSE SERIOUS HARDWARE DAMAGE.
All data on the new disk drive will be destroyed.
After confirming, unplugging or plugging is not allowed.
This may cause serious hardware damage.
Press RETURN to confirm!

| | | | | | | | | | |
|---------|---|---|---|---|---|---|---|---|---|
| No. | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| PCI 0/9 | A | 2 | | | | | | | |
| PCI 0/9 | A | 3 | | | | | | | |
| PCI 0/9 | A | 4 | | | | | | | |
| PCI 0/9 | A | 5 | | | | | | | |

GD16537RP in Local_Sys Sampling Rate= 1.0 sec

After this message we can unplug the old drive and plug the new one in again and confirm this procedure.



| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size[MB] | Drive |
| 0 | PCI 0/9 | A | 6 | 1 | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | 1 | SEAGATE | ST52160N | RM | 2068 | 3 |
| 2 | PCI 0/9 | C | 2 | 1 | SEAGATE | ST52160N | RM | 2068 | 2 |

| | | | | | | | | | |
|-----|--|--|--|--|--|--|--|--|--|
| No. | This disk drive belonged to the logical drive with number 3. This disk drive belonged to the disk array with number 0. The disk drive you have plugged in has already been initialized. This disk drive will be used for the Hot Plug if you confirm. All data on this disk drive will be destroyed! Press Alt+U to confirm! | | | | | | | | |
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |

GDT6537NP in Local_Sys Sampling Rate= 1.0 sec

GDTMON has detected data on the new drive (i.e., it was already used as a Logical Drive with a ICP Controller).

| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size[MB] | Drive |
| 0 | PCI 0/9 | A | 6 | 1 | SEAGATE | ST52160N | RM | 2068 | 0 |
| 1 | PCI 0/9 | B | 3 | 1 | SEAGATE | ST52160N | RM | 2068 | 3 |
| 2 | PCI 0/9 | C | 2 | 1 | SEAGATE | ST52160N | RM | 2068 | 2 |

| | | | | | | | | | |
|-----|----------|------|----|--|---------|----------|----|----------|-------|
| No. | Position | Chn. | ID | Do you really want to add this drive to the array union? | | | | Size[MB] | Drive |
| 0 | PCI 0/9 | B | 3 | No | YES | | | | 2068 |
| 1 | PCI 0/9 | B | 3 | | | | | 2068 | 3 |
| 2 | PCI 0/9 | B | 3 | | | | | 99 | |
| 3 | PCI 0/9 | C | 2 | 1 | SEAGATE | ST52160N | RM | 2068 | |
| 4 | PCI 0/9 | A | 6 | | | | | | |
| 5 | PCI 0/9 | A | 6 | | | | | | |
| 6 | PCI 0/9 | A | 6 | | | | | | |
| 7 | PCI 0/9 | A | 6 | | | | | | |
| 8 | PCI 0/9 | A | 6 | | | | | | |

GDT6537NP in Local_Sys Sampling Rate= 1.0 sec

This confirmation deletes all data on the new drive and prepares it for the Array Drive.



| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|--|
| Disk Drives | | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size[MB] | Drive | |
| 0 | PCI 0/9 | A | 6 | 1 | SEAGATE | ST52160N | RM | 2068 | 0 | |
| 1 | PCI 0/9 | B | 3 | 1 | SEAGATE | ST52160N | RM | 2068 | 3 | |
| 2 | PCI 0/9 | C | 2 | 1 | SEAGATE | ST52160N | RM | 2068 | 2 | |

| No. | Position | The new disk drive is built into the disk array ! Please wait ! | | | | | | Drive |
|-----|----------|--|---|--|--|--|--|-------|
| 0 | PCI 0/9 | | | | | | | 3 |
| 1 | PCI 0/9 | | | | | | | |
| 2 | PCI 0/9 | | | | | | | |
| 3 | PCI 0/9 | | | | | | | |
| 4 | PCI 0/9 | A | 1 | | | | | |
| 5 | PCI 0/9 | A | 2 | | | | | |
| 6 | PCI 0/9 | A | 3 | | | | | |
| 7 | PCI 0/9 | A | 4 | | | | | |
| 8 | PCI 0/9 | A | 5 | | | | | |

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

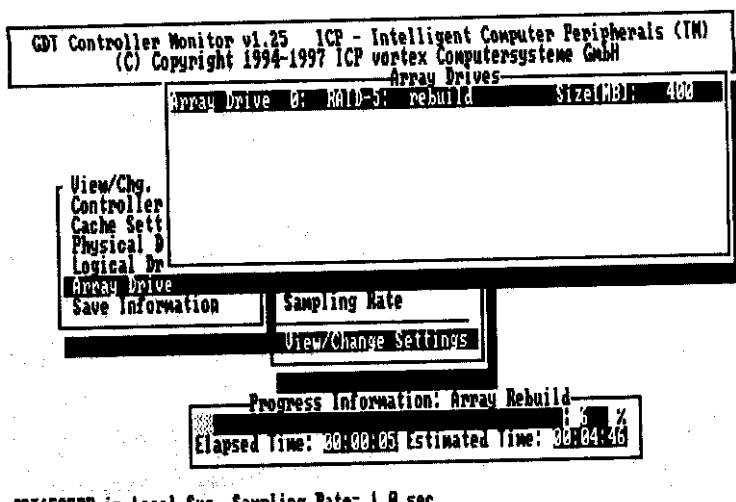
| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|--|
| Disk Drives | | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size[MB] | Drive | |
| 0 | PCI 0/9 | A | 6 | 1 | SEAGATE | ST52160N | RM | 2068 | 0 | |
| 1 | PCI 0/9 | B | 3 | 1 | SEAGATE | ST52160N | RM | 2068 | 3 | |
| 2 | PCI 0/9 | C | 2 | 1 | SEAGATE | ST52160N | RM | 2068 | 2 | |

| | | | | | | | | | | |
|--|---------|---|---|---|---------|----------|----|------|--|--|
| The Hot Plug was finished successfully ! The disk array's status has changed to REBUILD. The time the disk array needs to assume the READY status depends on the controller's utilization and the disk array's capacity. Press RETURN to confirm ! | | | | | | | | | | |
| 3 | PCI 0/9 | C | 4 | 1 | SEAGATE | ST52160N | RM | 2068 | | |
| 4 | PCI 0/9 | A | 1 | | | | | | | |
| 5 | PCI 0/9 | A | 2 | | | | | | | |
| 6 | PCI 0/9 | A | 3 | | | | | | | |
| 7 | PCI 0/9 | A | 4 | | | | | | | |
| 8 | PCI 0/9 | A | 5 | | | | | | | |

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

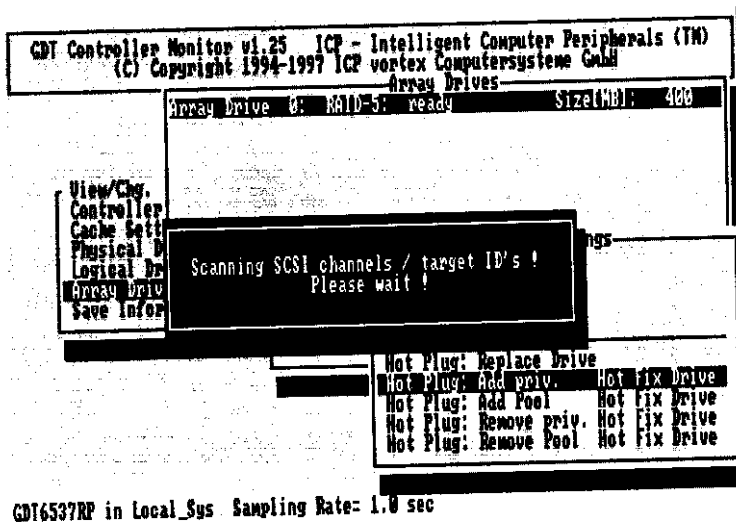
The Array Drive changes its state to *rebuild*. This means that the ICP Controller rebuilds the original data on the new drive.





K.3.6.6 Hot Plug: Add private Hot Fix Drive

This function allows you to add a Hot Fix Drive to an existing RAID 4 / RAID 5 Array Drive. "Private" means that this Hot Fix Drive is only available for the selected Array Drive and cannot be accessed from other Array Drives.



After selecting this option GDTMON scans the ICP Controller for free positions where the new Hot Fix Drive can be plugged in.



GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
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Array Drives
 Array Drive 0: RAID-5: ready Size(MB): 400

View/Chg.
 Controller

| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
|-----|----------|------|----|--------|---------|------------------|-------|----------|-------|
| 0 | PCI 0/9 | A | 0 | 1 | SEAGATE | ST52160N | RW | 2068 | |
| 1 | PCI 0/9 | B | 0 | 1 | QUANTUM | PI055 910-10-94x | RW | 99 | |
| 2 | PCI 0/9 | C | 4 | 1 | SEAGATE | ST52160N | RW | 2068 | |
| 3 | PCI 0/9 | A | 1 | | | | | | |
| 4 | PCI 0/9 | A | 2 | | | | | | |
| 5 | PCI 0/9 | A | 3 | | | | | | |
| 6 | PCI 0/9 | A | 4 | | | | | | |
| 7 | PCI 0/9 | A | 5 | | | | | | |
| 8 | PCI 0/9 | B | 1 | | | | | | |

Select the position of the new disk drive

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

For our example, we choose the drive on Channel C and SCSI ID 4. (if we would plug in now a new drive we would have to set the SCSI ID to 4 and make sure that the SCSI termination is set properly).

GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
(C) Copyright 1994-1997 ICP vortex Computersysteme GmbH
Array Drives
 Array Drive 0: RAID-5: ready Size(MB): 400

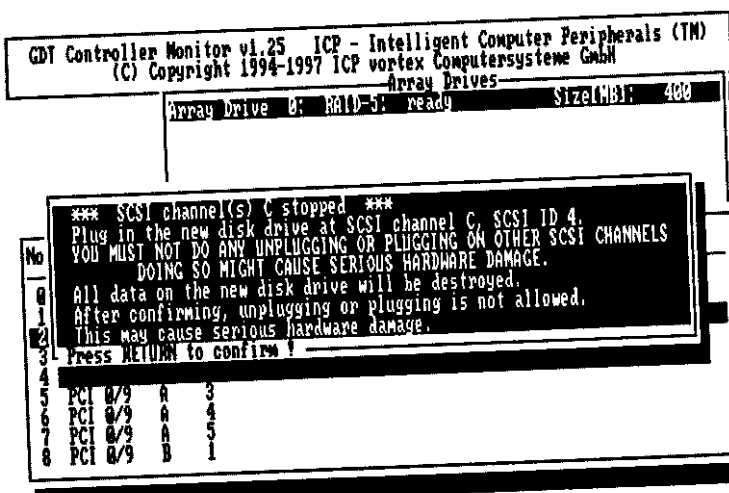
All SCSI devices connected to channel(s) C
 have to be stopped temporarily until the Hot Plug is completed.
 This affects Host Drive(s) 0.
 Please configure the new disk drive with SCSI ID 4.
 Check if SCSI bus terminators have to be added or removed.
 The new disk drive must have at least 200 MB capacity.
 Press RETURN to stop the SCSI channel for unplugging/plugging.
 Press RETURN to confirm !

| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
|-----|----------|------|----|--------|--------|------|-------|----------|-------|
| 0 | PCI 0/9 | A | 3 | | | | | | |
| 1 | PCI 0/9 | A | 4 | | | | | | |
| 2 | PCI 0/9 | A | 5 | | | | | | |
| 3 | PCI 0/9 | B | 1 | | | | | | |

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

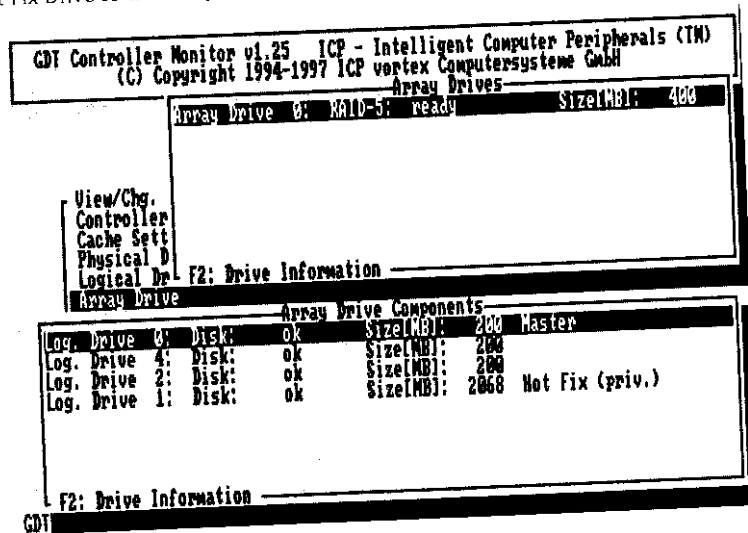
GDTMON adds the new drive to the selected Array Drive.





GDT6537MP in Local_Sys Sampling Rate= 1.0 sec

If we now look at the Array Drive's structure (press <F2>), we can see the new drive added as a Hot Fix Drive to the Array Drive.



K.3.6.7 Hot Plug: Add Pool Hot Fix Drive

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 RAID 4/5 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.



GDI Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
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Array Drives

Array Drive 0: RAID-5: ready Size(MB): 400

View/Chg.
Controller

Disk Drive Positions

| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
|-----|----------|------|----|--------|---------|------------------|-------|----------|----------|
| 0 | PCI 0/9 | A | 0 | 1 | SEAGATE | ST52160N | RM | 2068 | |
| 1 | PCI 0/9 | B | 0 | 1 | QUANTUM | P105S 910-10-94x | RM | 99 | |
| 2 | PCI 0/9 | C | 4 | 1 | SEAGATE | ST52160N | RM | 2068 | fragment |
| 3 | PCI 0/9 | A | 1 | | | | | | |
| 4 | PCI 0/9 | A | 2 | | | | | | |
| 5 | PCI 0/9 | A | 3 | | | | | | |
| 6 | PCI 0/9 | A | 4 | | | | | | |
| 7 | PCI 0/9 | A | 5 | | | | | | |
| 8 | PCI 0/9 | B | 1 | | | | | | |

Select the position of the new disk drive _____

GDI6537RP in Local_Sys Sampling Rate= 1.0 sec

We select SCSI Channel C and ID4 for the new Pool Hot Fix Drive.

GDI Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM)
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Array Drives

Array Drive 0: RAID-5: ready Size(MB): 400

View/Chg.
Controller
Cache Sett
Physical Dr
Logical Dr

F2: Drive Information

Array Drive

Array Drive Components

| Log. Drive | 0: | Disk: | ok | Size(MB): | 200 | Master |
|---------------|-------|-------|-----------|-----------|-----|----------------|
| Log. Drive 4: | Disk: | ok | Size(MB): | 200 | | |
| Log. Drive 2: | Disk: | ok | Size(MB): | 200 | | |
| Log. Drive 1: | Disk: | ok | Size(MB): | 2068 | | Hot Fix (Pool) |

F2: Drive Information _____

GDI

You may disable or enable the access of a certain RAID 4/5 Array Drive to the pool of Hot Fix Drives with the option "Pool Hot Fix Access" (see K.3.6.4).

K.3.6.8 Hot Plug: Remove Private Hot Fix Drive

This function is used, if you want to remove a private Hot Fix Drive from an Array Drive.



K.3.6.9 Hot Plug: Remove Pool Hot Fix Drive

In a similar way as with the "Remove private Hot Fix Drive" function, here you can remove a Hot Fix Drive from the Hot Fix Pool. A possible reason for this could be that you want to add it as a private Hot Fix Drive to an Array Drive.

| GDT Controller Monitor v1.25 ICP - Intelligent Computer Peripherals (TM) | | | | | | | | | |
|--|----------|------|----|--------|---------|----------|-------|----------|-------|
| Disk Drives | | | | | | | | | |
| No. | Position | Chn. | ID | Status | Vendor | Type | Attr. | Size(MB) | Drive |
| 0 | PCI 0/9 | C | 4 | 1 | SEAGATE | ST52160N | HW | 2868 | 1 |

Select one of the disk drives for Hot Plug

View/Chan

| |
|--------------------------------------|
| Hot Plug: Replace Drive |
| Hot Plug: Add priv. Hot Fix Drive |
| Hot Plug: Add Pool Hot Fix Drive |
| Hot Plug: Remove priv. Hot Fix Drive |
| Hot Plug: Remove Pool Hot fix Drive |

GDT6537RP in Local_Sys Sampling Rate= 1.0 sec

K.3.7 Save Information

The *Save Information* option gives you the possibility to save the configuration information regarding the selected ICP Controller and its devices in an ASCII-file. This may help if you require support and is also good for your system documentation.



Chapter L

GDTSETUP in Detail



L. GDTSETUP in Detail

We refer to firmware (RAIDYNE) as the operating system which controls the ICP Controller with all its functions and capabilities. The firmware exclusively runs on the ICP Controller and is stored in the Flash-RAM on the ICP Controller PCB. The controlling function is entirely independent of the PCI computer and the host operating system installed (for example UNIX), and does not "drain" any computing power or time from the PCI computer. In addition to disk chaining, RAID 0 and RAID 1, RAIDYNE allows you to install and control Array Drives of the types RAID 4 (data striping with dedicated parity drive), RAID 5 (data striping with distributed parity) and RAID10 (a combination between RAID 0 and 1). All ICP Controllers are equipped with a hardware which is particularly well suited for disk arrays. RAIDYNE uses this hardware with extreme 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).

L.1 The four Levels of Hierarchy in the GDT Firmware

RAIDYNE 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 = hard disks, removable hard disks, some MO drives are located on the lowest level. This can be either devices with a SCSI interface, or devices with a Fibre Channel Arbitrated Loop (FCAL) port.

They are the basic components of all "drive constructions" you can set up. However, before they can be used by the firmware, these hard disks must be "prepared", a procedure we call *initialization*. During this initialization each hard disk receives information which allows a univocal identification even if the SCSI-ID, FCAL-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 whole ICP Controller and the channels, IDs, without losing the data and the information on a specific disk array.

Level 3:

On this level of hierarchy, the firmware forms the **Array Drives**. This can be:

- Single Disks (one hard disk, some vendors call it JBOD - Just A Bunch Of Drives)
- Chaining Sets (concatenation of several hard disks)
- RAID 0 Array Drives
- RAID 1 Array Drives, RAID 1 Array Drives plus hot fix drive
- RAID 4 Array Drives, RAID 4 Array Drives plus hot fix drive
- RAID 5 Array Drives, RAID 5 Array Drives plus hot fix drive
- RAID 10 Array Drives, RAID 10 Array Drives plus hot fix drive



Level 4:

On the highest level of hierarchy, the firmware forms the **Host Drives**. In the end, only these Host Drives can be accessed by the host operating system of the computer. Drives C, D, etc. under MS-DOS, Windows NT, NetWare, etc. are always referred to as Host Drives by the firmware. 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 Host Drives of the most various kinds at the same time. An example for MS-DOS: drive C is a RAID 5 type Host Drive (consisting of 5 hard disks), drive D is a single hard disk, and drive E is a CD-ROM communicating with RAIDYNE through corelSCSI and the GDT ASPI manager.

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 GDTSETUP, each level of hierarchy has its own special menu:

| | | |
|----------------|---|---|
| Level 1 | ⇒ | Menu: Configure Physical Devices |
| Level 2 | ⇒ | Menu: Configure Logical Drives |
| Level 3 | ⇒ | Menu: Configure Array Drives |
| Level 4 | ⇒ | Menu: Configure Host Drives |

Generally, each installation procedure passes through these 4 menus, starting with level 1.

Therefore:

- First initialize the Physical Drives.
- Then configure the Logical Drives.
- Then configure the Array Drives (e.g. Array Drives with RAID 0, 1, 4, 5 and 10).
- Finally, configure the Host Drives.



L.1.1 Host Drive Types in RAIDYNE

The following summary gives you an overview of all Host Drive types you can create with the GDT firmware. **The ICP Controller can simultaneously control several Host Drives of most various types.**

For instance, MS-DOS drive C could be a Host Drive of the type disk (consisting of a single hard disk), MS-DOS drive D is a type RAID 5 Array Drive, MS-DOS drive E is a Host Drive of the type chain, and MS-DOS drive F is a CD-ROM which communicates with MS-DOS through corelSCSI and the GDT ASPI manager.

| Type of Host Drive | Description of Host Drive | Installation on Level | Minimum number of hard disks |
|--------------------|---|-----------------------|------------------------------|
| Disk | 1:1 assignment: Host Drive to hard disk | 2 | 1 |
| Chain | Concatenation of several hard disks | 2 | 2 |
| Mirror, RAID 1 | Mirroring of Logical Drives | 3 | 2 |
| RAID 0 | Data Striping | 3 | 2 |
| RAID 4 | Data Striping with parity drive | 3 | 3 |
| RAID 5 | Data Striping with striped parity | 3 | 3 |
| RAID 10 | Combined RAID 0 and 1 | 3 | 4 |

L.2 SCSI Devices Which can be Configured With GDTSETUP

SCSI devices which can be configured with GDTSETUP are called **Direct Access Devices** (SCSI devices such as hard disks or removable hard disks, or other devices behaving like a hard disk). SCSI devices other than SCSI hard disks or removable hard disks, or devices that do not behave like them, are called **Not Direct Access Devices**. **They are not configured with GDTSETUP and cannot form Host Drives.** These SCSI devices are either run through the ASPI interface (Advanced SCSI Programming Interface) (MS-DOS, Windows, Novell NetWare or OS/2), or they are directly accessed from the operating system (true for UNIX and Windows NT). For details on how to operate these devices, please refer to the corresponding chapters of this manual.

L.3 Loading GDTSETUP

Any installation or maintenance procedures regarding the ICP Controller are carried out with the configuration program **GDTSETUP**. The monitoring program **GDTMON** allows continuous monitoring and maintenance of the ICP Controller and the connected Array Drives. The GDTMON utility also include options to replace a defective drive with a new one (Hot Plug) and is available for most of the operating systems supported by the ICP Controllers. GDTSETUP allows you to set up single disks or complex Array Drives with simple and user-friendly installation procedures. Little previous knowledge is needed to be able to use GDTSETUP efficiently. It is only necessary to understand the hierarchy levels in the ICP Controller firmware. For the user's convenience the GDTSETUP program is available in two different variants:

- GDTSETUP loaded from the ICP Controller's Flash-RAM after switching on the computer
- GDTSETUP loaded from disk under MS-DOS.



The header of the GDTSETUP program indicates with a letter after the version number, whether GDTSETUP was loaded from disk or from Flash-RAM:

"R" for GDTSETUP loaded from the Flash-RAM after switching on the computer
 "D" for GDTSETUP loaded from Disk, i.e., under MS-DOS.

Loading GDTSETUP with <CTRL><G> from the Flash-RAM is very comfortable since no operating system is required to carry out the configuration and setup works.

On the other side, loading GDTSETUP from disk (i.e., under MS-DOS) becomes necessary for tasks like partitioning or enabling a totally disabled GDT BIOS (which includes GDTSETUP).

L.3.1 Special Keys in GDTSETUP

Cursor-keys ↑ and ↓

Used to select a menu option or command.

<ENTER> key

Confirms a choice, entry, warning or message in GDTSETUP.

<ESC> key

Exits the current menu.

<SPACE> bar

Multiple selections, or toggling between a number of preset options.

Function key <F2>

This key has different functions, depending on the menu you are in:

- a. Toggle between Express or Enhanced Setup.
- b. Display drive configuration.

Function key <F3>

To *Lock* and *Unlock* removable media.

Function key <F10>

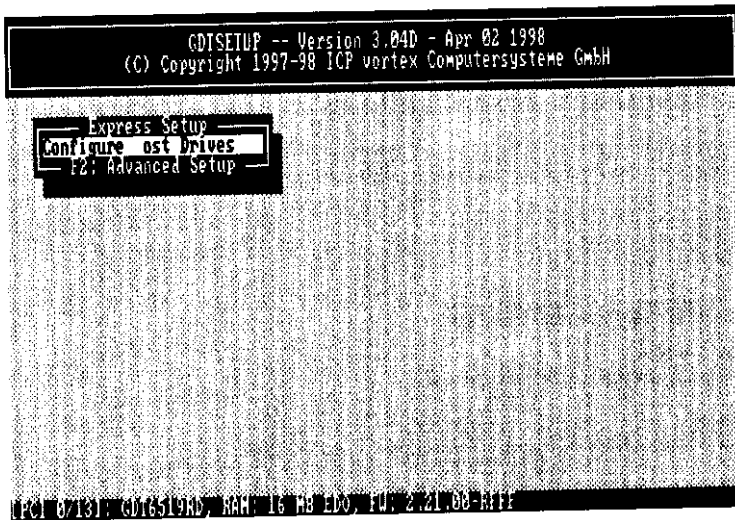
Refresh Information.

When GDTSETUP is loaded, the main menu appears as shown below:

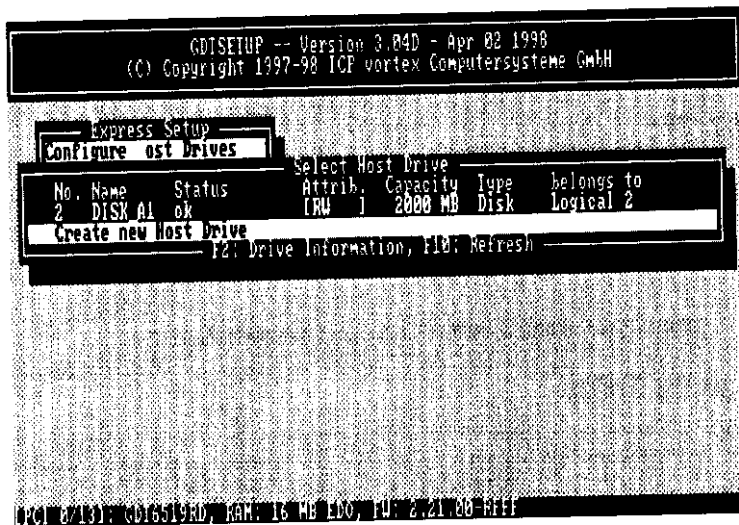
L.4 Express Setup

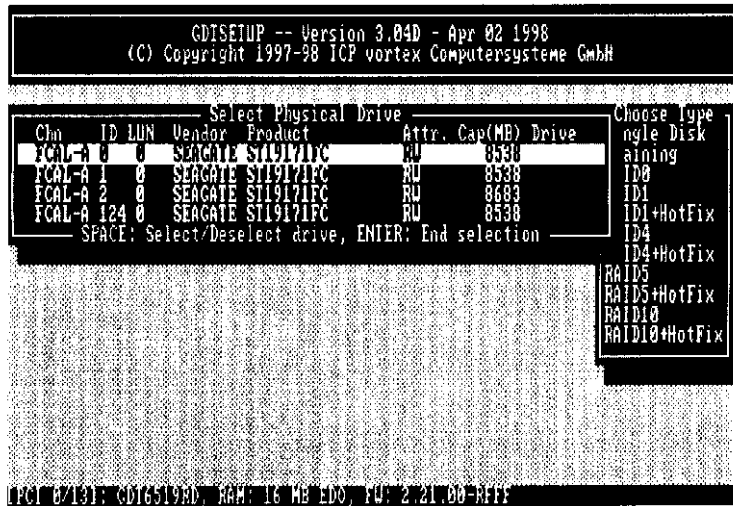
This function allows the easy setup of Array Drives and does not require any previous knowledge. If you choose this function, GDTSETUP carries out the complete installation entirely on its own, giving you, for example, a fully operational RAID 5 Array Drive with optimized settings (for instance, with all SCSI features of a given hard disk activated).



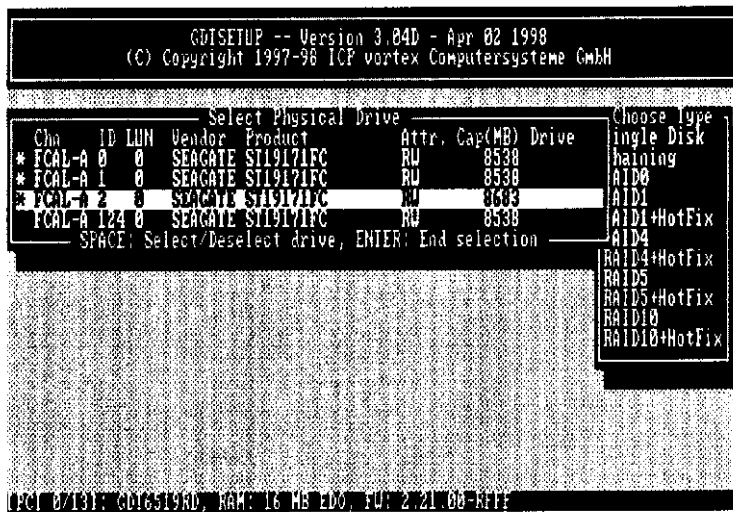


After selecting **Configure Host Drives** and **Create new Host Drive**, GDTSETUP scans the system for ICP Controllers and "free" hard disks (i.e., drives which are not yet logical drives or Host Drives or part of Array Drives).

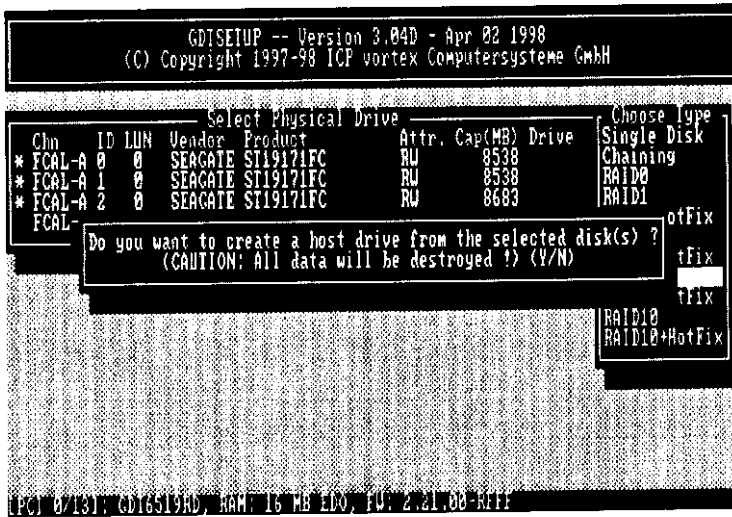




Select with the <Space> bar the hard disks you want to integrate into the new Host Drive. Depending on the number of selected drives in the *Choose Type* windows all possible Host Drive configurations are high-lighted.

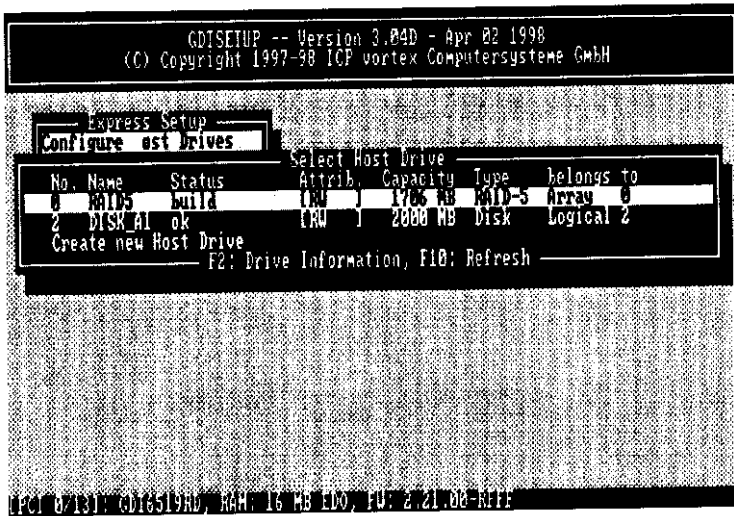


Press <ENTER> . You may select the desired Host Drive type. In our example select RAID5 and press <ENTER> .

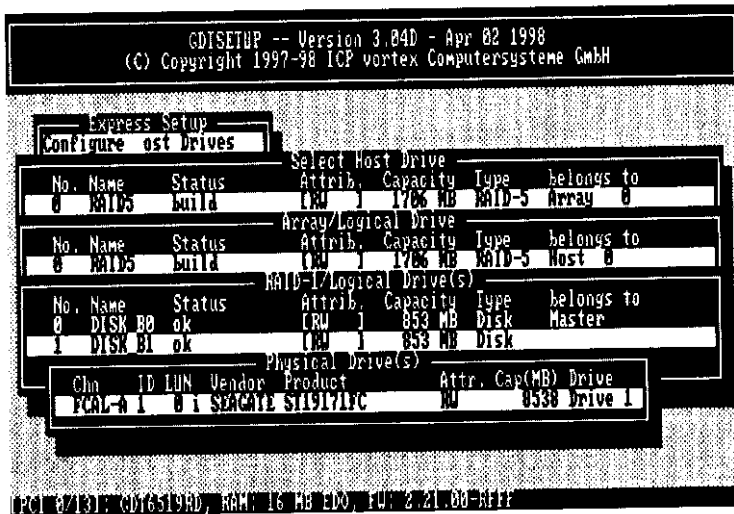


That's it!

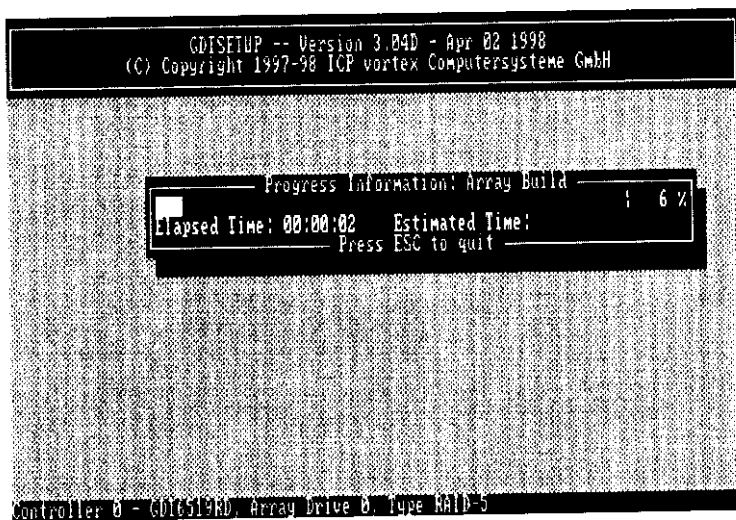
As you can see from the next picture, the RAID5 Array Drive has been fully automatically configured. It is in the build state.



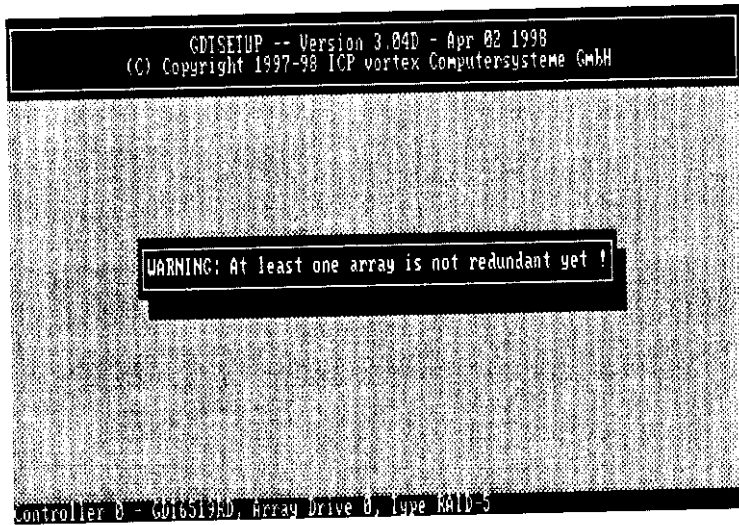
Press several times <F2> to get detailed information on the Array Drive's configuration and components.



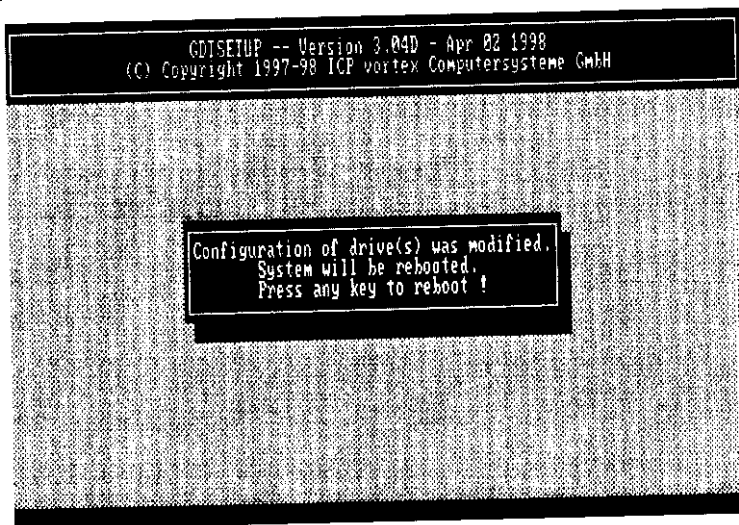
Press several times <ESC> to leave GDTSETUP. A new screen comes up giving you detailed progress information on the build process.



As you can see, there are already 6% of the build process completed. If you press <ESC> GDTSETUP warns you that the array is not yet redundant.



Pressing again <ESC> brings up the following screen, telling you the system needs a reboot to recognize the new Host Drive(s).

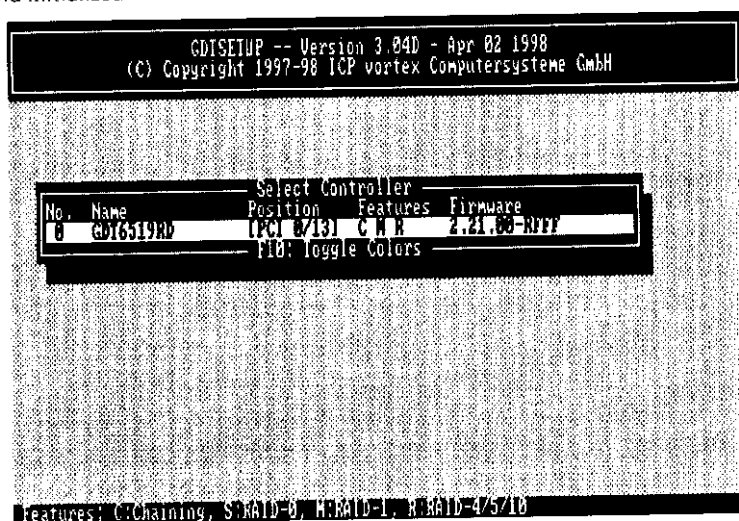


1.5 Select Controller

If there are more GDT RD Series controllers in the PCI computer, *Select Controller* lets you select the controller where you can apply all of the following GDTSETUP choices to. The currently selected controller is displayed on the lower left side of the screen. Below "Position", the PCI Slot number is displayed. The available features of the ICP Controller depend

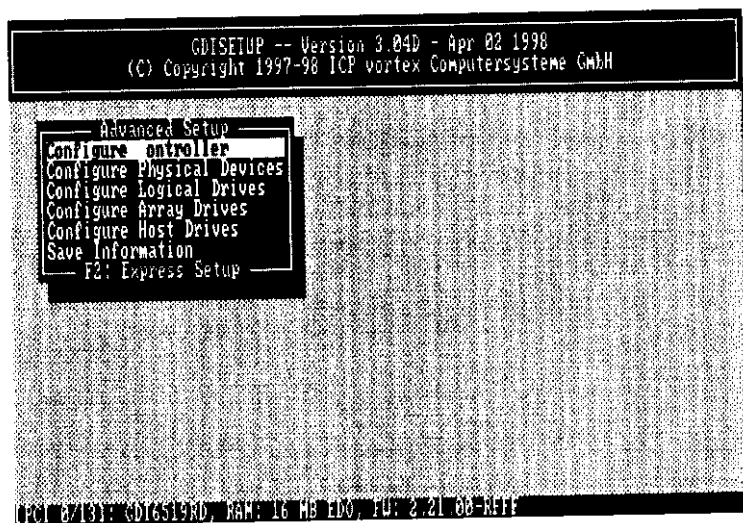


on the firmware installed. After a cold boot of the PCI computer, the controllers are recognized and initialized in the order of this list.



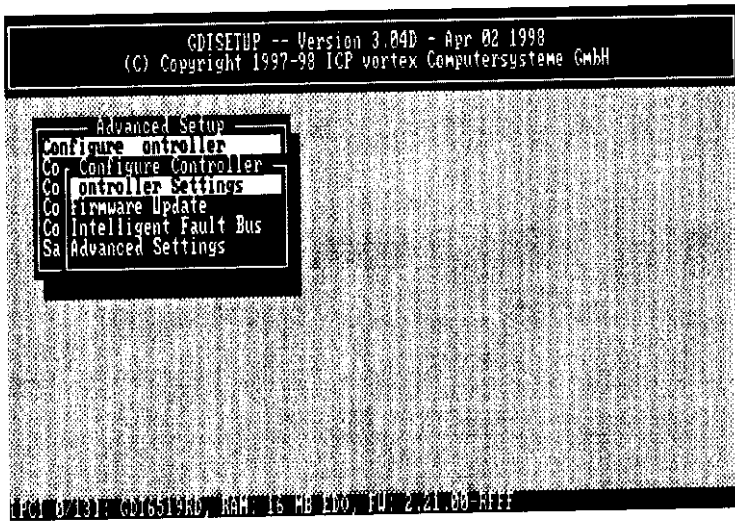
L.6 Configure Controller

After pressing <ENTER> and <F2> the *Advanced Setup* allows to select the *Configure Controller* menu option.



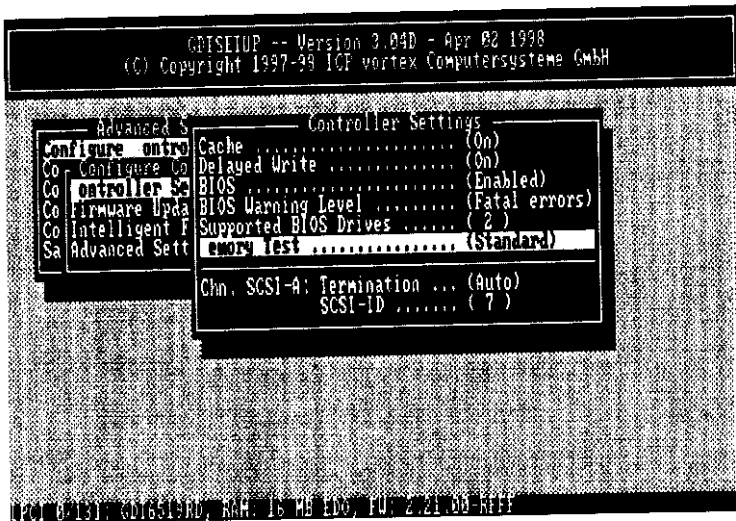
Press <ENTER> .





L.6.1 Controller Settings

(To change a setting, move the cursor keys ↑ and ↓ to the field and press <ENTER> .
Note: In order to obtain the full performance of your ICP Controller, it is very important that the Delayed Write function is **On**, too. If you find a different setting, we recommend changing it now.



| Function | Possible Settings | Factory Setting |
|-----------------------|---|-----------------|
| Cache On™ | On, Off | On |
| Delayed Write On™ | On, Off | On |
| BIOS | Enabled, Disabled | Enabled |
| BIOS Warning Level | All messages, Fatal errors | Fatal errors |
| Supported BIOS drives | 2, 7 | 2 |
| Memory Test | No Test, Standard, Double Scan, Intensive | Standard |
| SCSI-ID | 0, 1, 2, 3, 4, 5, 6, 7 | 7 |
| SCSI Termination | On, Off, Auto | On |

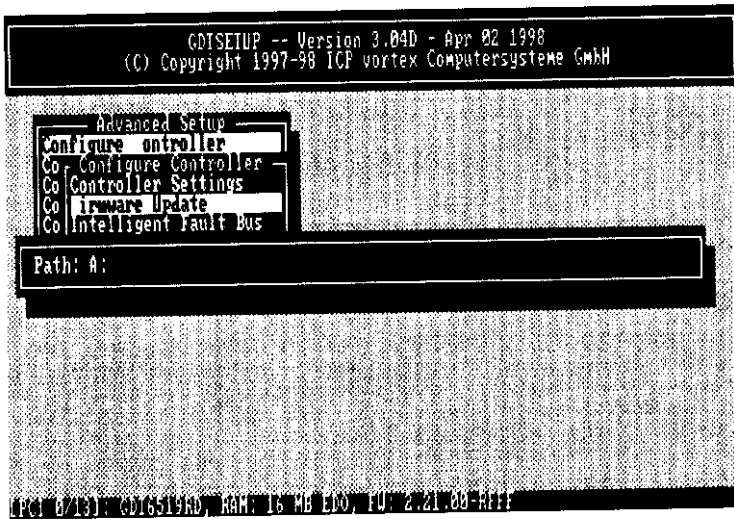
* Can also be changed with the GDTMON online utility.

L.6.2 Firmware Update

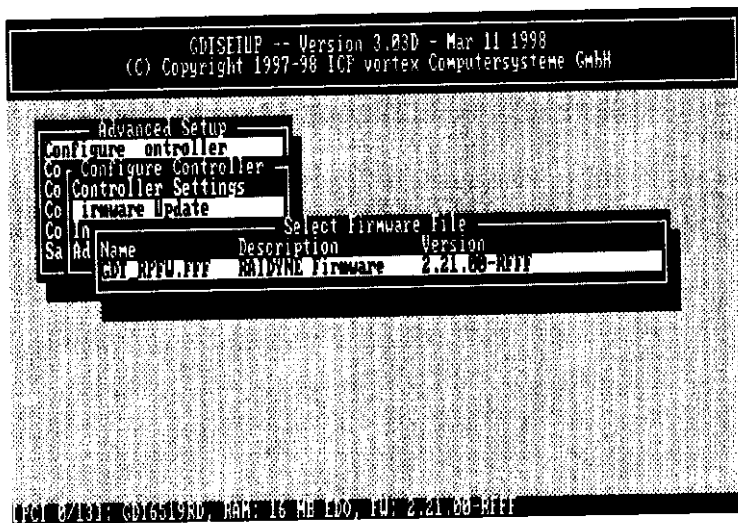
The firmware, the BIOS and the GDTSETUP program of the ICP Controller are stored in a Flash-RAM which is part of the ICP Controller hardware. In contrast to EPROMs, Flash-RAMs can be re-programmed many times and without the complicated UV-light erasing procedure. Thus, both software modules can be easily updated without having to remove the controller from its PCI slot. Firmware and BIOS are part of the **GDT_RPFW** file. The file has an extension (e.g. GDT_RPFW.009) which indicates the version stepping. The latest version of this file can be downloaded either from our 24h BBS (+49-(0)-7131-5972-15) or from our Website <http://www.icp-vortex.com>. We recommend that you also download the packed files which contain the latest programs/drivers for the operating system used on your system. Observe the following order when carrying out the updating procedure:

1. Get the latest GDT_RPFW file for the ICP Controller (download it from our BBS, or our Website, or ask for an upgrade disk if you do not have a modem). The file does NOT need to be expanded!
2. Format a 3.5" HD disk (1.44MB) and copy the GDT_RPFW file on this disk.
3. After loading GDTSETUP (from Flash-RAM or from disk under MS-DOS) select the desired ICP Controller for the firmware update and press the <F2>-key to enter the Advanced Setup.
4. Select *Configure Controller* and thereafter *Firmware Update*. Insert the disk with the firmware file into drive A. GDTSETUP loaded from the Flash-RAM will display a list of the valid files found on the disk. If you have loaded GDTSETUP from disk you have to enter the path "A:", first.





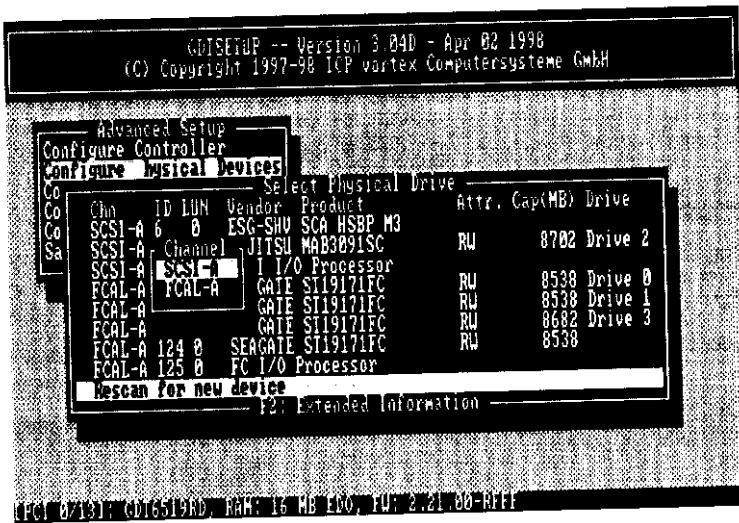
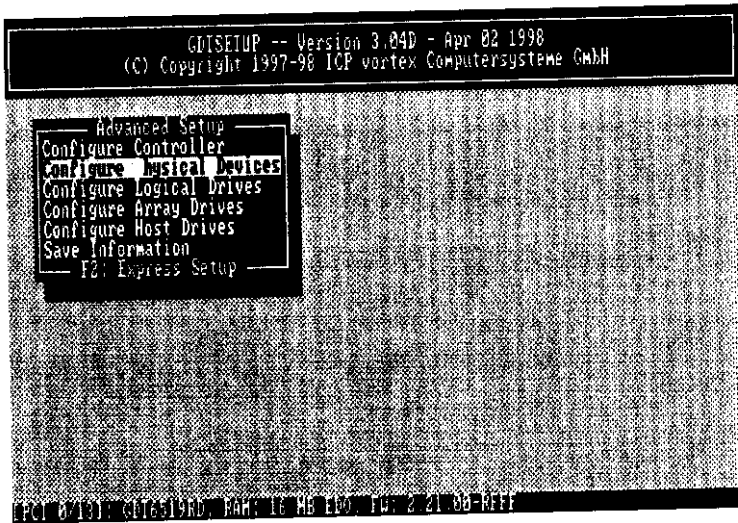
The update process starts as soon as the desired GDT_RPFW file has been selected. Strictly observe the messages and instructions of GDTSETUP. It is extremely important that the system is not switched off or reset during the update process. It is very likely that this would cause the ICP Controller to become inoperable.



The new versions of the GDT Firmware, the BIOS and GDTSETUP are available after the next cold-boot.

L.7 Configure Physical Devices

This menu allows you to prepare hard disks and removable hard disks for use with the ICP Controller (hierarchy level 1). You can scan the SCSI bus and the FCAL port(s) again for a given ID (this may become necessary when another device is being connected during the operating session).

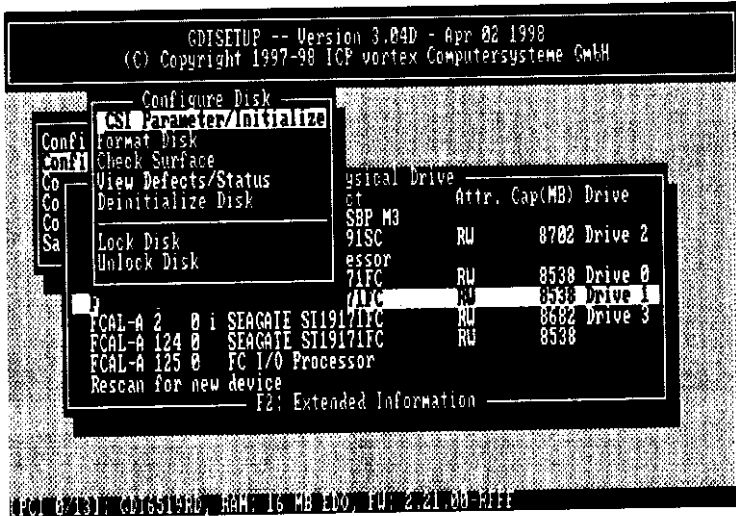


This screen tells you:



- the SCSI channel (SCSI) or FCAL port (FCAL)
- which a drive has (the entry *I/O processor* stands for the according I/O channel of the ICP Controller. Its default setting is ID 7 for SCSI and ID 125 for FCAL.
- the state of initialization ("i" = initialized)
- the names of the drives
- the state, [RW] = Read + Write, [RO] = Read only, [RM] = Removable
- the gross capacity
- if component of a Logical Drive

Use the cursor keys ↑ and ↓ to highlight the drive you wish to initialize. When a hard disk is selected with <ENTER>, a new screen is displayed.



You may select the high-lighted menu options. The other options are either not appropriate to the type of device (removable hard disk), or currently blocked because of security reasons (e.g., the drive belongs to an Array Drive)

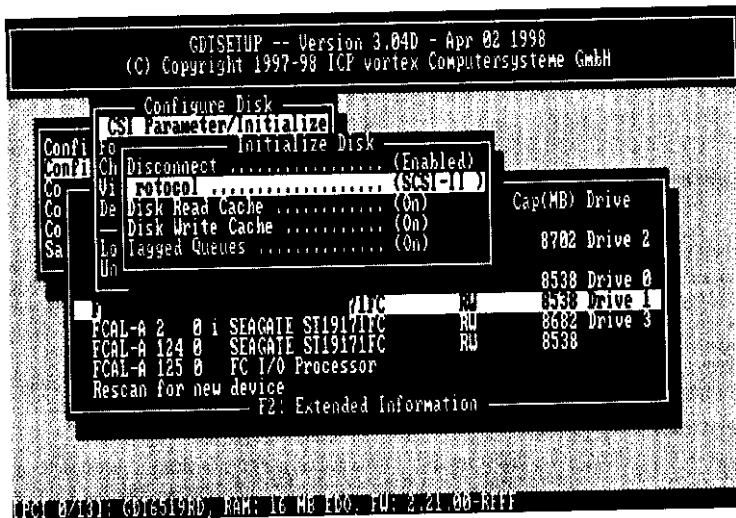
L7.1 SCSI Parameter / Initialize

This option can destroy all data on the hard disk.

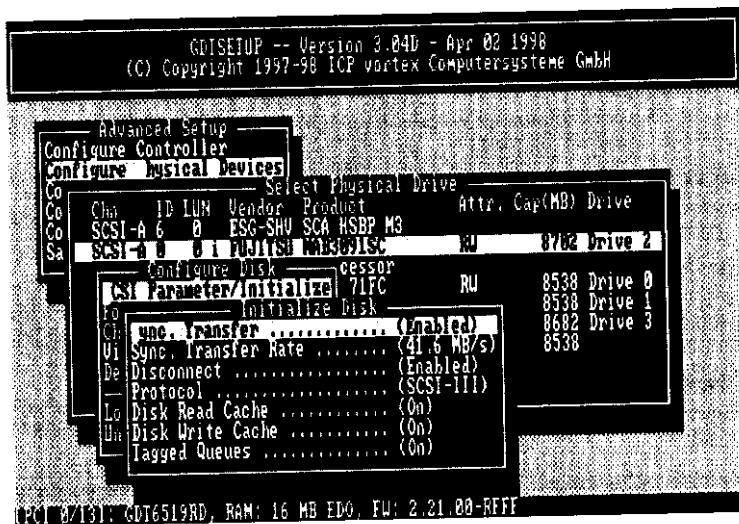
If a hard disk is not yet initialized, you have to initialize it first. GDTSETUP copies ICP specific configuration blocks on the hard disk, a primary block and a mirrored secondary block.

The possible settings are different if you select a SCSI hard disk or a Fibre Channel hard disk.

With a FCAL hard disk there are only a few settings which are relevant. You should always check that they are all "Enabled" or "On".



With SCSI hard disks there are a couple more settings:



1. Sync. Transfer: Enabled (Disabled)

The SCSI-bus knows two methods of data transfer: asynchronous and synchronous transfer. Each SCSI device must be able to perform the first type of transfer, the second one is optional. The advantage of the synchronous transfer consists in a higher data transfer rate, since the signal transfer times on the possibly long SCSI-cable have no influence on the



transfer rate anymore. Two SCSI-bus participants which want to exchange data between each other have to check if and how (i.e., with which parameters) a synchronous data transfer between them is possible. Therefore, the mere setting does not automatically enable synchronous data transfer; this mode is only effective if both devices support it and after they have checked their capability of communicating with each other in this mode.

2. Sync. Transfer Rate

This is the synchronous data transfer rate in MB/se. Ultra SCSI allows on a 8 Bit bus 20MB/s and on a 16 bit bus 40MB/s.

If a given SCSI-cable does not allow 10.0 MB/s (= FAST-SCSI), the data transfer rate can be reduced to a value that allows a trouble-free data transfer. The reason for such a restriction is not necessarily a "bad" SCSI-cable. Lowering the transfer rate may also become necessary when you set up a special configuration with a very long SCSI-cable whose length simply does not allow 10.0 MB/s.

Even if you set the maximum speed to 10, 20 or 40 MB/s, this does not mean that the SCSI device actually supports this transfer rate.

3. Disconnect: Enabled (Disabled)

The concept of the SCSI-bus allows several participants (8 IDs with 8 LUNs each). All these participants ought to be able to use the bus in a manner that causes the least reciprocal disturbance or obstruction. A participant should therefore vacate the bus if he does not need it. For reasons of performance, it is particularly important to guarantee a high degree of action overlapping on the SCSI-bus. This high degree of overlapping becomes possible when a SCSI device is enabled to be disconnected, thus leaving the bus to be used by another participant. If there is only one SCSI device connected to the SCSI-bus, "Disconnect" should be disabled.

4. Protocol (SCSI-II, SCSI-III)

If a drive supports a particular SCSI specification (II, or III) you should always use the highest protocol level the drive supports.

5. Disk Read Cache: On (Off)

This is the read ahead cache of the hard disk. Because of performance reasons it should always be enabled (On).

6. Disk Write Cache: On (Off)

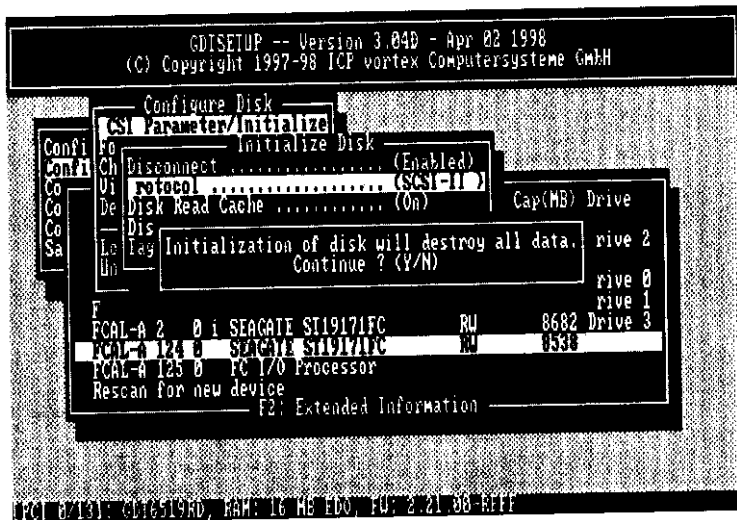
This is the delayed write cache of the hard disk. Because of performance reasons it should always be enabled (On), except during the installation of operating systems like Windows 95 and Windows NT.

7. Tagged Queues: On (Off)

Tagged Queues is a SCSI feature which allows the drive to execute more than one command at a time.

If you leave this configuration form with <ESC> and you have made changes, GDTSETUP displays a security request.





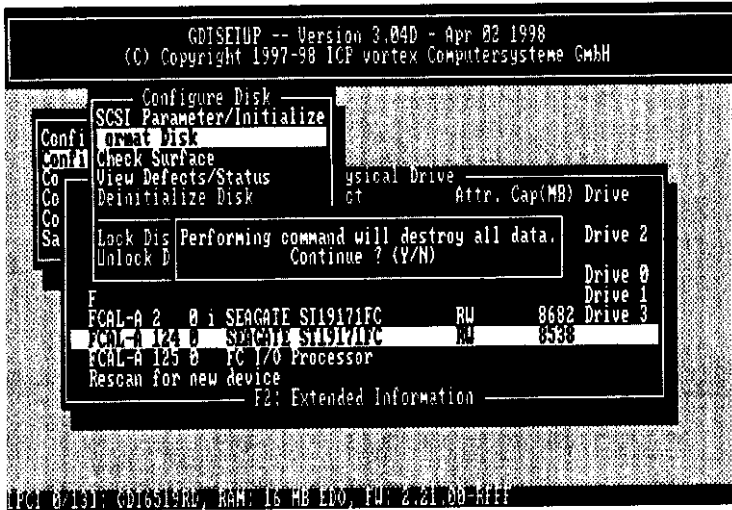
The warning of the destruction of all data implies different evaluations, depending on the device's current state and the options you selected:

1. *First Initialization of the Device*
In this case, the warning must be taken seriously. If the drive was previously connected to a different controller (e.g. NCR etc.) and still contains important data, this data will be lost now.
2. *The Device was already initialized*
If only internal parameters such as Disconnect, Synchronous Transfer, and SCSI Options have been changed, the data on the drive remains intact. Only the function state of the device changes.

L7.2 Format Disk

This option destroys all data on the hard disk.

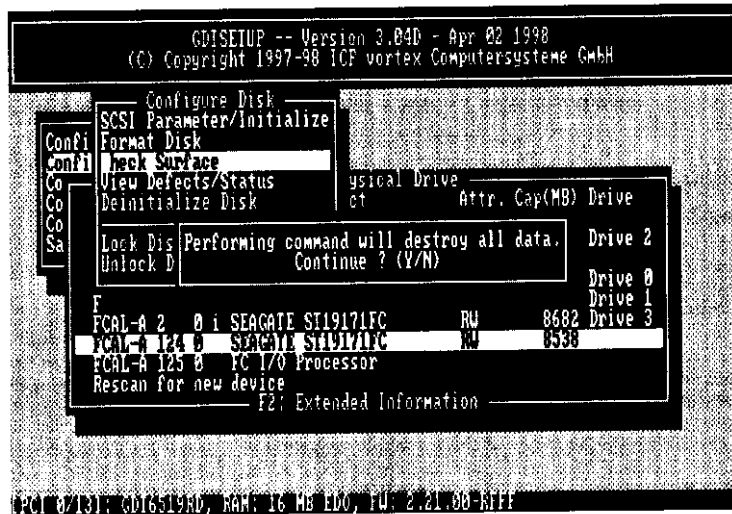
All manufacturers of hard disks deliver their products already formatted and surface-tested. For new hard disks it is neither necessary, nor advisable to perform the Format Disk. This procedure is only indicated if you have doubts on the hard disk's condition. The time required for the Format Disk of a hard disk depends on the hard disk itself. It can take quite a long time (up to days!). Often it seems that nothing happens and that the system hangs (no LED indication). If you put your ear on the hard disk you can hear the actuator stepping (with some drives one step per minute or longer). **Never interrupt a Format Disk procedure.** This may lead with a very high probability to a non-functioning hard disk. Before the actual formatting, GDTSETUP asks you whether the "Grown Defect" table of the hard disk should be deleted. Some users believe that this makes a hard disk with a lot of grown defects like new. This is wrong. As soon as the bad sectors are accessed again, a re-assign will happen, generating a new grown defect.



L.7.3 Check Surface

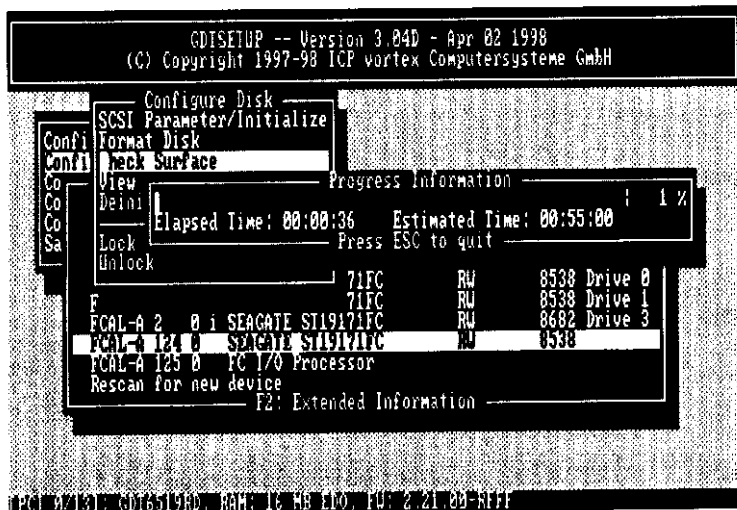
This option destroys all data on the hard disk.

This option allows the checking of the surfaces of the hard disk media. The GDT RD Series Controller writes and reads certain data patterns and checks them for correctness.



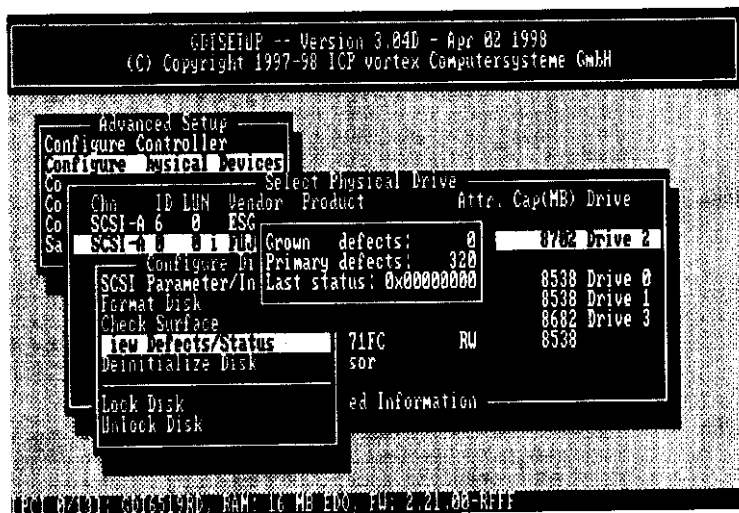
After confirming the security request, a progress information is displayed. You can interrupt the Check Surface option by pressing <ESC>.





L7.4 View Defects/ Status

This option allows you to check the number of media defects the selected hard disk has.



Grown defects. Number of media defects that have occurred in addition to the media defects the hard disk already had upon delivery.

Primary defects. Number of media defects that the hard disk already had upon delivery.



Last status: The Last Status gives detailed information on the last failure of a hard disk. The information is only present until the next hard reset of the system and may help for deeper failure analysis or tracing.

The following listed messages are part of the SCSI documentation. Format: **0x????70yz** (??? = additional device specific messages)

- 0x????7000h** NO SENSE. Indicates that there is no specific sense key information to be reported for the designated logical unit. This would be the case for a successful command or a command that received CHECK CONDITION or COMMAND TERMINATED status because one of the filemark, EOM, or ILI bits is set to one.
- 0x????7001h** RECOVERED ERROR. Indicates that the last command completed successfully with some recovery action performed by the target. Details may be determinable by examining the additional sense bytes and the information field. When multiple recovered errors occur during one command, the choice of which error to report (first, last, most severe, etc.) is device specific.
- 0x????7002h** NOT READY. Indicates that the logical unit addressed cannot be accessed. Operator intervention may be required to correct this condition.
- 0x????7003h** MEDIUM ERROR. Indicates that the command terminated with a non-recovered error condition that was probably caused by a flaw in the medium or an error in the recorded data. This sense key may also be returned if the target is unable to distinguish between a flaw in the medium and a specific hardware failure (sense key 4h).
- 0x????7004h** HARDWARE ERROR. Indicates that the target detected a non-recoverable hardware failure (for example, controller failure, device failure, parity error, etc.) while performing the command or during a self test.
- 0x????7005h** ILLEGAL REQUEST. Indicates that there was an illegal parameter in the command descriptor block or in the additional parameters supplied as data for some commands (FORMAT UNIT, SEARCH DATA, etc.). If the target detects an invalid parameter in the command descriptor block, then it shall terminate the command without altering the medium. If the target detects an invalid parameter in the additional parameters supplied as data, then the target may have already altered the medium. This sense key may also indicate that an invalid IDENTIFY message was received (6.6.7).
- 0x????7006h** UNIT ATTENTION. Indicates that the removable medium may have been changed or the target has been reset. See 7.9 for more detailed information about the unit attention condition.
- 0x????7007h** DATA PROTECT. Indicates that a command that reads or writes the medium was attempted on a block that is protected from this operation. The read or write operation is not performed.
- 0x????7008h** BLANK CHECK. Indicates that a write-once device or a sequential access device encountered blank medium or format-defined end-of-data indication while reading or a write-once device encountered a non-blank medium while writing.



| | |
|--------------------|---|
| 0x????7009h | VENDOR-SPECIFIC. This sense key is available for reporting vendor specific conditions. |
| 0x????700Ah | COPY ABORTED. Indicates a COPY, COMPARE, or COPY AND VERIFY command was aborted due to an error condition on the source device, the destination device, or both. (See 8.2.3.2 for additional information on this sense key.) |
| 0x????700Bh | ABORTED COMMAND. Indicates that the target aborted the command. The initiator may be able to recover by trying the command again. |
| 0x????700Ch | EQUAL. Indicates a SEARCH DATA command has satisfied an equal comparison. |
| 0x????700Dh | VOLUME OVERFLOW. Indicates that a buffered peripheral device has reached the end-of-partition and data may remain in the buffer that has not been written to the medium. A RECOVER BUFFERED DATA command(s) may be issued to read the unwritten data from the buffer. |
| 0x????700Eh | MISCOMPARE. Indicates that the source data did not match the data read from the medium. |
| 0x????700Fh | RESERVED. |

L.7.5 Deinitialize Disk

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

L.7.6 Lock / Unlock Disk

This option is only high-lighted when you have selected a removable hard disk (e.g., Syquest, Iomega). Before you can initialize a cartridge you have to lock it. Before removing it you have to unlock it.

L.7.7 Configuration of SAF-TE Subsystems

Before you can use the Auto Hot Plug with a SAF-TE subsystem, you first have to configure the subsystem (more precisely it's intelligence, the so-called SEP - SAF-TE Enclosure Processor).

In the following list of devices, the entry "ESG-SHV..." represents the SEP of the connected SAF-TE subsystem. With the GDT6519RD and GDT6529RD SAF-TE is only supported on the Ultra Wide SCSI channel.



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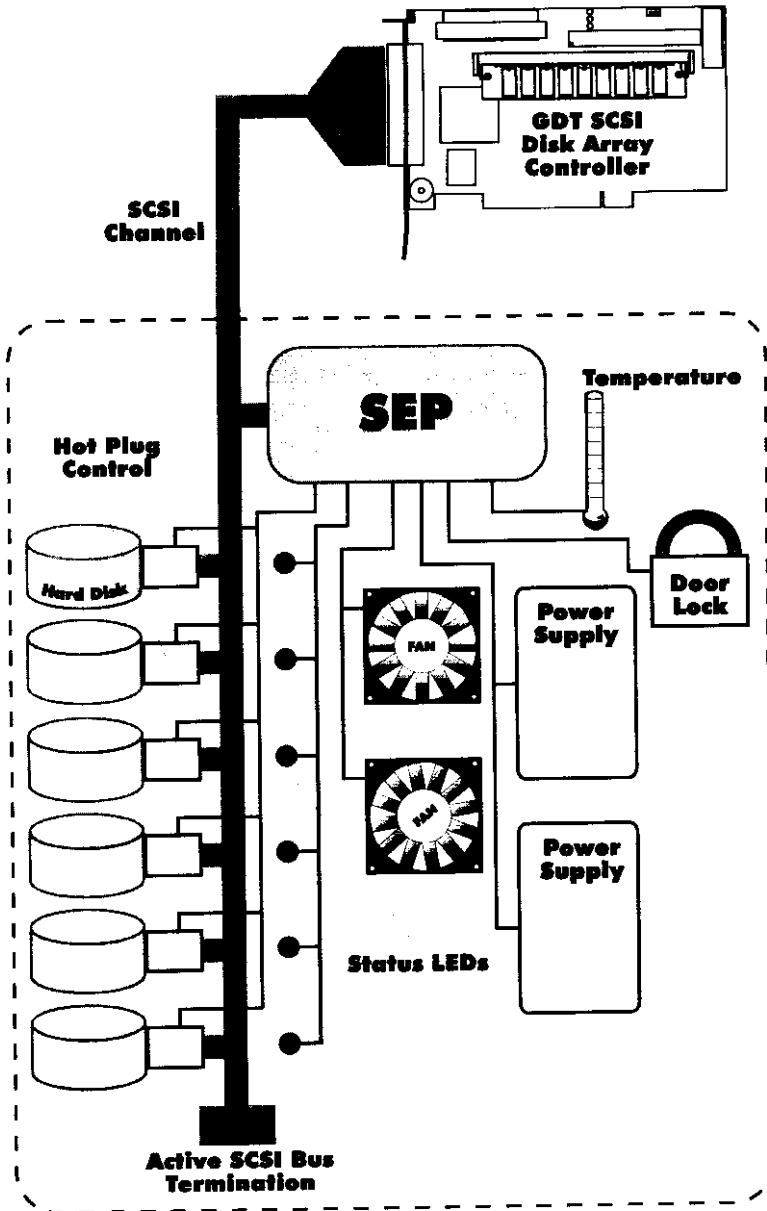
Advanced Setup
 Configure Controller
 Configure Physical Devices

| | | Select Physical Drive | | | | |
|--------------------------|--------|-----------------------|---------------|-------|---------|---------|
| Chn | ID LUN | Vendor | Product | Attr. | Cap(MB) | Drive |
| SCSI-A 6 | 0 | ASC-SIU | SCSI HSBP H3 | | | |
| SCSI-A 0 | 0 i | FUJITSU | MAE3091SC | RU | 8782 | Drive 2 |
| SCSI-A 7 | 0 | SCSI | I/O Processor | | | |
| FCAL-A 0 | 0 i | SEAGATE | ST19171FC | RU | 8538 | Drive 0 |
| FCAL-A 1 | 0 i | SEAGATE | ST19171FC | RU | 8538 | Drive 1 |
| FCAL-A 2 | 0 i | SEAGATE | ST19171FC | RU | 8682 | Drive 3 |
| FCAL-A 124 | 0 | SEAGATE | ST19171FC | RU | 8538 | |
| FCAL-A 125 | 0 | FC | I/O Processor | | | |
| Rescan for new device | | | | | | |
| F2: Extended Information | | | | | | |

FCI 0/131, 0016519RD, RAM: 16 MB EDO, FPU: 2.21.00-H111

The next page shows a block diagram of a SAF-TE subsystem.





GDSETUP -- Version 3.04D - Apr 02 1998
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```

Advanced Setup
Configure Controller
Configure Physical Devices
  Co
  Co
  Co
  Sa
  Select Physical Drive
  Chn ID LUN Vendor Product Attr. Cap(MB) Drive
  SCS-A 6 0 LSC-SNU SCA NSHP M3 RU 8702 Drive 2
  SAF-TE Configuration -AB3091SC
  Configure SAF-TE Slots
  View Enclosure Status
  F
  FCAL-A 124 0 SEAGATE ST19171FC
  FCAL-A 125 0 FC I/O Processor
  Rescan for new device
  F2: Extended Information
  
```

PCI 0/13: GD16519RD, RAM: 16 MB EDO, I/O: 2.21.00-R111

After selecting the SEP press <ENTER>. You can either configure the SAF-TE Slots (i.e., the drive bays in the subsystem), or view the enclosure's status.

```

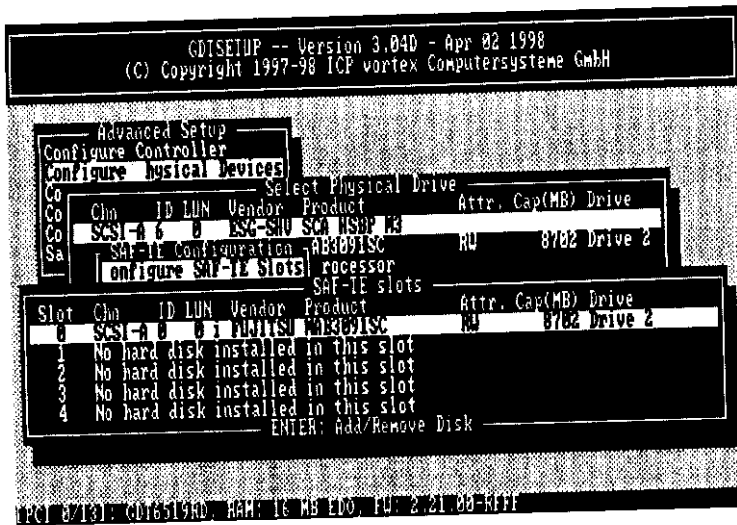
GDSETUP -- Version 3.04D - Apr 02 1998
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Advanced Setup
Configure Controller
Configure Physical Devices
  Co
  Co
  Co
  Sa
  Select Physical Drive
  Chn ID LUN Vendor Product Attr. Cap(MB) Drive
  SCS-A 6 0 LSC-SNU SCA NSHP M3 RU 8702 Drive 2
  SAF-TE Configuration -AB3091SC
  Configure SAF-TE Slots
  SAF-TE slots
  Slot Chn ID LUN Vendor Product Attr. Cap(MB) Drive
  0 No hard disk installed in this slot
  1 No hard disk installed in this slot
  2 No hard disk installed in this slot
  3 No hard disk installed in this slot
  4 No hard disk installed in this slot
  ENTER: Add/Remove Disk
  
```

PCI 0/13: GD16519RD, RAM: 16 MB EDO, I/O: 2.21.00-R111

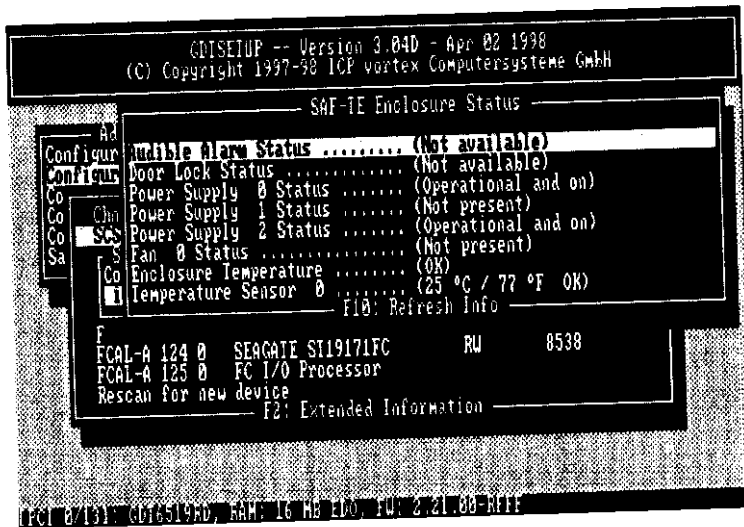
With the <SPACE>-bar you can assign hard disks to a SAF-TE slot. Once you have finished the assignment press <ENTER> to save the new configuration.





In this example 1 of the 5 available slots in the subsystem is occupied with a hard disk.

The following screen shows you the enclosure's status. Features which are marked with (Not available) are not implemented in the subsystem/SEP.

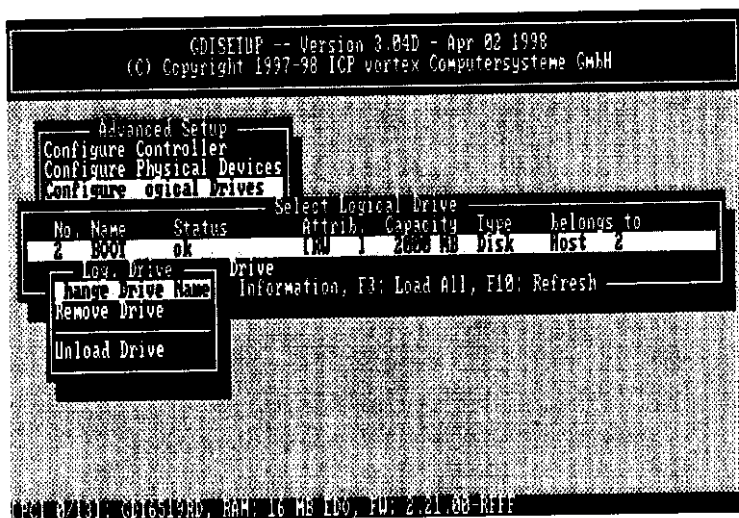
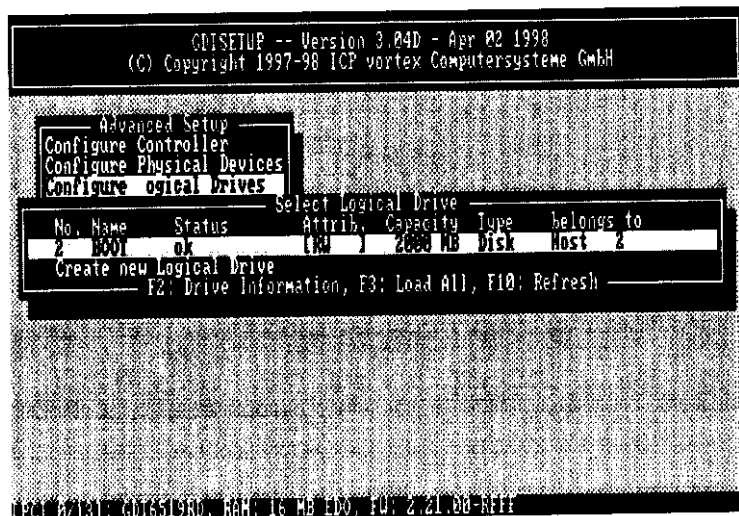


L.8 Configure Logical Drives

Logical Drives (hierarchy level 2) are installed in this main menu option. Selecting **Configure Logical Drives** leads you to the screen shown next. As you can see, there is already one Logical Drive in the list. The drive's name has been assigned automatically and



contains the channel description and the ID after the underscore ("_"). This can serve as a reminder when you install a complex system with many drives (naturally you can change the name). After having selected a Logical Drive, you can carry out various operations.

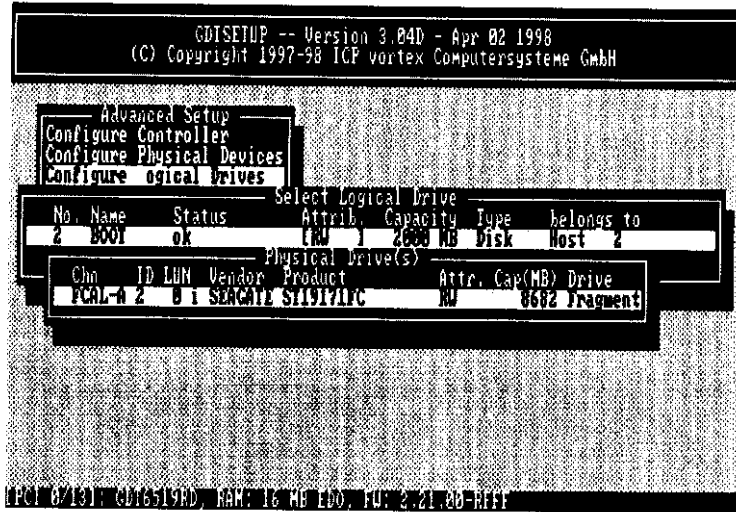


Change Drive Name. Here you can enter a name for the selected drive.

Remove Drive. This menu option lets you remove a single Logical Drive from the list of available Logical Drives. (Note: Logical Drives belonging to a RAID 0, 1, 4, 5 or 10 Host Drive cannot be removed. To do so, the corresponding Host Drive has to be removed first.)

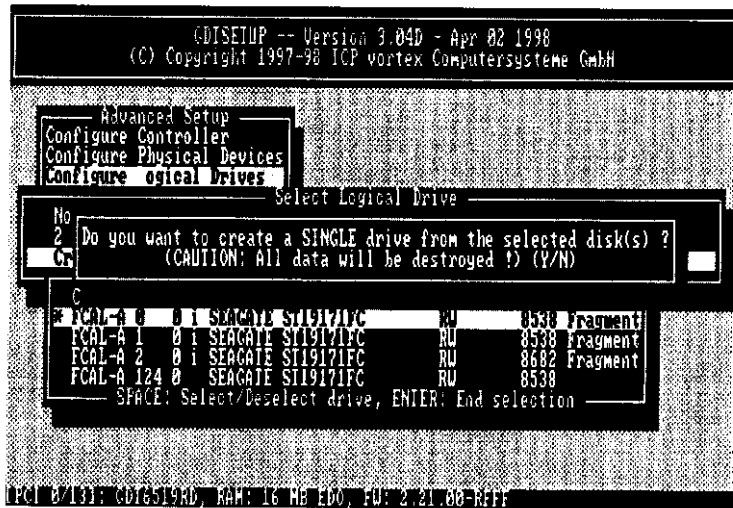
Unload Drive. Unlock the media of the removable hard disk, which belongs to the Logical Drive.

The <F2>-key gives you a list of all the hard disks this Logical Drive consists of. If it is a Logical Drive of the type **Disk**, it only consists of one single hard disk. If a Logical Drive consists of more hard disks, it is of the type **Chain** (concatenation of several hard disks).

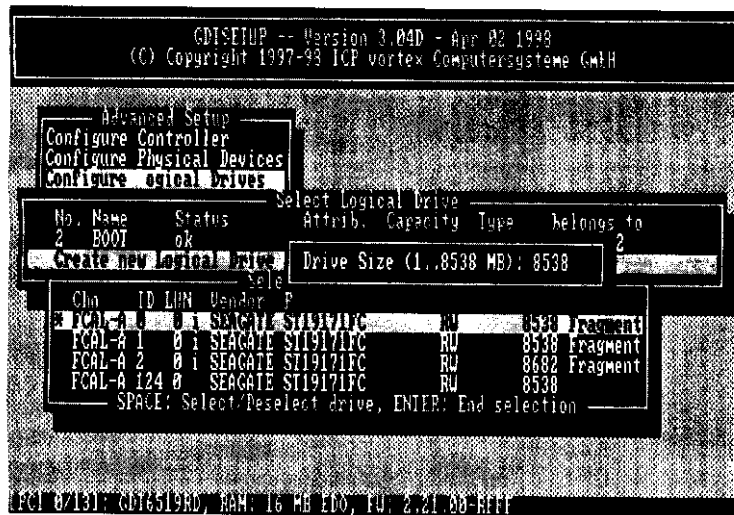


L.8.1 Installing a Logical Drive of the Type Disk

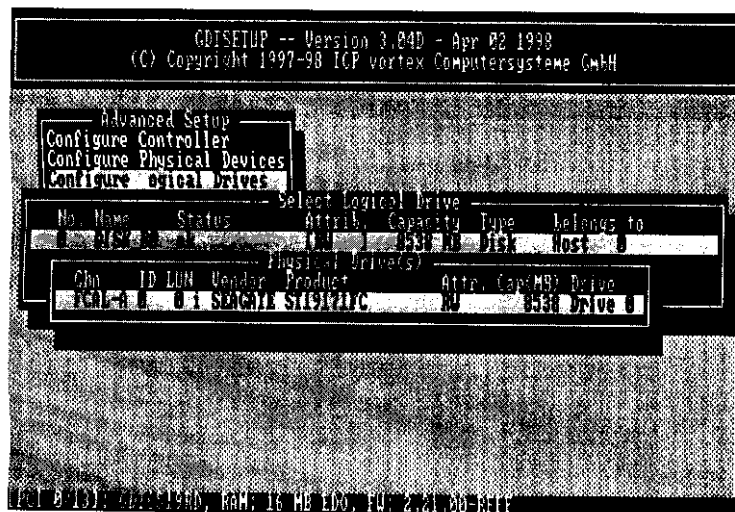
Mark the selected hard disk with the <SPACE>-bar (pressing the <SPACE>-bar again un-
does your choice) and confirm your choice with <ENTER>.



A security request appears. If you confirm with <Y>, GDTSETUP allows you to limit the size of the Logical Drive. This becomes interesting when you configure later on an Array Drive with several identical Logical Drives and you want to make sure that you get appropriate spare hard disks in the future. It would be bad luck if the new hard disk would have 8530MB, only. It simply wouldn't fit into the Array Drive. If you limit the capacity to e.g., 8500MB from the beginning, you can be sure that all future 9GB hard disk will have at least 8500MB and thus can be used as spare hard disk.



After pressing <ENTER> the list appears again, but with a new entry. The <F2>-key shows the hard disk forming the new Logical Drive.

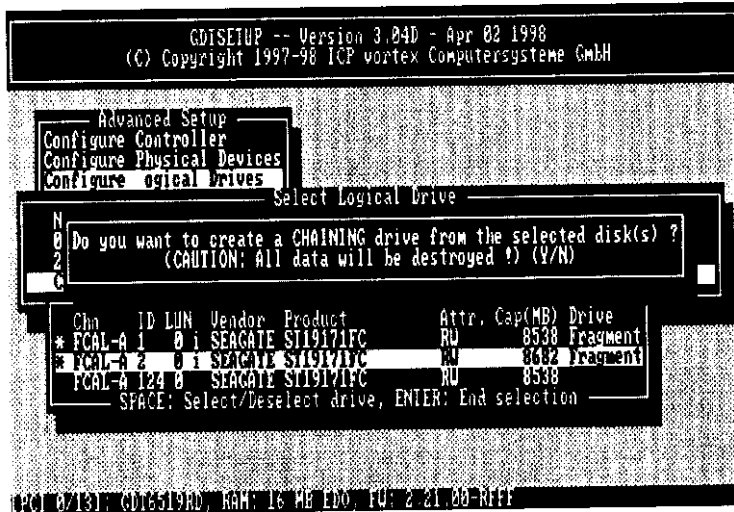


1.8.2 Installing a Logical Drive of the Type Chain

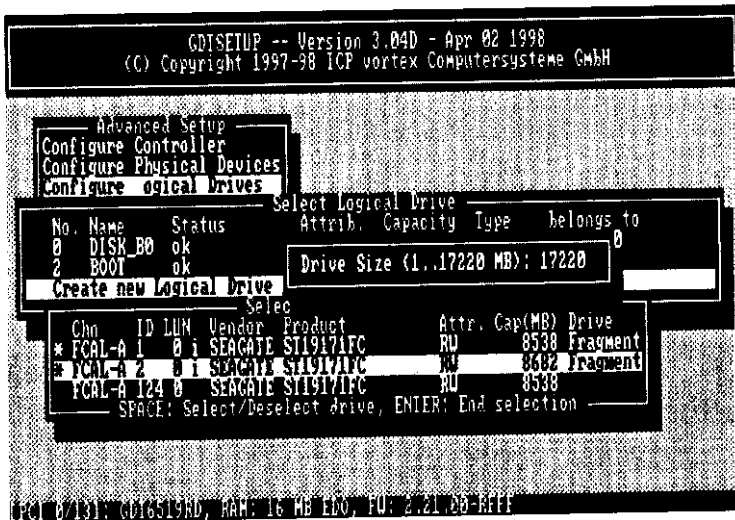
In some literature Disk Chaining is also called Disk *Spanning*. You can picture the functioning mechanism of a type *Chain* Logical Drive as follows: all hard disks forming the Logical Drive are linked together one by one in the exact same order in which they have been selected with the <SPACE>-bar. This concatenation can be compared with a chain. If, for example, the Logical Drive consists of 4 hard disks with 2000MB each, the Logical Drive will have a capacity of 8000MB. When data is written to this Logical Drive, the first hard disk 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.

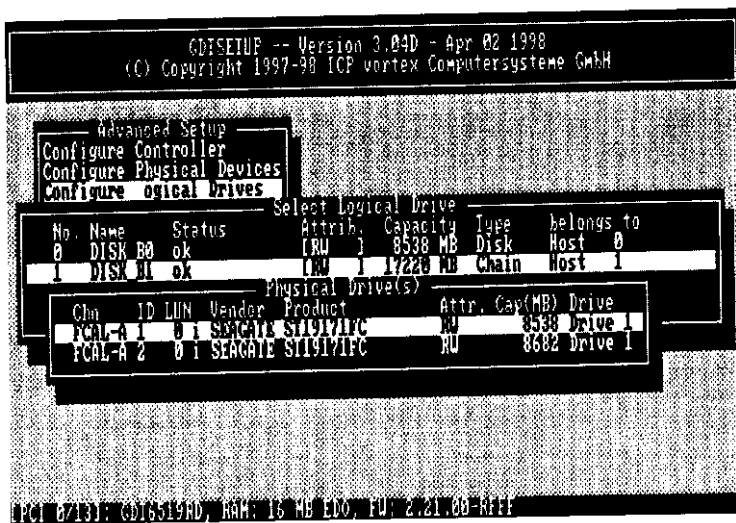
Select the hard disks with the <SPACE>-bar and then confirm with <ENTER>.



A security request appears. If you confirm with <Y>, GDTSETUP allows you to limit the size of the Logical Drive. This becomes interesting when you configure later on an Array Drive with several identical Logical Drives and you want to make sure that you get appropriate spare hard disks in the future. If you limit from the beginning the capacity to e.g., 8500MB, you can be sure that all future 9GB hard disk will have at least this capacity and thus can be used as spare hard disk.



After pressing <ENTER> the list appears again, but with a new entry. The <F2>-key shows the hard disk forming the new Logical Drive.



L.9 Configure Array Drives

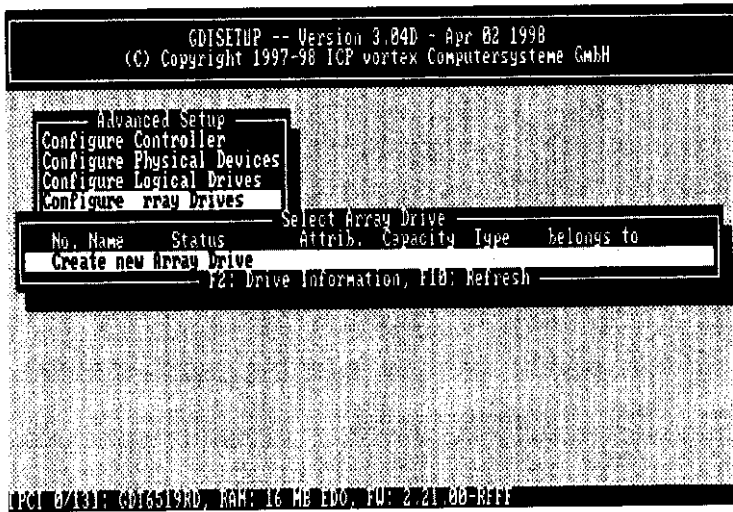
This main menu option allows you to configure Array Drives (level of hierarchy 3). Array Drives with the following listed RAID levels can be configured within this menu.

- RAID 0 pure data striping without redundancy
- RAID 1 disk mirroring

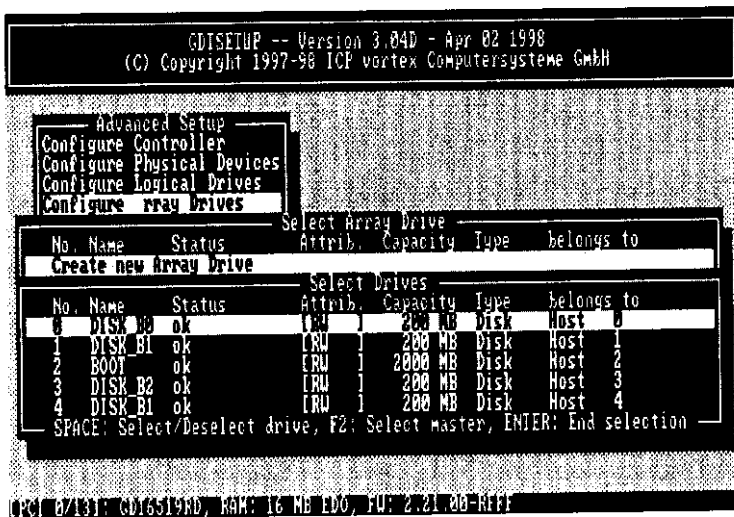


- RAID 4 data striping with dedicated parity drive
- RAID 5 data striping with striped parity
- RAID 10 RAID 0 combined with RAID 1

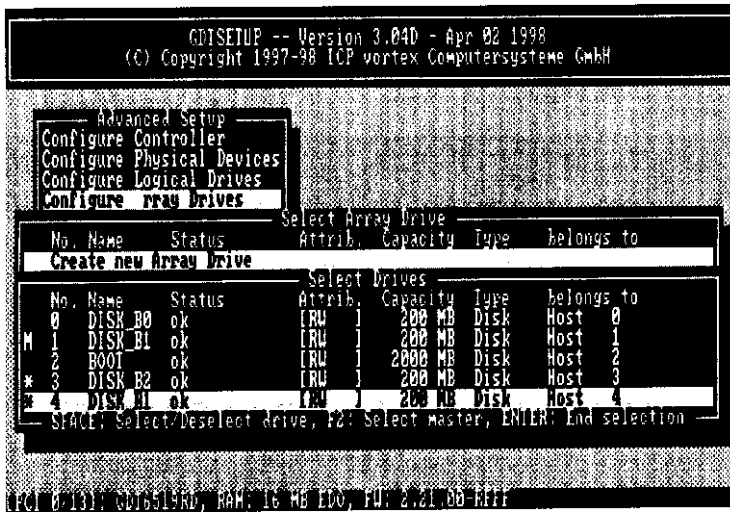
The ICP Controller can manage up to 35 Array Drives (with different RAID levels) simultaneously. Obviously, the physically existing number of hard disks will limit the number of parallel used Arrays.



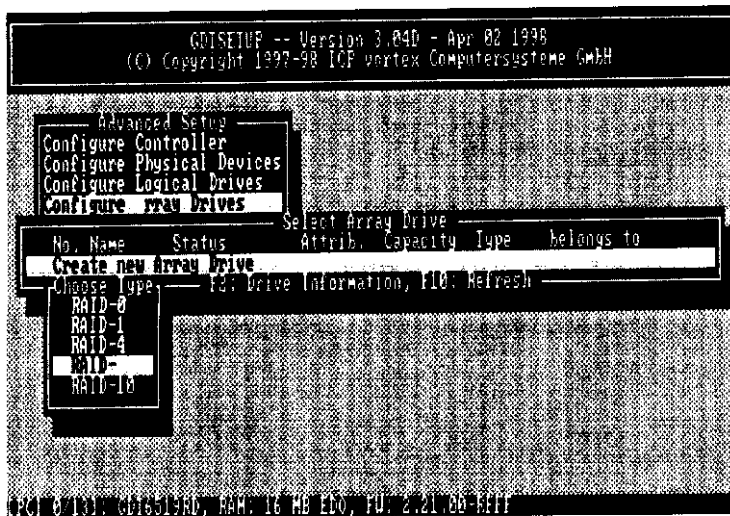
After pressing <ENTER>, GDISETUP lists all free Logical Drives, which are free (not yet part of Array / Host Drives).



Move the selection-bar to the second entry and select Logical Drives No. 1, 3 and 4.

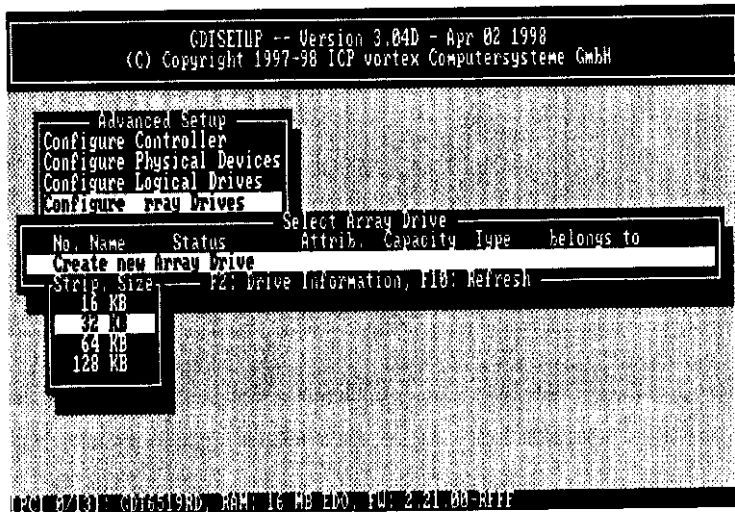


The "M" means Master. For a striping array (RAID 0, 4, 5, 10), this is the first Logical Drive in the array. For a RAID 1 (mirroring) array this is the Logical Drive which contains the valid data and which should be copied to the second Logical Drive. After pressing <ENTER> GDTSETUP displays a list of possible RAID levels. The number of previously selected Logical Drives determines the high-lighted levels. In our case RAID 10 is not selectable, since it requires at least 4 Logical Drives.

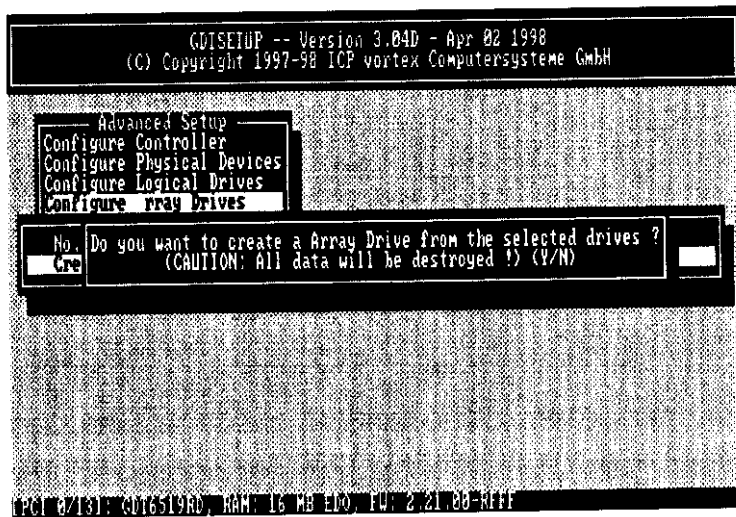


For this example we select RAID-5 and press <ENTER>

GDTSETUP will ask 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 32KB which we leave for this example and therefore press <ENTER>. (Note: 32KB stripe size is suggested because in various performance tests it has proved to be the best value).



This security request has to be taken seriously. If you confirm with <Y> all data are lost.



If necessary you can limit the Array Drive's capacity. For this example we take the complete capacity.

