# TECHNOLOGY BRIEF

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Compaq Computer Corporation

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# Pre-Failure Warranty for Compaq Servers

## EXECUTIVE SUMMARY

Compaq Server products using Compaq Insight Manager 2.0 or greater software are covered by the Compaq Pre-Failure Warranty. The Pre-Failure Warranty extends the advantage of Compaq's three-year limited warranty by providing coverage on critical components, such as hard drives, memory and Pentium Pro processors before they actually fail. The Pre-Failure Warranty ensures that when customers receive notification from their monitoring software that a critical server component may fail, the component is replaced free of charge under the warranty.

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## INTRODUCTION

The growing demands of business require servers to have more hard drive, memory, and processor capacities than ever before. Potential temptations exist to lower standards to meet demand; however, Compaq refuses to sacrifice quality to ship more products. In fact, this tenet is basic to the corporate mission and strategy. Compaq maintains the highest standards in the industry, as evidenced by the Compaq Pre-Failure Warranty.

The Pre-Failure Warranty, standard on all Compaq servers, extends the advantage of a Compaq three-year, limited warranty by applying it to critical components before they actually fail. Specifically, the Pre-Failure Warranty ensures that when customers receive notification from Compaq Insight Manager version 2.0 or higher that a critical server component may fail, the component is replaced free of charge under the warranty. Compaq S.M.A.R.T. (Self Monitoring and Reporting Technology) Wide-Ultra SCSI drives give the added benefit of independent pre-failure warnings during the Power-On Self Test (POST) as well as enhancing the reporting notifications from Compaq Insight Manager. With the Pre-Failure Warranty, system administrators can proactively schedule downtime for maintenance and not interrupt critical business operations that rely on these enterprise servers.

Compaq server customers benefit from the Pre-Failure Warranty in at least two significant ways: reduced total cost of ownership and reduced downtime.

### Background

Critical errors—errors that bring down a server—can be managed by *prevention*, run-time *correction*, and post-error *recovery*. The Pre-Failure Warranty is based on the simple philosophy that downtime is best reduced through proactive, preventive maintenance. Predicting critical errors is essential to preventing them and optimizing availability of a server. Identifying a degraded or failing condition before it happens is essential to performing preventive maintenance.

Compaq sophisticated management capabilities can monitor a server's components and environment and keep the system administrator apprised of the server's status. This ensures that for any potential or actual problems, the appropriate action can be taken, whether it is preventive maintenance or problem resolution.

The Pre-Failure Warranty was introduced in late 1993. The original warranty covered components with the capability to issue pre-failure alerts. These components included Error Correcting Code (ECC) memory and server hard drives, including SMART array controllers, Intelligent Drive Array (IDA), and IDA-2 drives. In mid-1996, Compaq extended its Pre-Failure Warranty to cover the Pentium Pro processors in the Compaq ProLiant 5000 Server and the Compaq ProLiant 2500 Server—a benefit unique to Compaq. In 1997, the Pre-Failure Warranty was again extended to cover Compaq S.M.A.R.T. Wide-Ultra SCSI drives. Competitor companies do not provide the complete coverage Compaq does: a Pre-Failure Warranty that protects hard drives, memory, and Pentium Pro processors.

### Geographic Variations

The Pre-Failure Warranty is available to Compaq customers throughout the world; however, because business conditions differ by geography, the warranty varies in each area. Local service entities can confirm how the Pre-Failure Warranty works in a particular country.

## HEALTH LOGS

Compaq servers use health logs to report failure or potential failure conditions. The monitoring software supports these server health features:

- Real-time clock
- Peripheral Component Interconnect (PCI) or Expanded Industry Standard Architecture (EISA) bus

- Lifetime of the hardware
- Automatic server recovery
- Power modules
- Fans
- Temperature

Table 1 identifies the health drivers for individual operating systems:

TABLE 1: HEALTH DRIVERS FOR OPERATING SYSTEMS

| Operating System | Health Driver |
|---|---|
| NetWare | CPQHLTH.NLM |
| Windows NT | SYSMGMT.SYS |
| UNIX | cpqasrd |
| OS/2 | CPQHLTH.SYS |

## PRE-FAILURE EVENT REPORTING

This section examines two common methods of monitoring for potential pre-failure events: Compaq Insight Manager and User Diagnostics.

### Compaq Insight Manager and Pre-Failure Warranty

Every hardware subsystem in Compaq servers—such as disk storage, system memory, and system processor—has a robust set of management capabilities. The tools that provide these capabilities are Compaq Insight Manager and Compaq Insight Management Agents.

Compaq reports pre-failure events through Compaq Insight Manager, monitoring software that detects almost all cases of. possible failure and ensures that the user gets the most benefit from the Pre-Failure Warranty. The S M.A.R.T. Wide-Ultra drives offer an additional error reporting channel during POST and enhances the Compaq Insight Manager software. The Compaq Insight Manager software architecture is typical of other network management solutions and comprises the server and client software, Compaq Insight Management Agents, and the management application software, Compaq Insight Manager. While there are other methodologies for monitoring server errors, Compaq Insight Manager version 2.0 or higher is required for the Pre-Failure Warranty.

Compaq Insight Manager is an easy-to-use, standards-based application that allows network administrators to manage and maintain Compaq servers remotely. It is a graphically intuitive tool based on the client/server Simple Network Management Protocol (SNMP)[1] and provides integrated management of the server environment.

Compaq Insight Manager is capable of monitoring performance and other operating characteristics of hard drives, memory, and processors. Compaq Insight Manager displays configuration information, operating system (OS) device driver version numbers, controller firmware version numbers, Pre-Failure Warranty information, and operating statistics. Compaq Insight Manager has two components: Compaq Insight Manager console application, which runs on the management PC, and the OS-specific agent, which runs on the server.

[1] SNMP, introduced in 1988, provides a standard means of communicating management information over networks.

### Compaq Insight Management Agents

Insight Management Agents operate on servers. These Agents indicate the current state of server subsystems by measuring certain operating parameters, counting the occurrence of particular events (for example, the number of read operations performed on a disk drive), and monitoring the state of critical functions (such as whether the system cooling fan is operating).

Insight Management Agents provide information to management applications such as Compaq Insight Manager and can generate alarm notifications for the system administrator if significant changes occur in the fault or performance aspects of system operation. When a server's health driver detects a processor threshold error, for example, the Insight Management Agents are alerted. The Agents then issue an alert through SNMP. Compaq Insight Manager receives the alert and subsequently issues an alarm to the system administrator.

### Alarms

Compaq Insight Manager uses alarms to notify the system administrator of significant events occurring on a server. These events can be fault or performance indicators. While most alarms are generated automatically by the Insight Management Agents, additional alarms can be requested for particular events.

When Compaq Insight Manager receives an alarm, it is added to the Alarm Log. After storing the alarm in the Alarm Log, Compaq Insight Manager can take one of several actions, depending on what preference has been specified in server setup:

- Display a window indicating that an alarm was received.
- Sound a tone indicating that an alarm was received.
- Forward notification of the alarm to a digital pager.
- Run an application or batch file in response to the alarm.

The Alarm Log window displays a summary of each alarm received by Compaq Insight Manager, which can be viewed, deleted, or printed.

### Thresholds

Insight Management Agents monitor the state of the server by measuring and collecting server operating parameters and comparing the measured values to a set of user-established values called thresholds. A *threshold* defines the minimum, maximum, or specific value for a given server parameter.

As the server operates, the Insight Management Agents check the value of server parameters against their thresholds. If the value of a server parameter falls outside of its threshold, the Insight Management Agents generate an alarm that Compaq Insight Manager can display or forward to a pager.

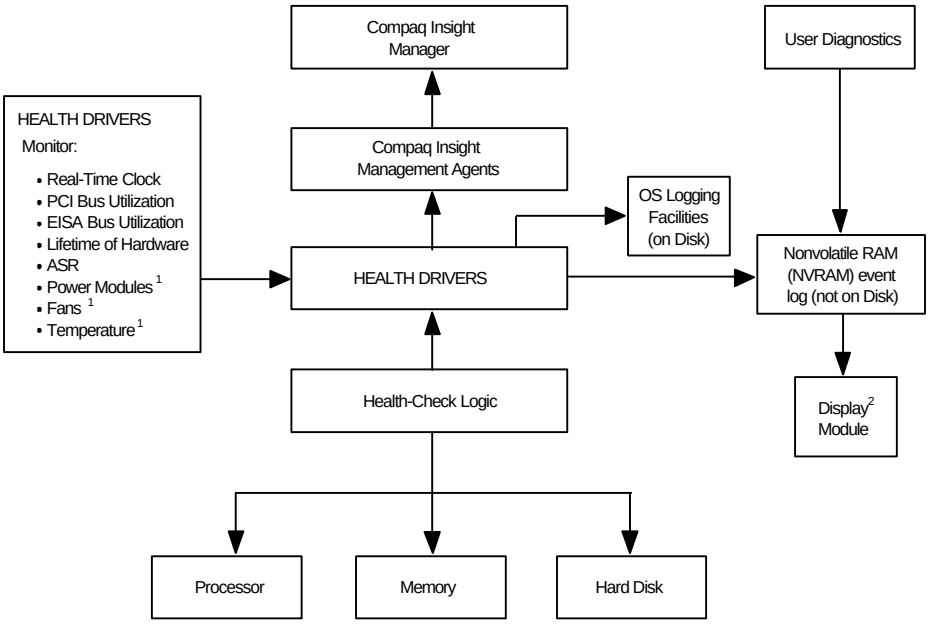
## User Diagnostics and Pre-Failure Warranty

Another common method of monitoring for pre-failure situations is User Diagnostics. User Diagnostics is a service tool generally employed to verify that a failure has occurred or used before installing an OS from the Compaq SmartStart CD-ROM. Since User Diagnostics does not issue an alert as Compaq Insight Manager does, system administrators most often refer to User Diagnostics when instructed to do so by Compaq Service representatives.

User Diagnostics can test most operating parameters of a Compaq server. If any failure occurs while User Diagnostics is running, an Event Log is created. If a processor error occurs while User Diagnostics is running, the test fails and Diagnostics generates an error message.

Figure 1 is a flow chart that illustrates the interrelated functioning of:

- The health drivers, Compaq Insight Manager, and its Agents




[1] Not covered by warranty but help server uptime. Fan and temperature alarms allow proactive action, while power module provides a redundant log.

[2] Coming in March 1997.

- The health drivers and User Diagnostics

*Figure 1. Flowchart showing functional interrelation of Compaq Insight Manager and of User Diagnostics with Health Drivers.*

## PRODUCTS AND COMPONENTS COVERED BY THE PRE-FAILURE WARRANTY

The Pre-Failure Warranty covers all Compaq servers using Compaq Insight Manager version 2.0 or later. The Pre-Failure Warranty specifically applies to memory; Pentium Pro processors; and server hard drives using the Compaq IDA, IDA-2, SMART SCSI array controllers, and S.M.A.R.T. Wide-Ultra SCSI drives. Since the memory, processors, and hard drives represent the three major building blocks of the system, the failure of any one may be catastrophic.

***The Pre-Failure Warranty covers only Compaq-made or Compaq-qualified components. Other third-party vendors' products are not warranted.***

## Hard Drives

A unique feature of Compaq drives is that they can be monitored for specific operating statistics so that problems can be anticipated before they occur. If the reliability of a drive falls below factory-preset performance expectations, the drive may be replaceable under the Compaq Pre-Failure Warranty program.

For Compaq servers, the Pre-Failure Warranty covers any drives attached to array controllers. These include Small Computer System Interface (SCSI) hard drives (except the 535-MB Fast-SCSI-2 hard drive) using IDA, IDA-2, or SMART SCSI array controllers, and S.M.A.R.T. hard drives using Wide-Ultra SCSI. With Pre-Failure Warranty, the performance of these components is monitored, and if a pre-established threshold is exceeded, the monitored component may be replaced prior to actual failure.

If Compaq System Configuration software detects a Compaq hard drive with no monitor and performance support, the system administrator receives a message saying that enabling the Pre-Failure Warranty requires a newer version of the configuration software.

### Drive Parameter Tracking

Pre-Failure Warranty is based, in part, on fatal error conditions reported by the server components and on the relative change of a number of critical operating parameters. Pre-Failure Warranty of Compaq hard drives is made possible by drive parameter tracking, which allows the Compaq array controller to detect drive problems and predict drive failures before they actually occur.

In a background task, Compaq hard drive array controllers monitor more than 15 critical operating parameters and functional tests such as start times, short-average-long seek times, media defect growth, recoverable data error rates, and unrecoverable data error rates. Periodically, the controller tests these parameters and determines if any have exceeded their defined thresholds. If so, the background task notifies Compaq Insight Manager. In turn, Compaq Insight Manager alerts the system administrator to the potential problem by reporting via graphical screens that the drive is degraded. By following the on-screen instructions, the system administrator navigates to a final screen that describes what has happened and recommends action to resolve the issue.

The preset thresholds are based on extensive pre-production tests of statistically significant samples from both the supplier and Compaq Engineering. The net result of drive parameter tracking is that components likely to fail catastrophically are identified so that the system administrator can schedule maintenance.

Of course, no one can predict all possible failure mechanisms. Server components are simply too complex. The Compaq method of "triggering" Pre-Failure Warranty provides reasonable protection against a significant number of possible failure scenarios.

### S.M.A.R.T. Drives

Beginning in 1997, all Wide-Ultra SCSI Compaq server-class hard drives will incorporate S.M.A.R.T. (Self Monitoring and Reporting Technology). S.M.A.R.T. hard drives are designed with the capability to inform the host when a hard drive is experiencing abnormal operation that is likely to lead to drive failure. Indicators which correlate to imminent drive failure are determined through research and monitoring of vital functions. S.M.A.R.T. hard disk drives take internal measurements of certain leading indicators (S.M.A.R.T. attributes) to determine performance or operation deterioration. The drive then analyzes these measurements in an attempt to detect a change. If the drive detects a measurement of a S.M.A.R.T. attribute that crosses a predefined threshold, then an error is reported to the host. By alerting the host of a S.M.A.R.T. threshold crossing in advance of the drive failure, we can alert the user to schedule drive replacement prior to drive failure. Compaq recommends that, in most cases, the drive should be replaced within 24 hours of a S.M.A.R.T. reporting. Drive failures can be identified as either predictable or non-predictable. Predictable failures

show a gradual and measurable decline, but non-predictable failures occur quickly. Compaq works closely with our drive suppliers to ensure that the implementation of S.M.A.R.T. will be effective and will have real predictive capability. Compaq S.M.A.R.T. SCSI drive error reporting protocol adheres to the SCSI-3 S.M.A.R.T. specification of the Information Exceptions Control Page.

#### Third-Party Drives

Before Compaq ships any drive model, it must pass a stringent battery of qualification tests. The Compaq testing process has been custom developed over many years of experience with disk drives and continually improved to detect even the most obscure problems. Because third-party drives have not undergone the Compaq qualification process, they ***are not covered*** by the Compaq Pre-Failure Warranty. In fact, Compaq customers who have purchased certain hot-pluggable hard drives that are advertised as 100% Compaq compatible but that are not qualified by Compaq may receive false pre-failure notification or no notification at all.

## Memory

With today's increasing need for uninterrupted system operation in complex networking environments, memory system integrity is critical. A memory subsystem failure can significantly affect a company's productivity. Basic fault-management components—such as Error Checking and Correction (ECC) memory and the Pre-Failure Warranty—are necessary because of extremely memory-intensive applications such as databases and the potential for a network memory failure to affect a great number of users.

Every memory subsystem, however well designed, may experience a hard or soft memory device failure. A *hard error* is a physical failure within a Dynamic Random Access Memory (DRAM) cell that prevents data from being stored reliably in one or more locations. Failure of a single DRAM cell can abruptly halt a system. *Soft errors* often result from a temporary loss of charge in a DRAM cell. These errors, which are commonplace in DRAM cells, cause data to be stored incorrectly in a memory location, but subsequent accesses can correctly store data into that cell. With properly tuned hardware and software, occurrences of soft errors *should be* months or possibly years apart. In reality, the environment and other hardware and software conflicts can cause noise or contention that may precipitate more frequent random memory errors.

To protect the server from data loss associated with these errors, Compaq offers parity nonmaskable interrupt (NMI) and ECC hardware approaches in various architectures. Compaq servers with ECC do support the Pre-Failure Warranty.

During the warranty period, the Pre-Failure Warranty covers the replacement of Single In-line Memory Modules (SIMMs) and Dual In-line Memory Modules (DIMMs) used in a server's main memory when the predefined thresholds for correctable errors have been exceeded. The predefined thresholds can differ among system architectures.

Nonrepeating correctable soft errors are not covered under warranty since their occurrence requires no action; however, the Compaq Pre-Failure Warranty allows replacement of SIMMs and DIMMs to customers who experience soft errors. Soft errors are recorded by the server and can be verified through Compaq Insight Manager or by running a diagnostics program.

### Third-Party Memory

Compaq recognizes that purchasing or upgrading a mission-critical server requires confidence that the server possesses high-quality memory compatible with the other components and subsystems, so Compaq subjects its memory modules to a tough testing and qualification process. Compaq quality and compatibility testing identifies the most reliable memory for use in each Compaq server.

Compaq is confident of the quality and testing performed on its components; therefore, the company warrants all products manufactured or distributed by Compaq Computer Corporation. Compaq warranties ***will not,*** however, cover damage resulting from use of third-party parts.

### Reporting

Compaq Insight Manager and Compaq Server Diagnostics have a threshold limit for correctable memory errors commensurate with the more robust system architecture of current Compaq servers. The new threshold limit takes into consideration variables such as multiple reads from a DRAM cell that has been written to or OS disabling of ECC. Consequently, the Compaq Insight Manager status box does not indicate a failure (by changing to yellow) unless a SIMM/DIMM replacement is required within the terms of the Compaq Pre-Failure Warranty. Since Compaq has continued to develop and improve Compaq Insight Manager, memory error notification varies based upon the version of Insight Manager being used. With Compaq Insight Manager 2.0, whenever a correctable memory error is detected, an error message instructs the system administrator to replace a specific bank of memory. With Compaq Insight Manager 2.2 through 2.60, anytime a correctable memory error is detected, the system administrator is instructed to locate the Correctable Memory Log window to identify the memory module in which the error occurred and if a pre-failure warranty condition exists. In addition, the status box on the console screen turns yellow to notify the console operator that a single correctable memory error has been detected.

Compaq Insight Manager 2.61 and later versions contain enhancements for ECC memory error reporting. Only when the threshold for correctable errors is exceeded, does the ECC memory error reporting under Compaq Insight Manager notify the system administrator that a memory module needs to be replaced. If the error occurs during the standard warranty period, the replacement is covered under the Compaq Pre-Failure Warranty.

## Processors

The Pentium Pro processor introduced Intel's Machine Check Architecture (MCA), which enables the Pentium Pro processor to provide enhanced processor and server reliability. Pentium Pro processors contain ECC functionality that allows Compaq to implement the Pre-Failure Warranty. Only Intel Pentium Pro processors are covered by the Pre-Failure Warranty.

### Reporting

A processor Pre-Failure Warranty event occurs when the preset threshold of errors is reached. This event is logged in the Critical Event Log and reported to Compaq Insight Manager.

Compaq Insight Manager pre-failure alerting for the Pentium Pro processor is unparalleled. Continuous monitoring of processor health enables Compaq Insight Manager to detect processor degradation and send an alert. Insight Manager notifies the system administrator of a processor event in one or more ways:

- An alarm displayed in the Insight Manager Alarm Log
- An on-screen message displayed in the Critical Event Log (illustrated in Figure 2)
- Pager call

- SNMP alerts (An alert does not necessarily mean that a warrantable event has occurred.)

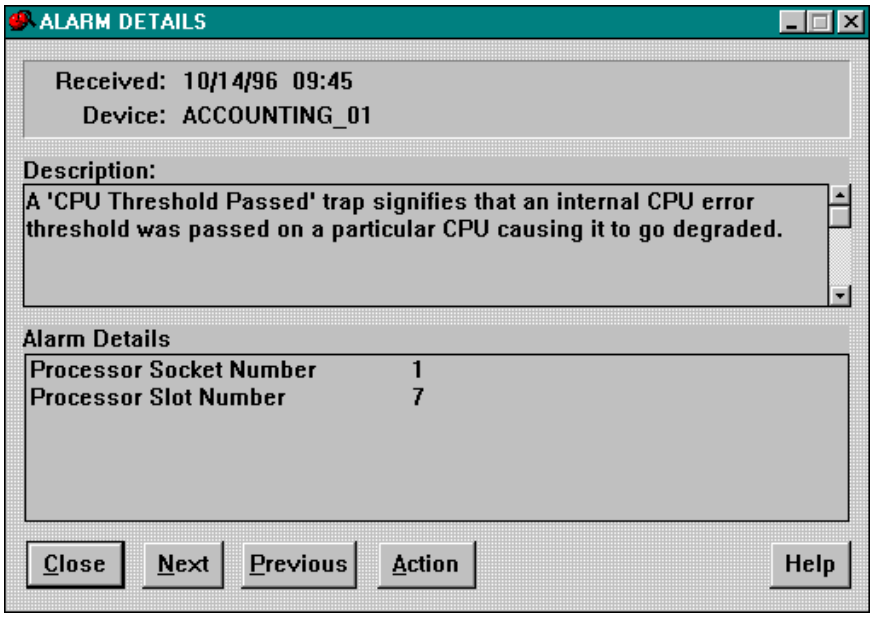



*Figure 2. Compaq Insight Manager Alarm Log*

### User Diagnostics

Compaq Insight Manager or Compaq Insight Management Agents are the normal mode by which the system administrator learns of a potential pre-failure event; however, system administrators can also employ User Diagnostics to evaluate processor problems. Unlike Compaq Insight Manager, User Diagnostics does not log events. Instead, Diagnostics uses an alternate algorithm to determine processor errors more rapidly. If Diagnostics detects errors, it issues the alert "failed MCA test." At this point, the system administrator dials the Compaq 800 number to learn what step to take next.

Because most system administrators do not run Diagnostics unless a Compaq Service representative tells them to, Diagnostics is used infrequently, when the processor experiences a significant problem. Thus, User Diagnostics is primarily a verification tool used by Service to double-check that there has actually been a failure.

## HOW TO TAKE ADVANTAGE OF PRE-FAILURE WARRANTY

This section details how system administrators are warned of potential Pre-Failure Warranty events. Because Compaq Insight Manager is the standard monitoring mechanism, the procedures are described in terms of what happens with Compaq Insight Manager.

Compaq Insight Manager identifies pre-failure conditions by displaying a yellow status indicator, to show that a component is degraded. Along with this yellow color code, Compaq Insight Manager also displays messages recommending replacement of the component in a pre-failure condition.

Upon receiving a Compaq Insight Manager alert that a component has degraded, the system administrator follows the on-screen instructions or contacts an authorized Compaq service provider to determine procedures and eligibility for replacement of the affected component under warranty.

The procedures outlined in this subsection describe how to use Compaq Insight Manager to take advantage of the Pre-Failure Warranty.

## Drives

When a drive error occurs, the Alarm Log indicates the problem. Upon notification of the drive error, the system administrator opens the windows in the order indicated in Table 2.

TABLE 2: IDENTIFYING DRIVE ERRORS

| Step | Action | Results |
|---|---|---|
| 1 | Click on the Launch field. | Opens the Server View window |
| 2 | Select the Mass Storage Overview field | Opens the Mass Storage Overview window. |
| 3 | Select the appropriate Logical Drive Controller window. | Opens the Logical Drive Controller window. |
| 4 | Select the appropriate Physical Drive window. | Opens the Physical Drive window. |
| 5 | Select the Indicators field. | Opens the Physical Drive Indicators window. |
| 6 | Examine the Predictive, Problem, and Failure Indicators. | Reveals the cause of the failure. |
| 7 | On Line 13 (Failure/Error) of the Parts Exchange/Warranty Reimbursement Form, write the name of the field(s) that indicates Replace Drive or Problem. | Ensures quick and appropriate service. |
| 8 | Print the alert screen to include with the reimbursement form. | Documents what Compaq Insight Manager actually saw. |
| 9 | Schedule maintenance. | Initiates Compaq repair/replacement process. |

Figure 3 shows the Compaq Insight Manager physical drive for a server drive. The Status field on the left screen will show a yellow or red band around the failing or failed server drive. The Action button on the bottom screen will say "Degraded" or "Failed" and "Replace Drv" when a pre-failure or failure condition occurs.

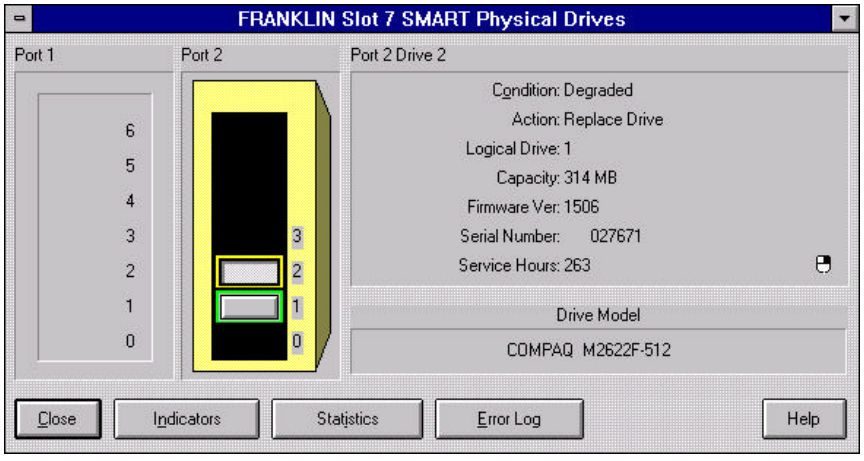



*Figure 3. Compaq Insight Manager Physical Drive Window*

Compaq Insight Manager uses similar screens to issue warnings of possible pre-failure events in memory and processors.

Figure 4 is the alarm details dialog box for a failed drive. It indicates that a factory preset threshold has been exceeded. The system administrator then selects the "Action" button, moving to a screen that outlines the steps required by the terms of the warranty.

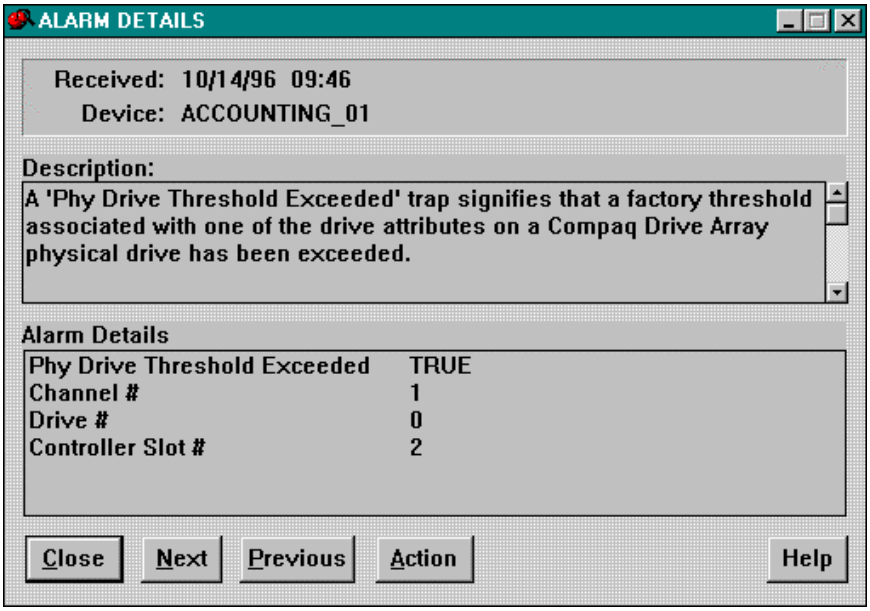



*Figure 4. Failed Drive Alarm Details Dialog*

### S.M.A.R.T. Drives

When a drive error occurs in Compaq's S.M.A.R.T. drives, it can also be reported during POST. A warning will be issued that reads:

*1720 – S.M.A.R.T. drive detects imminent failure. Replace drive immediately*

The user should then either run Compaq Insight Manager or initiate the Compaq repair/replacement process.

## Memory

All occurrences of correctable memory errors are recorded in the Correctable Memory Log window; however, not every occurrence means that a memory module needs replacing. The error description helps identify which module may require replacement.

Memory errors marked with an exclamation point ("!"), indicate that memory is degraded and corrective action is required. The degraded condition is indicated by a yellow band surrounding the Correctable Memory field in the Rapid Recovery window.

There are two types of memory alarms: correctable memory error and log station disabled.

### Correctable Memory Error Alarm

This non-critical alarm indicates that a block of memory has failed or is failing and may need replacing soon. Because the memory controller is able to correct the problem, this condition is generally non-critical, and the server continues to correct any errors it can. However, because this type of error indicates a failure or potential failure of a memory component, it should be corrected as soon as possible.

### Correctable Memory Log Status - Disabled

By design, logging of correctable memory errors ceases when the error count exceeds a factory-preset value. Continuing to log errors after the preset number is reached affects performance of the server.
This alarm indicates a failing or failed memory module. Though this alarm is classified non-critical, an error of this type indicates that a memory component is failing or has failed. The server continues to correct any errors it can, but the failing component should be replaced as soon as possible. Further degradation of the memory components may occur, and then errors may no longer be correctable; at that point, the server may shut down.

### Correcting a Memory Problem

When the Alarm Log indicates either of these memory problems, the system administrator notes the name of the server issuing the alarm and identifies the failed component by completing the steps in Table 3.

TABLE 3: IDENTIFYING A FAILED MEMORY COMPONENT

| Step | Action | Result |
|---|---|---|
| 1 | Click on the Launch field. | Opens the Server View window. |
| 2 | Select the Rapid Recovery field. | Opens the Rapid Recovery window. |
| 3 | Select the Correctable Memory field. | Opens the Correctable Memory Log. |
| 4 | Locate the error message reading "Count = n" (where n = any number greater than 1). | Reveals the memory module that needs to be replaced. |
| 5 | On Line 13 (Failure/Error) of the Parts Exchange/Warranty Reimbursement Form, write the name of the field(s) that indicate failed memory module. | Documents what Compaq Insight Manager actually diagnosed. |
| 6 | Schedule maintenance. | Initiates Compaq repair/replacement process. |

### Processor

When a potential processor pre-failure event is detected, the Compaq Insight Manager action screen indicates what action, if any, should be taken for the selected processor. Possible values include "No Action Needed" and "Replace Processor."

When a pre-failure condition exists under Compaq Insight Manager, a pop-up alarm screen displays the message "Processor Threshold Passed," indicating that some kind of corrective action must be taken. Although this alarm is non-critical, it requires prompt action.

At this point, the system administrator follows the steps outlined in Table 4.

TABLE 4: IDENTIFYING FAILED PROCESSOR COMPONENT

| Step | Action | Result |
|---|---|---|
| 1 | At the Alarm Log window, select "Launch." | The Server View window opens. |
| 2 | Select "System Board." | The System Board Window opens. |
| 3 | Identify the degraded processor that needs to be replaced by selecting the "Processor" field with a yellow (degraded) border. (Make sure that the action for the degraded processor is "Replace Processor.") | Reveals the slot and socket of the processor to be replaced. |
| 4 | Schedule maintenance. | Initiates Compaq repair/replacement process. |

When a component fails or pre-fails, the system administrator should contact Compaq Support. Support will require the following information:

- Technical support registration number
- Product serial number(s)
- Product model name(s) and number(s)
- Applicable error messages
- Add-on boards or hardware
- Third-party hardware or software
- OS type and revision level
- Detailed, specific questions

## CONCLUSION

The Pre-Failure Warranty extends the Compaq leadership role in service for server products by ensuring their maximum availability and performance. Other companies do not offer comparable warranty coverage. Pre-Failure Warranty extends the advantage of the Compaq industry-leading, three-year limited warranty by applying it to critical server components before they actually fail. The Pre-Failure Warranty includes coverage for servers that are monitored by Compaq Insight Manager 2.0 or higher.

For more information, contact your Authorized Compaq Reseller or the Compaq Technical Support Center.