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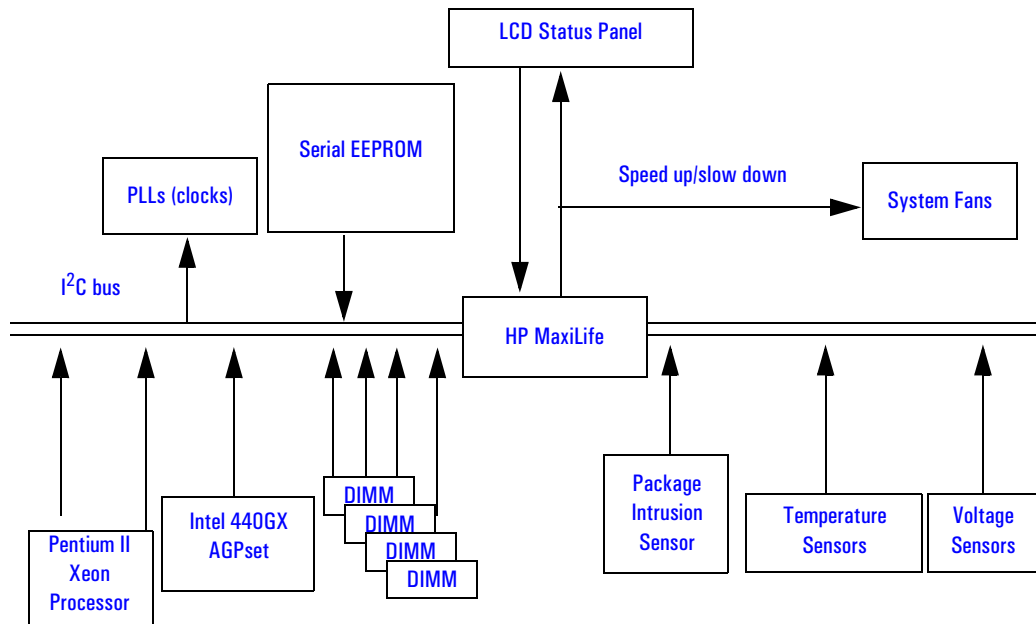
## HP MaxiLife<sup>®</sup> Hardware Monitoring

The described HP MaxiLife Hardware Monitoring feature is only valid for HP Kayak XU Series 0441 and XW Series 0480 PC Workstations. These PC Workstations are installed with the Intel Pentium<sup>®</sup> Xeon<sup>™</sup> processor.

HP MaxiLife is a hardware monitoring chip which is resident on the system board. Its responsibility includes On/Off and reset control, status panel management (Lock button, LEDs), hardware monitoring (temperature and voltage), early diagnostics (CPU, DIMMs, PLLs, boot start), run-time diagnostics (CPU errors, package intrusions), and other miscellaneous functions (such as special OK/FAIL symbols based on a smiling face).

### HP MaxiLife Architecture

The HP MaxiLife chip continuously monitors temperature and voltage sensors located in critical regions on the system board. This chip receives data about the various system components via a dedicated I<sup>2</sup>C bus, which is a reliable communications bus to control the integrated circuit boards.



## The LCD Menu

To access the LCD main menu, press one of the LCD keys. This menu is composed of several menu items which are displayed two at a time on the LCD screen. The following menus are available:

- *System Info*. Obtains information from the BIOS and the system's Serial EEPROM from a previously successful boot. This information includes: product name, BIOS version, serial number, the number of processors and speed, size of memory for each DIMM socket. The BIOS logs information in the serial EEPROM with SYSINFO.COM at the end of the boot.
- *Boot Steps*. Shows the Power-On Self-Test (POST) codes during the system startup. The POST code is provided by the BIOS and is displayed on the LCD panel as soon as it is available. If the system stops during the startup, the last successful boot step POST code is displayed on the LCD.
- *Diagnostics*. Runs a set of diagnostics assessing the system's components (CPU presence, CPU power errors, power supply, clocks, and DIMM presence). To view the test results for each system component, press ▼▲ button. If no errors are detected, a screen will display a smiling face. If an error is detected, an error screen appears indicating the problem.

## Using HP MaxiLife When the Computer Is Powered Off

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**NOTE**

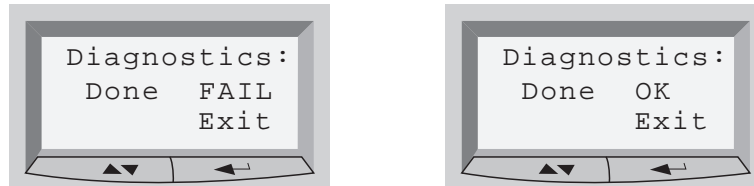
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HP MaxiLife is powered by VSTBY. This means that it is functional as soon as the power cord is plugged in. For HP MaxiLife to work correctly, the PC Workstation must always be connected to a grounded outlet.

Even if the computer is powered off (the LCD status panel will be blank), HP MaxiLife is still running and monitoring the state of the LCD buttons. From this state, the diagnostics program can be run by pressing one of these buttons. When the **Power on** option is selected, the main power supply is started, enabling the hardware monitoring chip to access the status of the computer's components. Although the main power supply has been started, the computer does not continue to complete a normal boot.

The system components are tested in sequence (press the Next button to move on to the following test).

When the diagnostics tests are complete, one of the following screens will be displayed:



If no errors are detected, you can exit the test session, and the main power supply will be turned off and the LCD status panel will become blank.

If an error is detected, a short message is displayed on the LCD status panel describing the type of error (memory, processor) that occurred. For example, the message **DIMM FOUND: 0** would be displayed if no memory modules could be located. You can then choose whether to continue viewing the results of the remaining tests.

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**NOTE**

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If the Diags program is run when the system is off, it returns to the Off state when exiting the test session. On/Off transitions are accompanied with a 'Please wait' screen to allow HP MaxiLife to power on and off correctly.

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## HP MaxiLife Test Sequence and Error Messages

When the PC is turned on (pressing the ON/OFF button), the system initiates the normal startup sequence which is composed of the following steps:

- Basic pre-boot diagnostics.
- BIOS launch.
- POST phase.
- Operating System boot phase.

If any errors are detected during the startup sequence, HP MaxiLife will not necessarily 'freeze' the system. However, some critical hardware errors are fatal to the system and will prevent the system from starting (for example, 'Power', and 'Board PLL' are serious malfunctions that will prevent the CPU to work correctly)

Errors that are not so critical (for example, 'CPU Socket' for missing terminator, or 'NO RAM') will be detected both during pre-boot diagnostics and POST where the BIOS boot process will abort after beeping. The MaxiLife LCD status panel will display the error. Some errors, such as the 'RAM type' error, are only detected during POST sequence, and will entail the same abort process.

Finally, while the PC is working, fan and temperature controls can be reported (for example, a fan error will be reported if a fan cable is not connected). This type of error disappears dynamically when the problem has been fixed (for example, the fan cable has been reconnected).

The different diagnostics are described below.

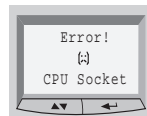
### Basic Pre-boot Diagnostics

The first diagnostic (called basic pre-boot diagnostics) is run to check the presence of the processor(s) or terminators, VRMs, power supply, CPU Board PLL and DIMMs.

The pre-boot diagnostic tests are run in order of priority with respect to their importance to computer functions. Refer to the table BIOS Launch and POST Phase, on page 9 for test sequences, failure messages and action to take to solve any problems.

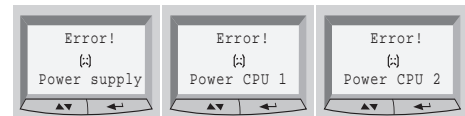
The first detected error displays a message on the LCD status panel. If this happens, one of the following screens could appear.

**Presence of CPUs or Terminators in the Processor Slots**



Missing or incorrectly installed CPU or Terminator.

**Control of Some Voltages: VRMs, 12V**



VRM or CPU power supply are not connected. If an Error ! Power is displayed, the likely cause could be that the power supply is not connected, or the VRM is installed in an unpopulated CPU socket (unsupported configuration).

**Control of the CPU Board**

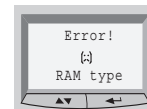


CPU Board is not connected, or the system board needs replacing.

**Number and Compatibility of DIMMs**



No Dimms are detected.



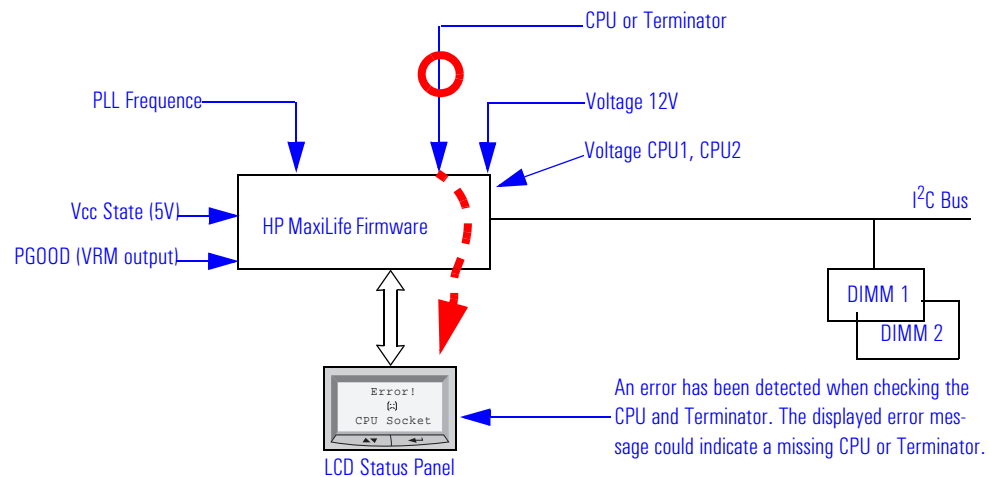
Installed DIMMs are not compatible. This is in fact the BIOS that is checking the inserted DIMMs.

**Video Board**



Video board is not installed. This test is executed by the BIOS.

The following diagram shows how the Pre-boot Diagnostics works when it encounters an error.



The following table shows the test sequence carried out, the type of error message, and the action to take.

**Table 1 Basic Pre-boot Diagnostics**

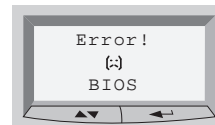
Test	Error Code	Action to Take
Presence of a processor in the BOOT PROC [1] processor slot. This is test is for a single processor system only.	NO CPU 1	<ul style="list-style-type: none"> <li>Check that the processor is correctly installed in the BOOT PROC [1] slot.</li> </ul>
Presence of either CPU or Terminator in the processor slot.	CPU SOCKET	<ul style="list-style-type: none"> <li>Check CPUs and Terminator and VRM of installed processor.</li> </ul>
Number of installed DIMMs	NO RAM	<ul style="list-style-type: none"> <li>Check that the memory module is correctly installed in the memory socket.</li> </ul>
Control of some voltages: VRMs, 12V	POWER SUPPLY	<ul style="list-style-type: none"> <li>Check the power supply connectors, VRM, CPU. In a single processor system, check that the VRM is not plugged into the terminator socket.</li> </ul> <p>The error message could also show: Power CPU1 and Power CPU2.</p>
Test of the correct power signals to the CPU. The power supply may be OK, whereas the VRM is not.	POWER	<ul style="list-style-type: none"> <li>Check that the VRM, processor and terminator are correctly installed.</li> <li>Check that the VRM is not plugged on a socket with a terminator (this could be the likely cause).</li> <li>Check or replace the VRM.</li> <li>Check the power supply unit connectors.</li> </ul>
Presence of VRMs and their associated processor.	POWER CPU	<ul style="list-style-type: none"> <li>Check that the VRMs are correctly installed in their VRM sockets.</li> </ul> <p>POWER CPU 1 - Check VRMs sockets 1 and 2.          POWER CPU 2 - Check VRM socket 3.          POWER CACHE - Check VRM socket 2.</p>
Presence of a VRM in VRM socket 2. This test is for both single and dual processor systems.	POWER CACHE	<ul style="list-style-type: none"> <li>Check that the VRM is correctly installed in VRM socket 2.</li> </ul>
Check the system board clock generators (PLL).	BOARD PLL	<ul style="list-style-type: none"> <li>Check the power supply connector.</li> <li>Replace the system board (PLL clock generator).</li> </ul>
Compatibility of DIMMs. The BIOS checks that the inserted DIMMs are both compatible with one another, and compatible with the Front Side Bus frequency.	RAM TYPE	<ul style="list-style-type: none"> <li>Check the installed memory modules. This error occurs when mixing incompatible memory modules, or when mixing Unbuffered and Registered memory modules.</li> </ul>

**Table 1**                      **Basic Pre-boot Diagnostics**

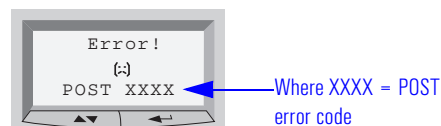
Test	Error Code	Action to Take
Availability of video controller. It is checked by the BIOS. If an error is detected, it is not a fatal one and the BIOS will continue its execution normally.	NO VIDEO	<ul style="list-style-type: none"> <li>Check that the video controller is correctly installed.</li> </ul> <p>Note: No error is detected if a monitor is not connected to an installed video controller. This is not a fatal error and the BIOS will continue its normal execution.</p>

## Post Test Sequence and Post Error Codes

In order to check that the CPU is able to run the BIOS boot code (POST phase) from the first CPU instructions through to DIMM detection, HP MaxiLife firmware waits for a synchronization event from the BIOS. Any failure that prevents the execution of the firmware will therefore trigger the BIOS error and will display the following message on the LCD status panel.

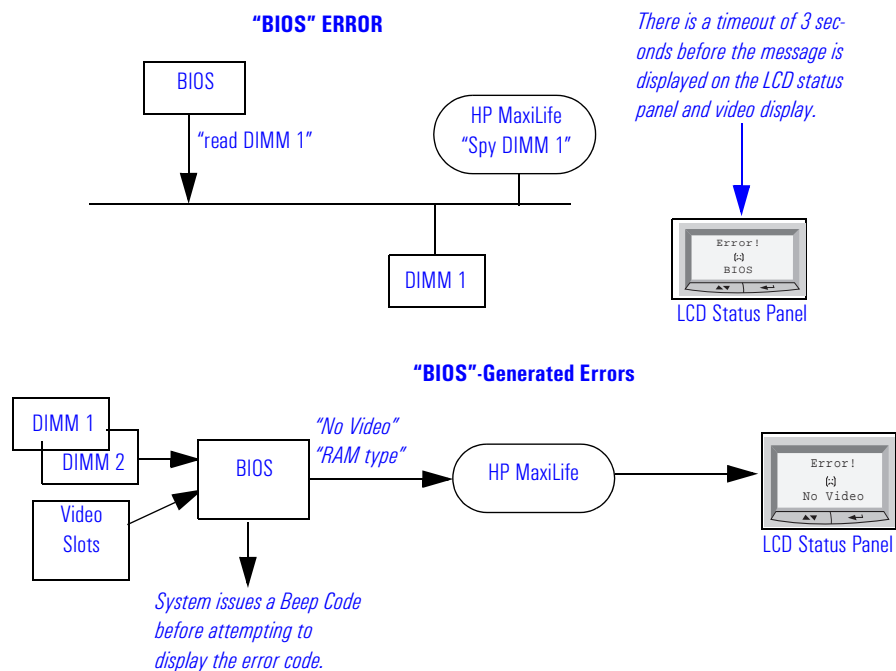


Then, the BIOS executes the Power-On Self Test (POST) sequence. In this phase, HP MaxiLife waits for any error messages that the BIOS may issue. If such an error occurs, then a screen similar to the following example is displayed. The error code that appears on the LCD status panel is the same as the one that appears on the PC screen. If the POST issues several error codes, only the last one is visible on the LCD status panel.





The following diagrams show the different BIOS-generated errors.



**Table 2 BIOS Launch and POST Phase**

Test	Error Code	Action to Take
In order to detect whether the CPU is able to run a given code, HP MaxiLife waits for a synchronization event from the BIOS. Any failure that prevents the execution of the firmware will trigger an error.	BIOS	<ul style="list-style-type: none"> <li>Flash the latest version of the system BIOS by using the system recovery procedure. Set switch 10 to the down position.</li> <li>Check that the RAM is correctly installed.</li> <li>Check that the CPU is firmly inserted.</li> </ul>
The BIOS then executes the Power On Self Test (POST) sequence. In this phase, HP MaxiLife waits for any error messages that the BIOS may issue.	POST XXXX	<ul style="list-style-type: none"> <li>If the screen is working, you can obtain the meaning of the error by typing "Enter" at the end of the POST. Or, you can check the list of errors available on the HP World-Wide Web support page: <a href="http://www.hp.com/go/kayaksupport">http://www.hp.com/go/kayaksupport</a></li> </ul>

## Operating System Boot Phase

If no error message has been displayed at this stage of the system startup by the BIOS, the operating system is launched and the LCD status panel will display the system platform and a "smiling icon."

## Run-Time Errors

During the normal usage of the PC, HP MaxiLife continually checks some of the vital system parameters. These include: temperature errors, fan malfunctions, power voltage drops, board PLL problems and CPU problems.

If several alarms or errors are active at the same time, they will be displayed by cycling every second through four “alarm sources”, with one error cause for each source:

- Pre-boot diagnostics.
- Run-Time error 1.
- Run-Time error 2.
- POST error.

The run-time errors are organized into two different sources.

*Run-Time error 1:* “Temperature I/O slot”, “Power errors”, “Fan CPU”, “Board PLL”.

*Run-Time error 2:* “Temperature disk”, “Temperature CPU”, “Fan disk”, “Fan I/O slot”, “CPU error”.

If both fan for disks and I/O slot are not connected (both are run-time error 1), only the “Fan disk” (run-time error 2) will be displayed.

**Table 3**                      **Run-Time Errors**

Test	Error Code	Action to Take
During normal usage of the PC, HP MaxiLife continually checks vital system parameters. If an error should occur, a message would be automatically displayed on the LCD panel.	FAN CPU	<ul style="list-style-type: none"><li>• Check the connection of the corresponding component, which could be: “Temp IO slot”, “Power errors”, “Fan CPU”, “Board PLL”, “Temp disk”, “Temp CPU”, “Fan disk”, “Fan IO slot”, “CPU error”.<sup>1</sup></li></ul>

<sup>1</sup>. Special cases: Board PLL = System board needs replacing. CPU error = Reset or power off the system to recover.

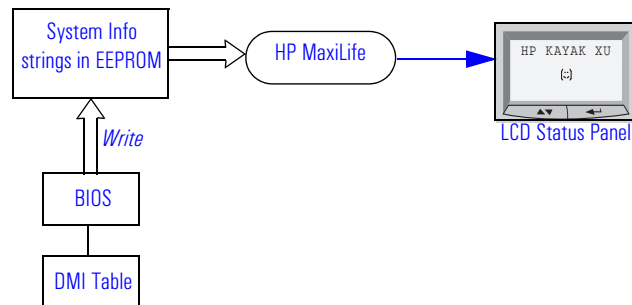
## Main Menu

The main menu is displayed when any of the LCD buttons from are presed (HP MaxiLife LCD status panel can be accessed even though the PC is turned off). The Main Menu comprises of three sub-menus: System Info, Boot Steps and Diagnostics.

## System Info

Obtains information from the BIOS and the system's Serial EEPROM from a previously successful boot. This information includes: product name (HP Kayak XU, or XW), BIOS version, serial number, number of processors and speed, size of memory for each DIMM socket.

The following diagram shows how the System Info obtains its information.

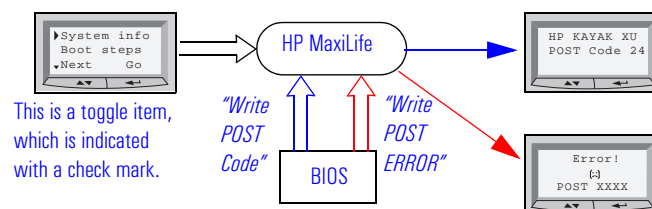


## Boot Steps

Shows the Power-On Self-Test (POST) codes during the system startup. The POST code is provided by the BIOS and is displayed on the LCD panel as soon as it is available. If the system stops during the startup, the last successful boot step POST code is displayed on the LCD. When Boot Steps is selected, the POST step will be shown on the LCD status panel during the subsequent boot processes.

To ensure that HP MaxiLife is ready to display the first POST codes as soon as possible, the Pre-boot diagnostics are not executed when the system is booted with the Boot Steps option selected.

The following diagram shows how Boot Steps obtains its information from the BIOS, and then displays a POST error if needed.



## Diagnostics

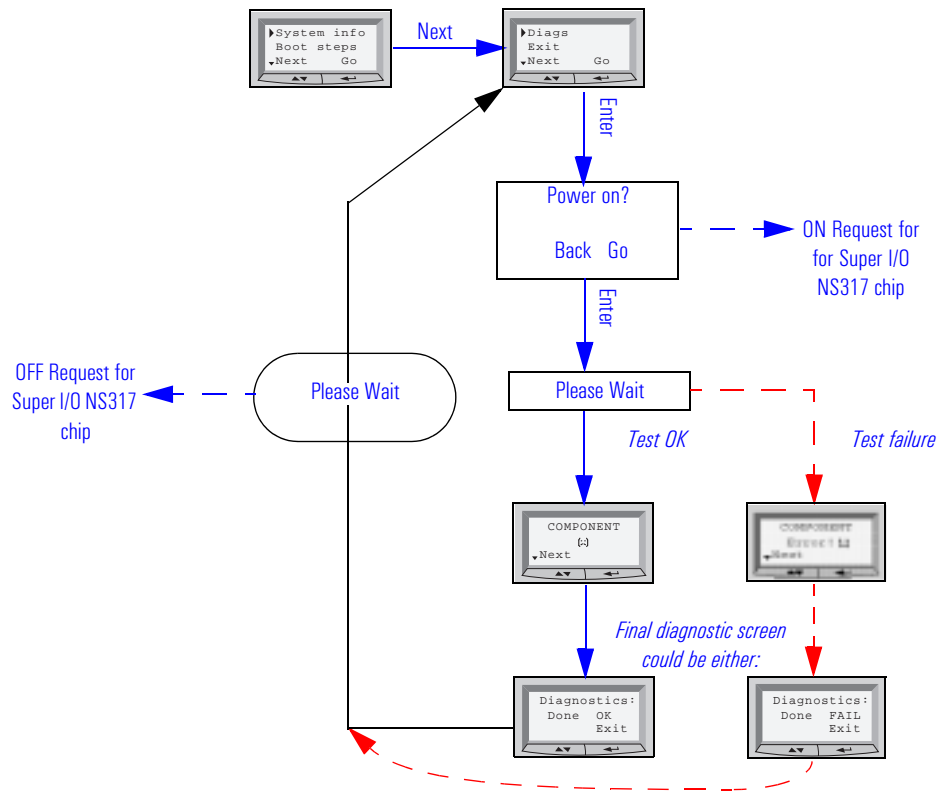
Runs a set of diagnostics assessing the system's components. Results of the tests are displayed on the LCD status panel, one after another when the LCD ▼▲ buttons are pressed.

For HP MaxiLife to access the status of some of the components, the power supply has to be in the ON state. If the system is turned off when Diags is launched, a menu will be displayed, requesting an authorization to power on the PC. It is possible to cancel the diagnostic process and return to the previous state by pressing the LCD key labelled "Back". When "GO" is selected, the main power supply is started but the PC is not allowed to do a normal boot. The purpose of this is to allow only these devices that can be tested to answer the diagnostic request from HP MaxiLife.

Components are tested in sequence when the "Next" button is pressed. When they have all been checked, a diagnostic screen is shown. Depending on the result of the diagnostics, the screen could indicate either: OK or FAIL.

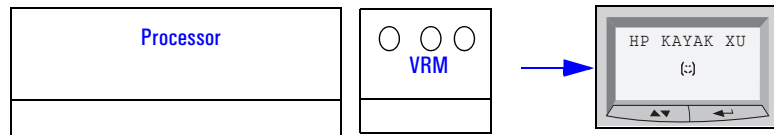
At the end of the test, you can exit the diagnostic mode by pressing the ← LCD button. If the power supply was off when the diagnostics was started, it will be turned off again.

The following diagram shows how the "Power On" is activated when the main power supply of the PC is turned off.

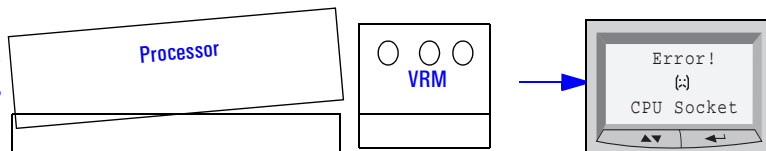


## Typical Diag Error Messages

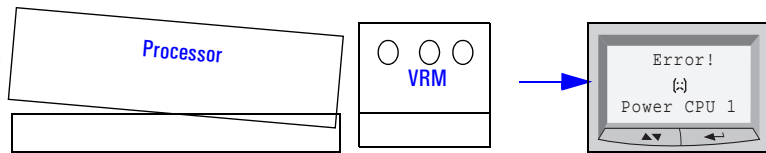
*When the Processor and VRM are correctly installed, the “smiling icon” is shown on the LCD status panel.*



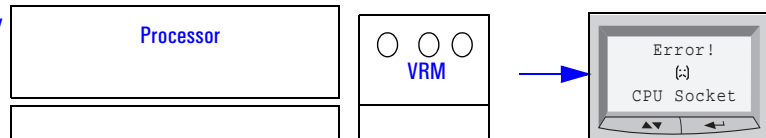
*If the Processor has only been partly inserted in the processor slot (opposite side to the VRM), then the displayed message will indicate a CPU socket error.*



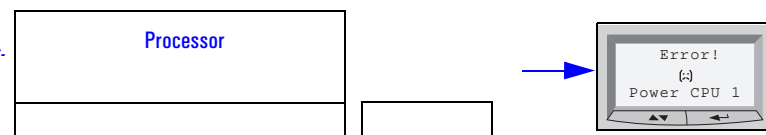
*If the Processor has only been partly inserted in the processor slot (closest side to the VRM), then the displayed message will indicate a Power CPU 1 error.*



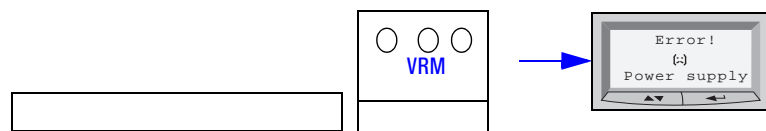
*The Processor has not been inserted correctly in the processor slot. The displayed message will indicate a CPU socket error.*



*The Processor has been correctly installed in the processor slot. However, the VRM is not installed. The displayed message will indicate a Power CPU 1 error.*

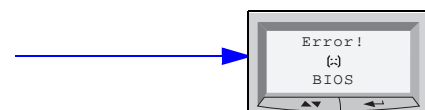


*There is no installed Processor. However, the VRM is correctly installed. The displayed message will indicate a Power error.*



*If one of the following fatal malfunctions occur, the displayed message will indicate a BIOS error:*

*The BIOS no longer works.  
There is no Flash.*



The components tested are described in the following table:

**Table 4**                      **Main Menu Diagnostics**

Test	Error Code	Action to Take
Presence of either CPU or Terminator in the processor slot.	CPU SOCKET	<ul style="list-style-type: none"> <li>● Check CPUs and Terminator and VRM of installed processor.</li> </ul>
Control of some voltages: VRMs, 12V	POWER SUPPLY	<ul style="list-style-type: none"> <li>● Check the power supply connectors, VRM, CPU. The error message could also show: Power CPU1 and Power CPU2.</li> </ul>
Test of the correct power signals to the CPU. The power supply may be OK, whereas the VRM is not.	POWER	<ul style="list-style-type: none"> <li>● Check that the VRM, processor and terminator are correctly installed.</li> <li>● Check that the VRM is not plugged in a socket with a terminator (this could be the likely cause).</li> <li>● Check or replace the VRM.</li> <li>● Check the power supply unit connectors.</li> </ul>
Check frequency of the system board (PLL).	BOARD PLL	<ul style="list-style-type: none"> <li>● Check the power supply connector.</li> <li>● Replace the system board (PLL clock generator).</li> </ul>
Number of installed DIMMs	NO RAM	<ul style="list-style-type: none"> <li>● Check that the memory module is correctly installed in the memory socket.</li> </ul>
Compatibility of DIMMs. The BIOS checks that the inserted DIMMs are both compatible with one another, and compatible with the Front Side Bus frequency.	RAM TYPE	<ul style="list-style-type: none"> <li>● Check the installed memory modules. This error occurs when mixing incompatible memory modules, or when mixing Unbuffered and Registered memory modules.</li> </ul>


**For More Information  
About HP MaxiLife**

Refer to the online *Upgrade and Configuration Guide* for more information about this diagnostics utility at the HP World Wide Web site:  
**<http://www.hp.com/go/kayaksupport>.**


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## Order in Which the Tests Are Performed

Each time the system is powered on, or a reset is performed, the POST is executed. The POST process verifies the basic functionality of the system components and initializes certain system parameters.

The POST starts by displaying a graphic screen of the HP PC Workstation's logo when the PC is restarted. If you wish to view the POST details, press  to get the HP Summary Screen.

If the POST detects an error, the error message are displayed inside a *view system errors* screen, in which the *error message utility* (EMU) not only displays the error diagnosis, but the suggestions for corrective action (see page 24 for a brief summary). Error codes are no longer displayed.

Devices, such as memory and newly installed hard disks, are configured automatically. The user is not requested to confirm the change. Newly removed hard disks are detected, and the user is prompted to confirm the new configuration by pressing . Note, though, that the POST does not detect when a hard disk drive has been otherwise changed.

During the POST, the BIOS and other ROM data is copied into high-speed shadow RAM. The shadow RAM is addressed at the same physical location as the original ROM in a manner which is completely transparent to applications. It therefore appears to behave as very fast ROM. This technique provides faster access to the system BIOS firmware.

### An example of an Error Code Message

This example explains the different coding messages that appear in the lower left corner of the screen when the POST detects an error during startup.

For example, if the error **0101 - 52** is displayed.

- **0101** - Post Error Code failure. This error code is accompanied by a short message. For this example, the message “keyboard error” is displayed. A table listing the error codes, causes and symptoms is on page 25.
- **52** - Post Checkpoint Code. This checkpoint code indicates that a test has failed at this stage of the POST.

A table listing the error codes, and POST routine descriptions is on the following page.



The following table lists the POST checkpoint codes written at the start of each test.

Checkpoint Code	POST Routine Description
02h	Verify Real Mode
03h	Disable Non-Maskable Interrupt (NMI)
04h	Get CPU type
06h	Initialize system hardware
08h	Initialize chipset with initial POST values
09h	Set IN POST flag
0Ah	Initialize CPU registers
0Bh	Enable CPU cache
0Ch	Initialize caches to initial POST values
0Eh	Initialize I/O component
0Fh	Initialize the local bus IDE
10h	Initialize Power Management
11h	Load alternate registers with initial POST values
12h	Restore CPU control word during warm boot
13h	Initialize PCI Bus Mastering devices
14h	Initialize keyboard controller
17h	Initialize cache before memory autosize
18h	8254 timer initialization
1Ah	8237 DMA controller initialization
1Ch	Reset Programmable Interrupt Controller
24h	Set ES segment register to 4 GB
26h	Enable A20 line
28h	Autosize DRAM
29h	Initialize POST Memory Manager

Checkpoint Code	POST Routine Description
2Ah	Clear 512 KB base RAM
32h	Test CPU bus-clock frequency
33h	Initialize POST Dispatch Manager
34h	Test CMOS RAM
35h	Initialize alternate chipset registers
36h	Warm start shutdown
37h	Reinitialize the chipset (MB only)
38h	Shadow system BIOS ROM
39h	Reinitialize the cache (MB only)
3Ah	Autosize cache
3Ch	Advanced configuration of chipset registers (V4.0, Release 6.0)
3Dh	Load alternate registers with CMOS values
40h	Set initial CPU speed
42h	Initialize interrupt vectors
44h	Initialize BIOS interrupts
45h	POST device initialization
47h	Initialize manager for PCI Option ROMs (Rel. 5.1 and earlier)
48h	Check video configuration against CMOS
49h	Initialize PCI bus and devices
4Ah	Initialize all video adapters in system
4Bh	QuietBoot start (optional) <sup>1</sup>
4Ch	Shadow video BIOS ROM
4Eh	Display BIOS copyright notice
50h	Display CPU type and speed
51h	Initialize EISA board

Checkpoint Code	POST Routine Description
52h	Test keyboard
54h	Set key click if enabled
56h	Enable keyboard
59h	Initialize POST display service
5Ah	Display prompt "Press F2 to enter SETUP"
5Bh	Disable CPU cache
5Ch	Test RAM between 512 and 640 KB
60h	Test extended memory
62h	Test extended memory address lines
64h	Jump to UserPatch1
66h	Configure advanced cache registers
67h	Initialize Multi Processor APIC
68h	Enable external and CPU caches
69h	Setup System Management Mode (SMM) area
6Ah	Display external L2 cache size
6Bh	Load custom defaults (optional) <sup>1</sup>
6Ch	Display shadow-area message
6Eh	Display possible high address for UMB recovery
70h	Display error messages
72h	Check for configuration errors
74h	Test real-time clock
76h	Check for keyboard errors
7Ah	Test for key lock on
7Ch	Set up hardware interrupt vectors
7Eh	Initialize coprocessor if present

Checkpoint Code	POST Routine Description
80h	Disable onboard Super I/O ports and IRQs
81h	Late POST device initialization
82h	Detect and install external RS 232 ports
83h	Configure non-MCD IDE controllers
84h	Detect and install external parallel ports
85h	Initialize PC-compatible PnP ISA devices
86h	Re-initialize onboard I/O ports
87h	Configure System Board Configurable Devices
88h	Initialize BIOS Data Area
89h	Enable Non-Maskable Interrupts (NMIs)
8Ah	Initialize Extended BIOS Data Area
8Bh	Test and initialize PS/2 mouse
8Ch	Initialize floppy controller
8Fh	Determine number of ATA drives (optional) <sup>1</sup>
90h	Initialize hard disk controllers
91h	Initialize local-bus hard disk controllers
92h	Jump to UsersPatch2
93h	Build MPTABLE for multi-processor boards
94h	Disable A20 address line (Rel. 5.1 and earlier)
95h	Install CD ROM for boot
96h	Clear huge ES segment register
97h	Fixup Multi Processor table
99h	Check for SMART drive (optional) <sup>1</sup>
9Ah	Shadow option ROMs
9Ch	Set up Power Management

Checkpoint Code	POST Routine Description
9Dh	Initialize security engine (optional) <sup>1</sup>
9Eh	Enable hardware interrupts
9Fh	Determine number of ATA and SCSI drives
A0h	Set time of day
A2h	Check key lock
A4h	Initialize typematic rate
A8h	Erase F2 prompt
AAh	Scan for F2 key stroke
ACh	Enter SETUP
A Eh	Clear boot flag
B0h	Check for errors
B2h	POST done - prepare to boot operating system
B5H	Terminate QuietBoot (optional) <sup>1</sup>
B6h	Check password (optional) <sup>1</sup>
B8h	Clear global descriptor table
B9h	Prepare boot
BAh	Initialize DMI parameters
BBh	Initialize PnP Option ROMs
BCh	Clear parity checkers
BDh	Display MultiBoot menu
BEh	Clear screen (optional) <sup>1</sup>
BFh	Check virus and backup reminders
C0h	Try to boot with INT 19
C1h	Initialize POST Error Manager (PEM)
C2h	Initialize error logging

Checkpoint Code	POST Routine Description
C3h	Initialize error display function
C4h	Initialize system error handling
C5h	Plug and Play Dual CMOS (optional) <sup>1</sup>
C8h	Force check (optional) <sup>1</sup>
C9h	Extended checksum (optional) <sup>1</sup>
D2h	Unknown interrupt
<b>The following are for boot block in Flash ROM</b>	
E0h	Initialize the chipset
E1h	Initialize the bridge
E2h	Initialize the CPU
E3h	Initialize system timer
E4h	Initialize system I/O
E5h	Check force recovery boot
E6h	Checksum BIOS ROM
E7h	Go to BIOS
E8h	Set Huge Segment
E9h	Initialize Multi Processor
EAh	Initialize OEM special code
EBh	Initialize PIC and DMA
ECh	Initialize Memory type
EDh	Initialize Memory size
EEh	Shadow Boot Block
EFh	System memory test
F0h	Initialize interrupt vectors
F1h	Initialize Run Time Clock

Checkpoint Code	POST Routine Description
F2h	Initialize video
F3h	Initialize system management mode
F5h	Boot to Mini DOS
F6h	Clear huge segment
F7h	Boot to Full DOS

<sup>1</sup>. Depending on the BIOS *Setup* configuration.

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## Error Message Summary

The Error Message Utility or EMU (.COM application written in C language) is to provide full screen online help messages (localized) on most common POST errors. When an error is generated in POST during the boot process, EMU is run by typing ENTER. The entry point of each EMU message is a 4-digits error code generated by POST.

If the POST reports an error, one of the following four error categories will be displayed.

**Category #1:** if the error requires Setup to be run, the POST should prompt:

**< F1= Continue > , < F2= Setup > , < Enter= View System Error >**

and pause. (Refer to autoconfig specification for more details on POST prompts)

**Category #2:** if the error is only a warning (i.e. key stuck), the POST should prompt:

**< Enter= View System Error >**

for 2 seconds then boot. (Refer to autoconfig specification for more details on POST prompts)

**Category #3:** if the error occurs because a device has been unplugged or removed, the POST should prompt :

**"If errors are reported because one or more of the listed components have been removed, press < F4 > to validate the changes."**

**< F1= Continue > , < F2= Setup > , < F4= Validate Change > , < Enter= View System Error >**

and pause. (Refer to autoconfig specification for more details on POST prompts)

**Category #4:** if the error is serious, the POST should prompt:

**The BIOS has detected a serious problem that prevents your PC from booting."**

**< F2= Setup > , < Enter= View System Error >**

and stop. Only the setup and the EMU can be run. The BIOS must never boot on HDD.



The following table lists the error codes, causes and symptoms, and the accompanying short messages that are displayed in the upper left corner of the screen.

Code #	Cause / Symptom	Short message (US)
0000h	Any POST error that is not listed below	<i>System error</i>
0010h	CMOS Checksum error (if no Serial EEPROM)	<i>Incorrect CMOS Checksum</i>
0011h	Date and Time (CMOS backed up from SE2P)	<i>Date and Time Lost</i>
0012h	PC configuration lost (both SE2P and CMOS lost)	<i>Incorrect PC Configuration</i>
0020h	Any POST error regarding an AT option ROM	<i>Option ROM Error</i>
0021h	Any POST error regarding an external PCI card issue	<i>PCI Error</i>
0022h	Any POST error regarding an AT PnP issue	<i>ISA P1P Error</i>
0030h	Unsupported CPU speed switch setting	<i>Wrong CPU Speed Setting</i>
0040h	Serial number corrupted (bad checksum or null #)	<i>Invalid PC Serial Number</i>
0041	Product flag not initialized or bad	<i>Invalid Internal product type</i>
0050h	Fan not connected (according to CPU)	<i>Fan Not Connected</i>
0060h	RPO initialization failure	<i>Remote Power On Error</i>
0100h	Keyboard stuck key	<i>Keyboard Error</i>
0101h	Keyboard self-test failure	<i>Keyboard Error</i>
0102h	Keyboard controller I/O access failure	<i>Keyboard Error</i>
0103h	Keyboard not connected	<i>Keyboard Not Connected</i>
0105h	Mouse self-test failure	<i>Mouse Error</i>
0106h	Mouse not detected (but configured in CMOS)	<i>Mouse Error</i>
0108h	Mouse and Keyboard connectors reversed	<i>Keyboard and Mouse Error</i>
0200h	Conflict on serial port (@, IRQ)	<i>Serial Port Error</i>
0201h	Conflict on parallel port (@, IRQ, DMA)	<i>Parallel Port Error</i>
0300h	Floppy A: self-test failure	<i>Flexible Disk Drive A Error</i>
0301h	Floppy B: self-test failure	<i>Flexible Disk Drive B Error</i>

Code #	Cause / Symptom	Short message (US)
0310h	Floppy A: not detected (but configured in CMOS)	<i>Flexible Disk Drive Error</i>
0311h	Floppy B: not detected (but configured in CMOS)	<i>Flexible Disk Drive Error</i>
0305h	Floppy A: plugged on Floppy B: connector	<i>Flexible Disk Drive Error</i>
0306h	General failure on floppy controller	<i>Flexible Disk Drive Error</i>
0307h	Conflict on floppy disk controller	<i>Flexible Disk Drive Error</i>
0400h	CD-ROM test failure	<i>CD-ROM Error</i>
0401h	CD-ROM not detected (but configured in CMOS)	<i>CD-ROM Error</i>
0500h	General failure on HDD onboard primary ctrl	<i>IDE Device Error</i>
0501h	General failure on HDD onboard secondary ctrl	<i>IDE Device Error</i>
0510h	HDD # 0 self-test error	<i>IDE Device # 0 Error</i>
0511h	HDD # 1 self-test error	<i>IDE Device # 1 Error</i>
0512h	HDD # 2 self-test error	<i>IDE Device # 2 Error</i>
0513h	HDD # 3 self-test error	<i>IDE Device # 3 Error</i>
0520h	HDD # 0 not detected (but configured in CMOS)	<i>IDE Device # 0 Error</i>
0521h	HDD # 1 not detected (but configured in CMOS)	<i>IDE Device # 1 Error</i>
0522h	HDD # 2 not detected (but configured in CMOS)	<i>IDE Device # 2 Error</i>
0523h	HDD # 3 not detected (but configured in CMOS)	<i>IDE Device # 3 Error</i>
0530h	Found a drive on slave connector only (primary)	<i>IDE Device Error</i>
0531h	Found a drive on slave connector only (secondary)	<i>IDE Device Error</i>
0540h	Conflict on hard disk controller	<i>IDE Device Error</i>
0600h	Found less video memory than configured in CMOS	<i>Video Memory Error</i>
0700h	Found less DRAM memory than at previous boot	<i>System Memory Error</i>
0711h	Defective DIMM (module 1, bank 1)	<i>System Memory Error</i>
0712h	Defective DIMM (module 2, bank 1)	<i>System Memory Error</i>
0721h	Defective DIMM (module 1, bank 2)	<i>System Memory Error</i>
0722h	Defective DIMM (module 2, bank 2)	<i>System Memory Error</i>

Code #	Cause / Symptom	Short message (US)
0731h	Defective DIMM (module 1, bank 3)	<i>System Memory Error</i>
0732h	Defective DIMM (module 2, bank 3)	<i>System Memory Error</i>
0800h	Found lower cache size than configured	<i>System Cache Error</i>
0801h	Cache self-test failure	<i>System Cache Error</i>
0900h	Lan (Chanteclerc) self-test failure	<i>Integrated LAN Error</i>
0901h	Lan (Chanteclerc) not detected (but enabled in <i>Setup</i> )	<i>Integrated LAN Error</i>
0A00h	Plug and Play video auto-setting failure (DDC hang)	<i>DDC Video Error</i>

The following table summarizes the most significant of the problems that can be reported.

Message	Explanation or Suggestions for Corrective Action
Operating system not found	Check whether the disk, HDD, FDD or CD-ROM disk drive is connected. If it is connected, check that it is detected by POST. Check that your boot device is enabled on the <i>Setup</i> Security menu. If the problem persists, check that the boot device contains the operating system.
Missing operating system	If you have configured HDD user parameters, check that they are correct. Otherwise, use HDD type "Auto" parameters.
Resource Allocation Conflict -PCI device 0079 on system board	Clear CMOS.
Video Plug and Play interrupted or failed. Re-enable in Setup and try again	You may have powered your computer Off/On too quickly and the computer turned off Video plug and play as a protection.
System CMOS checksum bad - run Setup	CMOS contents have changed between 2 power-on sessions. Run <i>Setup</i> for configuration.
No message, system "hangs"	Check that the main memory modules are correctly set in their sockets.
Other	An error message may be displayed and the computer may "hang" for 20 seconds and then beep. The POST is probably checking for a mass storage device which it cannot find and the computer is in Time-out Mode. After Time-out, run <i>Setup</i> to check the configuration.
4 - 4 - 2 - 4 (Beep code)	Switch 10 is not correctly set or flash is corrupted. The BIOS update crisis recovery procedure is to be used.

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## Beep Codes

If a terminal error occurs during POST, the system issues a beep code before attempting to display the error in the upper left corner of the screen. Beep codes are useful for identifying the error when the system is unable to display the error message.

Beep Pattern	Beep Code	Numeric Code	Description
— — — — —	1-2-2-3	16h	BIOS ROM checksum failure
— — — — —	1-3-1-1	20h	DRAM refresh test failure
— — — — —	1-3-1-3	22h	8742 Keyboard controller test failure
— — — — —	1-3-4-1	2Ch	RAM failure on address line <i>xxxx</i> <sup>1</sup>
— — — — —	1-3-4-3	2Eh	RAM failure on data bits <i>xxxx</i> <sup>1</sup> of low byte of memory bus
— — — — —	1-4-1-1	30h	RAM failure on data bits <i>xxxx</i> <sup>1</sup> of high byte of memory bus
— — — — —	2-1-2-3	46h	ROM copyright notice check failure
— — — — —	2-2-3-1	58h	Unexpected interrupts test failure
— — — — —	1-2	98h	Video configuration failure or option ROMs checksum failure
— — — — —	4-4-2-4	F7	Crisis Recovery Failure
-	1	F4h	This does not indicate an error. There is one short beep before system startup.

<sup>1</sup>If the BIOS detects error 2C or 2E (base 512K RAM error), it displays an additional word-bitmap (*xxxx*) indicating the address line or bits that failed. For example, “2C 0002” means address line 1 (bit one set) has failed. “2E 1020” means data bits 12 and 5 (bits 12 and 5 set) have failed in the lower 16 bits.

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