

*Maintenance Manual*

# **Extensa™ 51x Series Notebook Computers**

9811755-0001

April 1996



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**Extensa 51x Series Notebook Computers  
Maintenance Manual  
TI Part No. 9811755-0001  
Original Issue: April 1996**

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## Introduction

This manual provides installation, operation and servicing data for the Extensa™ 51x Series Notebook Computers.

## Intended Audience

This manual is primarily intended for use by qualified service technicians but contains information useful to non-technical users.

## Contents

This manual contains six sections and multiple reference appendices including:

- **Section 1: General Description** — Introduces the main features of the notebook family; provides a list of physical and electrical specifications.
- **Section 2: Installation** — Describes how to unpack, install options and cable up the notebook computer in a desktop environment.
- **Section 3: Operating Instructions** — Describes the notebook operating controls and indicators and modes of operation.
- **Section 4: Theory of Operation** — Describes detailed theory of operation for Extensa Series notebooks.
- **Section 5: Troubleshooting** — Provides troubleshooting procedures for the Extensa 51x Series notebooks.
- **Section 6: Field Service** — Provides corrective maintenance procedures for the notebook computer.
- **Appendix A: Self Test Error Messages**
- **Appendix B: PC-Doctor Reference Data**

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## Other Manuals About the System

The following documents provide additional information related to the Extensa 51x Series:

- **Extensa Series Notebook Computer User's Reference Manual** contains reference information regarding the Extensa Series Notebook Computer software including the TI custom utilities.
- **Windows® 95 Help** (online)
- **PC-Doctor Help and Technical Reference** (online)

## Ordering Parts and Supplies

To order a copy of any TI publication or to order option kits, spare parts or supplies for your system, contact your TI Reseller or:

Telephone Toll-free: **1-800-TI TEXAS**

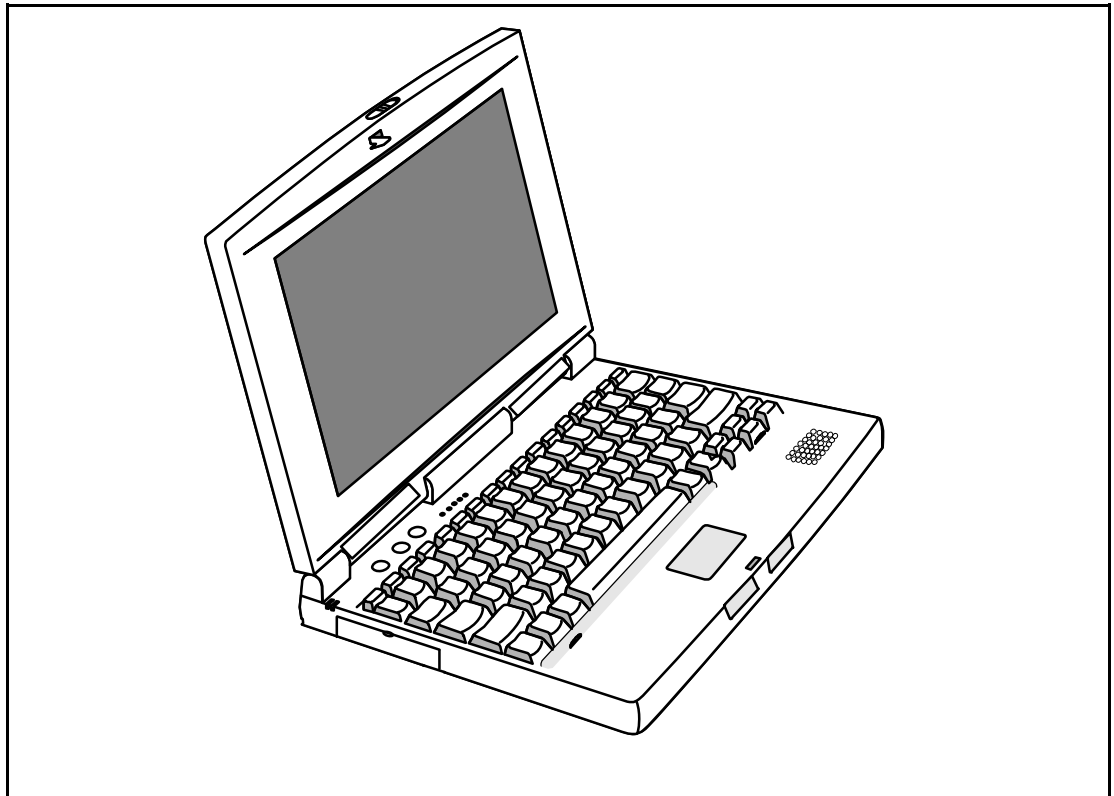


# General Description

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## 1.1 Introduction

This manual contains field and factory level servicing information for the Texas Instruments Extensa™ 51x Series of Notebook Computers (Figure 1-1). This section provides a general overview and specifications for the Extensa 51x Series Notebook Computers.



**Figure 1-1 Extensa 51x Series Notebook Computer**

## 1.2 Product Models

The two initial offerings in the 51x Series are differentiated by the software installed on the system at the factory. The Model 510 contains Windows® 95 and the Model 515 includes Windows 95 and a variety of applications as summarized in Table 1-1. Each model may contain either the 540 million byte hard disk drive (-00xx part number suffix) or 810 million byte hard drive (-01xx part number suffix).

**Table 1-1 Extensa 51x Series Notebook Computers**

<b>Model 510</b>	<b>Model 515</b>
<ul style="list-style-type: none"> <li>• U.S. Version Windows 95 or Windows for Workgroups</li> </ul>	Windows 95 Plus Microsoft Works, Quicken SE, Lotus Organizer, and Microsoft Entertainment Pack
<ul style="list-style-type: none"> <li>• Non U.S. Versions Windows 95</li> </ul>	

## 1.3 International Product Versions

The Extensa 51x Series Notebooks are available in one of 15 domestic and international configurations as listed in Table 1-2.

**Table 1-2 Notebook Domestic/International Configurations**

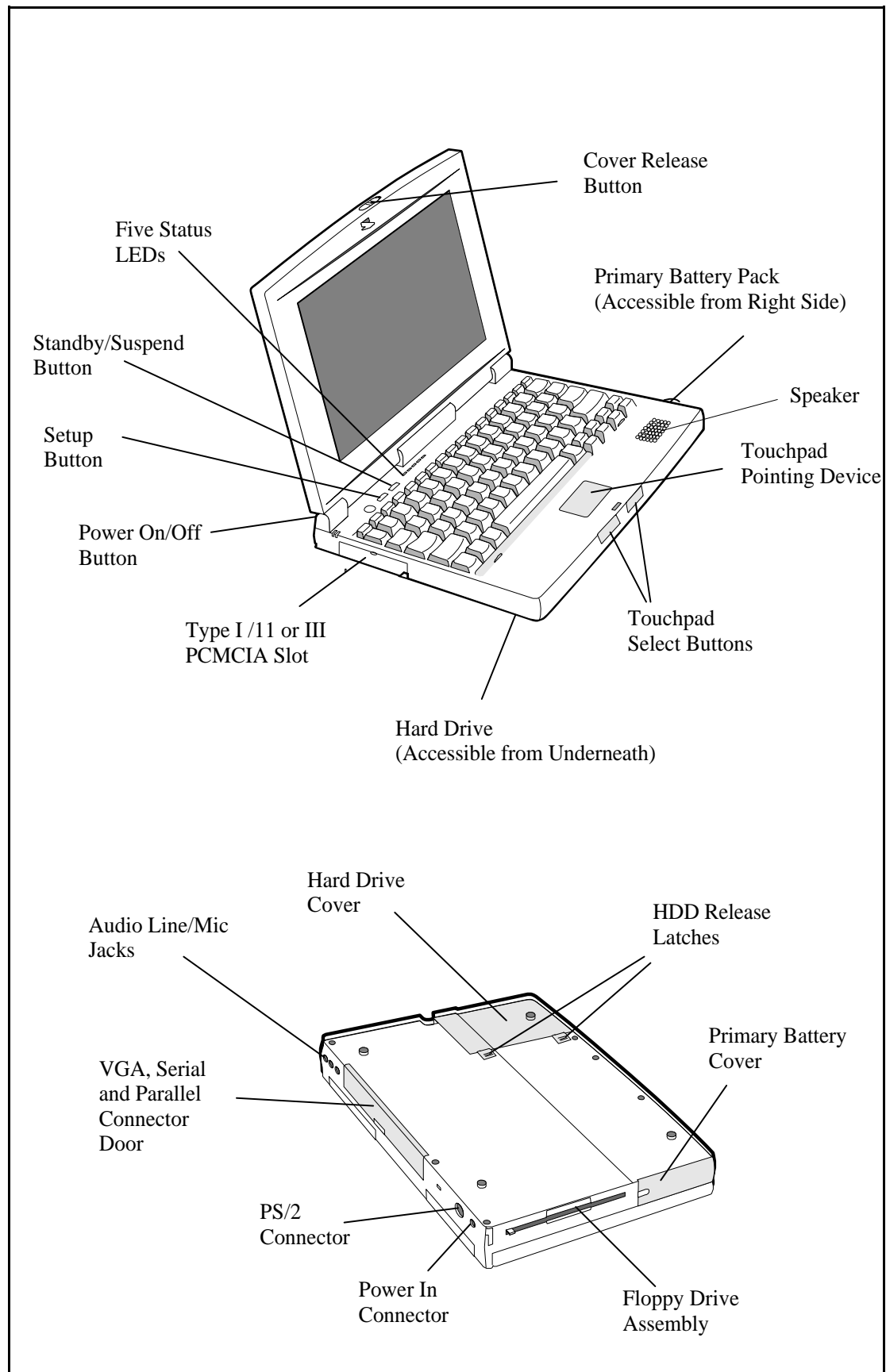
<b>Configuration</b>	<b>P/N Suffix</b>	<b>Configuration</b>	<b>P/N Suffix</b>
Domestic	-0001	Swedish	-0010
UK	-0002	Swiss/French	-0011
German	-0003	Danish	-0012
French	-0004	Norwegian	-0013
Spanish	-0005	Finish	-0014
Swiss/German	-0006	Belgium	-0015
Italian	-0007	Austrian	-0016
Portuguese	-0008	Asia Pacific	-0017
Western European	-0009	Latin American	-0018
		Chinese	-0019

## 1.4 Product Overview

All members of the Extensa 51x Series are high performance notebooks powered by the 100 MHz Pentium™ processor and Windows 95 Operating System software. As a standard feature, all members of the Extensa 51x family also contain the following features:

- 8 MB of EDO RAM memory (user-expandable to 40 MB)
- 128 bytes of battery-backed up CMOS RAM
- 1 MB of video RAM

- 
- 540 or 810 Million Byte Hard Drive (user replaceable)
  - Support for two PCMCIA Type I or II options or one Type III PCMCIA option card
  - Ergonomic keyboard with palm rest (2.7 mm travel); built-in touchpad pointing device
  - Most standard external device interfaces including serial, parallel, PS/2®, and external VGA™.
  - 3.5-inch, 1.44 MB Floppy Drive
  - 10.4 inch Dual Scan Color LCD
  - AC Adapter with autosensing (100 VAC to 240 VAC, 50 to 60 Hz); 34 Watts of DC output power
  - 10.8 Volt, 2400 mAH capacity, Nickel-Metal Hydride (NiMH); Standard Duracell DR35 battery pack
  - Built-in monaural speaker with ESS1688 sound solution
  - Three audio jacks: Line-In, Line-Out, and Microphone-In.



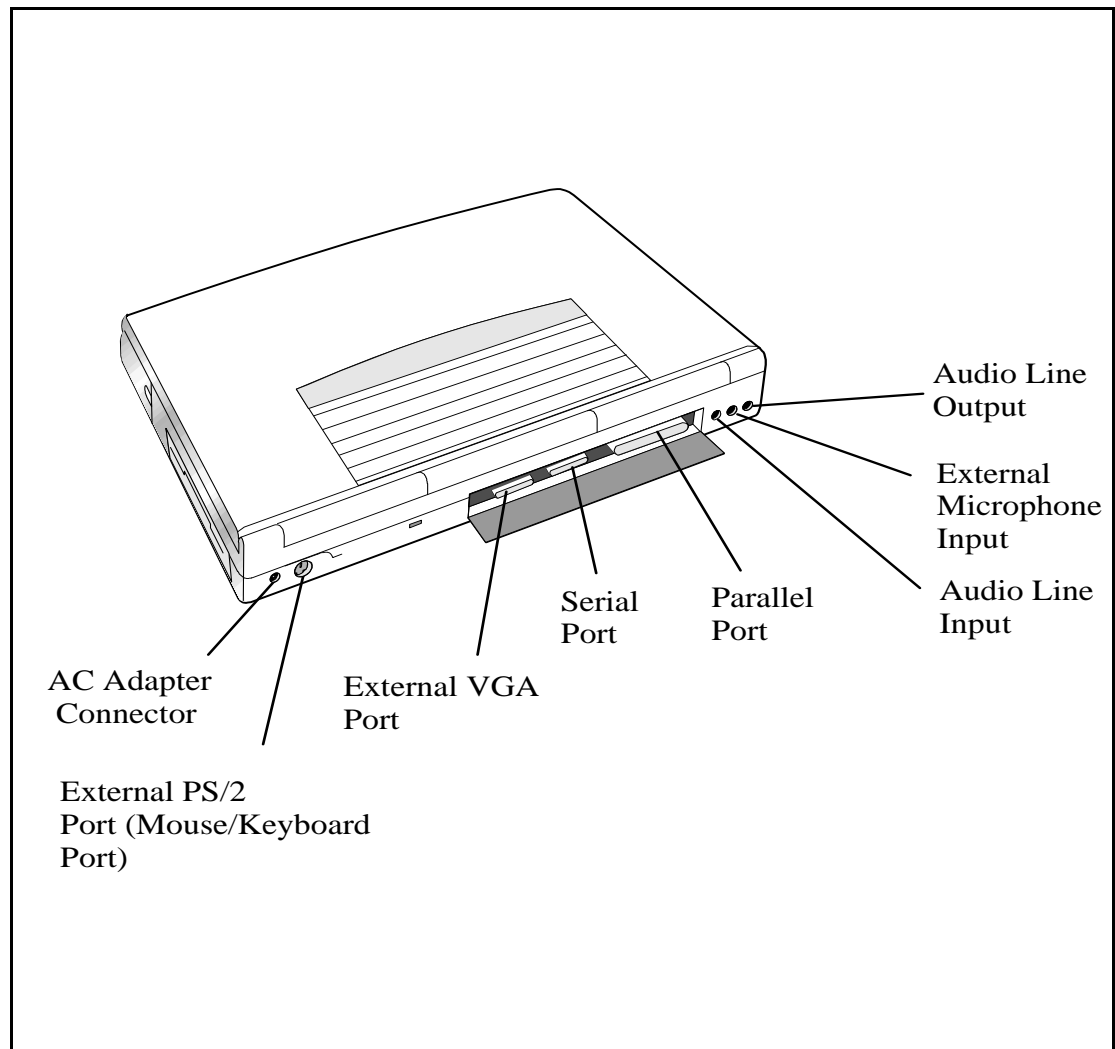
**Figure 1-2 Extensa 51x Series Features**

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## 1.4.1 External Ports

As shown in Figure 1-3, the notebook computer contains the following external ports:

- 9-Pin Serial Port for attaching any RS-232 type serial device to the Notebook
- 25-Pin Parallel Port for attaching bidirectional parallel devices
- Audio Line-In, Line-Out, and Microphone-In
- 15-Pin External VGA Monitor Port for attaching an external monitor
- 6-Pin PS/2 Port to attach an external Keyboard or Mouse
- AC Adapter Connector for attaching the AC Adapter to the notebook

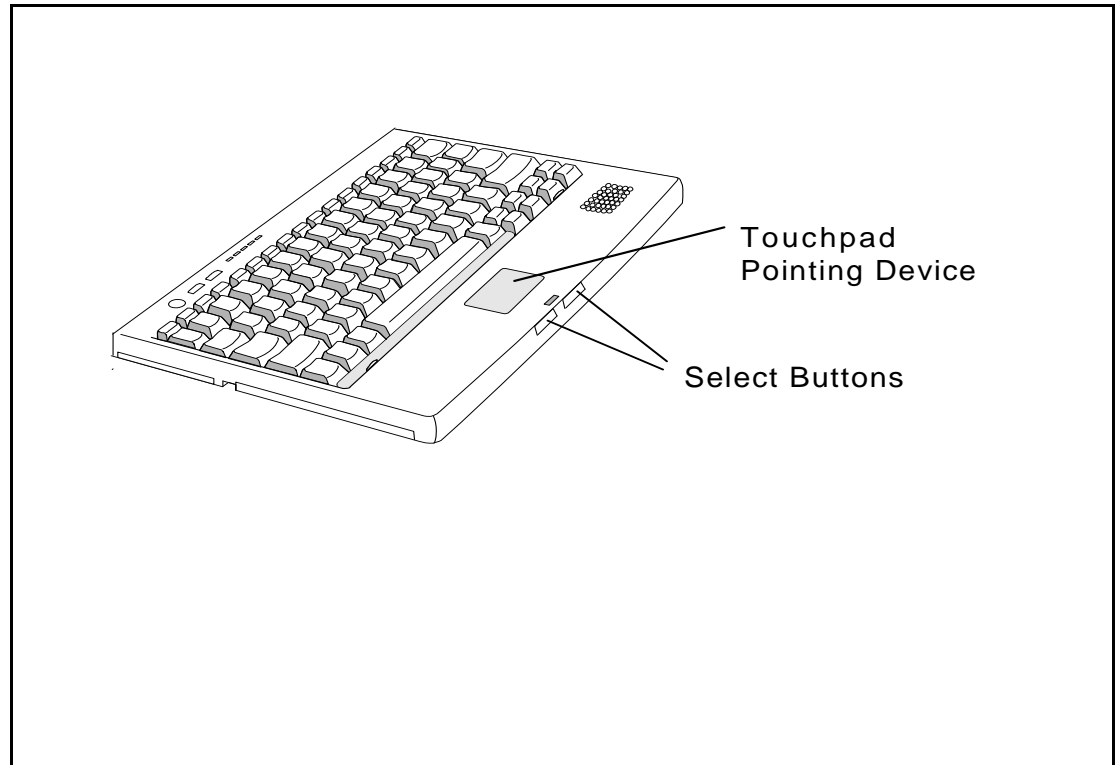


**Figure 1-3 Notebook External Ports**

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## 1.4.2 Touchpad Pointing Device

All members of the Extensa family feature a built-in touchpad pointing device located near the center of the keyboard palmrest. With light pressure, the cursor can quickly be positioned to the desired point; a quick double tap on the touchpad and you have selected an object. Two select buttons (switches) are located along the front edge of the notebook



**Figure1-4 Extensa Touchpad**

## 1.4.3 Keyboard

The Extensa Series Keyboard is an IBM™ enhanced-type keyboard with the standard character and function keys plus 12 programmable function keys (F1 through F12).

Using the Special Function (**Fn**) key which assigns multiple functions to keys, the keyboard can emulate the IBM 101/102 keyboards.

The keyboard features a special keyboard interface chip that can detect multiple levels of key input (good simulation of N-key rollover for up to 10 keys).

Some of the major features of the keyboard include:

- Integrated numeric keypad

- 
- "Inverted T" Cursor Control Key layout

The notebook keyboard is available in the following versions:

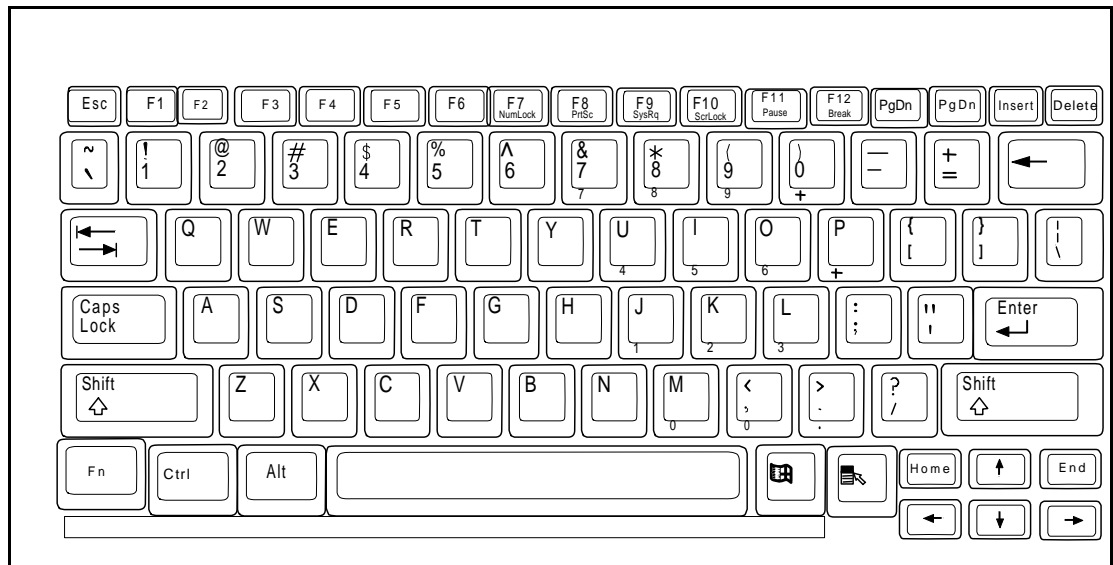
- U.S. English Keyboard, TI Part No. 9811398-0001- This version (also known as the domestic version) is generally used in the United States and Canada.
- International versions include:
  - United Kingdom Keyboard, TI Part No. 9811398 -0002
  - German Keyboard, TI Part No. 9811398 -0003
  - French Keyboard, TI Part No. 9811398 -0004
  - Spanish Keyboard, TI Part No. 9811398 -0005
  - Swiss Keyboard, TI Part No. 9811398 -0006
  - Italian Keyboard, TI Part No. 9811398 -0007
  - Portuguese Keyboard, TI Part No. 9811398 -0009
  - Swedish Keyboard, TI Part No. 9811398 -0010
  - Denmark Keyboard, TI Part No. 9811398 -0012
  - Norwegian Keyboard; TI Part No. 9811398 -0013
  - Belgium Keyboard, TI Part No. 9811398 -0014
  - Finish Keyboard, TI Part No. 9811398 -0015

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**Note:** The *Extensa Series Notebook Computer User's Reference Manual* contains descriptions of keyboard special function keys. A six-pin Mini-DIN connector can attach to either an external PS/2 keyboard (or 101 Keyboard via an adapter), PS/2 Mouse, or the optional PS/2 Numeric Keypad.

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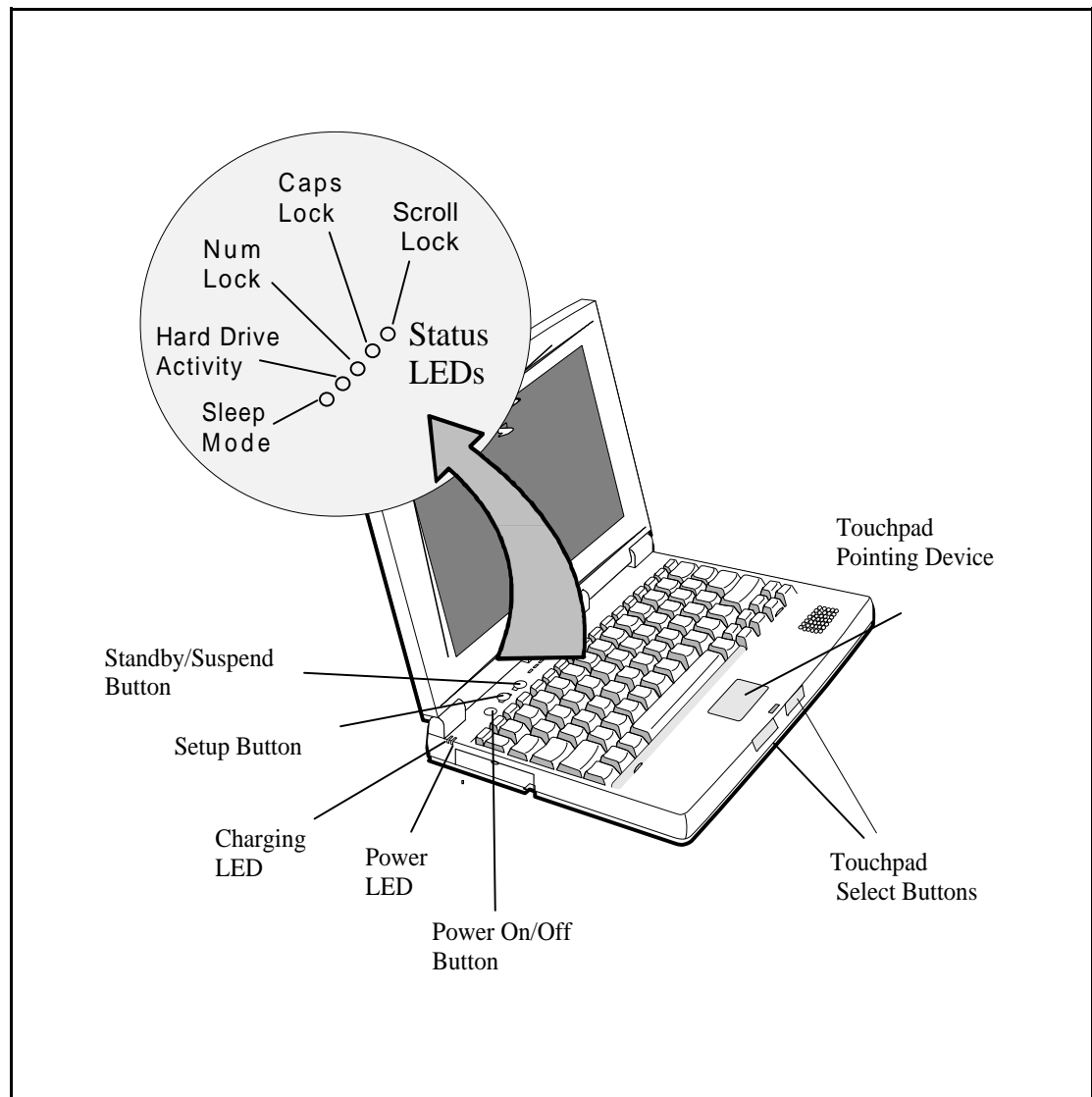
**Figure1-5 Extensa Keyboard**

### 1.4.3.1 Controls and Indicators

As shown in Figure 1-6, Extensa Series Notebook Computers contain a set of three buttons (switches) and five LED displays just above the keyboard including:

- **Power, Setup, and Standby/Suspend Buttons (Switches)**
- **Sleep Mode** Indicator. This LED lights when the notebook is in Sleep Mode.
- **Hard Drive** Activity Indicator. This LED lights when the notebook is accessing the hard drive (read or write).
- **Num Lock** indicator. This LED lights when you press the NumLk key to toggle on the numeric keypad lock function. When the LED is On, the embedded numeric keyboard keys generate AT™ keypad characters and functions when pressed in conjunction with the **Shift** key. When the indicator is Off, pressing the **Fn** key with the appropriate keys provides cursor movement, paging and other functions in the normal mode.
- **Caps Lock** indicator. This LED indicates that the keyboard is locked in the uppercase mode. To switch to the lowercase mode, press the **Caps Lock** key.
- **Scroll Lock** indicator. This LED lights to indicate that the keyboard is locked in the scroll mode.
- **Standby** Indicator. Lights when Notebook is in Standby mode.





**Figure1-6 Extensa Series Controls and Indicators**

## **1.4.4 Standard Power Features**

Notebook power for the Extensa 51x Series Notebook Computers is provided by an AC Adapter and a rechargeable 10.8 V, 2400 mAh Duracell DR35 nickel metal hydride (NiMH) battery pack that installs in a bay near the front of the notebook (right side).

All members of the Extensa 51x family feature a powerful Power Management subsystem (hardware and software) that provides longer portable operation and protection of files during low battery conditions.

## **1.4.5 Preloaded Software**

All members of the Extensa 51x Notebook family are preloaded with the Windows 95 Operating System. In addition, the Extensa Model 515 is shipped from the factory with the following software application packages installed on the hard drive:

- 
- Microsoft Works
  - Quicken SE
  - Lotus Organizer
  - Microsoft Entertainment Pack No. 4

### **1.4.6 Notebook Expansion Capabilities**

Expansion capabilities built into the Extensa notebook series include:

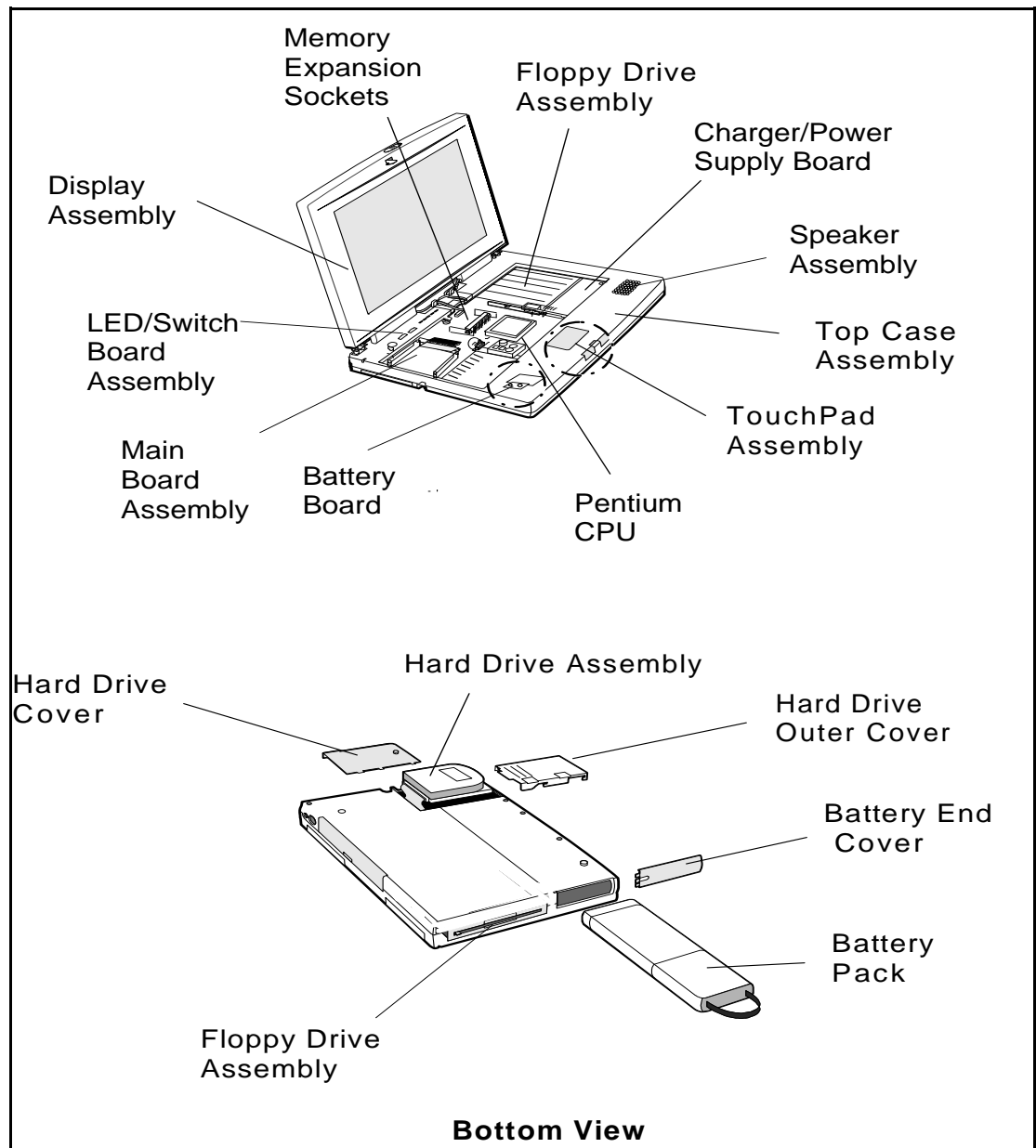
- User installable expansion RAM memory (to a maximum of 40 MB); notebook accepts either fastpage mode or EDO RAM modules.
- A Cable-Connect PS/2 Numeric Keypad option, TI Part No. 2581381-0001, can be attached to the external PS/2 Port.
- A parallel device can be attached to the notebook's external 25-pin parallel port (EPP/ECP compatible).
- Serial RS-232 Port for attaching any serial device
- External VGA Port for driving an external color monitor
- Third Party External PS/2 keyboard (or external mouse)
- Three audio jacks (line-in/out and microphone in)

## **1.5 Standard Test Features**

The Extensa Series Notebook Computers use modular design and built-in test features to reduce the mean time to repair. A power on self test automatically verifies the operational state of the primary circuits and a powerful suite of diagnostic tests are available to further test selected parts of the system.

## **1.6 Notebook Assemblies and Subassemblies**

The Extensa Series Notebooks are modular in design and can be disassembled for maintenance purposes using a standard set of flat-bladed, Phillips-head and hexagonal screwdrivers. The major assemblies that comprise a typical notebook in the Extensa family are shown in Figure 1-7 and briefly described in the following paragraphs.



**Figure 1-7 Notebook Assemblies**

### **1.6.1 Cover-Display Assembly**

The Cover-Display Assembly contains the LCD screen and associated high voltage power supply and video circuitry. The Cover-Display Assembly contains several field-replaceable components including:

- LCD Assembly
- Cable Assemblies
- Inverter Board
- Contrast Board

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The Display Assembly attaches to the System Base Assembly through four top mounted screws.

## **1.6.2 System Base Assembly**

As shown in Figure 1-7, the majority of the notebook's field-replaceable units (FRUs) are located in the system base assembly. These FRUs include:

- Main Board Assembly
- Hard Disk Drive Assembly
- Up to two Dual Inline Memory Modules
- Floppy Drive Assembly
- Power Supply Board Assembly
- Battery Board Assembly
- Battery Pack Assembly
- Top Case Assembly
- Touchpad Assembly
- Keyboard Assembly (removed in Figure 1-7 for clarity)
- Battery Board Assembly

## **1.7 Extensa 51x Series Notebook Specifications**

Specifications for the Extensa 51x Series Notebooks are provided in Table 1-3.

**Table 1-3 Extensa 51x Notebook Features**

<b>Specifications</b>	<b>Model 510</b>	<b>Model 515</b>
<b>Memory:</b>		
<b>Standard:</b>	8 MB	8 MB
<b>Maximum</b>	40 MB	40 MB
<b>Display</b>		
<b>LCD Type:</b>	10.4" Dual Scan Color	10.4" Dual Scan Color
<b>Simultaneous LCD/Ext. VGA</b>	Yes	Yes
<b>Video RAM Size:</b>	1 MB	1 MB
<b>Video Bus</b>	VLBUS with Graphics Accelerator	VLBUS with Graphics Accelerator
<b>Keyboard/Point Device</b>		
<b>Ergonomic Keyboard</b>	Yes	Yes
<b>Built-In Touchpad</b>	Yes	Yes
<b>Storage</b>		
<b>Floppy Drive:</b>	3.5", 1.44 MB	3.5", 1.44 MB
<b>Hard Drive:</b>	540 or 810 Million Byte	540 or 810 Million Byte
<b>Interfaces</b>		
<b>Serial (RS-232) Port</b>	Yes	Yes
<b>Parallel Port (EPP/ECP), Yes</b>	Yes	Yes
<b>External VGA Port</b>	Yes	Yes
<b>External PS/2 Port</b>	Yes	Yes
<b>PCMCIA Support</b>	Type I/II/III	Type I/II/III
<b>Software</b>	<b>U.S. Version:</b> Dual Load <b>Non-U.S. Versions:</b> Windows 95 only (International Load)	Windows 95, plus application software (Refer to Table 1-1)
<b>Physical Characteristics</b>		
<b>Dimensions:</b>	297 mm (L) x 45.5 mm (H) x 215 mm (W) 11.7" (L) x 1.7" (H) x 8.2" (W)	297 mm (L) x 45.5 mm (H) x 215 mm (W) 11.7" (L) x 1.7" (H) x 8.2" (W)
<b>Weight</b>	Approx. 5.9 lbs. (2.68 kg)*	Approx. 5.9 lbs. (2.68 kg)*

\* Weight specifications do not include AC Adapter

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## 1.8 Agency Approvals

All Extensa 51x Series products *meet* the following standards:

- Underwriter's Lab (UL) Standard 1950 (safety)
- Underwriter's Lab (UL), CN Listed (C22.2 No. 950) (safety)
- EN60950, TUV Rheinland (safety)
- FCC CFR 47, Part 15, Subpart J, FCC Level B (EMI/RFI )
- Canadian Department of Communications (DOC) ICES Class B (EMI/RFI)
- CISPR-22/EN55022 Class B (EMI/RFI)
- CE Mark

## 2.1 Introduction

This section contains unpacking and preparation for use instructions for the Extensa 51x Series Notebook Computers.

## 2.2 Unpacking Instructions

The packaging diagram for the notebook computer is shown in Figure 2-1. Unpack the computer using the following instructions:

1. Carefully cut the tape that seals the top flap of the shipping carton.
2. Remove the computer and the accessories from the main shipping carton.
3. Remove all protective coverings from the computer.
4. Remove the holding tape and open up the accessory box; remove the contents.

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**Note:** Save the shipping containers and packaging for later reuse.

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## 2.3 Installing Notebook Options

If you have no options to install at this time, skip to Paragraph 2.3. Otherwise, continue with Paragraph 2.3.1.

### 2.3.1 Installing Dual Inline Memory Module(s)

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**Note:** If not installing RAM Expansion option at this time, skip to the next paragraph.

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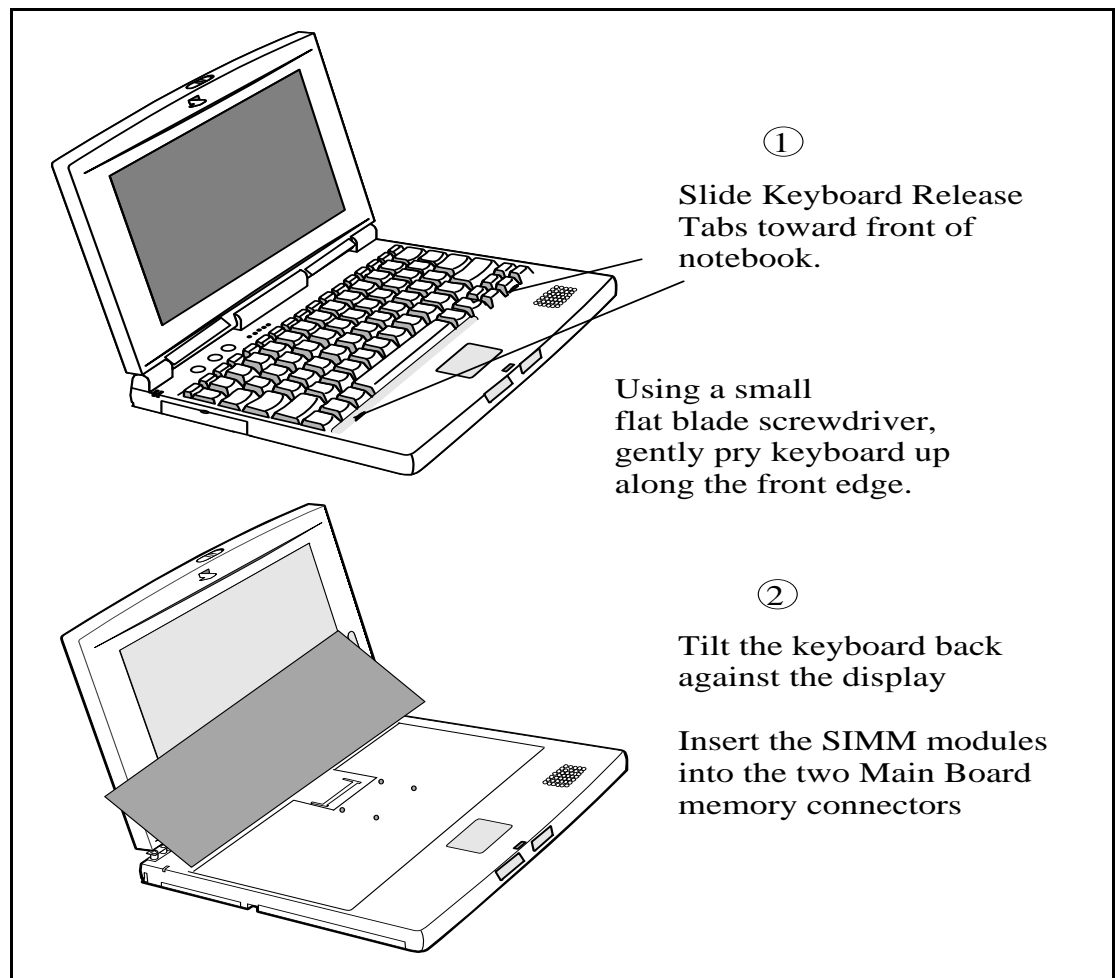
**Caution:** The Dual Inline Memory Module contains components that are sensitive to static electricity. When handling the module and the internal parts of the computer, protect against static electricity by using wrist or ankle grounding straps and grounded working mats. When moving or storing items, use the anti-static bags supplied with the items.

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1. Ensure that the notebook is powered off and that the AC Adapter and internal battery pack is removed from the notebook.
2. Remove the DIMM module(s) from its shipping container.

3. Release the Keyboard by pulling the keyboard release tabs forward (tabs are located underneath the Ctrl and right arrow keys).
4. Disengage the Keyboard using a straight blade screwdriver and gently lifting up along the front edge of the keyboard.
5. Using the back edge of the keyboard as a hinge, lift the front edge of the keyboard up and lay it against the display.
6. Insert the edge of the DIMM Board into the lower connector (refer to Figure 2-1). Use a rocking motion to fully insert the module. Push downward on each side of the DIMM module until it snaps in place.
7. Repeat the procedure in Step 6 (upper connector) to install the second DIMM module.
8. Replace the keyboard assembly and any other components removed in Step 1.

This completes the expansion memory module installation procedure.



**Figure 2-1 Installing Additional Memory**

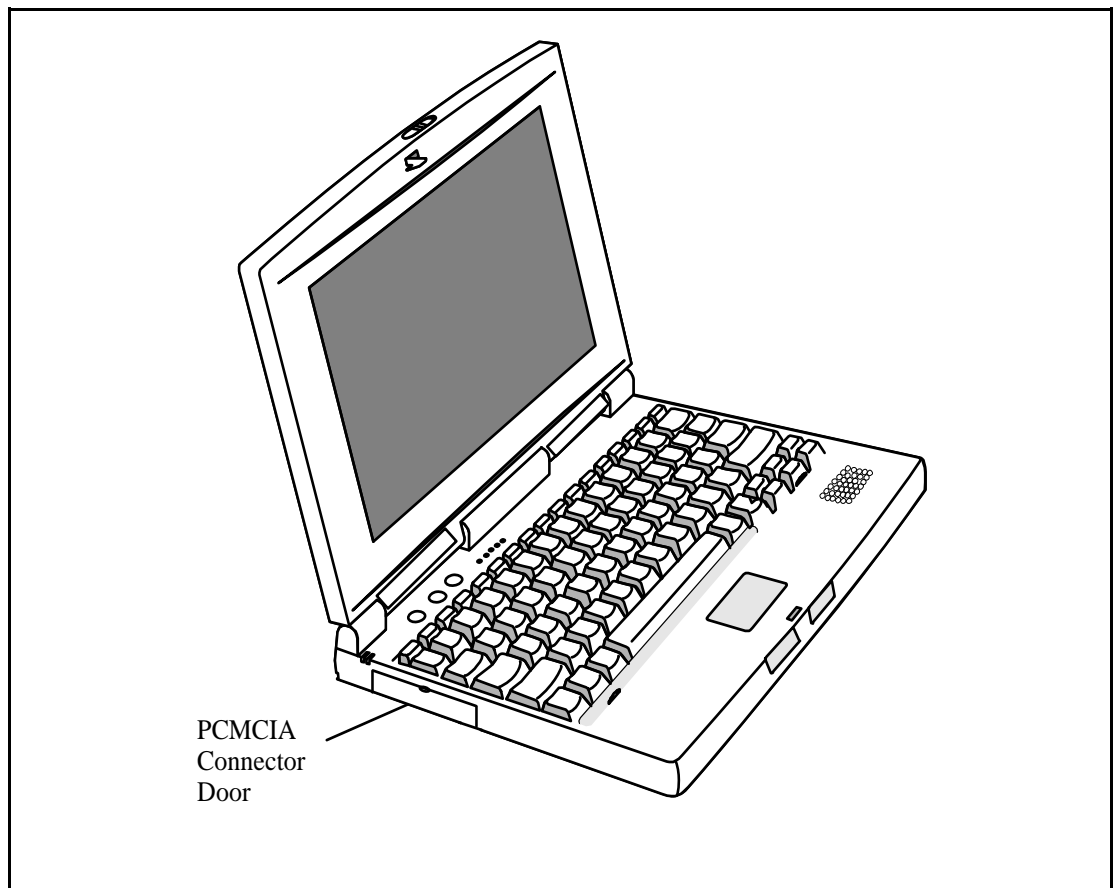


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## 2.3.2 Installing PCMCIA Options

The Notebook has provisions for two Type I/Type II or one Type III PCMCIA option card. Use the following procedure to install a PCMCIA option:

1. Review the installation instructions supplied with the PCMCIA option card(s).
2. Open the PCMCIA compartment cover on the left side of the notebook.
3. To insert a PCMCIA card, align the card with the socket and slide the card into the socket until it locks into place.
4. To eject a PCMCIA card, first ensure that the notebook is not accessing the memory card or device. Under Windows 95, go to the Control Panel, PC Card, and direct the card to stop before removing card.

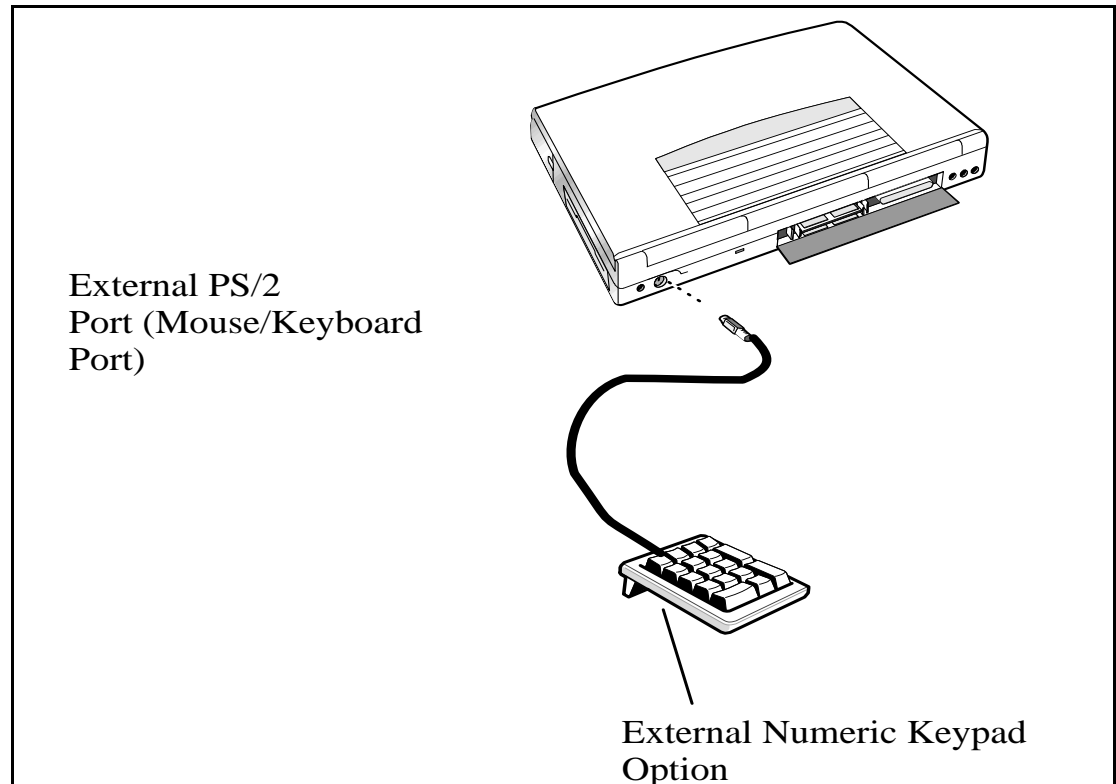


**Figure 2-2 Installing PCMCIA Options**

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### 2.3.3 Installing the Optional Numeric Keypad

An optional numeric keyboard can be attached to the notebook via the notebook PS/2 connector as shown in Figure 2-3.



**Figure 2-3 Installing the Numeric Keypad option**

## 2.4 Installing the Battery Pack(s)

The standard configuration of the Extensa Notebook is equipped with a single battery pack that is inserted from the front right side of the computer.

To remove or replace the battery pack, follow the steps below.

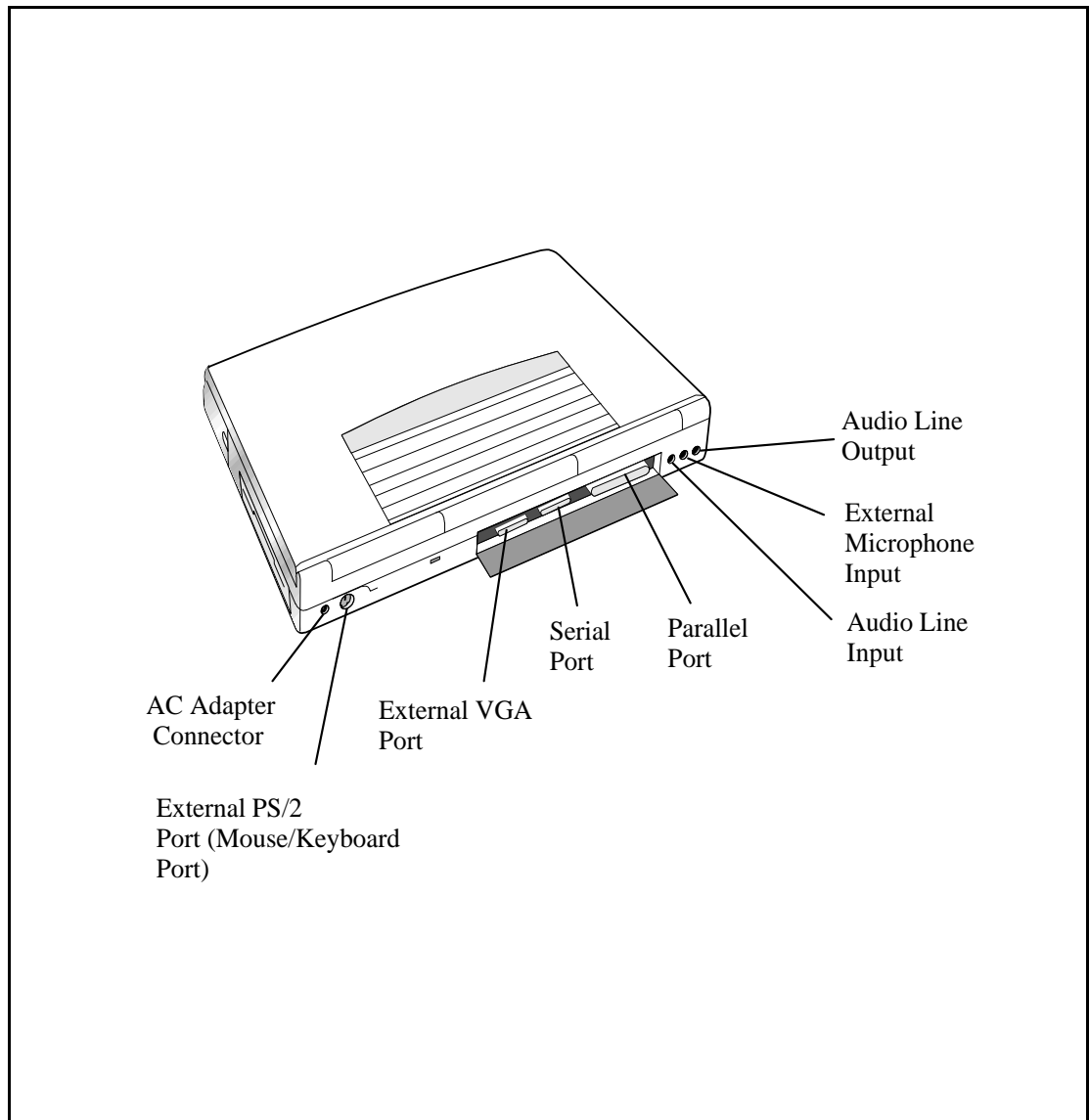
1. Power off the notebook, being sure to save your data first.
2. Locate the battery door (right side of notebook near the front). Press the battery door inward and slide the door toward the front of the notebook; remove the battery door.
3. Insert a new or recharged battery pack into the battery compartment bay. Make sure that the contacts are facing up and to the rear of the compartment. Check the label (facing up when inserted) indicating the positive and negative poles of the battery.

# C

**Caution: There is danger of explosion if the battery is incorrectly replaced. Replace the battery only with the same or an equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.**

## 2.5 Installing External Devices

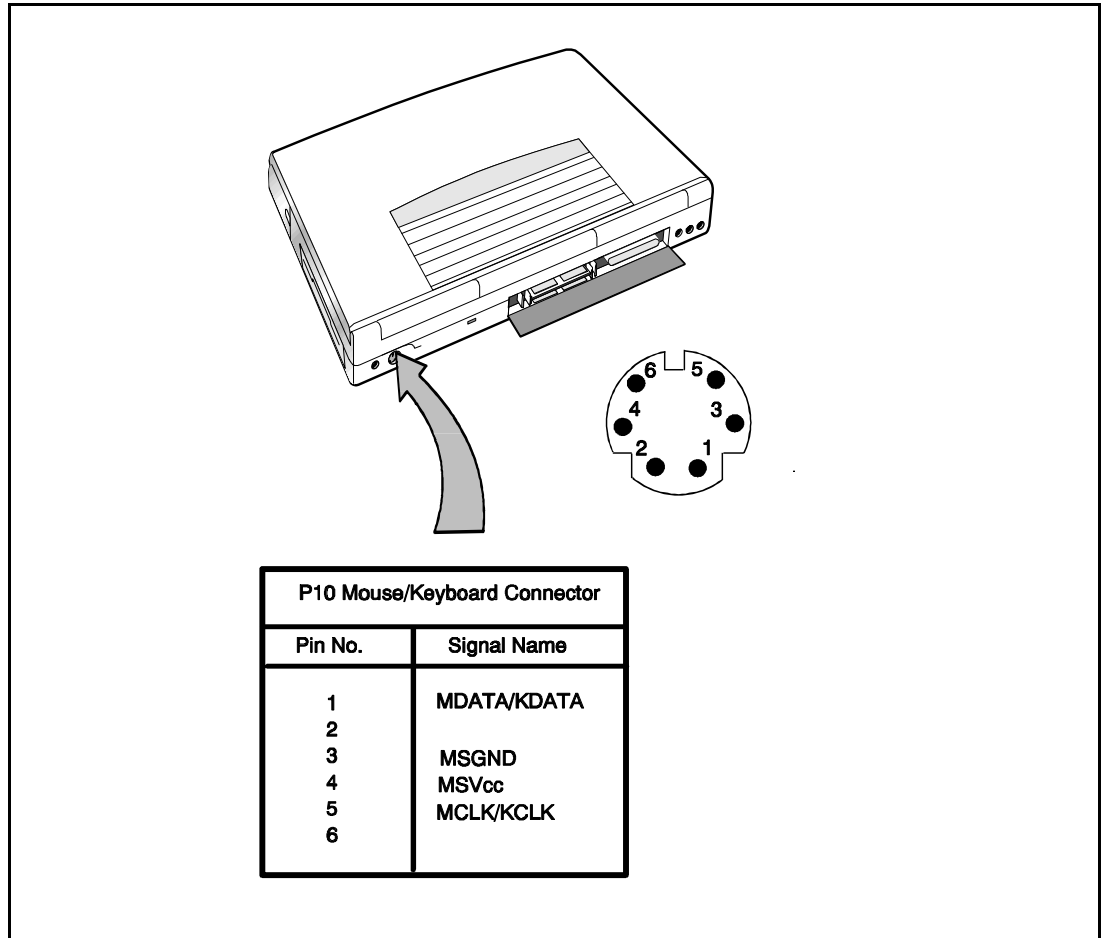
Most external devices connect to the Notebook via the connectors on the rear of the notebook (refer to Figure 2-4 for port assignments).



**Figure 2-4 Extensa Port Assignments**

## 2.5.1 Installing an External Keyboard/Mouse

As shown in Figure 2-5, the notebook has provisions for two external PS/2 compatible devices (keyboard, mouse, etc.) that may be attached to the notebook. The pinouts for the 6-pin Mini-DIN connectors are also provided in Figure 2-6.



**Figure 2-5 PS/2 Port Assignments/Pinouts**

To install an external keyboard or external PS/2 mouse on the notebook, use the following procedure:

1. Ensure that the notebook is powered off.
2. Locate the external PS/2 port at the rear of the notebook (refer to Figure 2-5).
3. Attach the PS/2 cable from your mouse and/or keyboard cable to the PS/2 port.
4. Power on any other peripheral devices you may have connected to the notebook, and then power up the notebook.

## 2.5.2 Installing External Parallel Printer

The Notebook is equipped with a bidirectional, ECC/EPP compatible, 25-pin parallel printer port. The connector pinouts and connector location are shown in Figure 2-6.

If you will be using a parallel interface, connect the 25-pin male connector of your printer cable to the 25-pin female parallel port on your notebook. Refer to the manual which accompanied your printer for instructions on configuring your operating environment

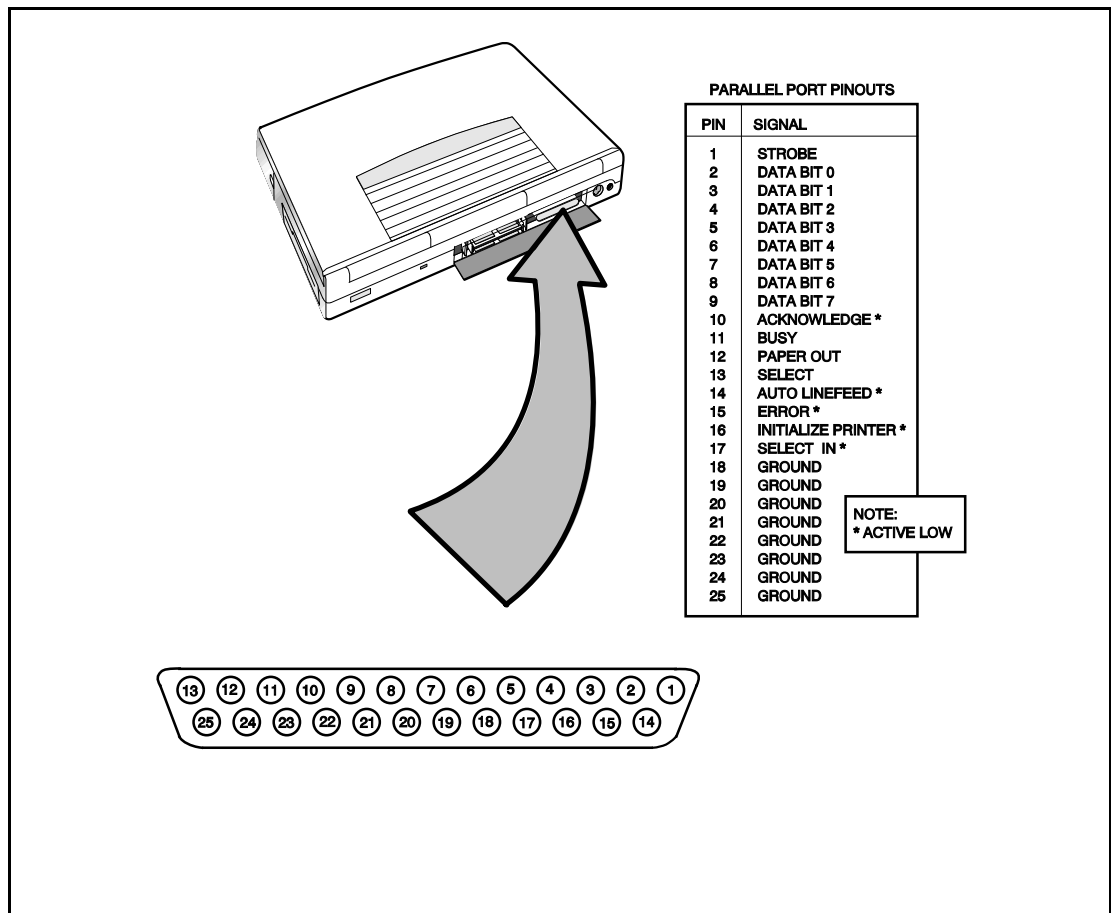


Figure 2-6 Parallel Port Location/Pinouts

### 2.5.3 Installing External Serial Port Device

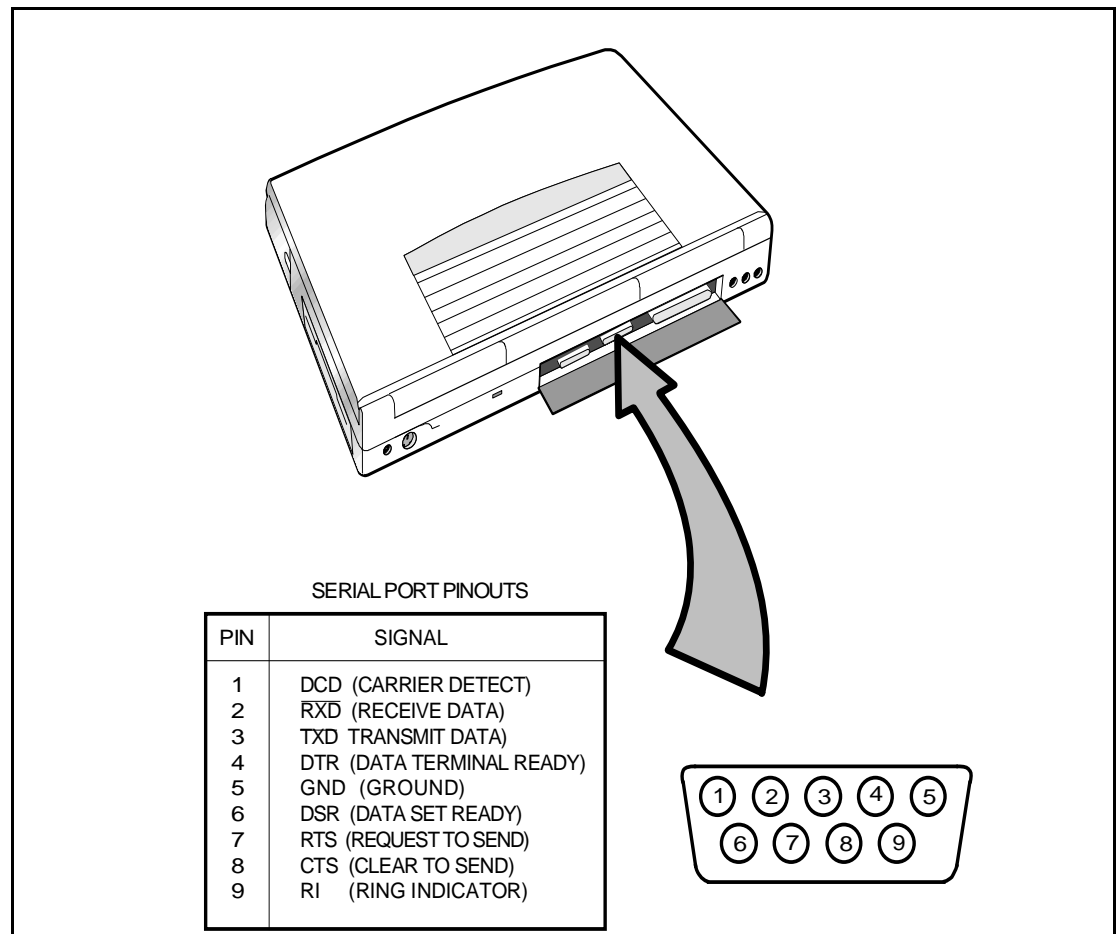
The notebook contains an RS-232 serial port with a male DB-9 connector as shown in Figure 2-7. The serial ports are used to interconnect such devices as:

- External Modem
- Serial Printer
- Any device that uses an RS-232 interface

To connect a printer to the notebook, ensure that both the notebook and the printer are turned off.

C

**Caution: Never connect a parallel device to a serial port or a serial device to a parallel port or video port; this may cause damage to the Notebook and/or peripheral device. If you are uncertain of what type connector the external device has, refer to the technical manual for the external device.**

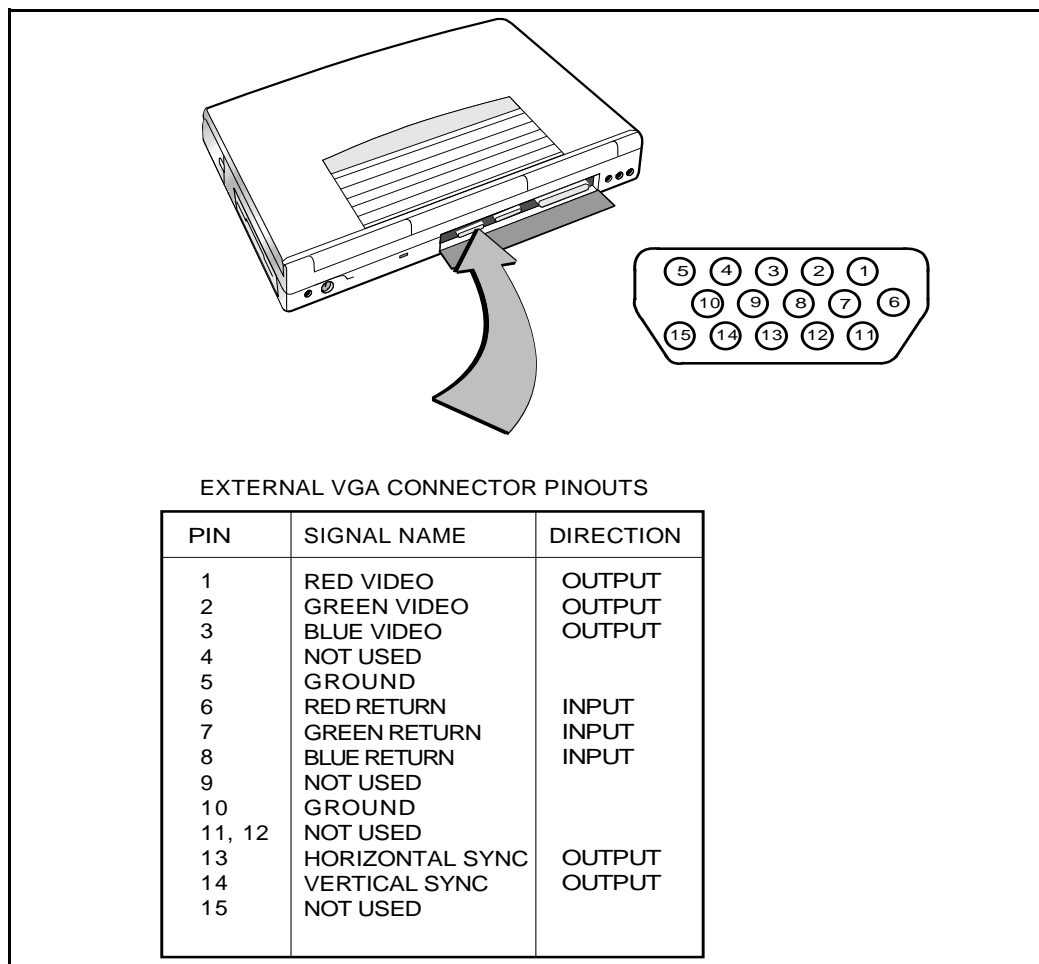


**Figure 2-7 Serial Port Location/Pinouts**

## 2.5.4 Installing External VGA Monitor

The notebook is capable of driving both its internal LCD display and an external VGA monitor (LCD only, simultaneous, or VGA only). The external monitor connector pinouts and connector locations are shown in Figure 2-8. To install an external monitor with the notebook, use the following steps:

1. Ensure that both the notebook and the external monitor are turned off.
2. Locate the 15-pin female VGA port on the rear of the notebook.
3. Attach the appropriate end of the monitor cable to the VGA port on your notebook. If the monitor cable connectors have retaining screws, tighten them down.
4. If necessary, connect the monitor power cable to the monitor, and plug the monitor power cable into an electrical outlet.
5. Power on the monitor, as well as any other peripheral devices connected to the notebook; then power up the notebook.



**Figure 2-8 External Monitor Port Pinouts**

---

## 2.5.5 Installing External Microphone

An external microphone can be attached to the notebook using the leftmost audio connector (when viewed from the rear of the notebook). When the external microphone is installed and the unit powered up, the internal microphone is disabled.

## 2.5.6 Installing External Audio Input Devices

The middle audio jack on the rear of the notebook allows you to connect an external sound source (e.g. tape player, radio, etc. ) to the notebook.

## 2.5.7 Installing External Audio Output Devices

The rightmost audio jack (when viewed from the rear of the notebook) provides an audio line output cable of driving external headphones, speakers or an external amplifier.

## 2.6 Installing the AC Power Adapter

Use the following procedures to connect the AC Adapter to the system:

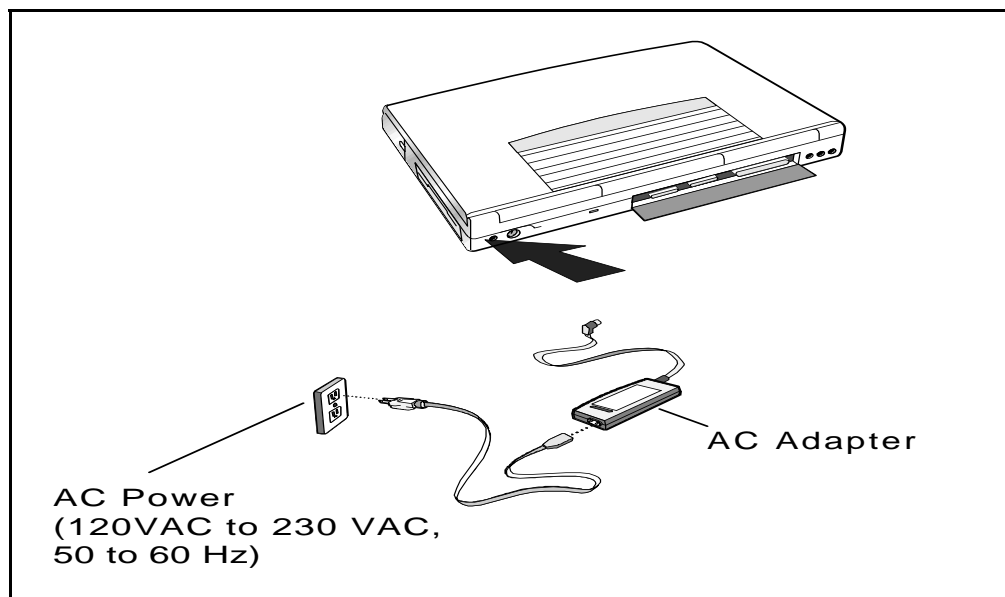
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**Caution: Use only the AC Adapter supplied with the computer; other adapters can damage the unit.**

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1. Remove the AC adapter from the packaging. Connect the round coaxial connector supplied with the notebook to the power receptacle on the rear of the notebook as shown in Figure 2-9.
2. Connect the female side of the AC Power cord to the AC Adapter and connect the male end to a grounded AC outlet



**Figure 2-9 AC Adapter Installation**



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## **2.7 Initial System Checkout**

After you've installed all internal options and external cabling, you're ready for system checkout and software configuration.

To check out the system, set the power switch on the notebook to the On (I) position which initiates the notebook self test. During self test execution, the computer checks the operation of all key hardware including memory and CPU (and displays copyright and version number data during test execution).

Upon successful conclusion of self test, the computer automatically loads its operating system and Windows environment. If self test fails to complete and an error message is displayed, try powering down the computer for a couple of minutes and turning power back on to repeat self test. If the error message persists, refer to Section 6 for troubleshooting information.

## **2.8 Configuring the System**

The first time you power up the notebook, it automatically runs the Setup Program which prompts you for country name and printer type. You will exit Windows and the notebook begins unzipping files and preparing the software for use.

## **2.9 Making Backups of System Software**

The Notebook is preloaded with Windows 95 or Windows for Workgroups operating system software. Prior to extended use of the notebook, create a backup set of diskettes containing the system software for use in the event you have to rebuild the software system ( you can restore your system using the Restore Utility and a set of backup diskettes).

## **2.10 Loading Application Software**

For assistance in loading Application Software, refer to Chapter 5 in the *Extensa Series Notebook Computer User's Reference Manual*.

# Operating Instructions

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## 3.1 Introduction

The first two subsections describe the Extensa 51x Series Notebook operating controls and indicators. The remainder of this section contains a summary of computer operations related to notebook maintenance including how to restore system software.

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**Note:** For additional operating instructions, refer to the *Extensa Series Notebook Computer Users Guide*.

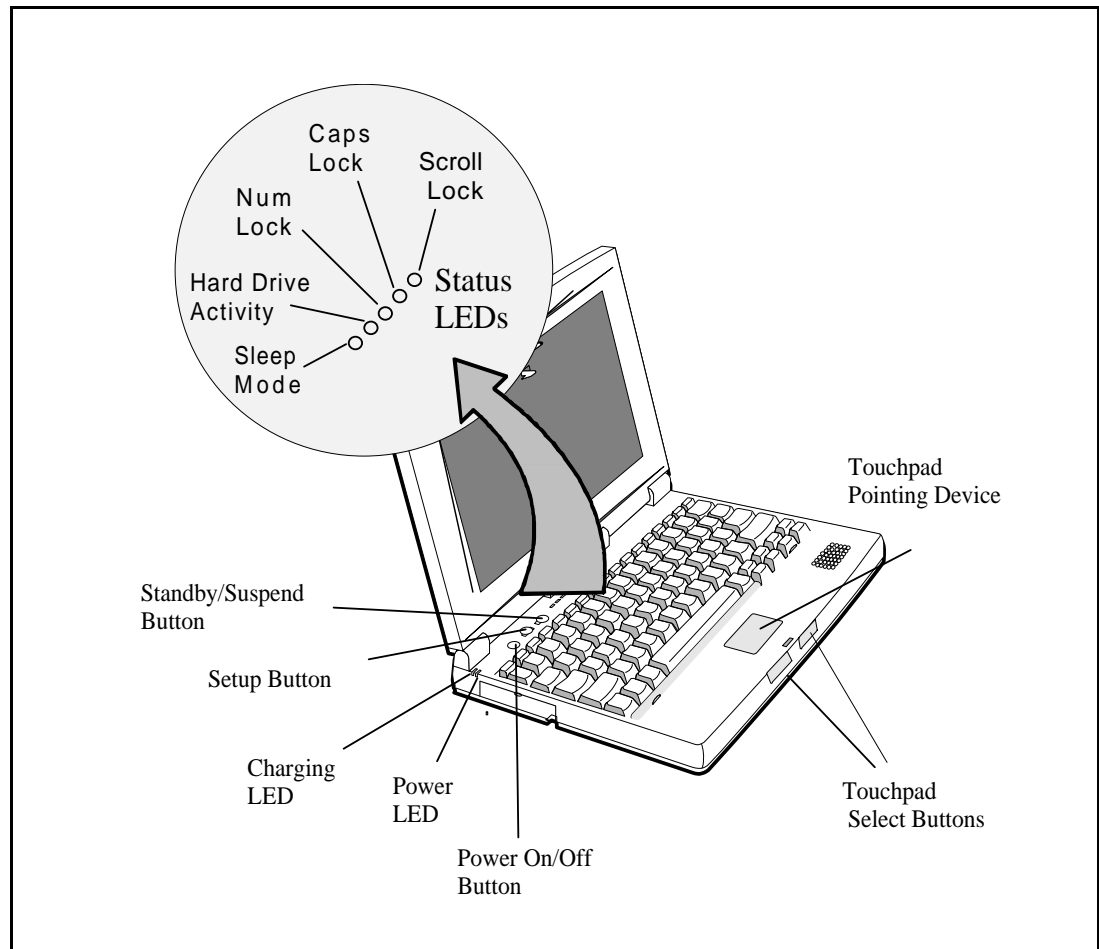
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## 3.2 Notebook Controls and Indicators

The Extensa Series Notebooks are equipped with the following controls and indicators:

- Group of five LEDs just above the keyboard (Sleep Mode, Hard Drive Activity, Num Lock, Caps Lock and Scroll Lock)
- Power, Setup, and Standby/Suspend buttons adjacent to the status LEDs
- Power LED and Charge LED indicators on the left rear corner of the notebook
- Touchpad and two select buttons at base of keyboard
- Combination key sequences on keyboard to control brightness, contrast and volume (refer to Paragraph 3.3.3).

These controls and indicators are shown in Figure 3-1 and described in greater detail in the following paragraphs.



**Figure 3-1 Extensa Series Controls and Indicators**

### **3.2.1 Button Switches**

The notebook contains two button switches above the keyboard including:

- **Power On/Off Switch** - Alternate action, button type switch that controls power to the unit. Pressing the Power button causes power to be applied to the notebook and power up self test to be run. The **PWR** LED (left rear corner of notebook) glows green and the computer then loads Windows 95. When the Power button is pressed again, the Notebook powers down and all data in RAM memory is lost.
- **Standby/Suspend Button Switch** - an alternate action touch switch that invokes the save to disk feature and places the unit in Standby Mode (if previously On) or On if previously in Standby Mode.

### **3.2.2 Cover Release Latch**

The Notebook contains one Cover Release latch. To open the notebook, slide the Release Mechanism to the right and lift up on the front edge of the notebook cover.

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### 3.2.3 Touchpad Controls

The Extensa 51x Series Notebook Computers are equipped with a built-in mouse device called "the Touchpad" physically located at the bottom of the keyboard (refer to Figure 3-1).

The cursor is positioned by touching and dragging your finger in the direction you want the cursor to go. The select functions are performed either by tapping the touchpad or by pressing the two buttons (switches) at the bottom of the keyboard.

You can change the operation of the pad by changing values in the mouse section of the Windows 95 Control Panel. Once your cursor is in the proper place and you want to select, use the left button to click or double-click just as you would a mouse.

### 3.2.4 Keyboard Mode LEDs

The Notebook contains three "keyboard mode" indicators just above the keyboard on the left side (notebook cover open). These LEDs include:

- **CAP (Caps Lock)** Indicator - This LED indicates that the keyboard is locked in the Uppercase mode. To switch to the Lowercase mode, press the **Caps Lock** key on the keyboard.
- **NM (NM Lock)** Indicator - This LED lights when you press the **Fn-F7** (numbly) keys to toggle on the numeric keypad lock function. When the LED is On, the embedded numeric keyboard keys generate AT-keypad characters and functions when pressed in conjunction with the **Fn** key. When the NM indicator is Off, pressing the **Fn** key with the appropriate keys provides cursor movement, paging and other functions in the normal mode. When the NM indicator is On, the embedded numeric keypad becomes a temporary numeric keypad that does not require you to press any other key.
- **SCROLL (Scroll Lock)** Indicator - This LED lights to indicate that the keyboard is locked in the scroll mode.

## 3.3 Operating Procedures

Some of the operating features useful for notebook maintenance are provided in the following paragraphs. For additional operating instructions, refer to the *Extensa Series Notebook Computer User's Manual*.

### 3.3.1 Floppy Drive Operating Procedures

To avoid damaging the floppy drive drive, and to protect data, take the following precautions:

- Never turn off or reset the notebook while the floppy activity indicator is lit.
- Keep the AC adapter at least 6 inches away from your drive.

- 
- Insert the floppy into the floppy drive slot with the label side up and the metal-shutter end first. Gently push the floppy into the floppy drive slot until the floppy clicks into place.
  - To remove a floppy, press the eject button until the floppy pops out.
  - Never force open the access shutter on a floppy.
  - Always remove a floppy from the floppy drive before turning off the computer.
  - Never transport the computer with a floppy in the floppy drive. Doing so can damage the drive head.
  - If a floppy appears to be damaged, try to make a copy of it, and immediately discard it.
  - Keep all floppies, when not in use, in a disk storage box to protect them from damage or loss.

### **3.3.2 Installing/Removing PCMCIA Options**

PCMCIA cards are inserted and ejected in much the same way as diskettes:

- Type I, Type II or Type III PCMCIA options may be installed in the compartment on the left side of the notebook.
- To insert a PCMCIA card, align the card with the socket and slide the card into the socket until it locks into place.
- To eject a PCMCIA card, go to the Windows 95 Control Panel, select **PC Card**, and select the card to stop; then press the release button and remove the PCMCIA option.

### **3.3.3 Computer Hot Keys**

The Extensa Series recognizes the following hot key sequences:

- **Ctrl-Alt-Del (warm boot)**
- **Ctrl-Alt-Esc** (Enter setup screen); to use, power up notebook and press **F8** at "*Starting Windows 95*" message. Select **Command Prompt Only**; then press **Ctrl-Alt-Esc**.
- **Fn-F2** (in combination with **Fn** and **left/right arrow** keys)(Screen brightness and contrast adjustments); **Fn-Esc** to get out of adjustment routine.
- **Fn-F5** (in combination with **Fn** and **left/right arrow** keys)(Audio volume control); **Fn-Esc** to get out of adjustment routine; **Fn-F1** for help.

---

### 3.3.4 Responding to Low Battery Conditions

The computer generally will notify you when you are reaching a low battery condition by the following actions:

- Four short beeps per minute (unless battery warning is disabled)
- The battery low warning is automatically disabled when the AC Adapter is installed on the notebook, regardless of the charge condition of the battery pack.
- If the AC adapter is not plugged in within three minutes of a detected battery low condition, the notebook enters Suspend mode (if low battery suspend is specified in setup). When the notebook enters Suspend mode, it issues one beep, saves contents of RAM to disk and powers down the unit.
- The Notebook returns to the normal operating mode when the power switch is activated. The unit then recovers RAM information from the hard drive and restores the unit to its previous "On" condition.

### 3.3.5 Minimizing Power Usage

The following actions can minimize power usage and protect your work during the critical minutes before you shut the system down or replace on the battery packs with a fully charged pack:

- Press **Ctrl-Standby** to shut off the alarm (if its enabled)
- Save **RAM Disk** (if using RAM Disk feature)
- Press **Standby/ Suspend** button to put the computer in Standby/Suspend mode whenever you are not actively using the computer. This will save all your work and remember the application and file you were previously using when you return to the On condition.
- Power down the system if you do not need the computer

### 3.3.6 Recharging the Battery Packs

The battery pack may also be charged in the notebook as follows:

1. Install the battery pack in your computer (if not already installed).
2. Connect the AC Adapter as described in Section 2.
3. To fully charge the battery pack, leave it charging in the Notebook until the Charge LED extinguishes (approximately 90 minutes).

---

### 3.3.7 Restoring Missing System Files

When you power up the Notebook, it automatically checks for certain key files that must be present for normal system operation. If any of these files are accidentally erased as indicated by error message, insert the *Windows 95 Startup* diskette and reboot the system. This will allow you to boot up and troubleshoot your system.

### 3.3.8 Rebuilding the System Software

In the event of a hard drive replacement or system board replacement which resulted in loss of system software, you may need to rebuild the entire system software structure.

The following items are required to rebuild the system software:

- Set of backup diskettes of the system software or *Windows 95 Startup* diskette
- Operational Notebook

Insert the *Windows 95 Startup* diskette in the Notebook floppy drive and power up the system.

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**Note:** For additional operating procedures, refer to the *Extensa Series Notebook Computer User's Manual*.

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# Theory of Operation

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## 4.1 Introduction

This section describes the notebook theory of operation.

## 4.2 Notebook Functional Description

Functionally, the notebook computer consists of the following major subsystems:

- Processor and Memory Subsystem
- I/O Subsystem
- Video Subsystem
- Hard Disk Subsystem
- Floppy Disk Subsystem
- PCMCIA Subsystem
- Power Subsystem

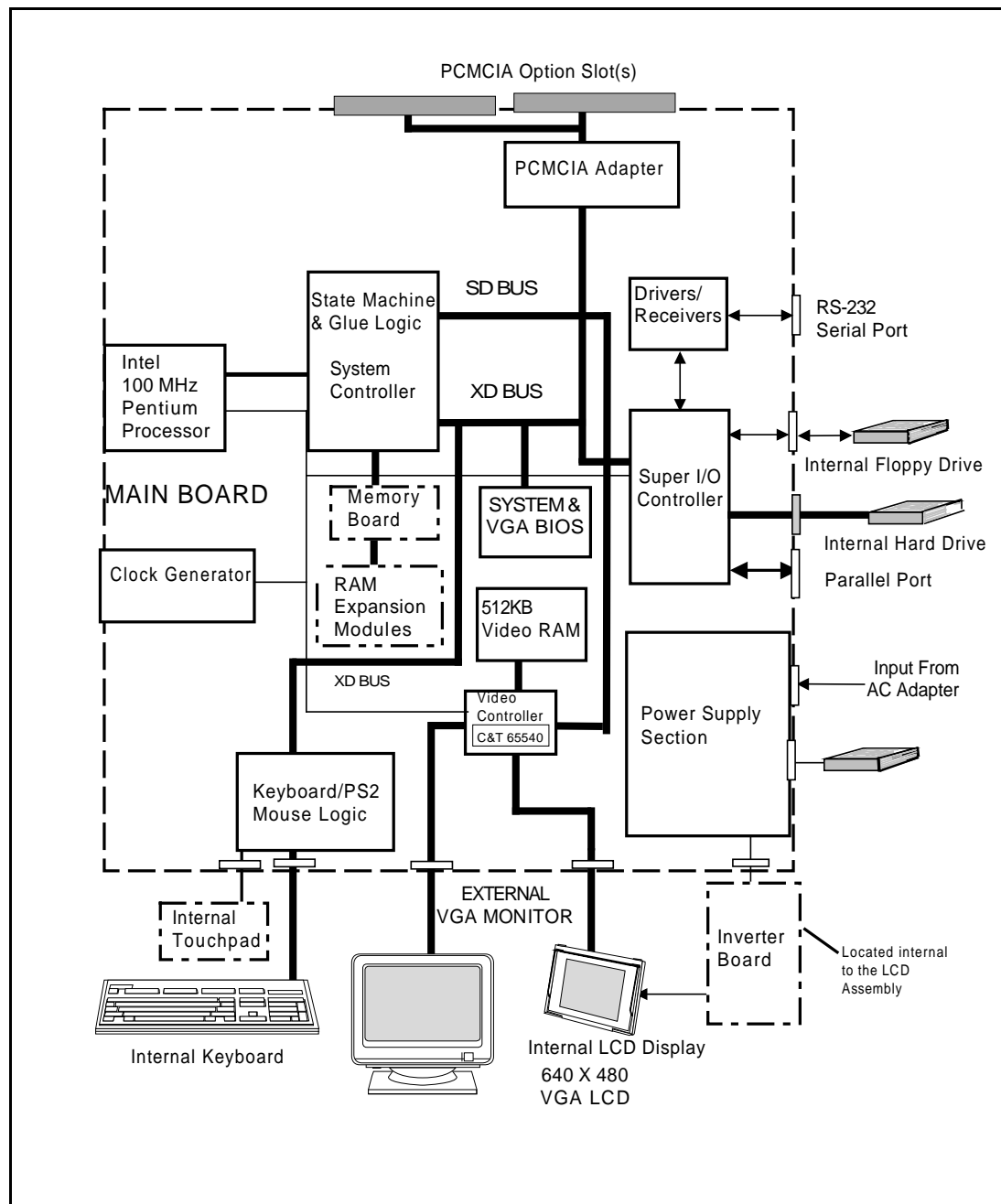
A functional block diagram of the Extensa Notebook is shown in Figure 4-1.

### 4.2.1 Processor/Memory Subsystems

The Processor function, housed on the Main Board, is implemented with a 100 MHz Intel Pentium Processor. The processor operates in conjunction with RAM and ROM Memory on the Memory Board and other control logic on the Main Board to process software instructions (BIOS, Windows 95, and Applications).

The memory subsystem, implemented on the Main Board and optional Dual Inline Memory Modules, provides 8 MB (expandable to 40 MB) of fast DRAM memory, 128 bytes of CMOS RAM (battery backed up) and 256 KB of Flash ROM for system and video BIOS storage. Tables 4-1 through 4-3 contain the Notebook I/O address map, DMA channel assignments and IRQ interrupt level assignments respectively.





**Figure 4-1 Notebook Functional Block Diagram**

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## 4.2.2 I/O Subsystem

The I/O subsystem, implemented with an NS87334 VJG Super I/O Controller Chip, provides for such functions as internal Hard Drive control, floppy drive control, and serial and parallel ports. The Super I/O Controller includes the following features:

- 100 percent compatible with ISA, EISA, and Micro-channel architectures
- Built-in Floppy Disk Controller
- Software compatible with the DP8473, the 765A and N82077
  - 16-byte FIFO (default disabled)
  - Burst and Non-burst modes
  - Perpendicular Recording drive support
  - New high-performance internal digital data separator (no external filter components required)
  - Low-power CMOS with enhanced power-down mode
  - Automatic media-sense support
- Two UARTs
  - Software compatible with the PC16550A and PC16450
  - MIDI compatible
  - Infrared support on UART2 (IRDA™-compliant)
- Bidirectional Parallel Port
  - Enhanced Parallel Port (EPP) compatible
  - Extended Capabilities Port (ECP) compatible, including level 2 support
  - Bidirectional under either software or hardware control
  - Compatible with ISA, EISA, and Micro Channel architectures
  - Ability to multiplex FDC signals on parallel port pins for external FDD
  - Includes protection circuit against damage caused when printer is powered up, or operated at higher voltages
- Integral IDE controller
  - Provides a complete IDE interface with DMA control (except for optional buffers)

- 
- Integral address decoder - provides selection of all primary and secondary ISA addresses including COM1-4 and LPT1-3.
  - Enhanced Power Management Function
    - Special configuration registers for power down
    - Enhanced programmable power-down and wake-up modes
    - Auto power-down and wake-up modes
    - 3 special pins for power management
    - Typical current consumption during power-down is less than 10A

### **4.2.3 Video Subsystem**

The video subsystem, implemented on the Main Board and on the LCD Display Unit, displays text, graphics and drives an external VGA port. The video subsystem is implemented with a Chips and Technology high performance flat panel/RT VGA controller and supporting logic and video RAM (1 MB).

The major features of the VGA controller include:

- Highly integrated design (flat panel / CRT VGA controller, RAMDAC, clock synthesizer)
- Multiple Bus Architecture Integrated Interface
  - Local Bus (32-bit CPU Direct and VL)
  - PCI Bus
  - EISA/ISA (PC/AT) 16-bit Bus
- Advanced frame buffer architecture uses available display memory, maximizing integration and minimizing chip count
- Integrated programmable linear address feature accelerates GUI performance
- High performance resulting from zero wait state writes (write buffer) and minimum wait state reads (internal asynchronous FIFO design)
- Supports panel resolutions up to 800 x 600
- SMARTMAP intelligent color to gray scale conversion enhances text legibility
- Text enhancement feature improves white text contrast on flat panel displays
- Fully Compatible with IBM VGA

---

### 4.2.3.1 External VGA Drive Capability

On the Extensa notebook, the external VGA port is provided by the port adaptor fixture in the form of a 15-pin, female, D-type connector which can be used to drive an external CRT (up to 1024 x 768 x 256 colors).

### 4.2.4 Hard Disk Subsystem

The Hard Disk Subsystem, controlled by the IDE interface compatible NS87334 VJG Super I/O Controller on the Main Board, provides disk storage for all system software and user files. The Extensa 51x Series Notebooks are equipped with either a 540 or 810 million byte drive.

During the manufacturing process, Texas Instruments formats the hard disk and then loads all supplied software including Windows 95.

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**Caution: Formatting the disk drive erases any data that may be stored on the disk. Therefore, do not attempt a format of the hard disk unless the computer self test and diagnostics confirm that the disk has not been formatted.**

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A Hard Drive activity LED is located along the top of the notebook. This LED lights during hard drive read/write accesses.

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**Caution: The notebook should not be moved when the HDD icon is lit to prevent accidental damage to the hard drive.**

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### 4.2.5 Floppy Diskette Drive Subsystem

The Floppy Diskette Drive Subsystem consists of a Floppy Controller and the Floppy Diskette Drive. The Floppy Diskette Drive can read/write standard 3.5-inch diskettes.

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## **4.2.6 PCMCIA Subsystem**

The notebook is equipped with an on-board PCMCIA host adapter (PCMCIA Controller) and sockets to support Type I, Type II or Type III options. The PCMCIA Controller has the following features:

- Single-chip PCMCIA host adapters
- Direct connection to ISA (PC AT) Bus
- Direct connection to PCMCIA 2.0 Bus
- PCMCIA 2.0- and JEIDA 4.1-compliant
- 82365SL-compatible register set, ExCA-compatible
- Automatic Low-power Dynamic Mode for lowest power consumption
- Programmable Suspend Mode
- Five programmable memory windows per socket
- Two I/O windows per socket
- Programmable card access cycle timing
- 8- or 16-bit CPU interface
- 8- or 16-bit PCMCIA interface support
- ATA disk interface support
- Automatic flash memory timing support
- Easy host interface using ISA I/O addresses 03E0h, 03E1h
- Mixed-voltage (3.3V or 5V) operation
- Dual-socket-interface, 208-pin QFP

## **4.2.7 Power Subsystem**

The Power Subsystem consists of the following major parts:

- Power Management (hardware and software components)
- AC Adapter
- Primary Battery Board
- Primary Battery Pack

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### **4.2.7.1 Power Management**

The notebook is equipped with a power management function that minimizes battery usage for prolonged battery operation and automatically recharges the batteries when the notebook is used with an AC adapter.

The power management modes and warnings include the following:

- LCD standby mode
- Hard disk standby mode
- System standby/suspend mode
- Battery-low warning
- Standby/suspend upon battery low

### **4.2.7.2 AC Adapter**

The notebook uses an AC adapter with built in over voltage and short circuit protection.

The adapter can withstand a continuous short-circuit to DC output without damage to the notebook logic components. The adapter operates in Shut-down mode shorting  $V_o$  trail and resets to the normal Power mode after the fault condition is removed.

### **4.2.7.3 Primary Battery Pack**

The Extensa Series Notebooks use the Duracell DR35 as the primary battery pack. Specifications for the Primary Battery Pack are provided in Table 4-4.

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**Table 4-4 Primary Battery Pack Specifications**

<b>Function</b>	<b>Specifications</b>
Battery type	NiMH (Nickel Metal-Hydride)
Cell structure	9 cells per pack (in series)
Nominal voltage	10.8 V
Cell energy capacity Typical Minimum	2400 mAH 2500 mAH 2330 mAH
Nominal rated capacity	27 Watt-hours
Operating Temperature- Discharge Charge	-20 to 50°C (at 95%RH) 0 to 45°C (at 95%RH)
Charge and discharge cycles	500 (minimum)
Weight	470 grams
Battery discharge time	3 hours (with APM) Battery charge time

# Troubleshooting Procedures

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## 5.1 General

This section provides the following information:

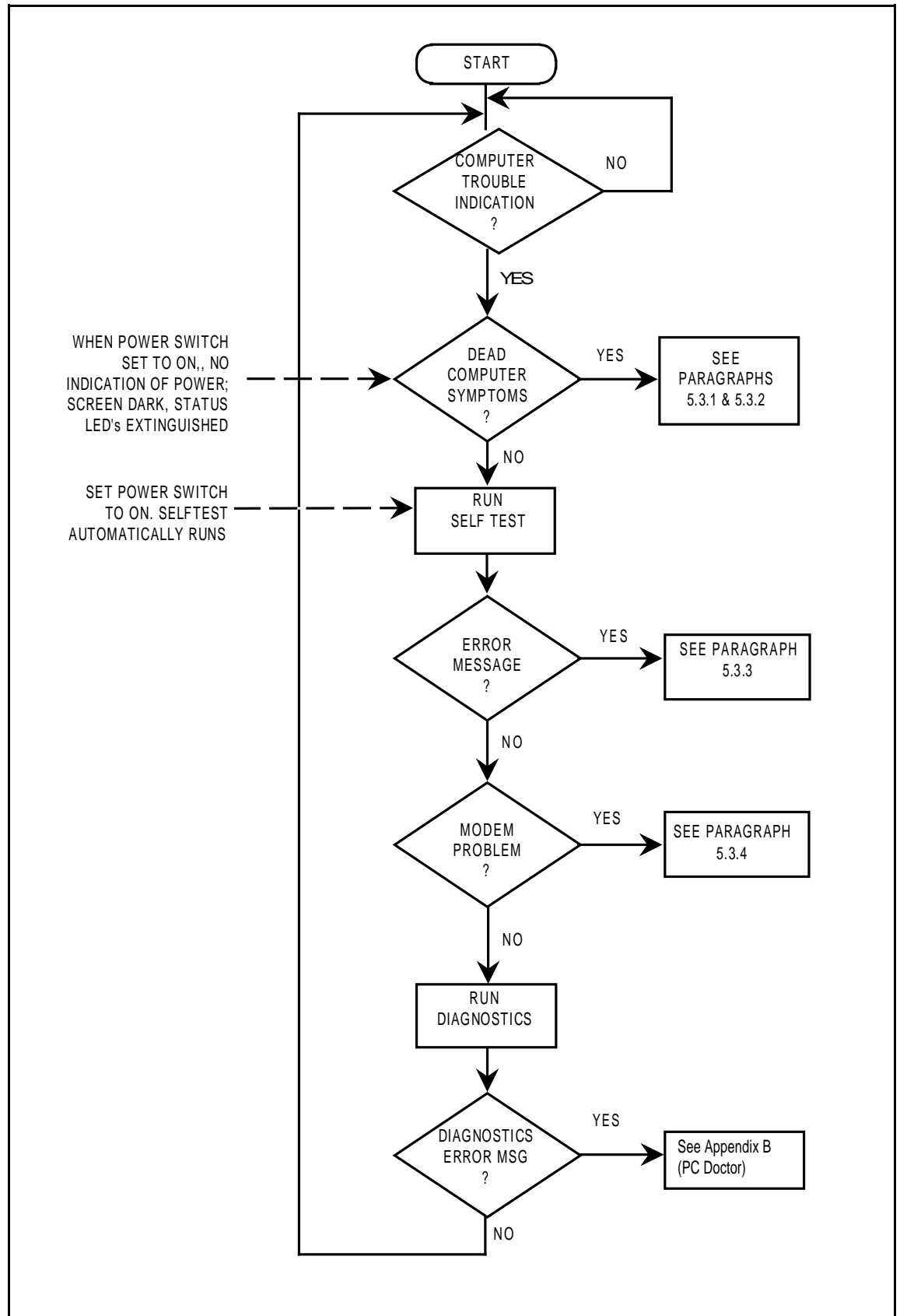
- Overview of the fault isolation process
- Guidelines for isolating computer malfunctions to replaceable subassemblies
- Instructions for executing diagnostics and interpreting error messages

## 5.2 Overview of Fault Isolation Process

The fault isolation process (summarized in Figure 5-1) consists of the following:

- Quick Check of the following:
  - Notebook power system (including battery packs and AC Adapter connections) - refer to Paragraph 5.4.
  - Switch settings (ensure **Power** switch is On, and press **Standby** switch to ensure that Notebook is not in Standby mode; press **Shift** to ensure the notebook is not in Auto-Suspend mode.
  - All external cabling (if any)
  - Check LCD Contrast adjustment (refer to Section 3)
- Record and attempt to resolve any displayed error messages/LED indications (refer to Paragraph 5.3 and Table 5-1)
- Record and attempt to resolve any series of beeps emitted from the notebook indicating test failure (refer to Table 5-2)





**Figure 5-1 Troubleshooting Flowchart**

- 
- Try rebooting the system (Ctrl-Alt-Del); restore system from diskettes, if necessary.
  - If the computer is capable of running the Setup program; check the serial and parallel port configurations, and other features that may affect system operation.
  - Run Diagnostics to further isolate problem area (refer to Paragraph 5.3.5).
  - For indicated hardware failures, cycle power and repeat self test to verify that a hard failure has occurred.
  - Remove and replace suspect hardware (as described in Section 6 of this manual) and retest the system using the diagnostic tests as described in Paragraph 5.3.5.

The detailed block diagram, shown in Figure 5-2, is useful in performing fault analysis of various internal subsystems. For example, an LCD hardware problem can be traced to either the LCD, Inverter Board, VR Board, or Battery Board. Other subsystem problems can be isolated in a similar fashion using the detailed block diagram as a troubleshooting tool.

## 5.3 Troubleshooting Procedures

The built-in self test program and the disk resident diagnostics program (PC-Doctor) are useful tools in computer troubleshooting. However, if the computer has a power, keyboard or display problem, you should first solve this problem before running diagnostics. If the computer powers up and displays messages on the LCD or emits a series of beeps, skip to Paragraph 5.4.3 for further instructions.

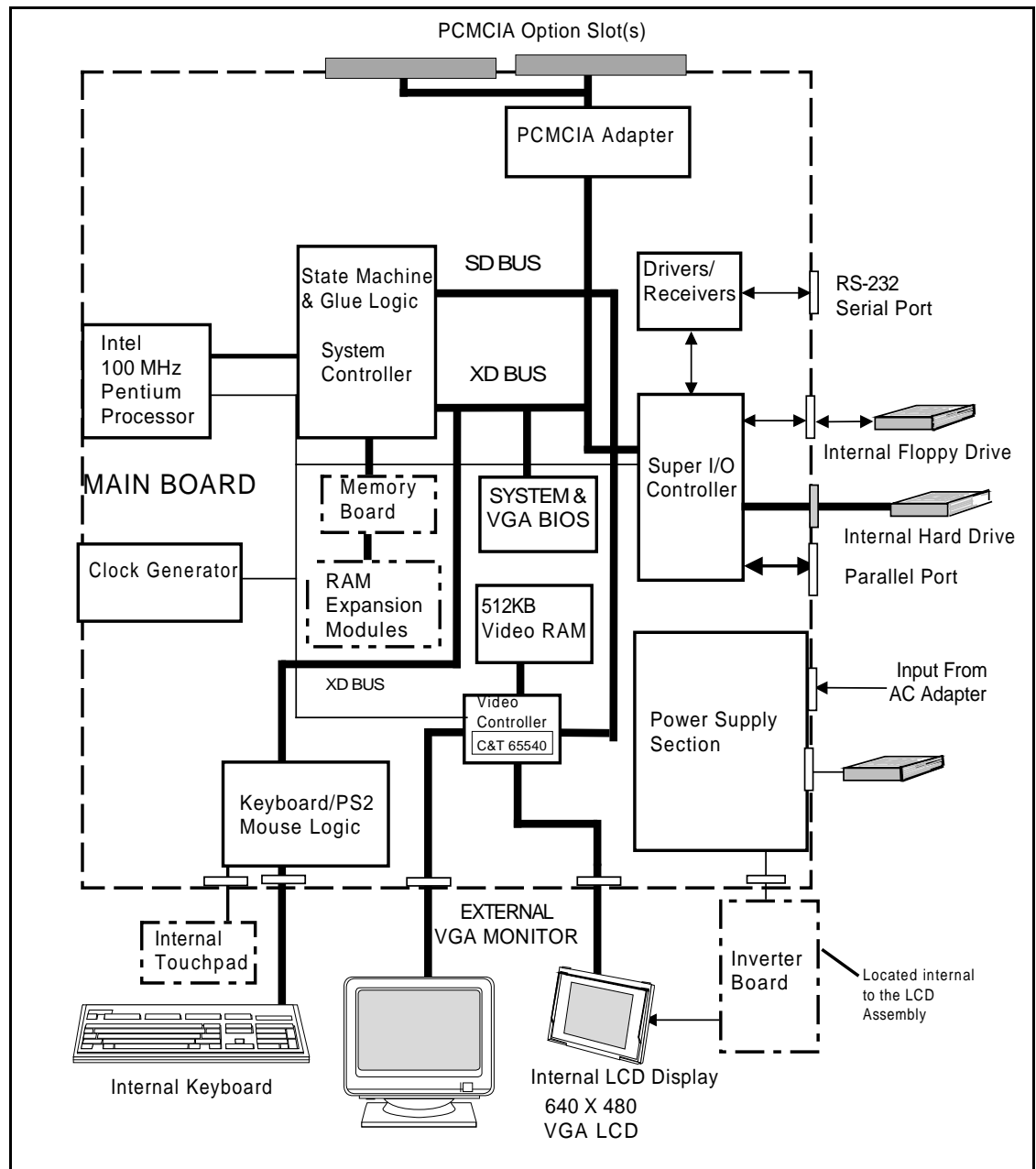
### 5.3.1 Troubleshooting a Power Supply Problem

If the computer does not power up when the Power Switch is set to the ON position, you most likely have a malfunction in the power subsystem (loss of power at the AC Outlet, faulty AC Adapter, discharged Battery Packs, or faulty Power Supply Board). With a power problem, all LEDs are extinguished, the LCD screen is blank, the system does not respond when the standby switch is pressed several times consecutively and no drive activity can be heard. The computer is unable to load software and displays no visible signs of activity.

To fault isolate a power problem, check the following:

- AC Adapter and Battery - Plug in the AC adapter and double check all connections on the Adapter and computer. Ensure that the Notebook **Power** switch is set to the On position and that the system is not in Standby or sleep mode.

- Measure the voltage at the AC Outlet or plug in a known good appliance (EG. a lamp) to verify that voltage is present. If the voltage is OK, try replacing the AC Adapter
- Check to see that the battery pack is installed correctly (try using a recharged battery pack if battery is discharged).
- If the AC outlet voltage, AC Adapter, and battery packs test normal, but the computer will not power up, replace the Power Supply Board and/or Battery Board as described in Section 6.



**Figure5-2 Troubleshooting Block Diagram**

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## 5.3.2 Troubleshooting a Display Problem

If the LCD remains blank when you turn on the computer, and the status indicators light, check the following controls on the display (refer to Figure 3-1):

- LCD Standby mode - If the LCD backlight remains off, even with the Brightness and Contrast Controls set to their highest positions (refer to Section 3), the LCD may be in **Standby Mode**. Press the **Standby** or **Power** button to resume the system.
- Notebook Set for External Monitor - use CMOS Setup to reset notebook.
- LCD - Replace the cover-display assembly as described in Section 6 of this manual.
- Low battery - Use a fully charged battery.

## 5.3.3 Fault Isolation Using Self Test

When the computer is first powered up, it automatically performs a self test of its central hardware and memory functions. During self test (which lasts for a few seconds), the display shows copyright and version number information.

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**Note:** Some procedures in this paragraph require you to use keystroke sequences, such as **Ctrl-Alt-Del**. To execute a keystroke sequence such as this, you must press all three keys simultaneously.

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### 5.3.3.1 Self Test Error Messages

Upon successful completion of the self test, the computer automatically loads its operating system and other built-in utilities. If the self test fails to complete successfully, the display shows one of the error messages described in Appendix A.

## 5.3.4 PCMCIA Modem Problems

If an optional PCMCIA modem does not work properly, check the following items:

- Proper installation of any PCMCIA options (check Modem settings under Control Panel).
- Dialing problem or wrong number - Try dialing a number that you have previously dialed successfully.

- 
- Faulty phone line - Connect a telephone to the line and listen for a dial tone.
  - Software program - Check to ensure that you have installed the software correctly.

### **5.3.5 Fault Isolation Using Diagnostics**

PC-Doctor, supplied with the Extensa Series Notebooks, is a powerful diagnostics tool that can help you scan an internal RAM system for viruses, determine the hardware configuration of a local or remote system, benchmark its performance, analyze the performance of all subsystems, and perform a suite of interactive and non-interactive tests on attached devices. The test results are stored in a log which can be printed out (by pressing **F2**) or saved in a disk file (by pressing **F3**).

Features of the diagnostic program are accessed through a series of pull-down menus and basic keyboard keys (cursor keys to move highlighted pointer, Enter key to select a highlighted feature, Esc key to cancel a function and move back one level).

PC-Doctor is typically user friendly but if you don't understand a feature, context-sensitive "help" information is available at any time by pressing the **F1** function key; pressing the **F1** function key twice accesses the online Technical Reference Manual for PC-Doctor.

A powerful set of utilities within PC-Doctor (that can be run locally or remotely) simplify the task of determining system configuration data, allocating and using system memory, IRQ and DMA use, what device drivers are installed, what COM and LPT ports are assigned and what ports are available, identifying partitioning data for fixed disk drive(s), determining the VGA setup information, reading the software interrupts/interrupt vectors, etc.

Functionally, PC-Doctor includes the following:

- Group of nine non-Interactive diagnostic tests that perform a non-destructive test of the major hardware functions in the notebook (Processor, Memory, System board, video section, serial and parallel ports (when loopback adapters are installed), hard disk and floppy disk.
- Group of seven Interactive tests (require operator input) for testing the keyboard, video sections, sound subsystem, mouse, joystick, diskette drive, printer subsystem and SCSI/CD-ROM Drive subsystems.
- Utility that provides detailed system information such as configuration data, allocation and use of system memory, IRQ and DMA use, what device drivers are installed, what COM and LPT ports are assigned and what ports are available, partitioning data for fixed disk drive(s), VGA setup information, software interrupts and interrupt vectors.

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- Group of special purpose utilities to run other tests from PC-Doctor, perform a virus scan of the internal RAM system, edit configuration files, surface scan hard drives, measure system performance, open a DOS prompt, provides terminal access to devices connected to serial ports, supports memory debug operations, enables remote operations, permits deep discharge of notebook batteries and provides an extensive test reporting function.

The PC-Doctor diagnostic program contains a group of nine non-Interactive diagnostics, available from the **Diagnostics** heading in the main menu, that permits testing various hardware sections without operator input. You can select one, several, or all tests from the Diagnostics menu. These tests are non-destructive; the serial and parallel port tests require disconnecting external devices from your notebook and installing loopback plugs. The Non-Interactive test categories include:

- CPU and Coprocessor-Processor Tests
- Base RAM memory test
- System Board test
- Video Test
- COM1 and LPT1 serial port tests
- Parallel Port Test
- Fixed Disk test
- Diskette Drive tests
- Other devices (Sound card, PCMCIA options, etc.)

### 5.3.5.1 Interactive Tests

The PC-Doctor diagnostic test includes a suite of seven Interactive tests that require operator input during the course of the test. The **Interactive Tests** category includes:

- **Keyboard** - tests the keyboard keys, LEDs and repeat function
- **Video** - tests the LCD and external VGA character sets, and colors
- **Speaker** - tests the volume response at different frequencies
- **Mouse** - tests the mouse driver, buttons and functionality
- **Joystick** - calibrates the external joystick connected to the system and tests the joystick buttons
- **Diskette Drive** - checks diskette drive functionality
- **Maximum System Load** - thoroughly exercises the system to the maximum extent possible for performing system "burn-in" and test

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- **Printer Test** - tests the operation of a connected printer
  - **SCSI Test** - sends test codes to attached SCSI devices (requires use of a Docking System with SCSI)
  - **CD-ROM Test** - checks out any attached CD-ROM Drive (requires attachment of a Docking System with CD-ROM capability)

### 5.3.5.2 Supporting Online Documentation

The PC-Doctor Diagnostic contains the following online information sources:

- **Online Technical Manual** - selected at any time by pressing the **F1** key twice or by clicking on the Question Mark in the upper left hand corner of any PC-Doctor Menu
- **On-line Help system** that provides context sensitive information from every PC-Doctor screen- accessed by pressing the **F1** key once (pressing **F1** twice gets you into the online manual)

PC-Doctor is structured as a text-mode, windowed user interface with pull-down menus. Program operation requires the use of the following keys:

- **Cursor Keys** - Move the highlighted pointer
- **Enter Key** - Selects the highlighted option
- **Esc Key** - Cancels current function and goes back one step
- **F1 Key** - Activates the context-sensitive help feature (pressing **F1** twice in a row calls up the online *Technical Reference Manual for PC-Doctor*)

Scrolling windows, which show the results of various operations, use the following keys:

- **Page Up/Page Down** - Moves the screen one page at a time
- **F2** - Prints the log to PRN
- **F3** - Saves the log to a file

You can also use the mouse, or Point, to interact with PC-Doctor. The leftmost **Select** key is used to choose objects (menu entries and action codes typically enclosed in brackets). The rightmost **Select** key is equivalent to the **Esc** key which takes you back to your previous step.

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### 5.3.5.3 Creating a Bootable Floppy Diskette

Prior to using PC-Doctor, create a bootable floppy diskette using the following procedure:

1. Power up the unit; when unit displays message, "Starting Windows 95", press **F8**. Choose **Command Prompt Only** from menu.
2. Using DOS, format a floppy diskette.
3. From the **A:** prompt, copy the basic MS-DOS files to the diskette using the following command:

**Format A: /F:1440 /S**

where the value 1440 is the capacity of the diskette (1.44 MB in this example).

4. Get into the PC-Doctor directory  
(type **CD C:\PCDR** and press **Enter**).
5. Copy the PC-Doctor files to the bootable diskette using the following command:

**XCOPY C:. A:**

After completion of this procedure, you should have a bootable diskette containing PC-Doctor.

### 5.3.5.4 Running PC-Doctor

PC-Doctor is a DOS-resident program that can be run from either hard disk or from the bootable diskette you previously created.

1. From the **C:\** prompt, change directory (type **CD C:\PCDR**) and press **Enter**.
2. From the **C:\** prompt, type **PCDR** and press **Enter**.
3. The Diagnostics Program loads into system memory, and the LCD displays the Diagnostics Header.

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**Note:** There are a number of command-line switches that can be entered when starting up PC-Doctor to enable automatic virus scanning, enable loopback testing of serial/parallel ports, work from the remote menu if performing remote operations, etc. To get a listing of the available command-line switches, startup PC-Doctor with the following command: **PCDR /?** and press **Enter**.

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**Note:** If PC-Doctor detects a virus, it will stop with an error message. You must then use one of the standard virus detection and removal programs to remove the virus.

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#### 5.3.5.5 Quitting PC-Doctor

To exit PC-Doctor, select the **Quit** pull down menu and then select the **Quit to DOS** option.

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**Note:** For additional information, press **F1** twice to access the online Reference manual for PC-Doctor.

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## 6.1 Introduction

This section contains preventive and corrective maintenance procedures for the Extensa 51x Series Notebook Computers. The first part of the section describes the computer cleaning procedures and preferred handling procedures for sensitive components (e.g. disk drives, batteries).

The second part of the section identifies all field-replaceable parts; the remainder of the section contains removal and replacement procedures for the field-replaceable parts.

## 6.2 Preventive Maintenance

Preventive maintenance is limited to cleaning the plastic case, the interior of the notebook including the keyboard, touchpad and the LCD screen.

### 6.2.1 Cleaning the Computer

When it is necessary to clean the plastic case and keyboard, use a soft, lint-free cloth, slightly dampened with a mild detergent solution or use the contents of any commercially available computer cleaning kit.

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**Caution: Never use alcohol, petroleum-based solvents, or harsh detergents to clean your computer. Also never spray any liquids directly on the computer case, keyboard, or screen. If the liquid-crystal display (LCD) screen has become smeared or dusty, clean the screen by first applying a mild glass cleaner to a soft, clean, lint-free cloth, and gently wipe the glass. Never apply liquids directly on the screen surface.**

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**Caution: Do not use paper towels to clean the display screen. Paper can scratch the display screen matte.**

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## **6.2.2 Protecting the Disk Drives**

To protect the disk drives and data, back up the system disk periodically on floppy diskettes. Periodically use a head-cleaning diskette in the floppy diskette drive to prolong the life of the drive and to help maintain data integrity.

## **6.2.3 Handling the Computer Battery Pack**

The battery pack furnished with the computer requires reasonable care and handling to ensure efficient operation and maximum life. Periodically inspect the battery terminals and the batteries for evidence of corrosion and oxide build-up; clean if necessary.

To ensure that the battery pack endures a normal life cycle, always observe the following precautions when handling the battery pack:

- Do not drop the battery pack or subject it to excessive shock and vibration.
- Do not expose the battery pack to direct sunlight, moisture, or chemical compounds.
- Do not disassemble the battery pack.
- Do not use the battery pack to power other devices.
- Do not short the battery leads or connect the battery with reversed polarity.
- Never attempt to charge the battery pack in any way other than as described in this manual.
- Always charge the battery pack as soon as possible after a low battery indication.

## **6.2.4 Restoring System Software**

The hard drive on the notebook computer is factory loaded with Windows 95 or Windows for Workgroups and ready for operation. Supplied with the system is a utility for creating backup diskettes of the system software. In the event of a disk crash or other problem, you can use the *Windows 95 Startup* diskette or other backup diskettes to boot the unit and perform troubleshooting.

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## 6.3 Required Tools and Equipment

All notebook computer corrective maintenance procedures can be performed using the following tools:

- Tweezers
- Small flat-blade screwdriver
- Small Phillips screwdriver
- Hexagonal Screwdriver
- Plastic Stick
- Conductive mat/wrist or ankle grounding strap system for electrostatic voltage protection.

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**Caution: All boards, options and peripherals contain components that are sensitive to static electricity. When handling any of these items, protect against static electricity by using wrist or ankle grounding straps and grounded conductive mats. When moving or storing items, use the anti-static bags supplied with the items.**

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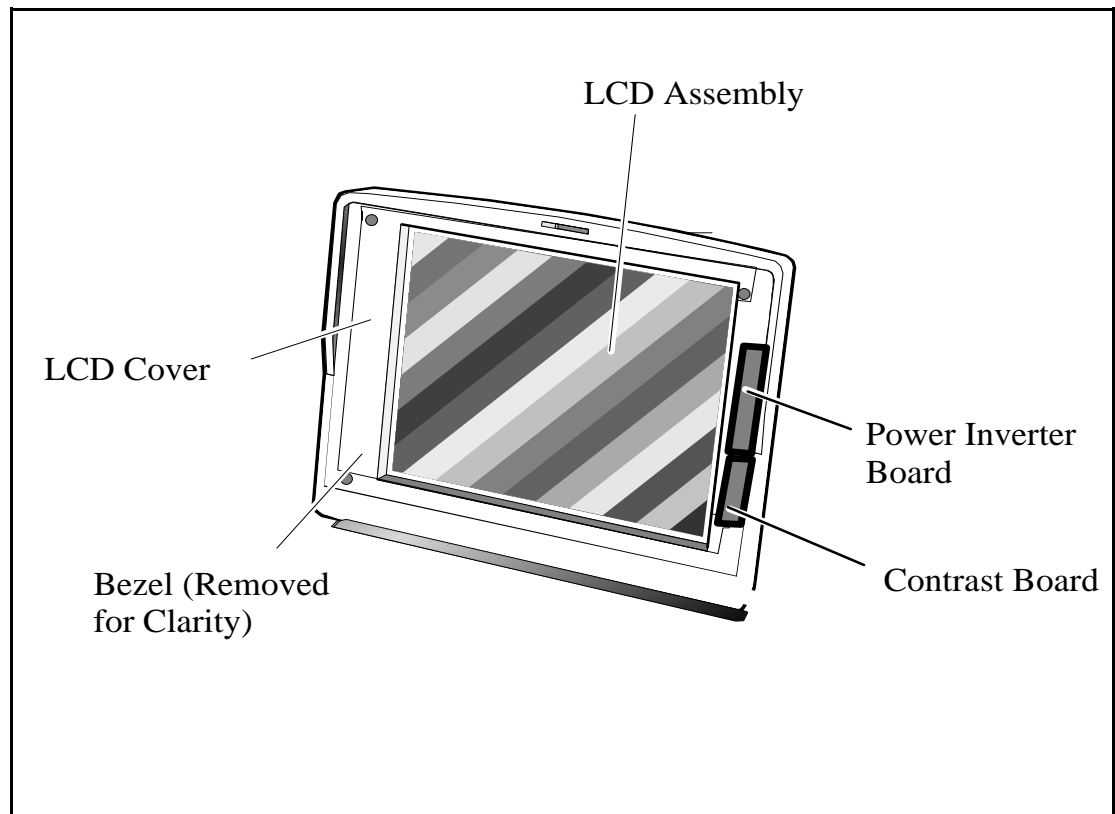
## 6.4 Notebook Field-Replaceable Parts and Assemblies

All members of the Extensa 51x Series Notebook Computers contain two major assemblies including the Cover-Display Assembly (upper half of notebook computer) and the System Base Assembly (lower half of the notebook). Each of these two assemblies contain FRUs as described in the following subparagraphs.

### 6.4.1 Display Assembly

As shown in Figure 6-1, the Display Assembly contains the LCD screen, Power Inverter Board and Contrast Board.

The Field-Replaceable Units (FRUs) and their respective TI Part No.'s and assembly/disassembly reference paragraph numbers are provided in Table 6-1.



**Figure 6-1 Cover-Display Assembly FRUs**

**Table 6-1 Cover-Display Assembly, Field-Replaceable Units (FRUs)**

<b>FRU Description</b>	<b>TI Part No.</b>	<b>Reference Paragraph No.</b>
Inverter Board, DSSTN 10.4"	9811361-0001	6.5.9
Display Assembly, 10.4" DSSTN 50X, 51X	9811363-0001	6.5.9
Bezel Assembly, DSSTN 10.4", W/O label	9811373-0001	6.5.9
LCD Panel, DSSTN, 10.4", 50X/51X	9811362-0001	6.5.9
Latch, LCD 50X/51X	9805745-0002	Ref
Spring, LCD Latch	9805745-0001	Ref
Cover, left side screws	9811379-0001	Ref
Cover, right side screws	9811379-0002	Ref
Cable Assembly, LCD to Main Board (29P)	9811385-0001	6.5.8
Nameplate, 515	9811375-0004	Ref
Nameplate, 510	9811375-0003	Ref
Connector Board, STN LCD	9811387-0001	6.5.8
Contrast Board	9811384-0001	6.5.9

<b>FRU Description</b>	<b>TI Part No.</b>	<b>Reference Paragraph No.</b>
Cable Assembly, Inverter (12P)	9811386-0001	6.5.8
LCD Cover, DSSTN, 10.4 inch	9811372	6.5.8

## **6.4.2 System Base Assembly**

As shown in Figure 6-2, the System Base Assembly houses a variety of field-replaceable subassemblies and components. The FRUs and paragraph references for removal/replacement procedures are listed in Table 6-2.

Table 6-3 contains a listing of Customer (non-technical user) replaceable units (CRUs) and associated TI Part Numbers.

**Table 6-2 Base Assembly, Field-Replaceable Units (FRUs)**

<b>FRU Description</b>	<b>TI Part No.</b>	<b>Reference Paragraph No.</b>
Main Board without CPU (transfer CPU to replacement board)	9811726-0001	6.5.13
IC, CPU, P54LM-100 SPGA (2.9V)	9811733-0001	6.5.14
Button Board Assembly	9811367-0001	6.5.6
Touchpad Board Assembly	9803991-0001	6.5.4
Smart Battery Control Board Assembly	9811734-0001	6.5.4
LED/Switch PWB Assembly	9811358-0001	6.5.4
Charger/Power Supply Board Assembly	9811360-0001	6.5.4
Floppy Drive Assembly	9811394-0001	6.5.5
Hard Disk Drive, 810 Million Byte	9811396-0001	6.5.6
Keyboard Assembly, U.S., EXT50x/51x	9811398-0001	6.5.2
Keyboard Assembly, UK, EXT50x/51x	9811398-0002	6.5.2
Keyboard Assembly, GER, EXT50x/51x	9811398-0003	6.5.2
Keyboard Assembly, FRA, EXT50x/51x	9811398-0004	6.5.2
Keyboard Assembly, SPN, EXT50x/51x	9811398-0005	6.5.2
Keyboard Assembly, SWS, EXT50x/51x	9811398-0006	6.5.2
Keyboard Assembly, ITA, EXT50x/51x	9811398-0007	6.5.2
Keyboard Assembly, PORT, EXT50x/51x	9811398-0009	6.5.2

<b>FRU Description</b>	<b>TI Part No.</b>	<b>Reference Paragraph No.</b>
Keyboard Assembly, SWD, EXT50x/51x	9811398-0010	6.5.2
Keyboard Assembly, DEN, EXT50x/51x	9811398-0012	6.5.2
Keyboard Assembly, NOR, EXT50x/51x	9811398-0013	6.5.2
Keyboard Assembly, BELG, EXT50x/51x	9811398-0014	6.5.2
Keyboard Assembly, FIN, EXT50x/51x	9811398-0015	6.5.2
FDD Cable	9811366-0001	6.5.5
HDD Cable	9811365-0001	6.5.6
Upper Case Assembly	9811370-0001	6.5.4
Lower Case Assembly (for non-U.S. units; lower case cannot be replaced in U.S. due to regulatory agency requirements)	9811371-0001	6.5.4
Clip, Speaker	9811390-0001	Ref
Cover, Cable	9805745-0006	Ref
Cover, HDD Assembly	9811374-0001	6.5.6
Hinge Cover	9805745-0007	Ref
Heat Sink Assembly	9811397-0001	6.5.3
Mouse Button (left)	9811399-0001	6.5.11
Mouse Button (right)	9811725-0001	6.5.11
Touchpad Cable Assembly	9811730-0001	6.5.11
Cover, Power Supply	9811392-0001	6.5.4

**Table 6-3 Notebook CRUs (Customer-Replaceable Units)**

<b>CRU Description</b>	<b>TI Part No.</b>	<b>Reference Paragraph No.</b>
AC Adapter Assembly	9803931-0001	Sec. 2
Internal Battery Pack, Ni-MH	9803928-0001	6.5.1
4 MB RAM SIMM	9803932-0001	6.5.7
8 MB RAM SIMM	9803950-0001	6.5.7
16B RAM SIMM	9803933-0001	6.5.7
Door, PCMCIA	9811381-0001	Ref
Rear Door	9811393-0001	Ref
Rubber Foot	9811382-0001	Ref

## **6.5 Notebook Subassembly Removal and Replacement Procedures**

The following paragraphs contain field service-level removal/replacement procedures for the Notebook.

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**Caution: Prior to removing any of the internal FRUs in the notebook, remove the AC Adapter, battery, hard drive and all external options installed on the notebook.**

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**Caution: Many internal cables are Flexible Printed-Circuit (FPC) cable types that require special handling. Ensure that locking-type connectors are unlocked (using a small flat-blade screwdriver) before removing cables. Do not force cables out of the connectors.**

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### **6.5.1 Removing/Replacing the Notebook Battery Pack**

The procedure for removing and replacing the battery pack is as follows:

1. Turn off the computer.
2. Locate the battery door (right side of notebook near the front). Lightly press inward on the battery door and slide the door toward the front of the notebook; remove the battery door.



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3. Grasp the ribbon loop on the battery and pull the battery out of the compartment.
  4. When replacing the battery, insert the end opposite the ribbon loop with the battery notches pointing upward. Slide the battery into the compartment and replace the battery door.

## **6.5.2 Removing/Replacing the Keyboard Assembly**

The procedure for removing and replacing the keyboard assembly is as follows:

1. Turn off the computer and disconnect the AC power adapter (if it is attached).
2. Remove the Battery Pack as described in Paragraph 6.5.1.

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**Note:** The top edge of the keyboard is held in place by plastic tabs beneath the Ctrl and Down Arrow Keys.

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3. Pull the keyboard release tabs toward the front of the notebook (tabs snap into an 1/8 inch recess in the plastics).
4. Using a small straight-blade screwdriver, lift the front edge of the keyboard upward.
5. Lift the front edge of the keyboard slightly and gently pull the keyboard toward the front of the notebook exposing two cables that connect the keyboard to the main board.

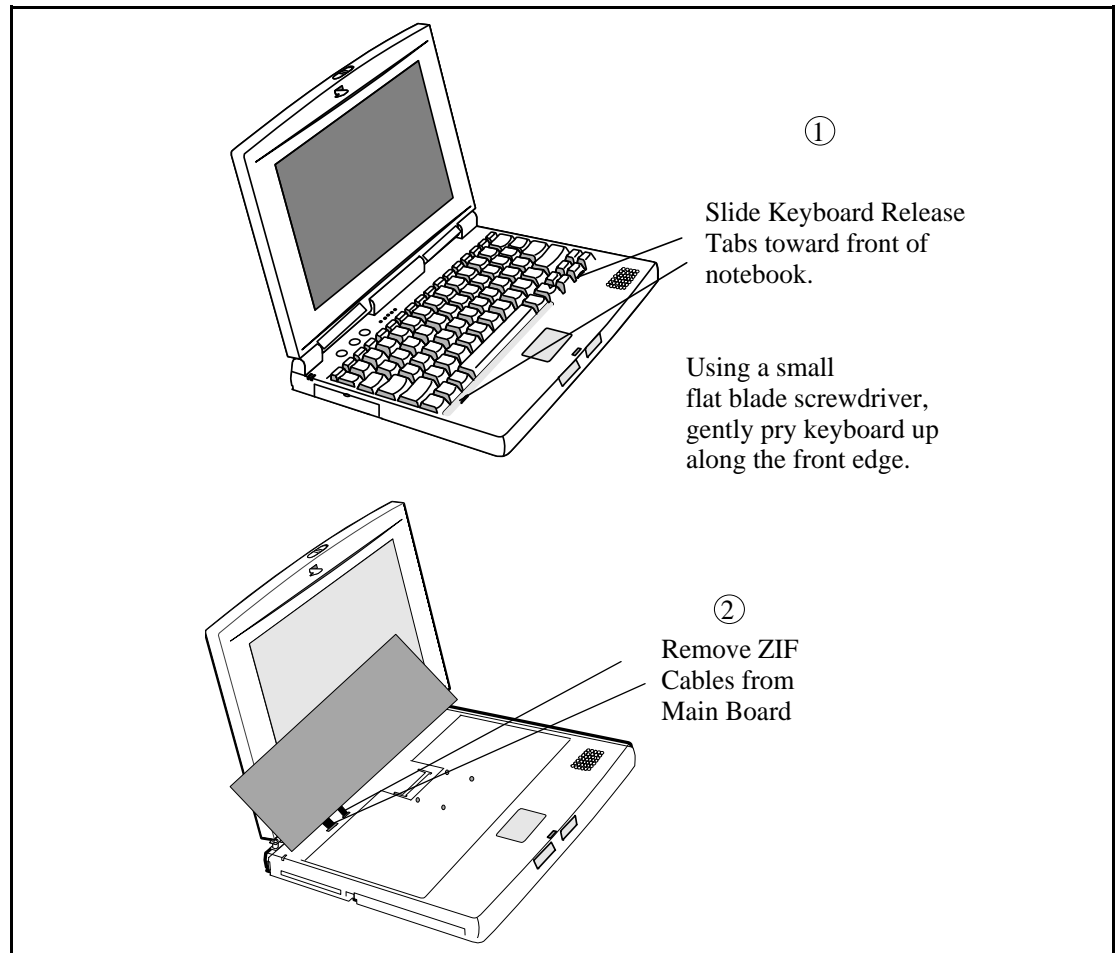
**C**

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**Caution:** Failure to release the ZIF connectors before removing cables will result in damage to the Keyboard Assembly.

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6. Release the two ZIF (zero insertion force ) connectors using a plastic stick or other nonmetallic object and remove the cables from the Main Board connectors.
7. Remove the keyboard assembly from the notebook.
8. Replacement is essentially the reverse of Steps 1 through 7.

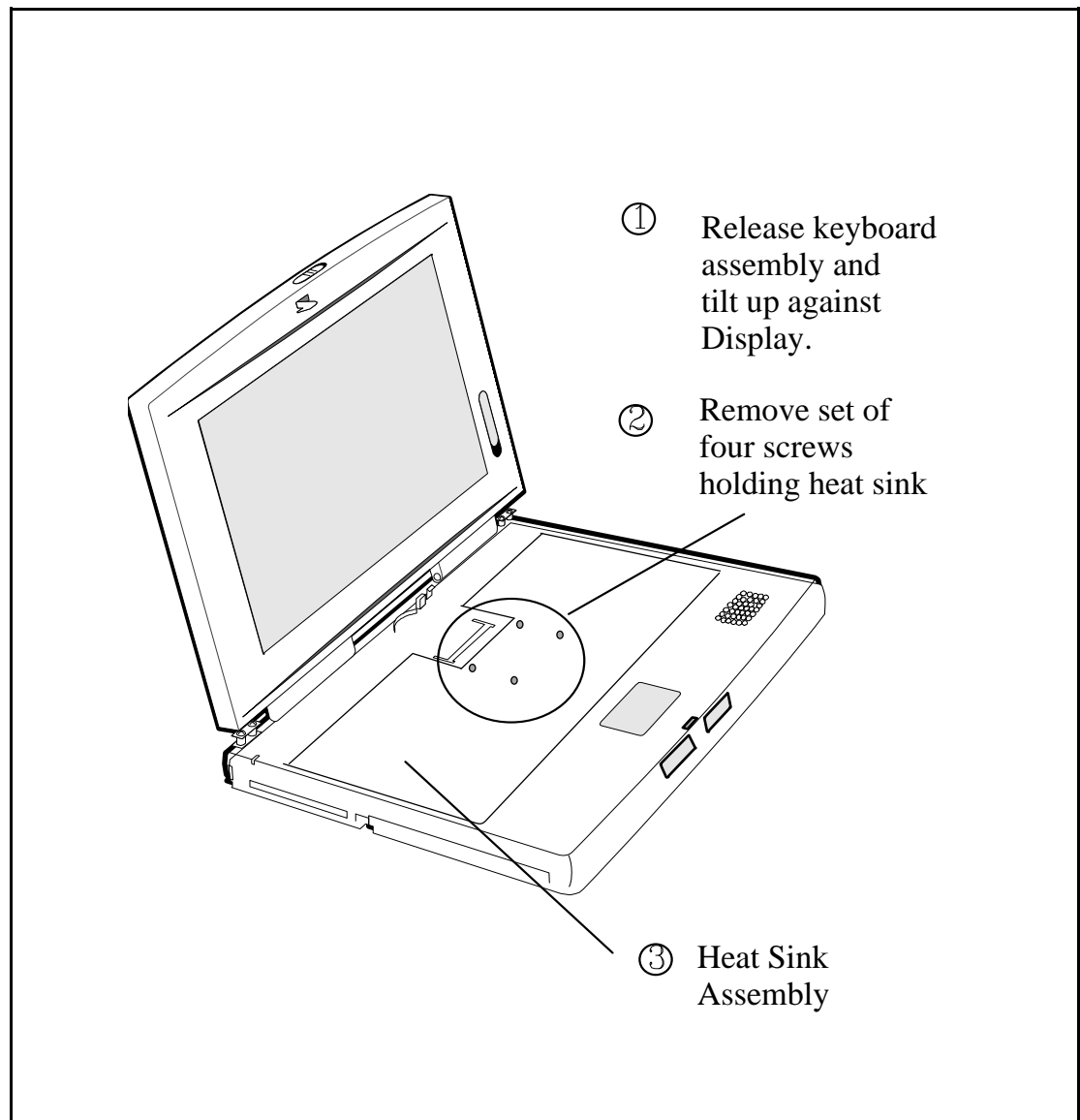


**Figure 6-2 Removing/Replacing the Keyboard**

### **6.5.3 Removing/Replacing the Heat Sink**

To remove and replace the heat sink, perform the following procedure:

1. Disconnect the AC adapter from the Notebook.
2. Remove the battery as described in Paragraph 6.5.1.
3. Loosen and tilt back the the keyboard assembly as described in Paragraph 6.5.2.
4. Remove the four Phillips-head screws that secure the heat sink to the main board.
5. Lift upward on the heat sink and remove it from the base.
6. Replacement is the reverse of Steps 1 through 5 above.



**Figure 6-3 Removing/Replacing the Heat Sink Assembly**

### **6.5.4 Opening/Replacing the Upper Case Assembly**

To remove/replace the Top Case Assembly, perform the following procedure:

1. Remove the AC Adapter, battery pack, any installed PCMCIA options, the Keyboard Assembly and Heat Sink Assembly as described in Paragraphs 6.5.1 through 6.5.3
2. Turn the notebook over and remove the six Phillips-head screws from the bottom of the notebook. Then turn notebook rightside up.
3. Remove the four screws that secure the Top Case Assembly to the base.

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4. Using a plastic stick, unlock the ZIF connector located near the Touchpad and remove the cable from the connector. Also, remove the 2-connector speaker cable from the Main Board Connector.
  5. Remove the cable cover below the display by lifting upward on the front edge of the cover.
  6. Disconnect three cables (two to the LCD and one to the LCD/Switch Board).
  7. Rotate the notebook so that the rear of the unit is facing you; open the rear door assembly.
  8. Several recesses are located just above the rear connectors. Use a small flat-blade screwdriver to disengage the snaps associated with the right and left recesses.
  9. Lift and push the Display Assembly forward to disengage it from the Base Assembly.
  10. Replacement of the Top Case Assembly is the reverse of Steps 1 through 9 above.

### **6.5.5 Removing/Replacing the Floppy Disk Assembly**

To remove/replace the Floppy Disk Assembly, perform the following procedure:

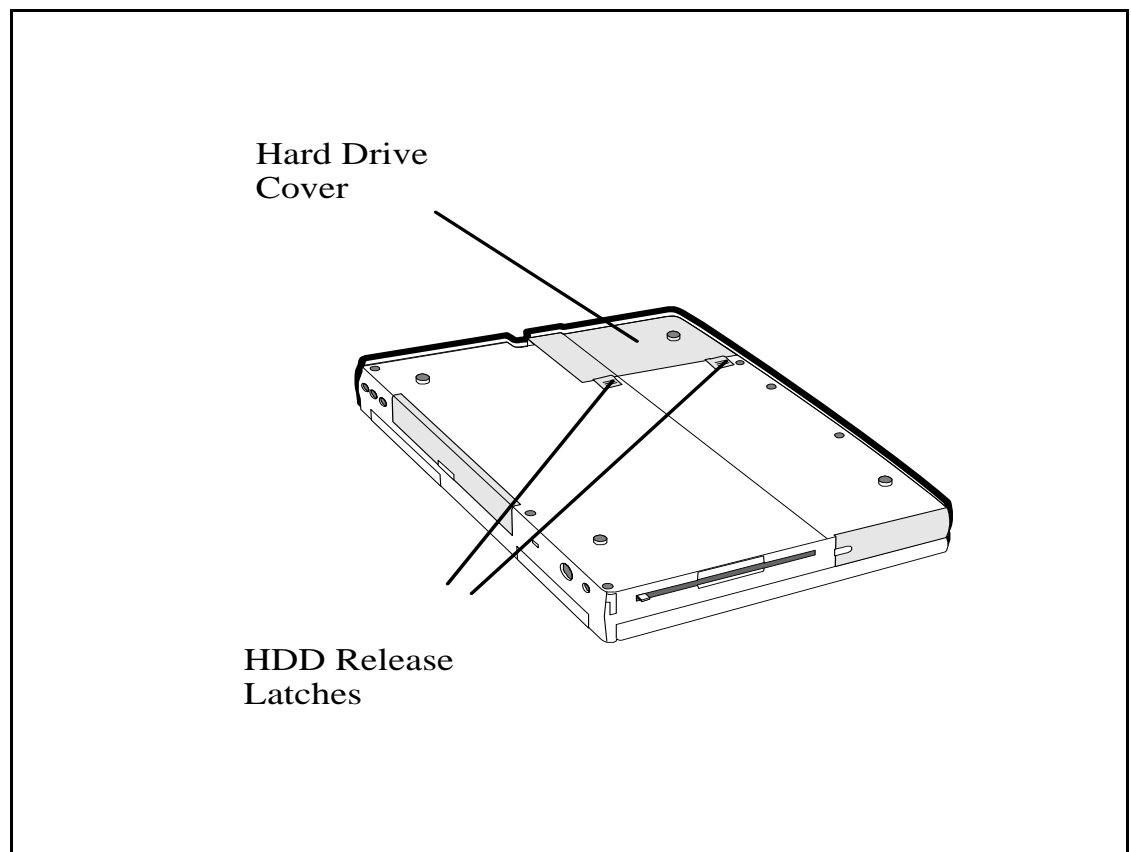
1. Remove the Keyboard Assembly and Heat Sink Assembly as described in Paragraphs 6.5.2 and 6.5.3.
2. Remove the Top Case Assembly as described in Paragraph 6.5.4.
3. Unlock the ZIF connector (using a plastic stick) and remove the Floppy to Main interface cable from the connector on the Main Board.
4. Remove the power supply shield.
5. Remove the screws securing the Floppy Disk Assembly to the Main Board and remove the Floppy Assembly from the notebook.
6. Remove the front and rear brackets from the Floppy Disk Drive.
7. Reassembly is the reverse of Steps 1 through 6 above.

### **6.5.6 Removing/Replacing the Hard Drive**

The procedure for removing and replacing the Hard Drive assembly is as follows:

1. Power down the notebook, remove the battery packs, and disconnect the AC Adapter, if installed.
2. Disconnect any peripheral device interface cables from the external interface connectors and remove any installed PCMCIA options.

3. Turn the computer over so that the Hard Drive panel is on your right side.
4. Press down on the two cover release tabs and slide to the left; lift up on the drive door and remove from the notebook.
5. Remove the two screws near the drive connector cable.
6. Insert a small blade straight slot screwdriver into the recess in the plastics near the front edge of the metal cover and gently move the drive back; lift upward when the metal lip clears the plastics.
7. Lay the drive over facing the rear of the notebook.
8. Gently pull on the plastic band to remove the cable connector from the disk drive.
9. Remove the disk drive from the bay. To remove the metal shield from the drive, remove the four recessed screws.
10. Replacement is essentially the reverse of Steps 1 through 9.  
**TIP:** Insert the frontmost edge of the drive in first so that the protruding metal lip clears the cutout in the plastics before guiding the remainder of the drive into the bay; then install and tighten the two rear-most screws and replace the plastic cover.



**Figure 6-4 HDD Removal/Replacement**

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## **6.5.7 Removing/Replacing DIMM Modules**

To remove and replace DIMM memory modules, use the following procedure:

1. Loosen the keyboard assembly (but do not disconnect keyboard cables) as described in Steps 1 through 4 of Paragraph 6.5.2.
2. Using the back edge of the keyboard as a hinge, lift the front edge of the keyboard up and lay it against the LCD assembly.
3. Push the two metal springs away from the board edge and remove the DIMM board.
4. When installing a DIMM board, insert the edge of the board into the rear of its connector using a slight rocking motion at an angle to the surface of the board.
5. Once the DIMM is fully inserted in the connector, push downward on both sides of the board to snap it in place.
6. Reinstall the Keyboard and replace components removed in Step 1.

## **6.5.8 Removing and Replacing the Display Assembly**

To remove the display assembly, perform the following procedure:

1. Remove the keyboard and heat sink as described in Paragraphs 6.5.2 and 6.5.3 respectively.
2. Remove the cable cover below the display by lifting upward on the front edge of the cover.
3. Unplug the video cables that mate with the Main Board.
4. Using a plastic stick, slide the right and left hinge covers away from the base assembly.
5. Lay the display completely back and remove the four screws that secure the display hinges to the base case assembly.
6. Observe cable routing and ensure that the display cables are free from the top case assembly; remove the display assembly.
7. Reinstallation of the Display Assembly is the reverse of Steps 1 through 6 above.

## **6.5.9 Removing and Replacing the Inverter Board or Contrast Board**

To remove and replace either the Inverter Board or the Contrast Board, perform the following procedure:

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**Caution: If the notebook is powered up with the LCD bezel removed, you can be exposed to high voltages which could result in shock and equipment damage. Ensure that the batteries and AC adapter are removed from the notebook when working on the LCD/Display assembly.**

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1. Use a narrow piece of plastic or pointed tweezers to apply light pressure to one edge of the lower screw covers. The lower screw covers will bow outward and can be removed.
2. Remove the rubber upper screw covers using a pair of tweezers.
3. Remove the six screws that secure the bezel to the display assembly (a small Phillips-head screwdriver is recommended for removing the two screws at the top of the bezel).
4. Pull on the inside edges of the bezel; remove bezel and lay aside for later reinstallation.
5. Peel back the EMI shield along the right side of the display to expose the Inverter Board and the Contrast Board.
6. Disconnect the connectors at the top and bottom of the Inverter Board and/or Contrast Board.
7. Use the small Phillips-head screwdriver to remove the two screws holding the Inverter Board or Contrast Board; remove the Board Assembly.
8. Reinstallation of the Inverter or Contrast Board is the reverse of Steps 1 through 7 above.

## **6.5.10 Removing/Replacing the Touchpad Assembly**

To remove and replace the Touchpad Assembly, perform the following procedure:

1. Remove the Upper Case Assembly as described in Paragraph 6.5.4.
2. Turn the Upper Case Assembly over and remove the four screws that secure a metal shield to the plastics.
3. Lift the plastic frame that rests on top of the touchpad.
4. Unplug the flex cable from the connector on the touchpad. Note that the board connector is a LIF (Low insertion force) type; the cable is held in place by friction.
5. Slide the board assembly to the right and remove from the unit.
6. Replacement of the Touchpad Board Assembly is essentially the reverse of Steps 1 through 5 above.

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### **6.5.11 Removing/Replacing the Smart Battery Board Control Board**

To remove and replace the Smart Battery Control Board, perform the following procedure:

1. Remove the Upper Case Assembly as described in Paragraph 6.5.4.
2. Disconnect the battery cable located next to HDD Connector.
3. Remove the two screws that secure the board to the plastics and remove the board.
4. Replacement is essentially the reverse of steps 1 through 3 above.

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**Note:** When reinstalling the Smart Battery Control Board, use the battery pack as a guide to ensure that the connector slots properly align with the battery slots.

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### **6.5.12 Removing/Replacing the Charger/Power Supply Board Assembly**

To remove and replace the Charger/Power Supply Board Assembly, perform the following procedure:

1. Remove the Top Case Assembly as described in Paragraph 6.5.4.
2. Remove the Floppy Drive Assembly as described in Paragraph 6.5.5.
3. Using a plastic stick, lift up on the end of the board that is adjacent to the processor. The board assembly snaps out. Remove board from unit.
4. Replacement is essentially the reverse of Steps 1 through 3 above.

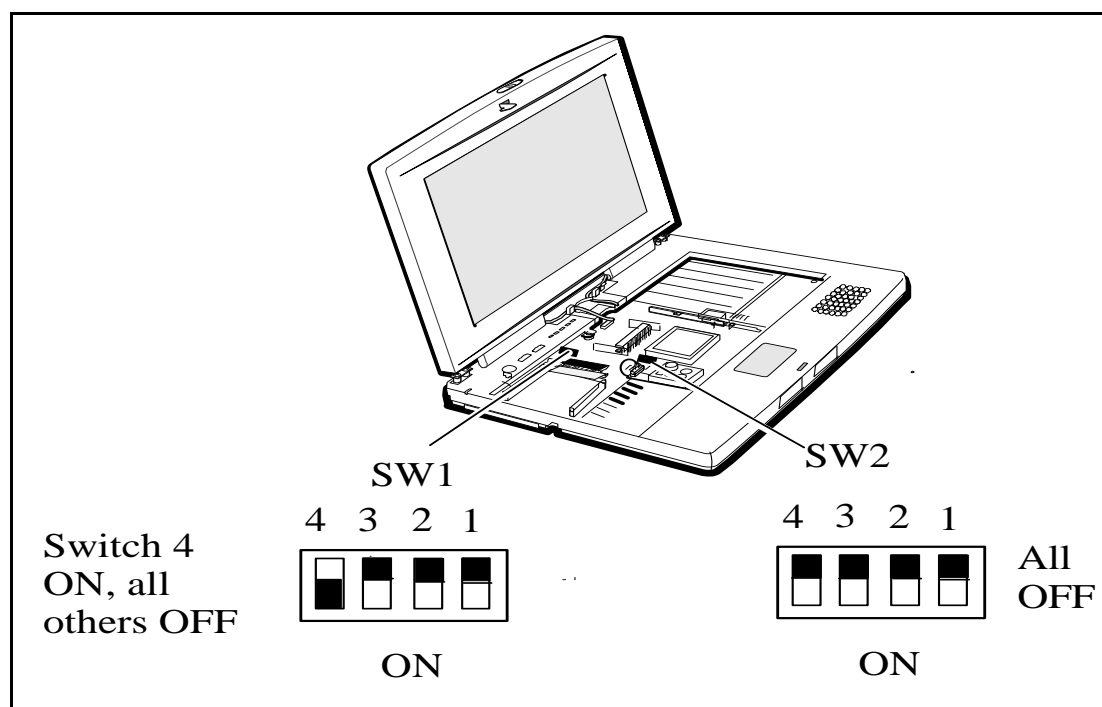
### **6.5.13 Removing/Replacing the Main Board**

To remove and replace the Main Board Assembly, perform the following procedure:

1. Remove the AC Adapter, Battery Pack and any installed PCMCIA options from the notebook.
2. Remove the keyboard assembly as described in Paragraph 6.5.2.
3. Remove the Heat Sink as described in Paragraph 6.5.3.
4. Remove the Charger/Power Supply Board as described in Paragraph 6.5.12.
5. Disconnect all interboard cable connectors.



6. Using a small flat blade screwdriver and apply light pressure in a rocking motion to remove the hard drive cable connector.
7. Remove four Phillips-head screws (one on each of the four sides of the heat sink opening) securing the board to the base assembly. Do not remove the smaller screws which are part of the PCMCIA connector hardware.
8. Remove the Phillips head screw at the left rear of the Main Board.
9. Lift up along the front edge of the Main Board Assembly until it clears the hard drive cavity; then pull the board forward and out of the plastics.
10. Refer to Paragraph 6.5.14 and transfer the CPU to the replacement Main Board.
11. Inspect the two configuration DIP switches on the replacement board; ensure that the settings are as described in Figure 6-5.
12. Reassembly is essentially the reverse of Steps 1 through 9 above.



**Figure 6-5 Switch Settings for Main Board**

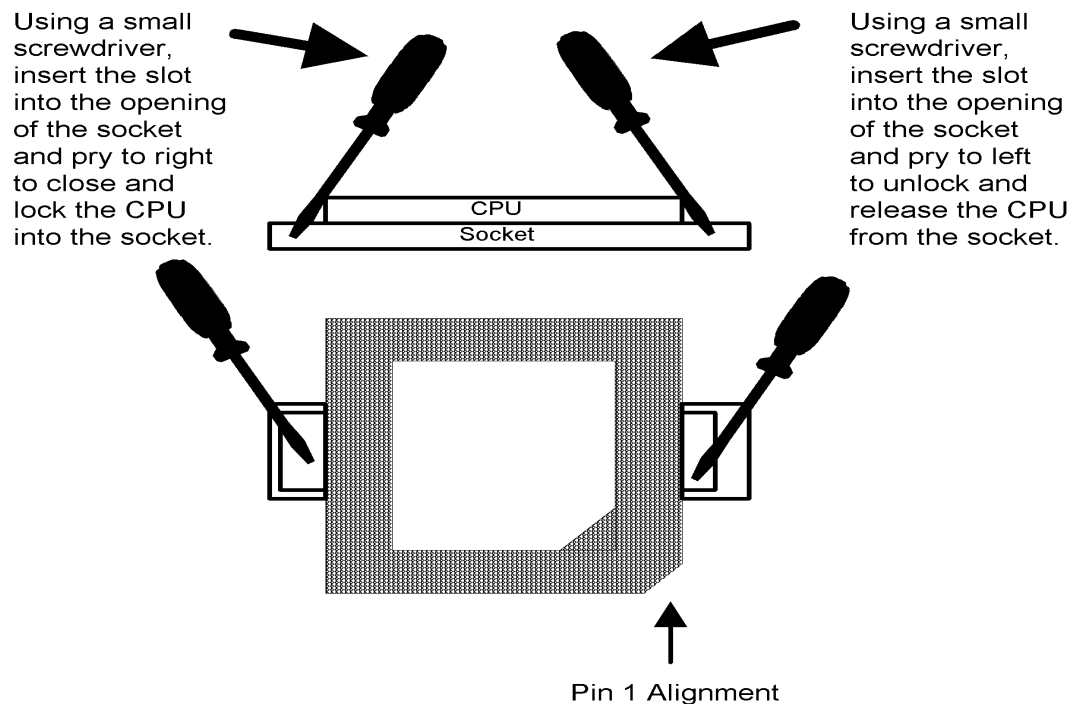
### **6.5.14 Removing/Replacing the Pentium Chip**

The illustration in Figure 6-6 shows the procedure for removing/replacing the processor from/to the processor socket on the Main Board.

1. Remove the Main Board assembly as described in Paragraph 6.5.13.
2. Insert a small flat-blade screwdriver into the rightmost opening as shown in Figure 6-6.

3. Gently pry to the left (with pin 1 alignment at the bottom right as shown in Figure 6-6).
4. Gently remove the chip from the socket.
5. To install a chip into a vacant CPU socket, insert a flat blade screwdriver into the opening at the right side of the processor socket (refer to Figure 6-6) and pry to the left to unlock socket.
6. Insert the processor chip into the socket.
7. Insert a flat blade screwdriver into the slot on the left side of the processor socket and pry to the right to close and lock the CPU into the socket.

To remove the CPU from the socket:



**Figure 6-6 Removing the Processor Chip**

# Self Test Error Messages

## A.1 Introduction

This appendix contains reference data useful in diagnosing and correcting self test errors.

**Table A-1 Self Test Error Messages**

<b>Error Message</b>	<b>Corrective Action</b>
CMOS Battery Bad	Replace Main Board
CMOS Checksum Error	Cycle power to Notebook; if problem persists, remove and replace Main Board.
Disk Boot Failure	Insert a system disk in drive A
Diskette Drive Controller Error or No Controller Present	Cycle power to Notebook; if problem persists
Diskette Drive Error	Insert Diskette and retry; if problem persists, try another diskette
Diskette Drive Type Mismatch	Press <b>Ctrl-Alt-Esc</b> to reconfigure the system.
Equipment Configuration Error	Press <b>Ctrl-Alt-Esc</b> to reconfigure the system.
Hard Disk 0 Error	Cycle power to Notebook; if problem persists, replace Hard Drive
Hard Disk 0 Extended Type Error	Cycle power to Notebook; if problem persists, replace Hard Drive
Insert system diskette and press key to reboot	Insert a system disk in drive A
I/O Parity Error	Cycle power to Notebook; if problem persists, replace Main Board
Keyboard Error or No Keyboard Connected	Cycle power to Notebook; if problem persists, check keyboard connections; if problem persists, replace Keyboard; if problem persists, replace Main Board.

<b>Error Message</b>	<b>Corrective Action</b>
Keyboard Interface Error	Cycle Power to Notebook. If problem persists, replace keyboard; if problem persists, replace Main Board.
Memory Size Mismatch	Enter and then exit the System Configuration Setup in the Setup utility.
Missing operating system	Correct the HDD type and reboot. Refer to the specification label pasted on the back side of the notebook or attached to hard disk drive.
Non-system disk or disk error. Replace and strike any key when ready	Insert a system disk in drive A and press any key
Pointing Device Error	Cycle Power to Notebook; if problem persists, replace Touchpad.
Pointing Device Interface Error	Cycle Power to Notebook; if problem persists, open up the notebook and check the touchpad cabling
Protected Mode Test Fail	Cycle power to Notebook
RAM BIOS Bad	Cycle power to Notebook
RAM Parity Error.	Cycle power to Notebook if problem persists, replace Main Board and/or DIMMs modules.
Real Time Clock Error	Press <b>Ctrl-Alt-Esc</b> to reconfigure the system.
Video RAM BIOS Bad	Cycle power to Notebook

**Table A-2 POST Checkpoint List**

<b>Checkpoint No.</b>	<b>Description</b>
D4h	Normal POST start
FCh	CMOS and BIOS ROM checksum test skip or complete
01h	80286 register test in-progress
02h	CMOS write/read test in-progress or failure
03h	BIOS ROM checksum in-progress or failure

<b>Checkpoint No.</b>	<b>Description</b>
D4h	Normal POST start
04h	Programmable Interval Timer test in-progress or failure
06h	DMA page register write/read test in-progress or fail
08h	RAM refresh verification in-progress or failure
09h	1st 64K RAM test in-progress
0Ah	1st 64K RAM chip or data line failure - multi-bit
0Bh	1st 64K RAM odd/even logic failure
0Ch	1st 64K RAM address line failure
0Dh	1st 64K RAM parity test in-progress or failure
10h	1st 64K RAM chip or data line failure bit 0
20h	Slave DMA register test in-progress or failure
21h	Master DMA register test in-progress or failure
22h	Master interrupt mask register test in-progress or fail
23h	Slave interrupt mask register test in-progress or fail
25h	Interrupt vector loading in-progress
27h	Keyboard controller test in-progress or failure
28h	CMOS power-fail and checksum checks in-progress
29h	CMOS config info validation in-progress
2Bh	Screen memory test in-progress or failure
2Ch	Screen initialization in-progress or failure
2Dh	Screen retrace tests in-progress or failure
2Eh	Search for video ROM in-progress
30h	Screen believed operable
34h	Timer tick interrupt test in-progress or failure
35h	Shutdown test in-progress or failure
36h	Gate A20 failure
37h	Unexpected interrupt in protected mode
38h	RAM test in-progress or failure above address 0FFFFh

<b>Checkpoint No.</b>	<b>Description</b>
D4h	Normal POST start
3Ah	Interval timer channel 2 test in-progress or failure
3Bh	Time-Of-Day clock test in-progress or failure
3Ch	Serial port test test in-progress or failure
3Dh	Parallel port test test in-progress or failure
3Eh	Math Coprocessor test in-progress or failure
50h	Initial M1429
52h	Dynamic Memory Configuration & check external Cache size
53h	Shadow BIOS
54h	Perform PCI device initialization
55h	Check CMOS checksum
56h	Check CMOS config against actual
57h	Enable/disable external cache
5Fh	Initial PnP device nodes
90h	Enable/disable external cache
70h	For PCI
71h	For PCI
72h	For PCI
73h	For PCI
74h	For PCI
75h	For PCI
76h	Begin PCI devices initialization
77h	Configures PCI VGA devices
78h	Except VGA
79h	Begin PCI service routines
7Ah	PCI Option ROM initialization
E0h	Shadow PCI non-VGA option ROM
E1h	Shadow PCI VGA option ROM to C000 segment
E3h	Start to find PCI option ROM
E4h	Begin to shadow PCI option ROM

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<b>Checkpoint No.</b>	<b>Description</b>
D4h	Normal POST start
1Fh	Begin to configures PCI VGA devices
D1h	Allocate Space for option ROM

# PC-Doctor Diagnostics

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## B.1 Introduction

The Extensa Series Notebooks are shipped with PC-Doctor, a powerful diagnostics tool that can help you determine the hardware configuration of a local or remote system, benchmark its performance, analyze the performance of all subsystems, and perform a suite of interactive and non-interactive tests on attached devices (such as printers, joystick devices, VGA monitors, SCSI devices, CD-ROM drives). The test results are stored in a log which can be printed out (by pressing **F2**) or saved in a disk file (by pressing **F3**).

Features of the diagnostic program are accessed through a series of pull-down menus and basic keyboard keys (cursor keys to move highlighted pointer, **Enter** key to select a highlighted feature, **Esc** key to cancel a function and move back one level.)

PC-Doctor is typically user friendly but if you don't understand a feature, context-sensitive "help" information is available at any time by pressing the **F1** function key; pressing the **F1** function key twice accesses the online Technical Reference Manual for PC-Doctor.

A powerful set of utilities within PC-Doctor (that can be run locally or remotely) simplify the task of determining system configuration data, allocating and using system memory, IRQ and DMA use, what device drivers are installed, what COM and LPT ports are assigned and what ports are available, identifying partitioning data for fixed disk drive(s), determining the VGA setup information, reading the software interrupts/interrupt vectors, etc.

## B.2 Starting PC-Doctor

PC-Doctor comes pre-installed on your Extensa Series Notebook Computer. To run the utility, reboot your computer.

The system continues the boot process and automatically displays the PC-Doctor Diagnostics main menu.



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## B.3 Mouse Navigation

You can use a mouse to navigate through PC-Doctor (alternately use the arrow keys from the keyboard). Use the left mouse button to choose objects (menu entries and action codes in square brackets). Use the right mouse button as you would the **Esc** key to take you back to your previous step. Click on the ? in the upper left corner of the screen for context-sensitive help Menus.

## B.4 PC-Doctor Menus

There are several selections available from the menu bar of the PC-Doctor Diagnostics main menu. These include:

- **Diagnostics**
- **Interactive Tests**
- **Hardware Info**
- **Utility**
- **Quit**

### B.4.1 Online Help (?)

To obtain context sensitive help from any menu, press **F1**. Pressing **F1** twice (or clicking on the question mark in the upper left-hand corner of the menu) provides you with complete online documentation.

### B.4.2 Diagnostics

The Diagnostics menu allows you to run non-destructive tests with little or no operator interaction. Options available from the PC-Doctor Diagnostics Menu include:

- **System Test** - tests all major aspects of the system except those found in Memory, Hard Disk, Floppy Disk, and the Miscellaneous Test categories.
- **Memory Test** - tests all types of main memory in the system including base, extended, expanded, and upper memory block (UMB) memory.
- **Hard Disk Test** - tests all hard disk drives in the system that are either IDE or provide a BIOS command interface.
- **Floppy Disk Test** - tests all floppy disk drives in the system.

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- **All Tests** - allows you to select which tests to run. You can also specify special testing options. By pressing **F2**, the following options are available:
    - **Halt On Errors** - interrupts testing if an error is detected.

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**Note:** External serial and parallel port testing requires loopback plugs (not provided with this software).

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- **External Loopback** - tests external loopback of COM and LPT ports. You can select the type of loopback adapter you want to use.
- **Pass Count** - selects how many times tests are repeated. The highest limit is 9999 times.
- **Test Logging** - opens the Log Options menu that lets you define how test results are printed or stored to a file during testing. By default, PC-Doctor produces a test result file at the end of testing if an error was detected.
- **Switch LCD** - lets you change your video output to either the internal LCD, external monitor, or SimulSCAN mode. If your system does not support SimulSCAN, both the external monitor and the built-in LCD screen go blank.
- **Cache Control** - allows you to leave the level 1 and level 2 cache enabled during memory testing. This assists in tracking down cache timing issues.

### B.4.3 Interactive Tests Menu

Interactive tests are diagnostics that need user interaction to complete. Interactive tests include:

- **Keyboard** - tests the keyboard keys, LEDs, and repeat rate
- **Video** - tests the character sets, colors, monitor, and VGA
- **Speaker** - tests the volume response at different frequencies
- **Mouse** - tests the mouse driver, buttons, and functionality
- **Joystick** - calibrates the joystick and tests the buttons. During the test, the joystick(s) should first be calibrated. To calibrate the joystick, move the stick to the extremes in each direction. PC-Doctor registers the coordinate data and adjusts the screen display accordingly.
- **Diskette Drive** - checks diskette drive functionality
- **Maximum System Load** - "burn-in" tests a system. This function simulates the operating conditions that are produced by operating systems such as OS/2 and Windows NT. Some systems are not compatible with the Maximum system Load test.

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- **Printer Test** - tests for the correct acceptance and execution of common printer control commands. Printer test information is stored in printer test files with an extension of *.PDP*.
  - **SCSI Test** - PC-Doctor contains SCSI device testing features that work if you have an ASPI or CAM device driver loaded. You can select which SCSI host adapter to work with if you have more than one SCSI adapter present.
  - **CD-ROM Test** - tests CD-ROM drives using the Microsoft CD-ROM Extensions (MSCDEX) and the standard CD-ROM device drivers.

## **B.4.4 Hardware Info Menu**

This menu contains functions that determine and report on the setup of the computer. None of these functions perform diagnostic tests; however any errors are included in the reports. The following functions are available from the Hardware Info menu:

- **System Configuration** - lists main system configuration data
- **Memory Contents** - shows allocation and use of system memory
- **IRQ and DMA use** - identifies interrupts for all standard IRQ and DMA devices
- **Device Drivers** - shows all essential data on DOS resident and installable device drivers
- **COM and LPT ports** - displays information about the installed serial and parallel ports. Only ports that are identified by BIOS are listed
- **Physical Disk Drives** - shows the basic characteristics for each installed fixed disk drive including the contents of partition tables
- **Logical Disk Drives** - displays information about each drive that is available and has a disk in it. If Stacker or DoubleSpace disk compression software has been installed, details about each "stacked" or "doubled" drive is shown
- **VGA Information** - identifies the type of installed VGA chip
- **Software Interrupts** - displays software interrupt vectors and the area of memory they point to
- **SCSI Devices** - lists information about SCSI devices and interface cards if a CAM or ASPI compliant SCSI device driver is present

## **B.4.5 Utility Menu**

PC-Doctor has a dedicated menu for utility functions. These functions include:

- **Run External Tests** - runs other programs from PC-Doctor

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- **Edit CMOS RAM** - gives access to CMOS RAM data
  - **File Editor** - allows editing of configuration files
  - **Surface Scan Hard Disk** - checks for defects on the hard disk
  - **Benchmark System** - measures system performance
  - **DOS Shell** - opens a DOS prompt from within PC-Doctor
  - **Terminal** - gives access to devices connected to a serial port (such as a modem)
  - **Memory Debugger** - displays memory contents in either hexadecimal, decimal, or ASCII form
  - **Remote Operation** - enables remote control if available
  - **Tech Support Form** - allows you to collect information about the current system
  - **Battery Rundown** - quickly deep-discharges the NiMh battery of a laptop computer.

## B.5 Quitting PC-Doctor

You can quit PC-Doctor in the following ways:

- **Exit (Alt-F4)** -
- **Reboot** - performs a cold boot. PC-Doctor flushes all files and attempts to flush write-caches
- **Park HD** - prepares a computer for transport

## B.6 Remote Operation

This selection only appears in the Utility menu if your PC-Doctor supports remote control. This entry opens the Remote Operation menu if you are not yet online, or closes the remote connection if the system is already remotely controlled.

When PC-Doctor is operated remotely, it is possible to perform a remote reboot. Remote rebooting is a complicated procedure that reloads the operating system and makes changes to CMOS RAM and configuration files. For further information on remote operations, refer to online documentation or help.

Printed in U.S.A.

