

Explorer II System

Field Training Bulletin

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GUIDE REVISION HISTORY

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This student guide is designed to be used as a self-study learning tool. This guide is not meant to be used as a self-contained document. The material contained herein is intended to be used in conjunction with other course materials. Frequent references are made to the manuals listed in the List of Materials section of this guide.

Revisions to this student guide are planned so that the most current product releases are addressed. However, TI products may be revised before it is possible for this student guide to be updated. As a result, there might be slight differences between your system and the descriptions of the products in this guide. Therefore, reference should always be made to the most current reference manuals.

**DATA SYSTEMS GROUP
EDUCATION & DEVELOPMENT CENTER
P.O. BOX 2909 — M/S 2220
Austin, Texas 78769**

Explorer II

Field Training Bulletin

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Appendix A Self Test Evaluation

1. Introduction/Overview

1.1. How to Use this Field Training Bulletin

This Field Training Bulletin will assist you in learning how to effectively service the Explorer II System (Model Code 430). It must be used with the:

- Explorer Field Maintenance Manual Supplement P/N 2537183-0001
- Explorer II Processor and Auxilliary Processor Options General Description P/N 2537187-0001
- Explorer 32-Megabyte Memory General Description P/N 2537185-0001
- Explorer 7-Slot Chassis General Description P/N 2243143-0001
- Explorer Diagnostics Manual P/N 2533554-0001 Rev. E
- Introduction To Explorer P/N 2243190-0001

Proceed through this self study at your own pace. You are provided with short learning worksheets in each section of the course. ***Use them as an emphasis*** of what you should learn. Answers to the worksheets are provided at each exercise. At the end of the course ***complete the final test*** in Appendix A of this package. The last thing to do is ***complete and mail*** the self-addressed post card. Once your card is received at the Ed Center, ***you will be posted*** with model codes 430 and 435.

Throughout this guide you will see comments or instructions to aid in your learning process. These instructions will appear in ***BOLD ITALIC***.

GOOD LUCK AND GOOD LEARNING!

Please find the worksheet on the following page and fill it out as you go through the material presented in this section.

1.2. Learning Worksheet

This worksheet is designed to emphasize the key points that you should learn about servicing the Explorer II system. Please fill it out as you procede through the Introduction/Overview section of this FTB.

1. List any possible differences in hardware between the Explorer I and Explorer II system below.

2. You wish to test the Explorer II processor board. What test would you run to fully check the processor?

3. List the major physical differences between the Explorer I and II processor boards below.

4. List the major functional differences between the Explorer I and II processor boards below.

5. List the major physical differences between the earlier 8 Mbyte and the new 32 Mbyte memory boards below.

6. List the major functional differences between the earlier 8 Mbyte and the new 32 Mbyte memory boards below.

7. Where is the Floating Point Processor board installed in the chassis?

8. List the major functional differences between the Explorer II chassis and the chassis used with Explorer I below.

1.3. Product Overview

The Explorer II System is an enhancement to the existing Explorer I System. Explorer II is software compatible with the earlier Explorer I system. The primary difference between Explorer I and II is that the Explorer II processor board is a single board CPU utilizing the high speed state-of-the-art VLSI Lisp processor chip. Other differences include the elimination of the Local bus (P-2), the addition of on-board Cache memory and virtual memory mapping on the processor board.

Other hardware additions introduced with the Explorer II system include:

- A floating point option processor that connects to the Explorer II processor via P-2. (This option will be available in the future).
- New error correcting memory boards in 8, 16, and 32 Mbyte sizes are also shipping with Explorer II. These memory boards are addressed over the NUBUS exclusively and utilize TI's 1 Megabit RAM chips.
- The use of the same 7-slot enclosure used with the BS1500 computer systems. This chassis uses the 110 amp power supply.
- A modified System Interface Board (SIB) P/N 2236645-0002 will be shipped with Explorer II systems. The Explorer II system uses the terminator clock for NuBus timing rather than the SIB on-board clock. Modifications were made to this board (PFWP and Overtemp signals rerouted) so that the "- 2" SIB can operate in the Explorer II backplane. The "- 2" SIB should not be installed in the Explorer I backplane.

All other system boards (Ethernet Controller, NUPI, etc.) are identical to those used with Explorer I systems.

The Release of LISP revision 3.0 software is concurrent with the Explorer II. Lisp 3.0 will run on Explorer I.

The Explorer II processor is offered both as a complete system from the factory and as a field upgrade to existing Explorer I systems.

1.4. Questions and Answers

OK let's get real. What are the major factors associated with the Explorer II system that effect my job?

You will install and troubleshoot the Explorer II systems.

- Though installation of these systems will be similar to earlier Explorer I systems you will have to learn the slot assignments for the new hardware and run the EXP2 test on the new processor/floating point and GDOS rev 1.4 tests on the new hardware. (*Section 2 of this FTB deals with this*)
- In order to troubleshoot the system you will have to learn how to interpret the Explorer II and memory board status LEDs; identify and interpret Floating Point Processor error conditions; perform single and multiple board test procedures; and run and interpret the new GDOS 1.4 and EXP2 tests. (*Section 4*)

You will upgrade an existing Explorer I to an Explorer II system in the field. (*Section 3*).

- Aid a customer in system upgrade preparation.
- Perform an Explorer I to Explorer II system upgrade by installing the new processor and possibly other purchased options.
- Load and Execute EXP2 test on the Explorer II Processor. Test all additional installed hardware GDOS 1.4 tests.
- Update the FNS data showing that the customer's system is now a Model Code 435.

P.S. You might think of the above as the objectives of this course.

What are the differences between GDOS revision 1.3 and 1.4.

GDOS release 1.4 was written to run under the Explorer II environment while still supporting Explorer I. Only minor changes were made to the GDOS test menus and those should not throw you when you execute GDOS release 1.4. Your GDOS tape includes one version of GDOS for Explorer I and one for Explorer II. In addition, EXPT (Explorer I) and EXP2 (Explorer II) are included on the tape.

What are the differences between EXPT and EXP2?

EXPT was written to test the Explorer I processor and memory boards. EXP2 was written to test the Explorer II processor and memory boards. EXP2 is designed to run in an environment that uses the NuBus to address all memory locations and test the Explorer II lisp chip and supporting architecture.

The EXP2 test is described in detail in Section 2 of this FTB.

What changes have been made to the existing Explorer documentation?

- The Field Maintenance Manual Addendum contains information pertinent to the Explorer II as well as the Explorer LX systems.
- The Explorer Diagnostic GDOS Manual was rewritten so that it covers the use of GDOS release 1.4. This covers the testing of all Explorers (I, II, and LX) including the use of EXP2 (Explorer II stand alone test).

What are the Product Codes for all these new products?

- Explorer II System - Product Code 430
- Explorer II Chassis - Product Code 432
- Explorer I upgraded to II - Product Code 435

What's involved in an Explorer I to II upgrade?

The major tasks are installing the Explorer II processor board (and options if any) and testing the new processor and other added options (if any).

I would tell you more at this point but upgrades are covered fully in section 3 of this FTB.

I've heard of the new TI Lisp Processor chip. What makes it so revolutionary?

The lisp processor chip has the highest number of components ever put in a VLSI format with 553,687 transistors and 116,736 bits of RAM. That is about twice the number of transistors than the next highest density chip.

What functional blocks are included in the Explorer II processor and option boards? How does this processor differ from the Explorer I?

Read section one of Explorer II General Description Manual for an overview of the processor board. A brief top-level view is given here. (See Figure 1-1) If you require more detailed information, refer to section 3 of the Explorer II General Description Manual. In a nutshell.....

- **Lisp Microprocessor chip** - A VLSI chip that replaces most of the logic on the Explorer I two-board assembly. The chip connects to the board over 264 pins. The Lisp processor operates at a higher clock speed than Explorer I; uses 64 bit microinstructions as opposed to 56 for Explorer I; and uses a four-deep microinstruction pipeline as opposed to two deep in the Explorer I; all giving the Explorer II higher throughput than Explorer I.
- **Error and Status LEDs** - The processor board has one fault LED and 12 status LEDs. If an error condition is detected during power up or normal operation, the fault led will light and the error reported on the 12 status LEDs. *Section 4 describes how to interpret these status LEDs.*
- **Processor Busses** - There are five internal busses used on the Explorer II Processor board. They include the Virtual Memory Address bus, the data bus, the internal NuBus data bus, the internal NuBus address bus, and the master address bus.
- **Virtual Memory Mapper** - This provides virtual-to-physical address mapping for the processor.
- **Cache Memory** - A two-way set-associative cache with 16K words each for a total capacity of 128 K bytes.
- **MicroInstruction Control Store** - Writeable Control Store (WCS) for the Explorer II is divided in two parts; ROM and RAM. The ROM portion is internal to the Lisp CPU chip and contains selftest and system loader information. WCS RAM is located on the processor board (external to the Lisp chip. This contains self test and system loader information.
- **Configuration ROM** - Stores board ID and configuration information (as in the Explorer I).

- **Connectors** - The processor is a Standard EuroCard with three connectors (P1 - P3). P1 is the NuBus interface connector. P2 is used to interface to the floating point option. P3 is a spy port used for diagnosing board failures in the factory.
- **Floating Point Processor Option** - The floating point processor adds flexibility and efficiency to Explorer II numeric processing. It is enclosed in a metal housing similar to the NuBus terminator cards. The option plugs into P2 of the processor slot on the opposite side of the mother board from the processor board.

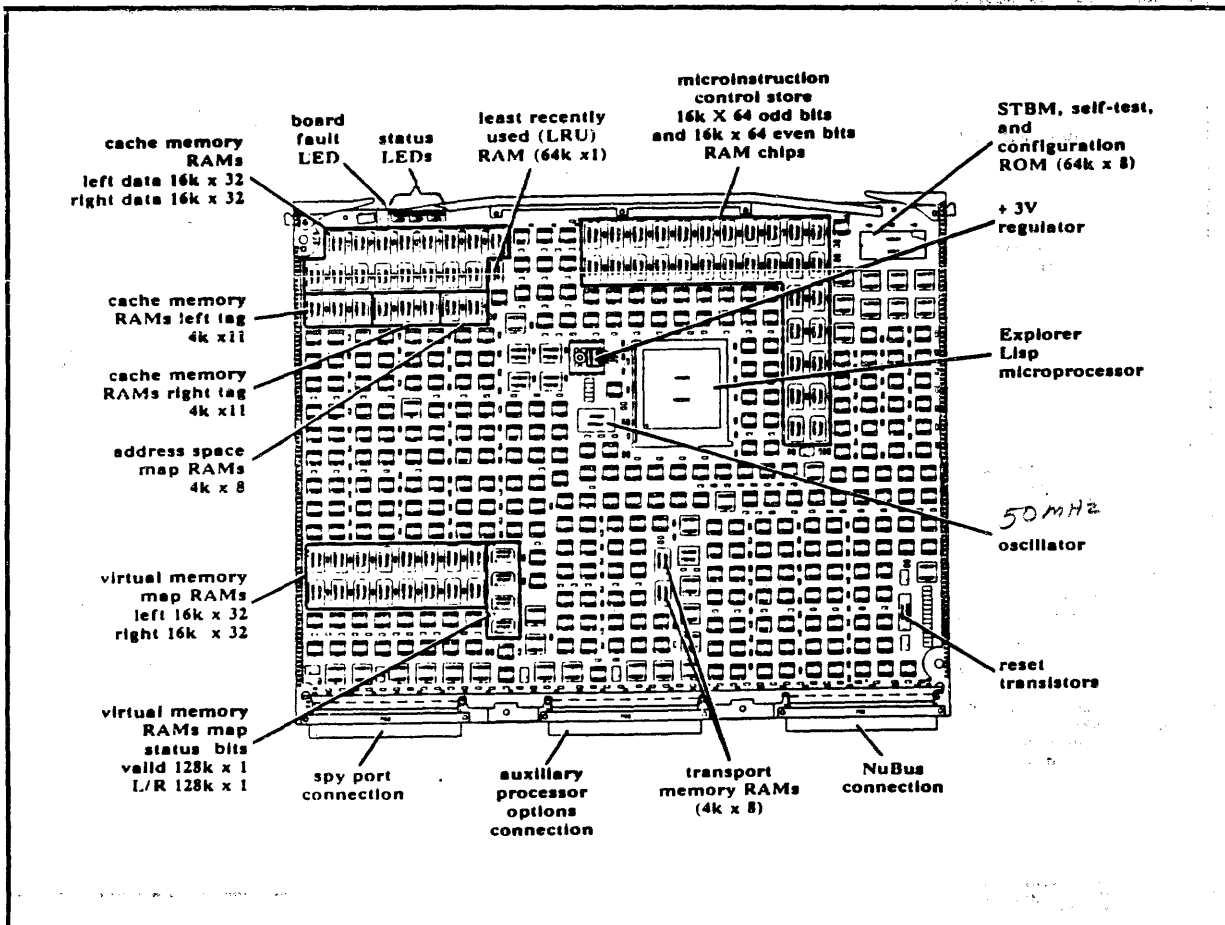


Figure 1-1 Explorer II Processor

What functional blocks are included in the 8, 16, and 32 Megabyte error correcting memory boards? How do they differ from the older memory boards?

Read Section one of the Explorer 32-Megabyte General Description Manual for a brief general description of the new memory boards. Refer to Section three of that manual if you require more information or detail than provided below. (See Figure 1-2)

- **DRAM Memory** - The board is organized into four rows of up to 64 1-Mbit DRAM chips. Each row consists of two banks (A and B) with 32 chips each. Each memory data word contains 32 bits (data) and a 7-bit check word.
- **Error Correction** - There are four rows of 14 check bit data chips that provide storage for the 7-bit check word. Parallel

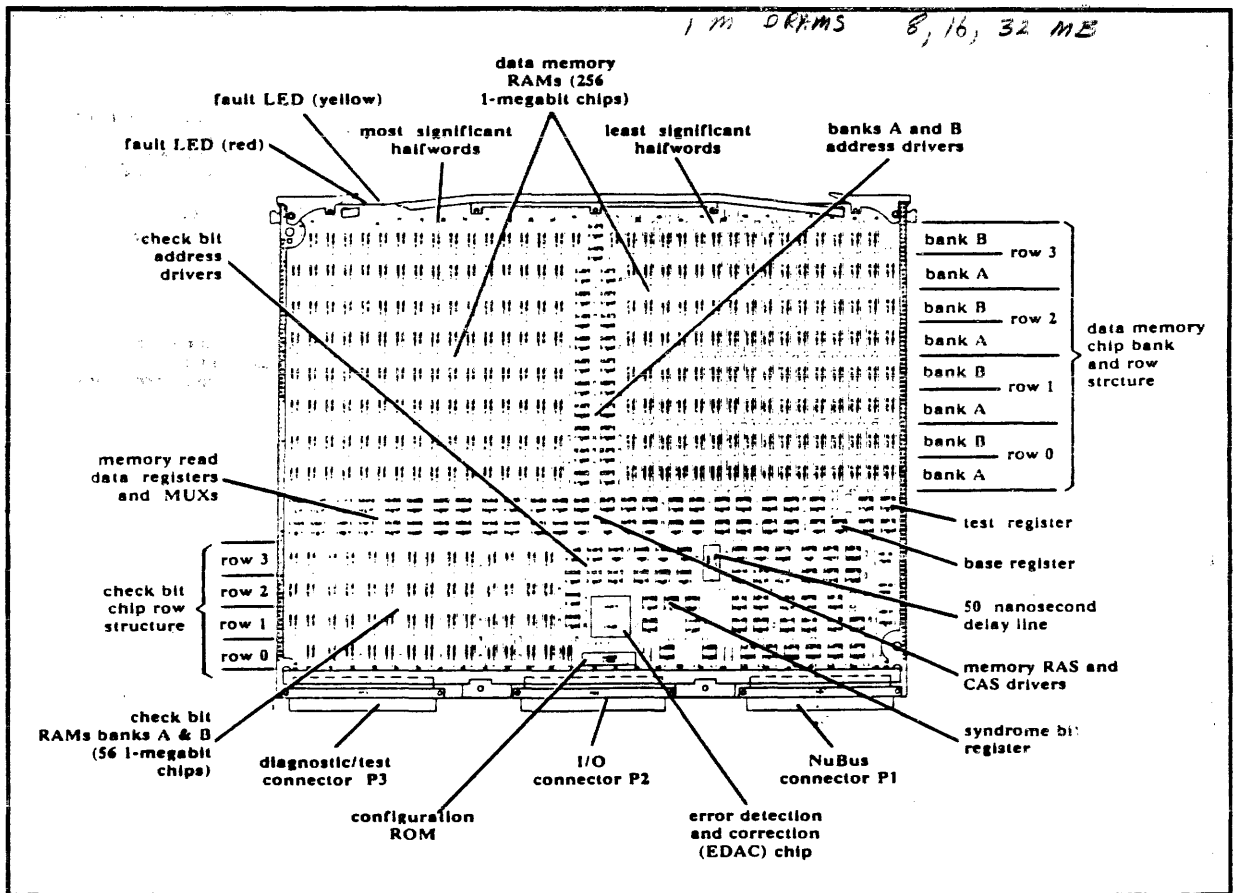


Figure 1-2 32 MByte Memory Board

error detection and correction logic compares each check word, detects errors (if any), and then attempts to correct them.

- **Error LEDs** - The memory board has one red and one yellow error LED. The red LED lights when an uncorrectable error is detected. The Yellow LED lights when a correctable error occurs.
- **Configuration ROM** - The configuration ROM stores board ID and system information as those used in earlier memory boards.
- **Connectors** - This is a standard EuroCard board with three connectors (p1 - p3). P1 is the NuBus interface connector. The new memory boards serve as a NuBus slave to other elements in the enclosure. P3 is used for general I/O operations. These new memory boards do not use the local bus. they are addressed through the NuBus exclusively. P3 is a test and diagnostic port for factory testing.

1.5. Learning Worksheet Answers

Use this to check your worksheet answers. References to additional information are for your convenience.

1. List any possible differences in hardware between the Explorer I and Explorer II system below.

Explorer II Processor Board; 8, 16, and 32 Mbyte memory boards; Floating point option board; "- 2" SIB; and S1500 7-slot enclosure. All other Explorer hardware is the same.

2. You wish to test the Explorer II processor board. What test would you run to fully check the processor?

EXP2 stand alone test

3. List the major physical differences between the Explorer I and II processor boards below.

The Explorer II processor is a single board opposed to the dual board Explorer I. The Explorer II has the Lisp processor chip and one error and 12 status LEDs.

Section one of Explorer II General Description Manual has a general overview of the processor board.

4. List the major functional differences between the Explorer I and II processor boards below.

Explorer II uses the Lisp Processor chip architecture providing higher throughput than the Explorer I. The Local Bus has been eliminated and Cache memory and virtual memory mapper has been incorporated into the Explorer II processor board. P2 is used for the Floating point processor.

If you require additional information, refer to section 3 of the Explorer II General Description Manual.

5. List the major physical differences between the earlier 8 Mbyte and the new 32 Mbyte memory boards boards below.

The 32 Mbyte board has a red (hard error) and a yellow (soft error) LED. It also uses four rows of up to 64 1-Mbyte RAM chips with four rows of error correcting memory chips.

Section one of the 32 Mbyte General Description Manual for a general overview of the memory board.

6. List the major functional differences between the earlier 8 Mbyte and the new 32 Mbyte memory boards boards below.

The 32-Mbyte memory board uses higher capacity RAM devices with parallel error detection and correction for each memory word. The data word is 32 bits of data with a 7-bit check word.

If you require additional information, refer to section 3 of the 32 Mbyte General Description Manual.

7. Where is the Floating Point Processor board installed in the chassis?

The Floating point is installed in P2 of slot 6.

8. List the major functional differences between the Explorer II chassis and the chassis used with Explorer I below.

The Explorer II chassis is the same one used with the S1500 system. It has a 110 amp power supply with a backplane with no Local Bus. The Explorer I chassis has an 80 amp power supply with Local Bus.

2. Explorer II Installation

This section deals with installation considerations for the Explorer II system and its components. Installing the Explorer II is not that different than an Explorer I installation. However, there are a few differences in the Explorer II you should be aware of:

- 7-slot Chassis differences
- Explorer II/Floating Point Processor board differences
- 32-Mbyte Memory board differences
- "- 2 SIB" differences
- System Testing differences
- Lisp 3.0 Highlights

Please find the question sheet on the next page and fill it out as you go over this material. Answers are provided at the end of this section.

2.1. Learning Quiz

Answer these questions as you go through the material in this section. This is a tool to aid you in learning the major Explorer II topics that effect your job.

1. Briefly list the major differences between the 110-amp chassis used with the Explorer II and the 80 amp chassis used with Explorer I below.

2. During normal operation, the processor status LEDs display 63. What is the happening to the system at that time?

3. How is it possible to use the 32 Mbyte error correcting memory board in an Explorer I system?

4. What does the yellow LED on the 32 Mbyte ECC memory board indicate in the ON condition?

5. You wish to test the Explorer II processor board. What test would you use? Briefly describe the steps you would use to load (off of a disk) and execute the test.

6. What new peripherals are now officially supported by Lisp release 3.0?

7. What new communication protocols are supported by Lisp release 3.0?

2.2. 7-Slot Chassis Installation Considerations

Quickly scan chapter 2 of the 7-slot General Description Manual. Note the differences between the Explorer I and II chassis in the manual and this section. Additional information on the chassis may be found in Section 3 of the General Description Manual.

The Explorer II system is shipped from the factory with the same 110 amp power supply and chassis used in the S1500. (See Figure 2-1)

Major differences between this chassis and the earlier include:

- The Explorer II chassis has a 110 amp power supply whereas the earlier chassis has the 80 amp power supply.

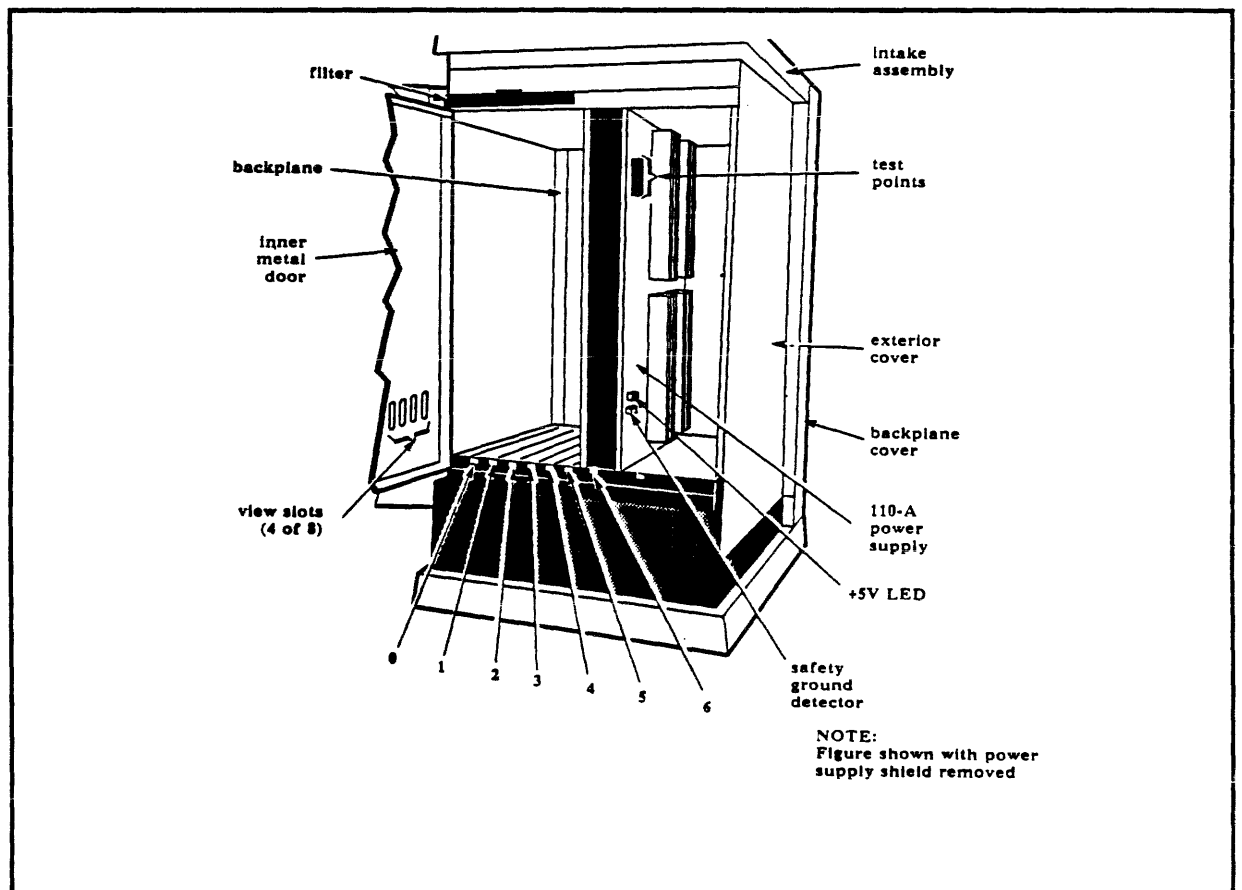


Figure 2-1 Explorer II Chassis

- The Explorer II chassis backplane does not support the Local Bus used by the Explorer I processor and other signals (POWER RESET, etc.) are routed differently. The Explorer II system runs off the NuBus terminator clock rather than the SIB on-board clock as in the Explorer I. The Explorer I processor or early (local bus) memory board do not function in this new chassis. Slot 6 (processor slot) P-2 supports the Floating Point Option that plugs in the same manner as NuBus terminator boards.
- The Explorer II AC power input section has circuit breaker protection as opposed to a fuse. The auxiliary AC plug receptacles used in the Explorer I are not provided in the Explorer II chassis. (See Figure 2-2). The fan motor power supply used in Explorer I chassis is replaced by the power interface board in the Explorer II chassis.

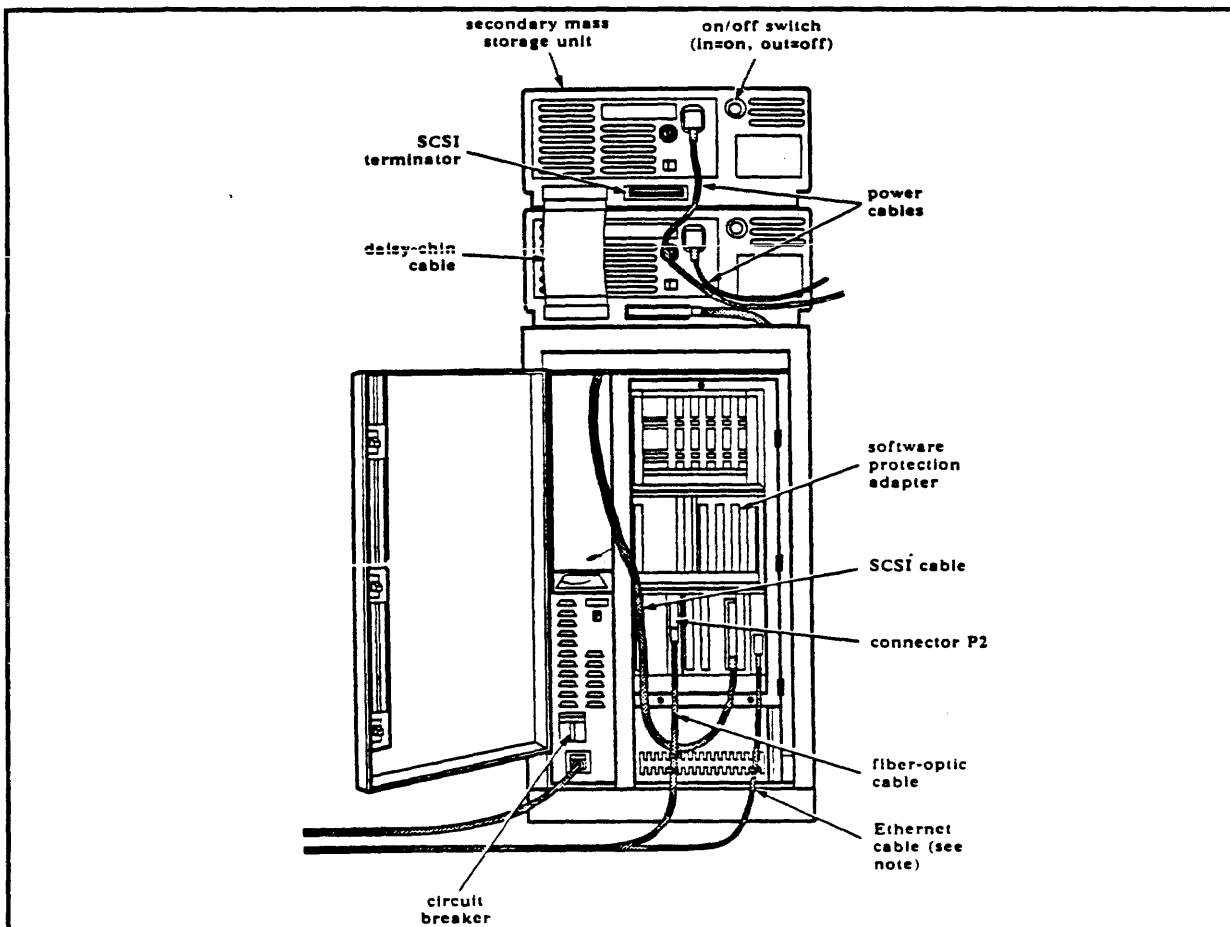


Figure 2-2 Explorer II Cabling

- The 110 Amp power supply has test points providing the following voltages: (Figure 2-3)

110 Amp Power Supply test points.

- TP8 - +12 VDC
- TP7 - -12 VDC
- TP6 - - 5 VDC
- TP5 - PFWD-
- TP4 - RESET-
- TP3 - TEMP-
- TP2 - + 5 VDC
- TP1 - GND

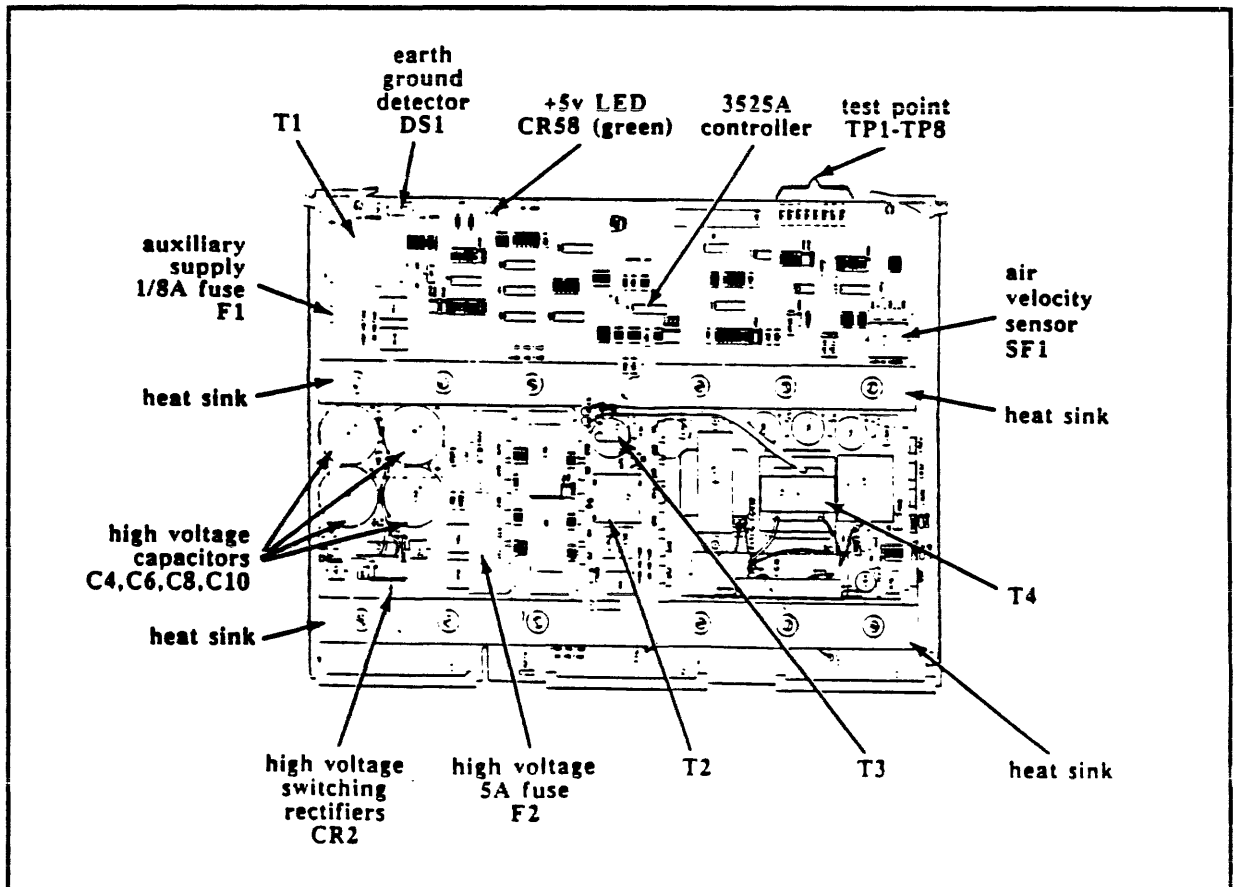


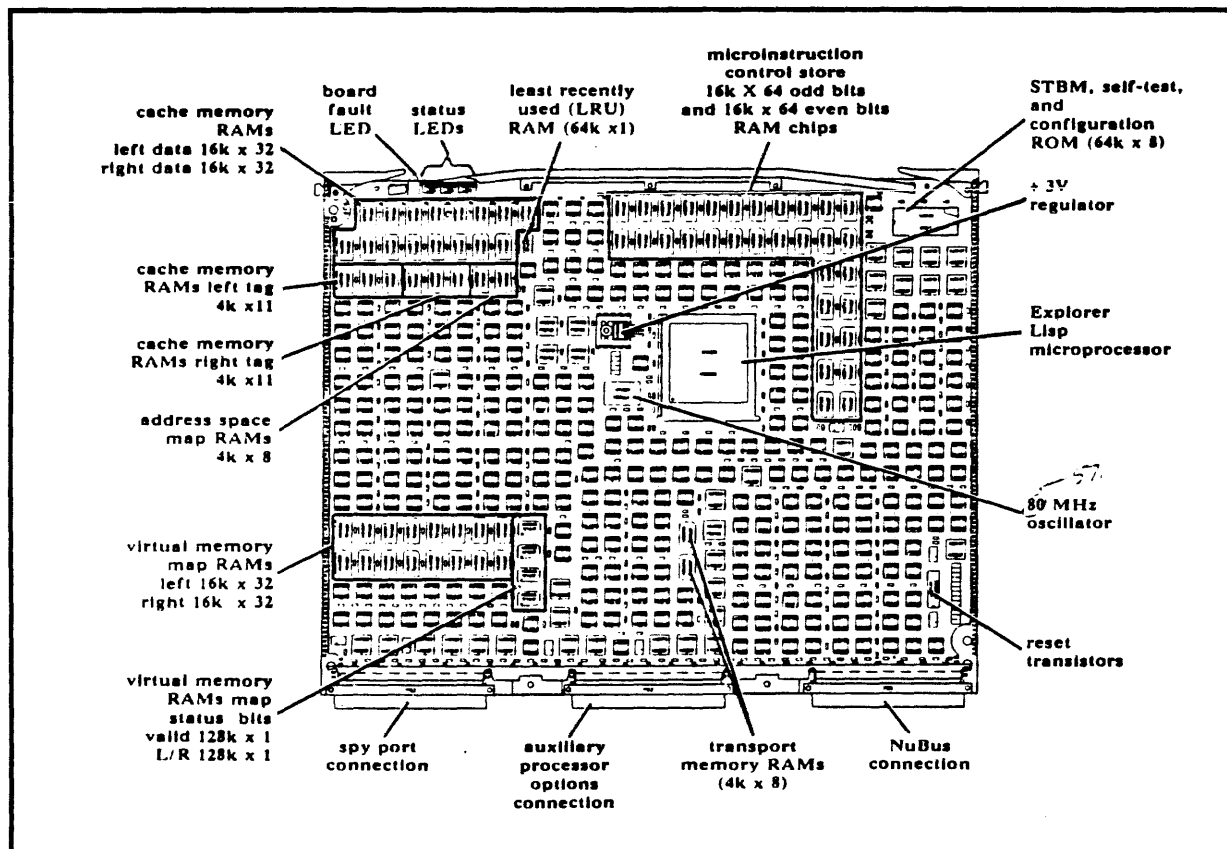
Figure 2-3 110 Amp Power Supply

2.3. Explorer II Processor Installation Considerations

The Explorer II processor can function in any slot of the chassis but must be installed in slot 6 only due to cooling requirements.

The Explorer II Processor board has one red and twelve yellow LEDs. (See Figure 2-4) During power up the board executes a self test and then coordinates other system testing much like the Explorer I. You will see the fault LED blink twice and the status LEDs blink through a set of patterns as self test and booting (STBM) progresses. If a processor fault occurs during power up, the red LED lights and the yellow LEDs show a status (see error status is in section 4 of this FTB).

During normal STBM operations, the processor LEDs also show status. These status codes are displayed with the red fault LED OFF. The STBM LED status is described in the next two tables.



2-4 Explorer II Processor Board

Reading from top to bottom, the first five processor LEDs are hardware defined bits. The last seven bits are read from top (most significant) to bottom (least significant bit) to form the status codes shown below. The red fault LED is at the bottom of the status LEDs.

LED Definition

- o HALT
- o HANG
- o LEFT CACHE HIT
- o RIGHT CACHE HIT
- o CACHE FILL
- o MSB STATUS
- o
- o SEE STBM STATUS TABLE
- o (NEXT PAGE)
- o
- o
- o LSB STATUS
- o RED FAULT LED

Once STBM operations complete, the LEDs continue to show status as the system boots and normal Lisp operations occur (see table below). If the system crashes during these operations, the Lisp status code remains displayed.

Explorer II Processor Lisp Status Reports

Status Hex Description

- | | |
|----|-----------------------------|
| 01 | Lisp boot code entered |
| 02 | System memory acquired |
| 03 | Lisp band disk label read |
| 04 | Entered first Lisp function |

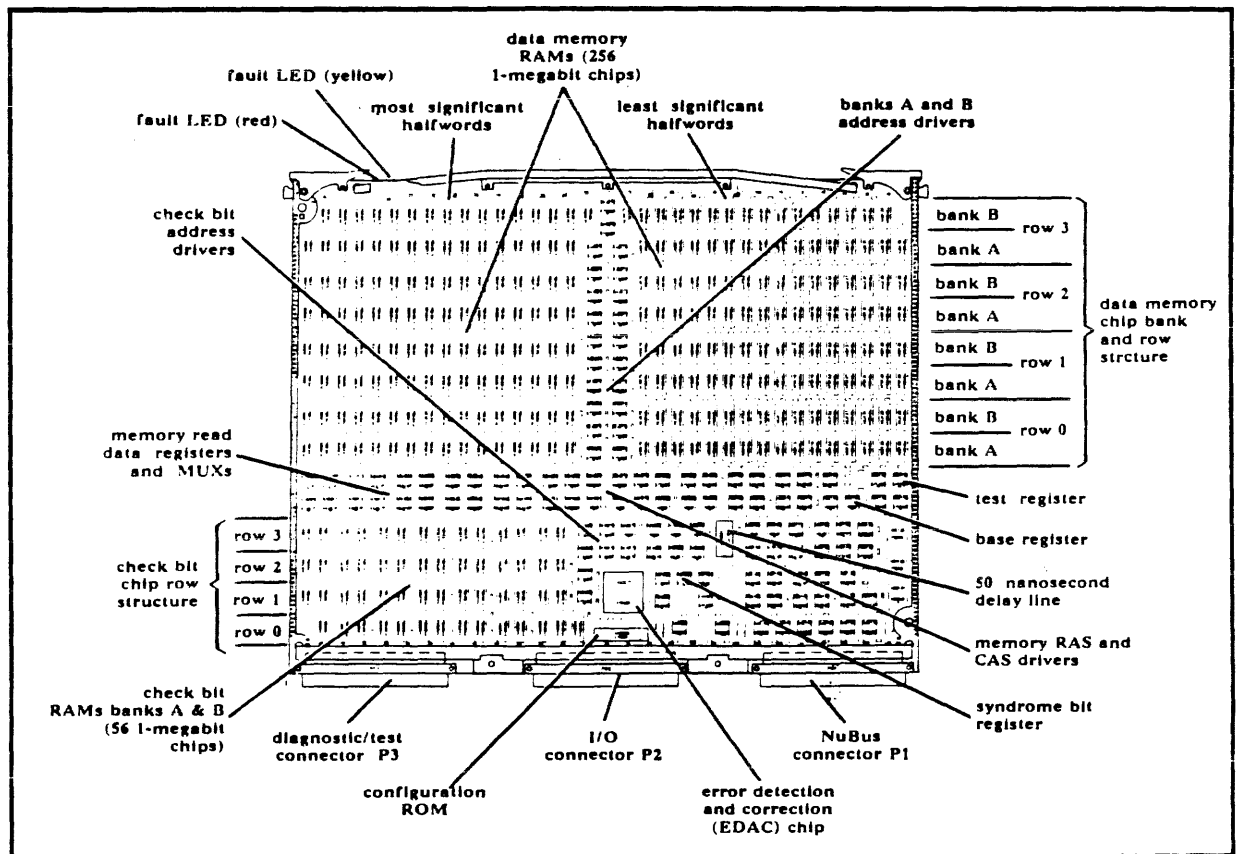
Explorer II Processor STBM Status Reports (Fault LED OFF)**Status Hex Description**

- 0n** STBM arbitration phase for slot n.
- 1n** NVRAM search phase for slot n.
- 2n** Monitor search phase for slot n.
- 3n** Memory search phase for slot n.
- 4x** STBM testing chassis slot with fault LED x = following:
 - 41** ROM test (C3, format version, CRC)
 - 42** Self-test
 - 44** NuBus test
 - 48** Interface diagnostic
- 5n** Keyboard search phase for slot n.
- 60** At top level of the STBM menu.
- 61** Attempting default boot.
- 62** Building device menu.
- 63** Waiting for load device to come ready.
- 64** Reading partition from load source.
- 65** Processing MCR sections, except last section.
- 66** Loading WCS, PDL to A-type/M-type, and entering new code.
- 70** Waiting for first Secondary event.
- 71** Processing first Secondary event.
- 72** Waiting for second Secondary event.
- 73** Processing booting quietly.
- 78** Waiting for RAM download (P3, mode 5).

2.4. 32 Mbyte Error Correcting Memory Board Installation Considerations

The 32 Mbyte error correcting memory board is marketed in either 8, 16, or 32 Mbyte configurations. For the purposes of this discussion any reference to the "32 Mbyte" memory board refers to all three configurations.

- The 32 Mbyte memory board is not addressed over the Local bus and therefore can operate in any slot of the Explorer II chassis. Typical systems shipped from the factory will have the 32 Mbyte memory board in slot 4 with option memory boards in slot 3.
- The 32 Mbyte memory board has a red and a yellow LED. (See Figure 2-5) These LEDs function as follows:



2-5 32 MByte EC Memory Board

<u>Red LED</u>	<u>Yellow LED</u>	<u>Condition</u>
OFF	OFF	No error (normal)
OFF	ON	Correctable (soft) error
ON	OFF	Self test running (or failed) or board reset.
ON	ON	Uncorrectable (hard) error

- The 32 Mbyte memory board can operate as an option memory board in Explorer I systems. However, the earlier 8 Mbyte memory board (P/N 2243910) must occupy slot 4 of the chassis or the system will not boot (due to use of the local bus). The new 32 Mbyte memory board can only be used as an option memory in any slot except slot 4 of Explorer I system enclosures.

2.5. "- 2" System Interface Board

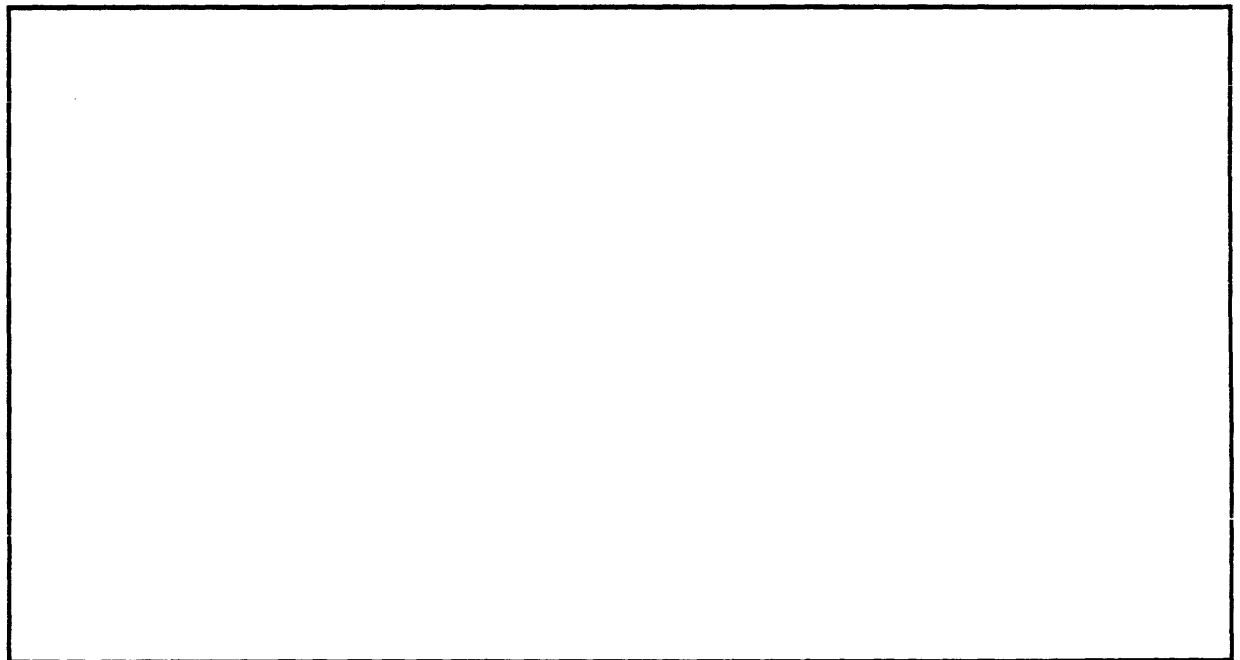
The SIB P/N 2236654-0002 used in Explorer II systems shipped from the factory have been modified and are functionally different than earlier "- 1" SIBs. The on-board clock has been disconnected and pins have been changed to accept certain signals (OVER TEMP and PFWP Power Failure Warning Pulse) from the backplane used in the Explorer II system. The "- 2" SIB cannot operate in the Explorer I (local bus type) enclosure and backplane.

2.6. System Testing Considerations

The Explorer II booting procedure is identical to that of the Explorer I with only minor changes made to the STBM menu.

To test the newly installed Explorer II systems you must load and execute GDOS rev. 1.4 or later and(or)the EXP2 (standalone processor) test.

- **GDOS** - GDOS rev. 1.4 is booted in an identical fashion as earlier releases. Simply boot the system and press "G" at the system boot menu. The GDOS menu will appear (once the appropriate load device is set). The main GDOS menu guides you in selecting the appropriate tests.
- **EXP2** - The Explorer II standalone test (EXP2) is brought up by selecting Menu load and then Diagnostic load (same procedure for EXPT). Once the Microcode load device is selected, a prompt will ask you if you wish EXP2 to be loaded. The EXP2 menu is then displayed. (Figure 2-6).



2-6 EXP2 Test Menu

Take a minute and scan section 2 of the Explorer Diagnostic manual paragraphs 2.1 through 2.6. These give you a review of The Explorer II STBM menu, how to boot GDOS and the standalone processor tests. Note that this manual has been rewritten to cover testing Explorer I, Explorer II, and Explorer LX systems.

The EXP2 diagnostic menu is quite different from that of EXPT. Normally you would wish to loop on all processor tests in the field. Note that most of the differences in EXP2 stem from the different logic used on the Explorer II processor board. In addition a Floating point processor test menu has been added.

Now read paragraph 2.7 of the Explorer Diagnostic Manual. This explains how to run EXP2 on your system. Note that Appendix B of that manual explains all of the EXP2 test menus. Take a look to see what each EXP2 test will do for you.

2.7. Lisp Revision 3.0 Highlights

Lisp 3.0 is released at the same time as the Explorer II. This revision of Lisp runs on both Explorer I and II. It is compatible with previous releases with the following major enhancements:

- This release of software includes several enhancements that allow faster program performance than earlier releases. Changes to the Lisp kernel, the complete implementation of common Lisp, and enhanced "Temporal" (time-related) garbage collection bring this about.
- Networking has been enhanced adding the DECnet and 3270 network protocols. Present network protocols (ie. SNA) have also been enhanced. Networking with Lisp 3.0 is totally different than with the earlier revisions.
- Software supports up to 128 Mbytes of physical memory, rather than the previous 16 Mbyte limit to make use of the 32-Mbyte error correcting memory boards.
- A later release of Lisp will support the use of the Explorer II optional floating point processor.

The following devices are officially supported with the release of Lisp 3.0:

- The WD900 SMD disk drive can be used with the MSC controller.
- The MT3200 1/2 inch reel tape drive with the NUPI controller. The tape drive uses the standard SCSI interface and is supported as a general backup device. It can not support a bootable tape format.
- The 880 printer is supported.
- The OmniLaser 2015 printer is supported in 855 and HPLaser Jet Emulation modes. The 2108 and 2115 PostScript OmniLasers will be supported shortly after the release of 3.0 via a patch.

The Introduction to Explorer Manual appendix B through F contain information regarding the setup and use of Explorer peripheral equipment.

2.7.1 How Lisp 3.0 Effects your Job

System Booting

The Explorer II boots in much the same manner as the Explorer I.

Take a look at section 4 "Starting the System" of the Introduction to Explorer manual for a review of system booting procedures and a look at the STBM and Lisp Listener menus.

Disk Maintenance

Lisp 3.0 base software for the Explorer I and II is contained in the same load band. However the microcode (MCR) band for Explorer I processors is different from that of the Explorer II.

Look at section 12 "Maintaining a Disk" of the Introduction to Explorer manual for information on disks used with the Explorer I and II.

Networking

The following new network protocols are supported with the release of Lisp 3.0.

- **DECnet** - This supports communication with DEC hosts via an Ethernet.
- **IBM 3270** - This supports communication using the communications carrier board in the Explorer in 3270 terminal emulation.

Lisp 3.0 networking has been redone using the "Namespace Management System." This system provides a general name management tool window with both a program interface and an interactive editor based on the ZMAC Editor. This provides an easy format for network creation and modification.

The Explorer Field Maintenance Supplement section ST chapter 2 contains a software overview for Explorer I, II, and LX systems including Lisp release 3.0. Paragraphs 2.1, 2.2, and 2.4 contain information pertaining to the Explorer II system and Lisp release 3.0.

2.8. Learning Quiz Answers

These are the answers to your learning quiz. References to information sources are provided for your convenience.

1. Briefly list the major differences between the 110-amp chassis used with the Explorer II and the 80 amp chassis used with Explorer I below.

The Explorer II chassis obviously contains a 110-amp power supply. The 110-amp chassis backplane contains no Local Bus so that Explorer I will not function in it at all. Power distribution is different in that the 110-amp contains a circuit breaker (instead of a fuse) and has no built in AC receptacles for the bricks.

The Explorer 7-slot System Enclosure General Description manual section 1 contains general information about the Explorer II chassis.

2. During normal operation, the processor status LEDs display 63. What is the happening to the system at that time?

63 = Waiting for load device to come ready.

The Explorer Field Maintenance Supplement section MP (Memory and Processor Boards) has Explorer II status LED Information.

3. How is it possible to use the 32 Mbyte error correcting memory board in an Explorer I system?

The 32 Mbyte error correcting memory board can be used as an option memory board in any slot (though normally slot 3) of the chassis. The earlier local bus memory boards must be used as primary memory in slot 4. The Explorer I processor board will not boot without a (local bus) memory board as primary memory.

The 32 Mbyte Memory General Description Manual section 2 (Installation) has installation consideration information.

4. What does the yellow LED on the 32 Mbyte ECC memory board indicate in the ON condition?

The yellow LED on the 32 Mbyte memory board indicates a soft (correctable) memory error when the red fault LED is not on. If both the red and yellow LEDs are lit at the same time, then a hard uncorrectable error has occurred.

5. You wish to test the Explorer II processor board. What test would you use? Briefly describe the steps you would use to load (off of a disk) and execute the test.

After running normal and extended self tests, the EXP2 standalone test should be used to fully test the Explorer II processor board. If EXPT exists on a disk it is brought up by booting the system, selecting Menu load, and then Diagnostic load (same procedure for EXPT). Once the Microcode load device is selected, a prompt will ask you if you wish EXP2 to be loaded. The EXP2 menu is then displayed. Select the test all option to test the processor.

The Explorer Field Maintenance Supplement section ST (System troubleshooting describes Explorer II processor troubleshooting. The Explorer Diagnostic Manual Section 2 and Appendix B describes how to load/execute EXP2 and what the EXP2 tests are.

6. What new peripherals are now officially supported by Lisp release 3.0?

The WD900 SMD disk drive can be used with the MSC controller. The MT3200 1/2 inch reel tape drive with the NUPI controller is supported as a general backup device only. The 880 printer and OmniLaser 2015 printer are also supported.

7. What new communication protocols are supported by Lisp release 3.0?

DECnet supporting communication with DEC hosts via an Ethernet is implemented in Lisp 3.0. IBM 3270 communication using the communications carrier board in the Explorer in 3270 terminal emulation is also included.

3. Field Upgrade

This section deals with upgrading an Explorer I system to an Explorer II. Field upgrades are covered in the following sections:

- Field Upgrade Considerations
- Field Upgrade Checklist

Please find the learning worksheet on the next page and fill it out as you go.

3.1. Learning Quiz

Use this worksheet as an aid to help you focus your learning.

1. Describe the hardware that could possibly be involved in an Explorer I to II upgrade call. How would you test this hardware after installation?

2. You arrive at an upgrade call, install the hardware, and notice that EXP2 is not available on the customer's disk. How do you test the new hardware?

3. What model code is assigned to an Explorer I system that has been upgraded to include the Explorer II processor?

3.2. Field Upgrade Considerations

Keep in mind the following items regarding Field Upgrades.

- The upgrade itself consists of installing the Explorer II processor board in the customer's existing 7-slot chassis (80 amp power supply). However the customer may order the Floating Point option processor or the 32 Mbyte EC Memory board at the time of the upgrade. You would install these boards with the Explorer II processor and test all new components in this case.
- Explorer II hardware is released at the same time as Lisp Release 3.0 software. The customer is responsible for updating his/her software to 3.0. It is not part of your upgrade procedure. Keep in mind that there are separate microcode (MCR) bands for the Explorer I and II processors.
- The Explorer II upgrade kit does not contain either Lisp 3.0 or GDOS 1.4.
- EXP2 test must be used to test the Explorer II processor board. The customer is responsible for placing EXP2 test onto their system disk.
- Once the upgrade procedure is accomplished, you will place a new label on the system designating it as product code 435 and update the FNS data base.

3.3. Field Upgrade Checklist

Use this checklist as a job aid when performing Explorer I to II field upgrades.

Explorer II Field Upgrade Checklist

1. _____ When you receive the upgrade call, contact the customer and verify the customer has received and installed LISP 3.0 and EXP2 test on a system disk. Be sure that you take a bootable tape containing of EXP2 and GDOS revision 1.4 on the upgrade call

2. _____ Confirm a time for the upgrade and make note of any special customer site requirements (i.e. security, etc.).

3. _____ Arrive on site and install the Explorer II processor board in slot six of the 7-slot chassis.

4. _____ Install any additional option devices (Floating Point Processor or 32 Mbyte Memory boards).

5. _____ Take a look at the enclosure to insure all boards are installed in the correct slots.

6. _____ Turn power on and observe the results of STBM selftesting. Note any board failure LEDs that remain lit after selftest.

7. _____ If EXP2 test is available on the customer disk skip step 9.

8. _____ Install and boot GDOS tape release 1.4 in the customer's tape drive.

9. _____ Load EXP2 and execute Loop on all tests for five minutes to test the Explorer II processor board. Execute extended tests on the rest of the system.

Do not copy EXP2 over the EXPT band on the customer's disk. EXP2 is larger than EXTP and may destroy customer data if it is copied over the EXPT band.

10. _____ After the system is tested, install the new serial number tag on the system enclosure. This identifies the system as Model code 435.

11. _____ Close out the upgrade ticket noting that the upgraded system is now Model code 435.

The customer must ensure that the Explorer II microcode band is present on the system disk for the Explorer II processor to operate.

3.4. Learning Quiz Answers

1. Describe the hardware that could possibly be involved in an Explorer I to II upgrade call. How would you test this hardware after installation?

Explorer II processor board tested using EXP2 standalone diagnostics. Floating point processor board tested using EXP2 standalone diagnostics. 32 Mbyte error correcting memory tested using EXP2 standalone diagnostics.

2. You arrive at an upgrade call, install the hardware, and notice that EXP2 is not available on the customer's disk. How do you test the new hardware?

The bootable diagnostic tape must be installed and booted. EXP2 test is then loaded and executed on the processor.

3. What model code is assigned to an Explorer I system that has been upgraded to include the Explorer II processor?

The Explorer I model code 420 is changed to 435 after the Explorer II upgrade is performed.

4. Troubleshooting

The Explorer troubleshooting procedures and philosophies are not changed that much with the introduction of the Explorer II system. Several factors of the Explorer II system actually make system troubleshooting easier.

- General System Self Test Considerations
- Explorer II Processor Faults
- Troubleshooting with Diagnostics

The Explorer Field Maintenance Supplement section ST Chapter 4 contains troubleshooting information pertaining the Explorer I, II, and LX systems. Section ST chapter 3 contains a diagnostic summary for all versions of the Explorer.

Please find the learning worksheet on the next page and fill it out as you go through this material.

4.1. Learning Worksheet

Complete this worksheet as you proceed through the material in this section. Answers to this worksheet are at the back of this section.

1. The customer says that the Explorer II system will not boot. The processor board fault LED is on and the status LEDs 03 (from top to bottom). What is the failure indicated? What steps would you take to correct the failure?

2. The customer says that the Explorer II processor fault LED is lit during power up. The status LEDs read 3A hex. What is the failure indicated? What steps would you take to correct the failure?

3. The customer complains of system crashes. The 32 Mbyte memory board red failure LED is lit. What would you do to isolate the failure?

4. On power up an Explorer II system the fault light on the processor board lights and a status of 44 is displayed on the status LEDs. What would you do to correct the failure?

4.2. General System Self Test Considerations

Explorer II system architecture does not use the local bus used in Explorer I systems. The Explorer II system, as shipped from the factory, uses the terminator clock to run the NuBus rather than the SIB on-board clock (as in Explorer I). These two factors change the way the system behaves when you perform self test board troubleshooting.

- **Single board testing** - Either the NUPI board or Explorer II processor board can execute self test as the only board in the chassis (other than the power supply). Suspected NUPI board failures can be isolated by pulling all other boards out of the chassis and executing self test. The Explorer II processor will also execute self test as the only board in the chassis.
- **2 Card SIB test** - Possible SIB failures can be isolated by executing self test with only the Explorer II processor (slot 6) and the SIB (slot 5) present. All other boards can be removed and are out of the loop.
- **2 Card Memory or Ethernet board testing** - Either the Memory or the Ethernet boards can run self test with the processor board as the only other board in the system. Additional test should use extended test and GDOS release 1.4.
- **Floating Point Processor troubleshooting** - When installed (P2 of the Explorer II Processor), the floating point option card will be tested by the processor. Error codes on the processor board will indicate a floating point failure. The floating point should be removed and self test run again to confirm the failure. Further testing can be done using EXP2.

Read paragraph ST 4.8 of the Explorer Field Maintenance Supplement for more information on general system troubleshooting.

NOTE Explorer I upgraded to Explorer II in the field uses the earlier SIB (with NuBus clock) and therefore should be tested using the same procedures for board testing that apply to Explorer I.

4.3. Explorer II Processor Faults

The Explorer II processor has one red fault and 12 yellow status LEDs. During power-up self test the red fault led lights and the status LEDs report each test as it occurs. If a failure is detected the red LED remains on and the status LED indicates which part of the test has failed as shown in the next table. Generally, any of these failures would indicate a bad processor or NuBus hangup. Re-execute the self test to confirm the failure. Then isolate the processor and repeat the self test as shown under General System Troubleshooting.

Reading from top to bottom, the first five processor LEDs are hardware defined bits. The last seven bits are read from top (most significant) to bottom (least significant bit) to form the status codes shown below. The red fault LED is at the bottom of the status LEDs.

LED Definition

- o HALT
- o HANG
- o LEFT CACHE HIT
- o RIGHT CACHE HIT
- o CACHE FILL
- o **MSB STATUS**
- o
- o SEE NEXT TABLE
- o
- o
- o
- o **LSB STATUS**

- o **RED FAULT LED**

See next table for fault status codes.

Explorer II Fault Indicator LED Codes**Error Description****HEX**

- 01 LED Pattern test failed.
- 02 Lisp-Chip Signature Analyzer test failed.
- 03 Zeros and Ones test failed.
- 04 EPROM Integrity Check test failed.
- 05 Writable Control Store RAM Low test failed.
- 06 Kernal self-tests passed. Error occurred while attempting to load remainder of tests (07-3C) and STBM.
- 07-0F LISP-CHIP test failed.
- 10 External Control Register test failed.
- 11 Exchange Register test failed.
- 12 Event Posting Registers test failed.
- 13 NuBus Test Register test failed.
- 14 NuBus Configuration Register test failed.
- 15 NuBus Flag Register test failed.
- 16 Micro Second Timer test failed.
- 17 Event Timer test failed.

continued on next page

Explorer II Fault LED Codes continued**Error Description****HEX**

- 18-1B On board virtual Memory tests failed.
- 1C-1F On board Cache RAM tests failed.
- 20 Least Recently Used RAM test failed.
- 21 Transport RAM test failed.
- 22 Address Space Map RAM test failed.
- 23-2C NuBus Tests failed.
- 2D Page Fault test failed.
- 2E Virtual Memory Onboard test failed.
- 2F VMM NuBus Address test failed.
- 30 VMM NuBus Data test failed.
- 31 Address Space Map Functions test failed.
- 32 Cache XCRTFILLRD Path test failed.
- 33 Cache Unmapped test failed.
- 34 Cache Mapped test failed.
- 35 Cache Tag Addr Comparator test failed.
- 36 External Macro Test with Cache test failed.
- 37 External Macro Test with NuBus test failed.
- 38 Auto-Transport Test with Cache test failed.
- 39 Auto-Transport Test with NuBus test failed.
- 3A-3C Floating Point test fail
- 44 NuBus test failed when the STBM was testing itself.
- 71 There are no online devices from which to download specified.
- 72 A bad microcode format was found during an attempted download.
- 73 A device error occurred during an attempted download.
- 74 No good system memory was found.
- 75 A NuBus error occurred during download from the NuBus memory.
- 76 An MCR partition requires the floating point board.
- 7F The processor was unable to load code from the EPROM.

More detail regarding these fault indications can be found in Section 5 of the Explorer Diagnostic Manual.

4.4. Troubleshooting with Diagnostics

Most of the Explorer Diagnostics have not changed that much (with EXP2 being the exception. There are a few points to keep in mind though:

- **Extended Tests and Troubleshooting** Use the Explorer extended self tests as you always have in troubleshooting the system.
- **GDOS Release 1.4 and Troubleshooting** GDOS has been rewritten to run on any Explorer environment. However, the changes apparent to you are minimal. Load, boot, and execute GDOS rel. 1.4 as you have earlier releases.
- **EXP2 and Troubleshooting** EXP2 should be run in loop on all processor tests to thoroughly test the Explorer II processor board and the floating point option processor. Most processor related faults should appear during power up self test, however EXP2 is a more extensive test to be used for intermittent or other hard to find failures.

Appendix B of the Explorer Diagnostic manual has EXP2 test descriptions. Section 2.7 of that manual has EXP2 loading procedures.

4.5. Learning Worksheet Answers

Use these answers to check your work. Refer section CM 2.4 of the Explorer Field maintenance supplement for additional information. In addition, Explorer Diagnostics manual contains detailed diagnostic and self test error information.

1. The customer says that the Explorer II system will not boot. The processor board fault LED is on and the status LEDs 03 (from top to bottom). What is the failure indicated? What steps would you take to correct the failure?

The fault LED and status 03 indicate a zeros and ones test failure. This test is internal to the Lisp Processor chip and would indicate a hard processor board failure. To confirm the failure, repeat the self test (STBM) procedure. If the fault repeats then change the processor board and repeat the test. Once the fault is eliminated, run EXP2 test on the new processor.

2. The customer says that the Explorer II processor fault LED is lit during power up. The status LEDs read 3A hex. What is the failure indicated? What steps would you take to correct the failure?

The fault LED and status 3A indicate a floating point test failure. Repeat the self test to confirm the failure. Power down and remove the floating point processor. Repeat self test to see if the error goes away. Replace the floating point and repeat self test. Once the system passes self test, run EXP2 to fully test the new floating point processor.

3. The customer complains of system crashes. The 32 Mbyte memory board red and yellow LEDs are lit. What would you do to isolate the failure?

Both red and yellow LEDs light when an uncorrectable memory error occurs. That and the fact that system crashes have occurred, would indicate a hard failure on the 32 Mbyte memory board. Test that board using extended self test to confirm the failure. Replace the memory board and repeat the extended memory test to confirm the fix.

4. On power up an Explorer II system the fault light on the processor board lights and a status of 44 is displayed on the status LEDs. What would you do to correct the failure?

The fault LED and a status of 44 indicate that the NuBus test failed while STBM was testing itself. NuBus failures can be caused by any board in the system. Repeat the self test to confirm the failure. To isolate between the boards, pull all boards except the processor (and power supply) and repeat the test. If the test fails, then replace the processor and repeat the test. If the test passes, then pull the processor, insert the NUPI board, and repeat the test to check that board. The "-2" SIB can then be checked with only the processor and itself in the chassis. Memory and Ethernet boards can be checked with the processor as the only other board in the system as well. Once the NuBus hang up is found and corrected, test the entire system with extended self tests and EXP2 to confirm the fix.

You May now turn to Appendix A in this document and take the self evaluation. Follow directions in that Appendix to complete this course.

A. Self Evaluation Quiz

The purpose of this quiz is to provide you with some means to evaluate how well you have learned the material covered in this course. Take the quiz and then score your answers against those found at the end of this appendix. If you miss more than three of the questions, go back and review the material covered in that question. Use this to reinforce what you have learned in this course.

Once you have completed this self-evaluation, find the mail back post card and fill it out. Once that card is received at the Ed Center, you will be posted as trained on Model Codes 430 (Explorer II System) and 435 (Explorer I to II upgrade system).

Your author sincerely wishes that this course has done you some good. Thank you for taking time out of a very busy work day to take it.

Good luck with those calls!

A.1. Explorer II Self Evaluation

1. True or False. The SIB P/N 2236645-0002 functions in the 80 amp Explorer I 7-slot chassis.

a. True

b. False

2. The 32 Mbyte EC Memory Board has two LEDs (one yellow, one red). Describe below the function of these LEDs.

3. What is the test you should use to fully test the Explorer II processor and the floating point option processor during an Explorer I to II field upgrade?

a. EXPT

b. Extended test mode

c. EXP2

d. GDOS processor test.

4. The Explorer II processor board has twelve yellow and one red LED. Fill in the functions of these LEDs in the blanks provided below. Where do you find the processor status code meanings?

0 = _____ TOP

0 = _____

0 = _____

0 = _____

0 = _____

0 = _____

0 = _____

0 = _____

0 = _____

0 = _____

0 = _____

0 = _____

0 = _____ BOTTOM

_____ Manual

5. Which of the Explorer II functional blocks listed below are major differences between the Explorer II and the earlier Explorer I.

- a. Lisp processor chip
- b. Cache Memory
- c. Status LEDs
- d. Floating point option processor
- e. A, b and d of the above.
- f. All of the above.

6. Where is the floating point processor installed in the Explorer II system enclosure?

- a. In any slot in the system.
- b. In slot 4
- c. P2 of slot 6
- d. P2 of slot 4
- e. P3 of slot 4
- f. P2 of slot 6

7. Which of the 32 Mbyte functions listed below are major differences between the 32 Mbyte board and earlier 8 M byte boards?

- a. 1 Mbit RAM chips
- b. Error correction
- c. Configuration ROM
- d. A and b of the above
- e. All of the above.

8. Briefly describe the differences between the Explorer II system enclosure backplane and the one used in earlier Explorer I systems.

9. Can the Explorer I processor function in the Explorer II system enclosure? If so how?

10. Can the 32 Mbyte error Correcting Memory board function in the earlier Explorer I 80-amp enclosure? If so how?

11. Briefly describe any differences between Lisp 3.0 and earlier releases.

12. Your Explorer II system NuBus is appears to be hung up and you suspect the NUPI board. How would you isolate the failure?

13. The Explorer II processor fault LED stays on when self testing. The status LEDs read a hex 1C. What is the failure?

- a. Floating Point test failed.
- b. On board Cache failed.
- c. Lisp chip signature analysis failed.
- d. Event timer test failed.
- e. None of the above.

14. You wish to fully test the floating point option processor in an Explorer II system. What is the most extensive test you can run?

- a. Power up self test.
- b. EXPT floating point test.
- c. EXP2 floating point test.
- d. Extended system tests.

15. The Explorer II processor fault LED stays on when self testing. The status LEDs read a hex 74. What is the failure?

- a. No good system memory was found.
- b. Lisp chip signature analysis failed.
- c. Floating Point test failed.
- d. Event timer test failed.
- e. None of the above.

A.2. Explorer II Self Evaluation Answers

1. B

2. The 32 Mbyte memory board has a red and a yellow LED. LEDs function as follows:

<u>Red LED</u>	<u>Yellow LED</u>	<u>Condition</u>
OFF	OFF	No error (normal)
OFF	ON	Correctable (soft) error
ON	OFF	Self test running (or failed) or board reset.
ON	ON	Uncorrectable (hard) error

3. C

4. Reading from top to bottom, the first five processor LEDs are hardware defined bits. The last seven bits are read from top (most significant) to bottom (least significant bit) to form the status codes shown below. The red fault LED is at the bottom of the status LEDs.

LED Definition

- o HALT
- o HANG
- o LEFT CACHE HIT
- o RIGHT CACHE HIT
- o CACHE FILL
- o MSB STATUS
- o STATUS
- o STATUS
- o STATUS
- o STATUS
- o STATUS
- o STATUS
- o LSB STATUS
- o RED FAULT LED

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5. F

6. C

7. D

8. The Explorer II chassis backplane contains no Local Bus so that Explorer I will not function in it at all. In addition, other signals (ie POWER FAILURE WARNING PULSE, POWER RESET, etc.) have been rerouted to other pins.

9. No. The Explorer I processor cannot function in the Explorer II chassis. There is no Local bus support in the Explorer II chassis

10. Yes. The 32 Mbyte memory board can function in any slot of an Explorer I enclosure except slot 4.

11. System throughput has been improved. New hardware is now supported. The WD900 SMD disk drive can be used with the MSC controller. The MT3200 1/2 inch reel tape drive with the NUPI controller is supported as a general backup device only. The 880 printer and OmniLaser 2015 printer are also supported. New communication protocols have been added. DECnet supporting communication with DEC hosts via an Ethernet. IBM 3270 communication using the communications carrier board in the Explorer in 3270 terminal emulation is also included.

12. The quickest way to isolate the NUPI board in an Explorer II system (430) is to remove all other boards (except power supply) and execute self test.

13. Failure 1C = On board Cache RAM test failed.

14. C

15. Failure 74 = No good system memory was found.