

PRELIMINARY

**Basic Four Series 2000
Desktop Computer System
Error Logging Facility
Technical User's Guide**



*Basic Four[®] Series 2000
Desktop Computer System
Error Logging Facility
Technical User's Guide*

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March, 1985

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PREFACE

This manual describes the use of the (software) error logging facility in the MAI 2000 series Desktop Computer System. The information in this manual is intended for for use by customer engineers (C.E.'s) in the field.

The major topics covered in this manual are:

PARAGRAPH 1.0	INTRODUCTION
PARAGRAPH 2.0	FUNCTIONAL DESCRIPTION
PARAGRAPH 3.0	ERROR LOG DISPLAY/PRINTOUT FORMATS
PARAGRAPH 4.0	OPERATION
PARAGRAPH 5.0	FLOPPY DISK
PARAGRAPH 6.0	WINCHESTER DISK
PARAGRAPH 7.0	PARITY ERROR
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MAI 2000

ERROR LOGGING FACILITY

1.0 INTRODUCTION

Error logging is a standard feature in the MAI 2000 operating system (BOSS/IX). It enables the C.E. to print a history of hard and soft errors in the MAI 2000 System. From an analysis of this printout, he may acquire information useful in troubleshooting the system hardware.

2.0 FUNCTIONAL DESCRIPTION

A software routine writes error information to main memory RAM. Then, to permanently retain a record of the error, a program that has been monitoring the logging of error information records the RAM contents to disk.

When a loggable error occurs in the MAI 2000 System, the software routine that monitors the portion of hardware associated with that error makes a system call to the Error Logger routine. This routine is located in main memory RAM (read/write random access memory) and is always present and prepared for a call.

The Error Logger routine accepts error information from callers and places it into a dedicated area in main memory RAM. This area will hold a total of eight such entries.

Another routine, the Error Log Program, automatically starts when the user initiates the multiuser mode. The program periodically transfers error information in RAM to a disk log file on a (Winchester) disk. In addition to updating that file, it displays/prints the information in the file and the current error information located in RAM. (The program is located in the user area of main memory RAM, and hence may be swapped between RAM and disk.)

Two categories of error information may be recorded in the disk log, in two distinct sections:

- By type (BY TYPE LOG)
- By occurrence (CHRONOLOGICAL LOG)

The top line of the BY TYPE LOG records the kind (or "type") of error logged (e.g., disk error, memory parity error, etc.) and the total number of occurrences of that type of error. The remaining lines record information about the most recent occurrence. Barring file destruction, the error count can remain in the MAI 2000 system permanently.

The By occurrence section is an optional CHRONOLOGICAL LOG, 100 records long by default. Error information is recorded in this section when the error occurs and is a copy of the main memory RAM entry for that error.

3.0 ERROR LOG DISPLAY/PRINTOUT FORMATS

The BY TYPE log is displayed/printed first and is followed by the CHRONOLOGICAL LOG. The CHRONOLOGICAL LOG entries are displayed/printed in the order of the most recent occurrence first, i.e., the most recent occurrence is at the top of the display/printout.

The display format of the error log is cryptic; the text identifiers displayed/printed are described in paragraph 3.2. The datum following a character is raw, for example:

A: 428 B: -79 C: FFFF8000

Space is allocated for up to five decimal and three hexadecimal entries and one 4-character text field. Thus a disk driver (operating system routine controlling the disk hardware) may wish to report a block number and track number in decimal fields A and B; but the tape driver may use fields A and B in the tape error log entry to mean a soft error count and timeout error type. Hence field interpretation is tied closely to the kind ("type") of device whose error information is being logged and thus cannot be generalized. Specific information is supplied in paragraphs 5.0 through 13.3

3.1 BY TYPE Log Format

The BY TYPE log display/printout is formatted as follows:

Device name Minor: First: (day, date, time) Count:

Following this is a copy of the last entry logged in RAM for that device. (Refer to paragraph 3.2 for a description of the format.) One display/printout entry is provided for each "type" of device. A sample of the BY TYPE log is shown in figure 3-1.

- Device name - the common name of the device, e.g., floppy disk, 4-way controller, etc., followed by the minor number
- Minor - provides additional information as to location of error
- First - first time this error occurred (24-hour clock format)
- Count - total count of this type since the Error Log Program was restarted

3.2 CHRONOLOGICAL LOG Format

The CHRONOLOGICAL LOG display/printout is formatted as follows:

Device name	Minor:	Type:	(day, date, time)		
No.:	No. since boot:	Class:	Rev:		
A: decimal	B: decimal	C: decimal	D: decimal	E: decimal	
T: hex number	U: hex number	V: hex number	Z: text		

Rev : 8

File: /etc/error, log
Created Wed Feb 13 1985 09:50 26 with 100 records
Updated Tue Feb 26 1983 10:45:04 with error number 54

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System Serial Number: 2000-90204
Booted OS Version : EOS7139C, BOSS/IX release 7. 1A*34 (Jan 12 1985 05:04)

BY TYPE LOG:

Bus error

Illegal instruction

Bpt/trace

lot

Power fail

System call

Trap instruction

Parity error First: Tue Feb 26 1985 10:43:32 Count: 4
 Type: -32767 Tue Feb 26 1985 10:45:04
No : 53) No since boot: 20 Class: Rev. :
 A 148 B 0 C: 0 D: 0 E: 0
 T: C0000 U: 40 V: 0 Z:

PIRQ

Floating point

Memory Management

Odd address

Div by 0

Check

Overflow

Privilege

Error halt

Dev 1.0

Dev 2.0

Dev 3.0

Dev 4.0

Parallel printer Minor: 0

Cartridge tape Minor: 0

Floppy disk Minor: 0

Printer filter Minor: 0

CMB Minor: 0 First: Mon Feb 25 1985 16:14:43 Count: 16
 Type: 1 Mon Feb 25 1985 16:16:28
No. : 50 No since boot: 17 Class: Rev. :
 A 0 B: 0 C: 0 D: 0 E: 0
 T: 10 U: 0 V: 0 Z:

Four way Minor: 0

Dev 11.0

Dev 12.0

RMI disk Minor: 0

Winchester disk Minor: 0

Figure 3-1. Sample, BY TYPE Log Format

The fields identified by titles are defined as follows:

- Device name - the common name of the device, e.g., floppy disk, 4-way controller, etc., followed by a Minor number when required
- Type - a decimal number, usually a system error
- Day Date Time - the time the error occurred, presented in a 24-hour clock format
- No. - the nth logged error since the CHRONOLOGICAL LOG was initialized
- No. since boot - the nth logged error since the system was last booted
- Class - a character whose meaning is specifically defined by the device/failure type, e.g., H or S could be used to differentiate between fatal (hardware) errors and recoverable (soft) errors
- Rev - a revision letter used if necessary to identify a change in the entry meaning from one release level to the next

The fields identified by letters are device/failure specific. They may mean a count, an operation code, device status, etc. To interpret these, refer to paragraphs 5.0 through 13.3. A sample of the CHRONOLOGICAL LOG is shown in figure 3-2.

4.0 OPERATION

The following paragraphs discuss the display and printing of the BY TYPE and CHRONOLOGICAL error logs and the initialization of the CHRONOLOGICAL LOG.

4.1 Displaying/Printing the Error Logs

The Error Log Program is automatically initiated when the system multi-user mode is selected. To run the program (log errors) in the single-user mode, type the following:

```
/sys/errlog /etc/error.log -quiet
```

To display only the eight memory error log entries, type the following:

```
/sys/errlog | p
```

To print only the eight memory error log entries, type the following:

```
/sys/errlog | lpr
```

To display the disk/memory error logs, type the following:

```
/sys/errlog /etc/error.log | p
```

 CHRONOLOGICAL LOG

```

Parity error          Typt: -32767      Tot  Ftb  26 1985 10:45 04
No : 54  No since boot: 21  Class  Rev.:
A: 146  B: 0      C: 0      DO      E: 0
T: C0000 U: 20     V: 0      Z:

Parity error          Typt: -32767      Tut  Ftb  26 1965 10:45:04
No. : 53  No. since boot: 20  Class:  Rev. :
A: 146  B: 0      C: 0      D: 0      E: 0
T: C0000 U: 40     V: 0      Z:

Parity error          Typt: -32767      Tut  Ftb  26 1965 10:43:32
No. : 52  No since boot: 19  Class:  Rev. :
A: 146  B: 0      C: 0      D: 0      E: 0
T: C0000 U: 0      V: 0      Z:

Parity error          Type: -32767      Tut  Feb  26 1985 10:43:32
No. : 51  No. tince boot: 16  Class:  Rev. :
A: 146  B: 0      C: 0      D: 0      E: 0
T: C0000 U: 40     V: 0      Z:

CMB          Minor: 0  Type: 1      Mon Feb 25 1985 16:16:28
No. : 50  No. since boot: 17  Class.  Rev. :
A: 0      B: 0      C: 0      D: 0      E: 0
T: 10     U: 0      V: 0      Z:

CMB          Minor: 0  Type: 1      Mon Feb 25 1985 16:15:32
No. : 49  No. since boot: 16  Class:  Rev. :
A: 0      B: 0      C: 0      D: 0      E: 0
T: 10     U: 0      V: 0      Z:

CMB          Minor: 0  Type: 1      Mon Feb 25 1985 16:15:32
No. : 48  No since boot 15  Class:  Rtv. :
A: 0      B: 0      C: 0      D: 0      E: 0
T. 10     U: 0      V: 0      Z:

CMB          Minor: 0  Type: 1      Mon Feb 25 1985 16:15 30
No. : 47  No. since boot. 14  Class:  Rtv. :
A: 0      B: 0      C: 0      D: 0      E: 0
T: 10     U: 0      V: 0      Z:

CMB          Minor: 0  Type: 1      Mon Feb 25 1985 16:15:17
No. : 46  No. since boot 13  Class  Rtv. :
A: 0      B 0      C: C      D: 0      E: 0
T: 10     U. 0     V. 0      Z:

CMB          Minor: 0  Type 1      Mon Feb 25 1985 16:15:16
No. : 45  No since boot: 12  Class:  Rev. :
A: 0      B: 0      C: 0      D: 0      E: 0
T: 10     U: 0      V: 0      Z:

CMB          Minor: 0  Typt: 1      Mon Feb 25 1985 16:15:15
No. : 44  No since boot: 11  Class:  Rtv. :
A 0      B: 0      C: 0      D: 0      E: 0
T: 10     U: 0      V: 0      Z:

CMB          Minor 0  Type: 1      Mon Ftb 25 1985 16:15:05
No. : 43  No. since boot: 10  Class:  Rtv. :
A: 0      B: 0      C: 0      D: 0      E: 0
T: 10     U. 0     V: 0      Z:

CMB          Minor: 0  Type: 1      Mon Ftb 25 1985 16:15:05
No. . 42  No. since boot: 9  Class:  Rev :
A 0      B: 0      C: 0      D: 0      E: 0
T: 10     U: 0      V: 0      Z:

CMB          Minor. 0  Type: 1      Mon Ftb 25 1985 16:15:04
No. : 41  No. sinct boot: 6  Class:  Rtv. :
A: 0      B: 0      C: 0      D: 0      E: 0
T: 10     U: 0      V: 0      Z:

CMB          Minor: 0  Type: 1      Mon Ftb 25 1985 16:14 44
No : 40  No. sinct boot: 7  Class:  Rev. :
A 0      B: 0      C: 0      D: 0      E 0
T: 20     U: 0      V: 0      Z:
  
```

Figure 3-2. Sample, CHRONOLOGICAL LOG Format

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To print the disk/memory error logs, type the following:

```
/sys/errlog /etc/error.log | Ipr
```

The BY TYPE log is displayed/printed first, followed by the CHRONOLOGICAL LOG. The CHRONOLOGICAL LOG entries are displayed/printed in the order of the most recent occurrence first, i.e., the most recent occurrence is at the top of the display/printout.

4.2 Initializing the CHRONOLOGICAL LOG

Normally, the Error Log Program initializes the CHRONOLOGICAL LOG. The LOG is initialized with default values of 100, for the number of entries in the LOG, and 0, for the starting count, so that the LOG will start counting errors from the number 1.

However, the CHRONOLOGICAL LOG can be reinitialized by the user (C.E.):

- a. To change the size of the file
- b. To change the starting error count, so that new errors will start from the new count (useful when a new error log file is desired, and the current file has entries)

Initializing the CHRONOLOGICAL LOG should only be done in the system single-user mode.

A newly initialized CHRONOLOGICAL LOG starts counting errors from 1. When the number of logged errors reaches the errors value (100 by default), the next entry overwrites the first.

To change the file size, type the following:

```
/sys/errlog /etc/error.log -initial -size=(new number of entries desired)
```

For example, to change the number of entries desired to 50, type the following:

```
/sys/errlog /etc/error.log -initial -size=50
```

To change the starting error count, type the following:

```
/sys/errlog /etc/error.log -initial -errors=(new errors value)
```

For example, to change the starting number of the next entry to 15, type the following:

```
/sys/errlog /etc/error.log -initial -errors=15
```

Or, you could do both at the same time, by typing the following:

```
/sys/errlog /etc/error.log -initial -size=50 -errors=15
```

5.0 FLOPPY DISK

The purpose of this section is to aid the C.E. in interpreting the fields in the error log display/printout pertaining to the floppy disk subsystem of the MAI 2000 Series Desktop Computer System.

Since the Floppy Disk Controller hardware is an integral part of the Central Microprocessor Board (CMB), in the Model 4108 Base Unit, this section provides additional hardware-related information not included in other sections (which pertain to plug-in PCBAs).

5.1 Minor Field

If the Minor field displays 0 through 31, the error is associated with drive 1; if the number is 32 through 63, the error is associated with drive 2.

5.2 Type Field

The possible error numbers, shown in the Type field, are -63, -86 and -99. They are interpreted as follows:

- 63 - A write-protected diskette was in the drive prior to the error.
- 86 - The error was a seek error or a data transfer error.
- 99 - The originally-mounted diskette was not found.

5.3 Lettered Fields

The single-letter paragraph titles below represent the nine error log fields that are headed by those characters (in this case, only five fields are used). The corresponding paragraph interprets that field.

A

Field A contains the logical block (decimal) number of the starting block of data (in main memory RAM) to be transferred to the floppy disk.

B

Field B contains the number of blocks to be transferred to the floppy disk.

T

Field T indicates the status of the floppy disk driver routine prior to the error. This field contains the hexadecimal representation of the contents of a software status register in the routine.

The bits in that register are interpreted as follows (bit 0 is the least significant bit):

- 0 -- Read. This was the most recent command to the FDC chip.
- 1 -- Write. This was the most recent command to the FDC chip.
- 2 -- Recalibrate. This was the most recent command to the FDC chip.
- 3 -- Seek. This was the most recent command to the FDC chip.
- A -- Not used. This bit is always 0.
- 5 -- Not used. This bit is always 0.
- 6 -- Error. This bit indicates that an FDC error occurred; the bit is always set (1) in the error log display/printout.
- 7 -- Interrupt. This bit indicates that an interrupt request (INTRQ) from the FDC chip occurred prior to the error.

For example, if the number in field T is 42 (hex), the binary equivalent is 0100 0010. The interpretation is that an error occurred (bit 6=1) during a Write command (bit 1=1). Interpretation of fields U and V depends on T.

U

Field U indicates the status of the floppy disk controller (FDC) chip prior to the error. The driver routine reads the status register inside the FDC chip to obtain this information. Field U contains the hexadecimal representation of the contents of that register.

The bits in the register are interpreted as follows (bit 0 is the least significant bit):

- 0 -- Busy. This bit is always 0.
- 1 -- Index Pulse/DRQ. If the most recent command to the FDC chip prior to the error was a ("Type I") Seek or Recalibrate (Restore) command (as indicated by bits 3 or 2 set in field T), then this bit set indicates that the index mark from the floppy drive had been detected before the error occurred. This bit is an inverted copy of the IP input to the FDC chip (pin 35) from the drive.

If the most recent command to the chip prior to the error was one of the ("Type II/III") Write or Read commands (as indicated by bits 1 or 0 set in field T), then this bit is a copy of the DRQ (Data Request) output from the FDC chip (pin 38).

When set, the bit indicates that the data register inside the FDC chip is full (on a Read operation) or empty (on a Write operation). The bit is reset (0) otherwise.

- 2 -- Track 00/Lost Data. If the most recent command to the FDC chip prior to the error was a ("Type I") Seek or Recalibrate (Restore) command (as indicated by bits 3 or 2 set in field T), then this bit set indicates that the read/write head was positioned over Track 00 prior to the error. The bit is an inverted copy of the TROO input to the FDC chip (pin 3A) from the drive.

If the most recent command to the chip prior to the error was one of the ("Type II/III") Write or Read commands (as indicated by bits 1 or 0 set in field T), then this bit set indicates that the CPU did not respond to the DRQ (Data ReQuest) output from the FDC chip (pin 38) in one byte time.

(When high, DRQ indicates that the data register inside the FDC chip is full [on a Read operation] or empty [on a Write operation]; DRQ is low otherwise. The CPU needs this signal to know when to transfer data to or from the data register inside the FDC chip; and it must complete the operation within the time it takes a byte to be shifted into or out of the data shift register inside the FDC chip.)

- 3 -- CRC Error. If the most recent command to the FDC chip prior to the error was a ("Type I") Seek or Recalibrate (Restore) command (as indicated by bits 3 or 2 set in field T), then this bit set indicates that a CRC error was encountered in the ID field of the recorded format.

If the most recent command to the chip prior to the error was one of the ("Type II/III") Write or Read commands (as indicated by bits 1 or 0 set in field T), and if bit 4 of field U (this field) also is set, then this bit set indicates that the CRC error was found in one or more ID fields of the recorded format.

But if bit 4 is not set, this bit set indicates a data field error.

- 4 -- Seek Error/Record Not Found. If the most recent command to the FDC chip prior to the error was a ("Type I") Seek or Recalibrate (Restore) command (as indicated by bits 3 or 2 set in field T), then this bit set indicates that the desired track was not verified.

(When a Seek, Step or Restore [Recalibrate] command is executed, a verification operation begins at the end of the settling time after the read/write head is loaded against the disk. The track number from the first encountered ID field is compared against the contents of the track register, inside the FDC chip. If the track numbers compare and the ID field CRC is correct, then the verify operation is complete.)

If the most recent command to the chip prior to the error was one of the ("Type II/III") Write or Read commands (as indicated by bits 1 or 0 set in field T), then this bit set indicates that a desired track, sector or side was not found.

- 5 -- Head Loaded. This bit can be set only if the most recent command to the FDC chip prior to the error was a ("Type I") Seek or Recalibrate (Restore) command (as indicated by bits 3 or 2 set in field T).

This bit set indicates that the read/write head was loaded and engaged when the error occurred.

(The bit is a logical AND of the HLD [Head Load] and HLT [Head Load Timing] signals from the FDC chip [pins 28 and 23J].)

- 6 -- Write Protect. If the most recent command to the FDC chip prior to the error was a ("Type I") Seek or Recalibrate (Restore) command (as indicated by bits 3 or 2 set in field T) or one of the ("Type II/III") Write commands (as indicated by bit 1 set in field T), then this bit set indicates that a write-protected disk was in the drive at the time of the error.

- 7 -- Not Ready. This bit is set whenever the READY input to the FDC chip (pin 32) is low.

Example: Assume that the most recent command to the FDC chip was a ("Type II/III") Write or Read command, as indicated by bits 1 or 0 set in field T. If the number in field U is 18 (hex), the binary equivalent is 0001 1000. The interpretation is that a CRC error (bit 3=1) was found in one or more ID fields of the recorded format (bit 4=1). (Note: if bit 4=0, then the CRC error is in a data field.)

V

Field V indicates the most recent control command sent to the floppy disk controller (FDC) prior to the error. This field contains the hexadecimal representation of the contents of a software command register in the FDC driver routine.

The bits in that register are interpreted as follows (bit 0 is the least significant bit):

NOTE

The default, or normal, value for Field V is A (binary equivalent: 0000 1010). If any other commands are represented in this field, someone has entered them for some reason. To enter the default commands, refer to the following paragraph.

0 - Not used (bit is always 0)

1 - Retries Enabled

- 2 - Not used (bit is always 0)
- 3 - Disable Error Messages
- 4 - Enable Write Verification
- 5 - Not used (bit is always 0)
- 6 - Not used (bit is always 0)
- 7 - Not used (bit is always 0)

For example, if the number in field V is 18 (hex), the binary equivalent is 0001 1000. The interpretation is that Retries was enabled, and Write Verification was disabled. These are not default commands. To enter the default commands, do the following:

NOTE

The following operation can be done only if the (software) Tool Command Set is installed. Otherwise,

```
ADMIN> control -help
Can't execute 'control.' File does not exist.
```

will be displayed.

1. Type 'control -help*. The usage will appear on the screen as follows:

```
-c toggle ECC correction
-e toggle error messages
-o toggle seek optimization
-r toggle retries
-s set to driver defaults
-v toggle write verify
```

2. Type 'control /dev/(device name) -(letter of desired toggle command).'

Example:

```
ADMIN> control /dev/wd0 -s
Control now set to:
  automatic retries
  no driver error messages
  no write verification
Old value was:
  no retries
  driver error messages
  no write verification
```

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6.0 WINCHESTER DISK

The purpose of this section is to aid the C.E. in interpreting the fields in the error log display/printout pertaining to the hard (Winchester) disk subsystem of the MAI 2000 Series Desktop Computer System.

Since the Winchester Disk Controller hardware is on a printed circuit board assembly (PCBA) that plugs into the Central Microprocessor Board (CMB) , in the Model 4108 Base Unit, this section provides only the necessary information to isolate a fault to that PCBA or to the Winchester drive.

6.1 Minor Field

If the Minor field displays 0 through 31, the error is associated with drive 1; if the number is 32 through 63, the error is associated with drive 2.

6.2 Type Field

The only possible error number, shown in the Type field, is -2. It is interpreted as an I/O (input/output) error.

6.3 Lettered Fields

The single-letter paragraph titles below represent the nine error log fields that are headed by those characters (in this case, only six fields are used). The corresponding paragraph interprets that field.

A

Field A contains the logical block (decimal) number of the starting block of data (in main memory RAM) to be transferred to the Winchester disk.

B

Field B contains the number of blocks to be transferred to the Winchester disk.

C

Field C contains a 1 or a 0. A 1 in this field means that there were some problems in the transfer of data to the disk, but, after a few retries, the transfer was successfully completed. A 0 in this field means that, after a specified number of retries, the data was not successfully transferred.

This error log entry should be preceded by another Winchester disk error log entry whose C field contains a 1. If it is not, then the Retry function probably was turned off by the user (refer to paragraph V).

T

Field T indicates the most recent status of the Winchester disk driver routine prior to the error. The field contains the hexadecimal representation of the contents of a software status register in the routine. The bits in that register represent the most recent command to the controller prior to the error. The contents of the register are interpreted as follows (codes 32 through FF are not used):

- 0 -- Test Unit Ready. This command tests the status of the drive(s). If the drive is on line and ready, a "zero status" will be returned in the command completion status byte. If the drive is not ready, the "Check condition" bit will be set in the command completion status byte. A Request Sense command may then be issued to return the SCSI error code.
- 1 -- Rezero Unit. This command sets the selected drive to track zero and returns the command completion status byte. If the "Check condition" status bit is set, a Request Sense command will return the applicable SCSI error code.
- 2 -- Not used.
- 3 -- Request Sense. This command is valid when the "Check condition" bit is set in the command completion status byte. The command will return the Sense bytes containing the SCSI error codes and, when applicable, the logical block address of the bad data.
- 4 -- Format Unit. Upon receipt of this command, the Formatter causes the drive(s) to write from index to index all ID and data fields with a pattern of \$6C6C\$ and with a block (sector) size of 512 bytes, as specified in an immediately preceding Mode Select command. Note that the Format Unit command uses a defect list to skip bad sectors in a track when formatting the drives. This list is compiled by a previous Translate command.
- 5-7 -- Not used.
- 8 -- Read. This command transfers a specified number of data blocks from the drive to the Controller, beginning at a specified logical block address. When the Read command is received, the Formatter, using drive data stored during the power-up/self-test routine, will verify a valid logical block starting address and seek the drive to that address. When the seek is complete, the Formatter then reads the starting address data into a FIFO buffer, checks the ECC (Error Correction Code), and begins the DMA data transfer to the Controller.
- 9 -- Not used.

A -- Write. This command transfers a specified number of data blocks from the Controller to the drive, beginning at a specified logical block address. When the Write command is received, the Formatter will verify a valid logical block starting address and seek the drive to that address. When the seek is complete, the Formatter then transfers the starting address data into the FIFO buffer and writes the buffered data and its associated ECC onto the addressed logical sector.

B -- Seek. Upon receipt of this command, the Formatter, using drive data stored during the power-up/ self-test routine, will verify a valid logical block address and seek the drive to that address. The command completion status byte is returned immediately after seek pulses are issued and head motion is started, thereby freeing the bus for additional commands prior to seek completion. Commands received with a seek in progress will cause a command completion Busy status to be returned.

This permits the Controller to use the SCSI bus for other processing while the Formatter waits for a SEEK COMPLETE. When the seek is complete, the Formatter returns the command completion status byte. Verification of the ID field is not attempted. It should be noted that the Formatter uses an implied seek on Read and Write commands, eliminating the need for a separate Seek command with each operation.

C-E -- Not used.

F -- Translate. This command performs a logical address to physical address translation for a given block address (sector) and reports its physical location. The report identifies the actual cylinder in which the sector resides, the actual head associated with the cylinder, and the number of bytes from Index at which the sector is located.

If there is a data error in the ID field of a given sector, a "Check condition" will be returned in the command completion status byte. It is then necessary to translate the sectors before and after the targeted sector to determine its location (i.e., a process of elimination). The Translate command is also used to report the physical location of a sector flagged as bad.

10-12 -- Not used.

13 -- Write Buffer. This command permits the drive Controller to write 1 Kbyte of test data into the FIFO buffer, which can then be read for diagnostic purposes.

14 -- Read Buffer. This command permits the drive Controller to read 1 Kbyte of test data from the FIFO buffer for diagnostic purposes.

- 15 -- Mode Select. This command provides the Formatter with a list of parameters that the Format command will use in formatting the drive. As the drive is formatted, the parameters sent with the Mode Select command are stored on track zero. On subsequent power-up Resets, the Formatter will read the parameters from the drive to perform self-tests, and exercise the drive. The drive parameters are specified in 14 bytes of two data blocks that follow the Mode Select command.
- 16-19 -- Not used.
- 1A -- Mode Sense. This command permits the operating system to read the drive parameters stored by the Formatter during a power-up Reset sequence.
- 1B -- Start/Stop Unit. This six-byte command is intended for use with drives that have a designated shipping or landing zone. A Start command is indicated when bit 0 of byte 04 is set; otherwise it is a Stop command. A Stop command positions the read/write heads over the designated landing zone.
- 1C -- Receive Diagnostic. TBD
- 1D -- Send Diagnostic. This command sets the ECC mode to correct read errors that are correctable and to set the Check Condition bit in the command completion status byte for read errors that are uncorrectable.
- 1E-24 -- Not used.
- 25 -- Read Capacity.
- 26-27 -- Not used.
- 28 -- Read.
- 29 -- Not used.
- 2A -- Write.
- 2B -- Write and Verify.
- 2C-2E -- Not used.
- 2F -- Verify.
- 30 -- Not used.
- 31 -- Search Data Equal.

Example: If the number in field T is 2B (hex), then the interpretation is that the most recent command to the Winchester Disk Controller was to Write and Verify.

U

Field U indicates the most recent status of the Winchester Disk Controller (WDC) prior to the error. The driver routine reads the status register on the WDC PCBA to obtain this information, and field U contains the hexadecimal representation of the contents of that register.

Field U is interpreted as follows (codes 26 through FF are not used):

- 0 -- No Sense.
- 1 -- No Index Signal. This code indicates a probable failure in the drive interface or in the WDC PCBA.
- 2 -- No Seek Complete. This code indicates a probable failure in the drive.
- 3 -- Write Fault. This code indicates a probable failure in the drive.
- 4 -- Drive Not Ready. This code indicates a probable failure in the drive or in the drive interface.
- 5 -- Not used.
- 6 -- No Track 0. This code indicates a probable failure in the drive or in the drive interface.
- 7-F -- Not used.
- 10 -- ID CRC Error. This code indicates a probable failure in the WDC PCBA.
- 11 -- Uncorrectable Data Error. This code indicates a probable media error.*
- 12 -- ID Address Mark Not Found. This code indicates a probable media error* or WDC PCBA fault.
- 13 -- Data Address Mark Not Found. This code indicates a probable media error* or WDC PCBA fault.
- 14 -- Record Not Found. This code indicates a probable media error* or WDC PCBA fault.
- 15 -- Seek Error. This code indicates a probable media error* or drive fault.
- 16-17 -- Not used.

* Before disk reformatting is undertaken, it is imperative that either the customer or a Basic Four analyst save as much of the customer files as possible. (This is not a C.E. responsibility.)

- 18 -- Data Check Without Retry. This code indicates a probable media error.*
- 19 -- ECC Error During Verify. This code indicates a probable media error.*
- 1A -- Interleave Error. This code indicates a probable system software error.*
- 1B -- Not used.
- 1C -- Blown Format. This code indicates a probable unformatted disk.*
- 1D -- Self Test Failed. This code indicates a probable WDC PCBA fault.
- 1E -- Defective Track. This code indicates a probable media error.*
- 1F -- Not used.
- 20 -- Invalid Command. This code indicates a probable system software error.
- 21 -- Illegal Block Address. This code indicates a probable system software error.
- 22 -- Not used.
- 23 -- Volume Overflow. This code indicates a probable system software error.
- 24 -- Bad Argument. This code indicates a probable system software error.
- 25 -- Invalid Logical Unit Number. This code indicates a probable system software error.

* Before disk reformatting is undertaken, it is imperative that either the customer or a Basic Four analyst save as much of the customer files as possible. (This is not a C.E. responsibility.)

Example: If the number in field T is 15 (hex), then the interpretation is that a Seek error has occurred, probably caused by either the Winchester drive electronics or the disk (media).

V

Field V indicates the most recent control command sent to the Winchester Disk Controller (WDC) prior to the error. This field contains the hexadecimal representation of the contents of a software command register in the WDC driver routine. The bits in that register are interpreted as follows (bit 0 is the least significant bit):

NOTE

The default, or normal, value for field V is A (binary equivalent: 0000 1010). If any other commands are represented in this field, someone has entered them for some reason. To enter the default commands, refer to the following paragraph.

- 0 -- ECC and Retries Disabled
- 1 -- Retries Enabled, Report ECC
- 2 -- Queue Optimization Disabled
- 3 -- Disable Error Messages
- 4 -- Enable Write Verification
- 5 -- Not used (bit is always 0)
- 6 -- Not used (bit is always 0)
- 7 -- Not used (bit is always 0)

For example, if the number in field V is C (hex), the binary equivalent is 0000 1100. The interpretation is that Queue Optimization and Retries, Report ECC were disabled. These are not default commands. To enter the default commands, do the following:

NOTE

The following operation can be done only if the (software) Tool Command Set is installed. Otherwise,

```
ADMIN> control -help
Can't execute 'control.' File does not exist.
```

will be displayed.

1. Type 'control -help'. The usage will appear on the screen as follows:

```
-c toggle ECC correction
-e toggle error messages
-o toggle seek optimization
-r toggle retries
-s set to driver defaults
-v toggle write verify
```

2. Type 'control /dev/(device name) -(letter of desired toggle command).'

Example:

```
ADMIN> control /dev/wd0 -s
Control now set to:
  ECC
  automatic retries
  seek optimization
  no driver error messages
  no write verification
Old value was:
  no ECC
  no seek optimization
  driver error messages
  no write verification
```

7.0 PARITY ERROR

The purpose of this section is to aid the C.E. in interpreting the fields in the error log display/printout pertaining to the main memory subsystem of the MAI 2000 Series Desktop Computer System.

Since the Memory Array RAM chips reside on printed circuit board assemblies (PCBAs) that plug into the Central Microprocessor Board (CMB) , in the Model 4108 Base Unit, this section provides only the necessary information to isolate a fault to one of the 12 possible Memory Array PCBA RAM banks. (There are two 128K-byte RAM banks per PCBA.)

7.1 Minor Field

The Minor field always displays 7.

7.2 Type Field

The only possible error number, shown in the Type field, is -32767. It indicates that non-existent memory was specified for a system call.

7.3 Lettered Fields

The single-letter paragraph titles below represent the nine error log fields that are headed by those characters (in this case, only three fields are used). The corresponding paragraph interprets that field.

A

Field A contains the process identification number of the process that was executing when the error occurred.

T

Field T indicates the (hex) address of the 128K-byte bank that failed. The addresses of the 12 possible Memory Array PCBA RAM banks are as follows:

BOARD NO.	LOW BANK ADDRESS	HIGH BANK ADDRESS
1	00000-1FFFF	20000-3FFFF
2	40000-5FFFF	60000-7FFFF
3	80000-9FFFF	A0000-BFFFF
4	C0000-DFFFF	E0000-10FFFF
5	100000-11FFFF	120000-13FFFF
6	140000-15FFFF	160000-17FFFF

(When a main memory parity error occurs, CMB hardware detects the error and latches address bits 17 through 20 in a parity error register [CMB circuit symbol 3N]. At the same time, the parity error logic on the CMB generates a level 7 interrupt, and control is transferred to the appropriate interrupt service routine. The routine reads the bits in the parity error register and stores them in a software register. The contents of this register are displayed in field T [hexadecimal representation with four 0's appended] as the beginning address of the 128K-byte RAM bank {in a Memory Array PCBA} that produced the parity error.)

U

Field U contains additional parity error information. This field contains the hexadecimal representation of the contents of a hardware parity error register on the CMB. (This is the same CMB register that contains the address information.)

The bits in this register are interpreted as follows (bit 0 is the least significant bit):

- 0 -- If this bit is a 1, the parity error occurred on an access by a peripheral device controller board on the system I/O bus.

If this bit is a 0, the parity error occurred on an access by the 68010 microprocessor, on the CMB.

- 1 -- Not used. This bit is always 0.
- 2 -- Not used. This bit is always 0.
- 3 -- Not used. This bit is always 0.
- 4 -- Not used. This bit is always 0.
- 5 -- If this bit is a 1, the parity error occurred on an access to the lower (odd order) byte of a word. Note: This bit is valid only for the -2 CMB artwork; the bit may be 1 or 0 for the -1 artwork.
- 6 -- If this bit is a 1, the parity error occurred on an access to the upper (even order) byte of a word. Note: This bit is valid only for the -2 CMB artwork; the bit may be 1 _or 0 for the -1 artwork.
- 7 -- If this bit is a 1, the 68010 was in the supervisor mode when the error occurred.

If this bit is a 0, the 68010 was in the user mode when the error occurred.

For example, if the number in field U is 80 (hex), the binary equivalent is 1000 0000. The interpretation is that the parity error occurred during a memory access by the 68010 (bit 0 = 0) in the supervisor mode (bit 7=1).

8.0 TRAP

The purpose of this section is to aid the C.E. in interpreting the fields in the error log display/printout pertaining to the kinds of errors that result in traps to the operating system of the MAI 2000 Series Desktop Computer System.

A trap is both an unprogrammed conditional jump, activated by hardware, and a programmed unconditional jump, using 68010 TRAP instructions. Initiation of a trap causes a 68010 exception, and exception processing is performed in much the same manner as interrupt processing.

8.1 Name Field

The possible TRAP error names, along with their interpretation, are as follows:

NAME	DESCRIPTION
Bus error	<p>Software or hardware error. A reference was made to an address outside the boundaries of physical memory (installed RAM) address space.</p> <p>(When an attempt is made to read or write main memory RAM, a Data Transfer Acknowledge [PDTACK-] signal must be returned to the 68010 from the Memory Array PCBA before a specified timeout; otherwise, a BERRF- [Bus ERROR Flag] signal is returned to the 68010, and [externally generated] exception processing will be initiated.)</p>
Illegal instruction	<p>User software error. An attempt was made to execute an instruction that is not included in the 68010 instruction set.</p> <p>(If an opcode is fetched whose bit pattern is not that of one of the defined instructions, then [internally generated] exception processing will be initiated.)</p>
BPT/trace	<p>Not an error. A system call was made to the debugger program in the operating system.</p>
Iot	<p>Not used.</p>
Power fail	<p>Self-explanatory</p> <p>(When power supply failure is imminent, an INT7- [INTerrupt level 7, the non-maskable interrupt] is generated on the Central Microprocessor Board, and control is transferred to a handler routine.)</p>
System call	<p>User software error. A user-generated trap instruction was used to make a call to a routine in the operating system kernal.</p>

NAME (con't)	DESCRIPTION (con't)
Trap instruction	<p>User software error. When a trap instruction is processed, program execution commences at another address. That address is contained in an exception vector, which is a memory location in low RAM memory.</p> <p>This vector can be one of 16 trap vectors. Currently, only A vectors are being used:</p> <p style="margin-left: 40px;">- syscall - bpt - syscallregs - nmilv7</p> <p>Any reference to the remaining 12 vectors will result in a trap instruction error.</p>
Parity error	Hardware fault. A separate error log entry should exist for this error. See "PARITY," paragraph 7.
PIRQ	Not used.
Floating point	Not used.
Memory management	User software error. One of the following errors has occurred:

NOTE

Each of the following six violations, when detected, causes the following three major events to occur, in the order presented.

- A write cycle to main memory RAM is prevented. As a result, there is no return of the data transfer acknowledge [PDTACK-] signal from the Memory Array board to the 68010.
- This causes a bus error and forces the 68010 to process an exception; control is transferred to the appropriate handler routine in system software.
- The handler routine then reads a status register on the Central Microprocessor Board to determine that the bus error originated in the Memory Management Unit.

- a Write to a read-only segment
- an instruction fetch from a data segment
- an access to a non-existent segment

NAME (con't)	DESCRIPTION (con't)
Memory management (cont'd)	<ul style="list-style-type: none"> - an access to an address beyond the length of a segment - an access to an address beyond the end of a stack - an access to an address in the warning area of a stack
Odd address	User software error. An attempt was made to reference a word (or a long word) at an odd address.
Divide by 0	User software error. This occurred during an arithmetic operation using the DIVS or DIVU instruction. As the instruction was executing, an attempt was made to divide a number by zero, an illegal operation.
Check	User software error. As a consequence of the use of the CHK instruction (which allows a program to check whether the contents of a 68010 data register are less than zero or equal to some predetermined value), internally generated exception (trap) processing was initiated (indicating the register that was checked failed the CHK test).
Overflow	User software error. As a consequence of the use of the TRAPV instruction (which allows a program to check whether the 68010 status register overflow flag bit is set), internally generated exception (trap) processing was initiated (indicating an arithmetic result greater in magnitude than that which can be represented in a 68010 data register).
Privilege violation	User software error. An attempt was made by the user program to execute one of the following privileged instructions.

NOTE

The following instructions are reserved for use only in the 68010 supervisor mode; an attempt to execute them in the user mode initiates internally generated exception [trap] processing.

- STOP
- RESET
- RTE
- MOVE to SR

NAME (con't)	DESCRIPTION (con't)
Privilege violation (cont'd)	- AND (word) Immediate to SR - EOR (word) Immediate to SR - OR (word) Immediate to SR - MOVE USP
Errorhalt	Fatal system (hardware/software) error; cpu is halted.

All the foregoing errors can occur when the processor is in the user mode, except Errorhalt.

To ensure the protection of users' programs, the system cannot allow a user to enter the system software partition of main memory (whether accidentally or maliciously). To this end, the 68010 processor defines certain instructions to be privileged instructions and determines two separate modes of operation: the user mode and the supervisor mode. A bit in the 68010 status register indicates the current processor mode.

The 68010 allows privileged instructions to be executed only in the supervisor mode. If an attempt is made to execute a privileged instruction in the user mode, the 68010 does not execute it but treats it as an illegal instruction and traps to the operating "system. The operating system software executes only in the supervisor mode; a requested address is the actual physical location in RAM memory, and any address in memory may be referenced.

The user mode, on the other hand, provides the execution environment for the majority of applications programs. Under the user mode, logical addresses requested by the user are mapped (by memory management unit [MMU] hardware) into the user's allocated segment of physical (RAM) memory. Any attempt to access an address outside this memory segment results in a Bus error, and a Memory management error is logged.

8.2 Type Field

The only possible error number, shown in the Type field, is -32767. It indicates that non-existent memory was specified for a system call.

8.3 Lettered Fields

The single-letter paragraph titles below represent the nine error log fields that are headed by those characters (in this case, only seven fields are used). The corresponding paragraph interprets that field.

A

Field A contains the process identification number of the process that was executing when the error occurred.

B

Field B contains a 1, if the 68010 was in the user mode when the error occurred, or a 0, if the 68010 was in the supervisor mode.

C

Field C contains the reference classification of the 68010 at the time of the error. This identifies the kind of bus activity that was being performed at that time.

(When the 68010 makes a reference, it classifies the kind of reference being made by putting an encoded reference classification number on three Function Code output lines. This allows external translation of addresses, control of access, and differentiation of special processor states, such as interrupt acknowledge.)

If the error is a Bus error, an Odd address error, or a Memory management error, field C will contain the following reference classification numbers (otherwise, field C will contain 0):

- 0 -- Not used
- 1 -- User data
- 2 -- User program
- 3 -- Not used
- 4 -- Not used
- 5 -- Supervisor data
- 6 -- Supervisor program
- 7 -- Interrupt acknowledge

D

If the error is a Bus error, an Odd address error, or a Memory management error, field D will contain a 1, if the type of access was a Read when the error occurred, or a 0, if the type of access was a Write. Otherwise, field D will contain 0.

T

Field T displays the (hex) address contained in the 68010 program counter (plus 2 to 10 bytes) at the time of the error.

U

If the error is a Bus error, an Odd address error, or a Memory management error, field U will contain the first word ("opcode") of a 68010 instruction.

This is the instruction that was in progress when the bus error occurred. Otherwise, field U will contain 0.

V

If the error is a Bus error, an Odd address error, or a Memory management error, field V will contain the (hex) address that was accessed at the time of the error. Otherwise, field V will contain 0.

9.0 PRINTER FILTER (PRINTER)

The purpose of this section is to aid the C.E. in interpreting the fields in the error log display/printout pertaining to the status of serial and parallel printers attached to the MAI 2000 Series Desktop Computer System.

9.1 Minor Field

The decimal numbers that can be displayed in the minor field represent the various ports at the rear of the Model 4108 Base Unit. (Figure 9-1 shows the location of the ports.) The 14 possible numbers, along with the names and numbers of the ports they represent, are as follows:

NUMBER	PORT
0	Central Microprocessor Board parallel printer port (#2)
1	Central Microprocessor Board serial port (#0)
2	Central Microprocessor Board serial port (#1)
3	4-Way Controller PCBA number one (port #3)
4	4-Way Controller PCBA number one (port #4)
5	4-Way Controller PCBA number one (port #5)
6	4-Way Controller PCBA number one (port #6)
7	4-Way Controller PCBA number two (port #7)
8	4-Way Controller PCBA number two (port #8)
9	4-Way Controller PCBA number two (port #9)
10	4-Way Controller PCBA number two (port #10)
11	4-Way Controller PCBA number three (port #11)
12	4-Way Controller PCBA number three (port #12)
13	4-Way Controller PCBA number three (port #13)
14	4-Way Controller PCBA number three (port #14)

9.2 Type Field

The only possible error numbers, shown in the Type field, are -62 and -108. The interpretation of -62 is that the requested operation has timed out; the number -108 indicates a printer I/O transmission error has occurred.

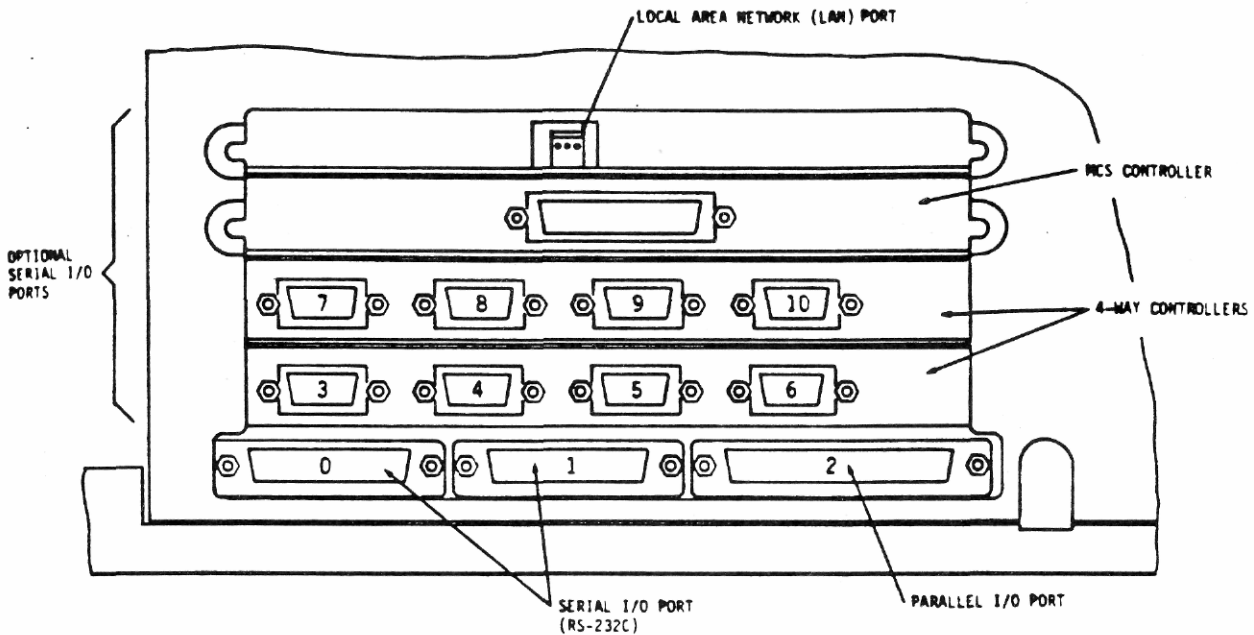


Figure 9-1. Rear View of Base Unit, Showing Location of All Ports

9.3 Lettered Fields

The single-letter paragraph titles below represent the nine error log fields that are headed by those characters (in this case, only seven fields are used). The corresponding paragraph interprets that field.

A

Field A contains the current page number.

B

Field B contains the current line number.

C

Field C contains the current column position (usually the end of the line).

D

Field D contains the Basic Four printer protocol. A 1 in this field indicates that the protocol is on; a 0 indicates that the protocol is off.

E

Field E indicates the make (brand) of attached printer associated with the error. This field contains the hexadecimal representation of the contents of a software register in the "printer filter" routine, which monitors printer I/O.

The bits in this register are interpreted as follows (bit 0 is the least significant bit):

BIT	PRINTER MAKE
0	Printronix
1	Tritel
2	Whisper
3	MVP
4	Diablo
5	Okidata 82a
6	Not used (this bit is always 0)
7	Not used (this bit is always 0)

For example, if the number in field E is 20 (hex), the binary equivalent is 0010 0000. The interpretation is that the attached printer associated with the error is an Okidata 82a (bit 5=1).

T

Field T indicates the status of the attached printer associated with the error, at the time the error occurred. This field contains the hexadecimal representation of the contents of a software register in the "printer filter" routine, which monitors printer I/O.

The bits in this register are interpreted as follows (bit 0 is the least significant bit):

BIT	STATUS
0	Power up
1	Default VFC in effect
2	Not used
3	Offline

BIT (cont'd)	STATUS (cont'd)
4	VFC error
5	Paper out
6	Busy
7	Not used (this bit is always 0)

For example, if the number in field T is 20 (hex), the binary equivalent is 0010 0000. The interpretation is that the attached printer associated with the error is out of paper (bit 5 * 1).

U

Field U indicates the status of the printer driver routine at the time the error occurred. This field contains the hexadecimal representation of the contents of a software register in that routine.

The bits in this register are interpreted as follows (bit 0 is the least significant bit):

BIT	STATUS
0	Frame error
1	Parity error
2	Receive overrun error
3	LRC error
4	Buffer overrun error
5	Not used
6	Acknowledge alternator flag
7	Not used (this bit is always 0)

For example, if the number in field U is 01 (hex), the binary equivalent is 0000 0010. The interpretation is that the attached printer associated with the error is out of paper (bit 1 = 1).

10.0 FOUR WAY

The purpose of this section is to aid the C.E. in interpreting the fields in the error log display/printout pertaining to the 4-Way Controller boards in the Model 4108 Base Unit (in the MAI 2000 Series Desktop Computer System).

Since all the 4-Way Controller hardware is on a printed circuit board assembly (PCBA) that plugs into the Central Microprocessor Board (CMB), in the Model 4108 Base Unit, this section provides only the necessary information to isolate a fault to that PCBA, and to the port associated with the error.

10.1 Minor Field

The decimal numbers that can be displayed in the minor field represent the various ports at the rear of the Model 4108 Base Unit. (Figure 9-1 shows the location of the ports.) The 11 possible numbers, along with the PCBA number and the port number, are as follows:

NUMBER	PCBA NUMBER/PORT #
0	4-Way Controller PCBA number one/port #3
1	4-Way Controller PCBA number one/port #4
2	4-Way Controller PCBA number one/port #5
3	4-Way Controller PCBA number one/port #6
4	4-Way Controller PCBA number two/port #7
5	4-Way Controller PCBA number two/port #8
6	4-Way Controller PCBA number two/port #9
7	4-Way Controller PCBA number two/port 110
8	4-Way Controller PCBA number three/port #11
9	4-Way Controller PCBA number three/port #12
10	4-Way Controller PCBA number three/port #13
11	4-Way Controller PCBA number three/port #14

10.2 Type Field

The only possible error numbers, shown in the Type field, are -1 and -2. The interpretation of -1 is that an attempt was made to access beyond the end of a file; the number -2 indicates an I/O error has occurred.

10.3 Lettered Fields

The single-letter paragraph titles below represent the nine error log fields that are headed by those characters (in this case, only two fields are used). The corresponding paragraph interprets that field.

T

Field T contains the status of the SCC (Serial Communications Controller) chips on board the 4-Way Controller PCBA associated with the error, at the time the error occurred. This field contains the hexadecimal representation of the contents of the status register inside the SCC chip. The bits in this register are interpreted as follows (bit 0 is the least significant bit):

BIT	STATUS
0	Not used
1	Not used
2	Not used
3	Not used
4	Parity error
5	Receive overrun error (indicates that a character was received but not read from the receiver data register inside the SCC chip, resulting in the loss of one or more characters)
6	CRC/framing error (a framing error indicates the loss of character synchronization, faulty transmission, or a break [all spaces] condition)
7	End of frame

For example, if the number in field T is 10 (hex), the binary equivalent is 0001 0000. The interpretation is that the SCC chip associated with the 4-Way Controller error detected a parity error (bit 4 = 1).

U

Field U contains the status of a hardware register on the 4-Way Controller PCBA associated with the error. This field contains the hexadecimal representation of the contents of that register. The contents of the register are interpreted as follows (only two errors are defined):

HEX	ERROR
81	Illegal command (software error)
83	Bus error (hardware error)

11.0 CMB (SCC CHIP)

The purpose of this section is to aid the C.E. in interpreting the fields in the error log display/printout pertaining to the serial I/O subsystem hardware on the Central Microprocessor Board (CMB), in the Model 4108 Base Unit (in the MAI 2000 Series Desktop Computer System).

11.1 Minor Field

The numbers that can be displayed in the minor field represent the two serial ports at the rear of the Model 4108 Base Unit. (Figure 9-1 shows the location of the ports.) If the Minor field displays 0, the error is associated with port 0; if the number is 1, the error is associated with port 1.

11.2 Type Field

The only possible error number, shown in the Type field, is -1. The interpretation is that an attempt was made to access beyond the end of a file.

11.3 Lettered Fields

Of the nine error log fields that are headed by characters, only field T is used. Field T contains the status of the SCC (Serial Communications Controller) chip (on board the CMB) associated with the error, at the time the error occurred. This field contains the hexadecimal representation of the contents of the status register inside the SCC chip. The bits in this register are interpreted as follows (bit 0 is the least significant bit):

BIT	STATUS
0	Not used
1	Not used
2	Not used
3	Not used
4	Parity error
5	Receive overrun error (indicates that a character was received but not read from the receiver data register inside the SCC chip, resulting in the loss of one or more characters)
6	CRC/framing error (a framing error Indicates the loss of character synchronization, faulty transmission, or a break [all spaces] condition)
7	End of frame

For example, if the number in field T is 40 (hex), the binary equivalent is 0100 0000. The interpretation is that the SCC chip associated with the CMB serial port error detected a CRC/framing error (bit 6 - 1).

12.0 DEV 11,0 (LAN)

The purpose of this section is to aid the C.E. in interpreting the fields in the error log display/printout pertaining to the Local Area Network Controller (LANC) boards in the Model 4108 Base Unit (in the MAI 2000 Series Desktop Computer System).

Since all the LANC hardware is on a printed circuit board assembly (PCBA) that plugs into the Central Microprocessor Board (CMB), in the Model 4108 Base Unit, this section provides only the necessary information to isolate a fault to that PCBA.

12.1 Type Field

The possible error numbers, shown in the Type field, are -665, and -670 through -676. They are interpreted as follows:

- 665 -- Board disable
- 670 -- Hardware-generated error/retry count exhausted
- 671 -- Length too long for receiving socket
- 672 -- Uninitialized socket
- 673 -- Invalid transmit control length
- 674 -- Invalid socket number
- 675 -- RCV socket busy
- 676 -- Destination host specification bad

12.2 Lettered Fields

The single-letter paragraph titles below represent the nine error log fields that are headed by those characters (in this case, only two fields are used). The corresponding paragraph interprets that field.

D

Field D displays the conditions for LANC shutdown. These conditions are valid only when error -665 occurs (see "Type Field," above). The three condition numbers, along with the condition name, are as follows:

- 1 -- Bus error
- 11 -- LAN write timeout
- 21 -- Another LAN node (LANC PCBA) has the same address

E

Field E contains the (hexadecimal) address of the LAN node (station) to which a LAN transmission failed. This address is valid only for error numbers -670 through -676 (see "Type Field," above).

13.0 CARTRIDGE TAPE

The purpose of this section is to aid the C.E. in interpreting the fields in the error log display/printout pertaining to the Magnetic Cartridge (tape) Streamer (MCS) subsystem of the MAI 2000 Series Desktop Computer System.

Since the MCS Controller hardware is on a printed circuit board assembly (PCBA) that plugs into the Central Microprocessor Board (CMB), in the Model 4108 Base Unit, this section provides only the necessary information to isolate a fault to that PCBA or to MCS itself.

13.1 Type Field

The possible error numbers, shown in the Type field, are -2, -62, -63, -89, -97 and -98. They are interpreted as follows:

- 2 -- An I/O error has occurred
- 62 -- The requested operation has timed out
- 63 -- The cartridge is write protected
- 89 -- The streamer is off-line
- 97 -- There is no cartridge in the streamer
- 98 -- ERDERCON

13.2 Class Field

The Class field contains one of three letters: F, N or S; the interpretation of these characters is as follows:

- F -- Fatal error. This is an MCS Controller error, a tape read/write abort error or an MCS timeout error. Only fatal errors are displayed/printed as a "By Type" log entry. All fields in this entry are explained in the following "Lettered Fields" paragraphs.
- N -- Non-fatal error. This is a "no cartridge" error, a write-protected cartridge error or a "drive not ready" error. (Note: An application such as "backup/restore" may need to be restarted for these errors.) All fields in this entry are explained in the following "Lettered Fields" paragraphs.
- S -- Summary of tape statistics. This is a summary that is supplied whenever the cartridge is rewound, and is not an error. Field A displays the number of 512-byte blocks processed (not including file marks). Fields B, C and D are as explained in the following "Lettered Fields" paragraphs. Fields E, T and U are not used.

13.3 Lettered Fields

The single-letter paragraph titles below represent the nine error log fields that are headed by those characters (in this case, only seven fields are used). The corresponding paragraph interprets that field.

A

Field A displays the (decimal) block number at the time the error occurred.

B

Field B displays the (decimal) number of files processed since the beginning of the tape.

C

Field C displays the (decimal) number of Underruns returned by the streamer.

E

Field E contains a number that indicates the most recent operation command sent to the streamer before the error occurred. The numbers and their interpretation are as follows:

- 0 -- MCS controller initialize
- 1 -- Space forward tape
- 2 -- Rewind
- 3 -- Retension
- 4 -- Erase
- 5 -- Read streamer (drive) status
- 16 -- Raw read
- 17 -- Raw write
- 18 -- Append

T

Field T contains a number that indicates the streamer status at the time of the error. The numbers and their interpretation are as follows:

- 1 -- Power on/reset
- 2 -- End of recorded tape

4 -- Bus parity error
8 -- Beginning of tape
10 -- Marginal block detected
40 -- Illegal command
80 -- A bit is set (1) in the byte that this hexadecimal number represents
100 -- File mark read
200 -- Bad block was not located
400 -- Unrecoverable data error
800 -- End of tape
1000 -- Write protected
2000 -- Catastrophic error
4000 -- Cartridge is not in place
8000 -- A bit is set (1) in the most significant byte of the two bytes that
this hexadecimal number represents (8000)

U

Field U contains a number that indicates the MCS Controller status at the time of the error. The numbers and their interpretation are as follows:

1 - Error, streamer (drive) status required
2 - Catastrophic error
4 - Power fail/reset
8 - Wrote to end of tape
10 - Unerased in area of append
20 - Aborted
40 - Write protected
80 - File mark detected
100 - No cartridge in streamer (drive)
200 - Bad data transfer

- 400 - Read to end of tape
- 800 - Filler sent
- 1000 - Chain processing terminated
- 2000 - IOPB parameter terminated
- 4000 - End of data
- 8000 - Operation successful