Chapter 3
11750

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Revision: Updated November 93 to include old factflashes

3.1 11750 Revisions

There are a number of different revisions of 11750 in the field. To determine the revision of a particular system you must examine the SID register. There are a number of different ways to examine this register.

1. From the console with the CPU halted.

```
^p
>>> E/I 3E
```

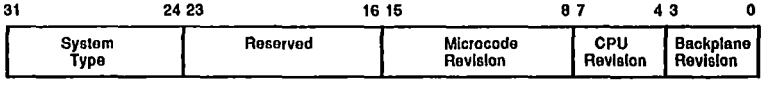
2. From any terminal when the system is running VMS

```
$ revision = f$getsyi("SID")
$ show symbol revision
```

3. From an errorlog

```
$ anal/error
(system ID is given in the first line of each entry)
```

The SID contains the following fields . . .



- The System Type is always 02 (hex).
- The reserved field is always 00 (hex).
- The Microcode Revision should be 68 (hex).
  If the system has just been powered on and the PCS microcode is not yet loaded then the microcode revision will be 5F (hex). If the microcode revision is not 68 (hex) then you should read the section on PCS microcode and then update your PCS to rev 68 (hex).

- The CPU Revision will be **7**, **8**, or **9** depending on whether you have a rev 7, rev 8 or rev 9 11750. The main difference here is that rev 8 and 9 boot ROMs load the PCS microcode from the console TU58 before booting, thus making sure it gets loaded.
- The final hex digit shows the backplane revision. It should be **0** , **8** or **C** .

SID	Backplane Revision	Memory Type	Memory Controller	Maximum Memory	Minimum Memory
xxxxxxx0	B	MS750-A	L0011	2 MByte	¼ MByte
xxxxxxx8	C	MS750-C	L0016	8 MByte	1 MByte
xxxxxxxC	D	MS750-H	L0022	14 MByte	8 MByte

So an 11750 that is completely up to revision would have a SID of 0200638C, but another 11750 with a SID of 02006270 might be at an acceptable revision if it is not in a cluster.

3.1.1 MS750-H upgrade

3.1.1.1 Component parts.

MS750-H consists of:-

- L0022 Memory controller. Replaces L0011 or L0016. Goes in slot 10. Any of these modules is known as a CMC (Comet Memory Controller).
- M7199-AA 4MB array. Must have **EXACTLY** 2. Go in the first two memory slots. [11+12]
- M8750 1MB array. Can have 6 max. for a total of 14MB. Slots 13-18.
  [Note that M8728 ¼MB arrays are NOT supported at all].
- EK-MS75H-UG the user guide.
- BE-FI26A-DE Pre-release diagnostic TU58. [contents as in "diagnostic revisions"]
  Not needed if VAXPAX 24 or later is available.

3.1.1.2 Installation notes.

To install MS750H the backplane MUST be rev C or later. This can be checked by examining the SID (See Section 3.1) If the SID is not xxxxxxx8 a rev C backplane must be fitted. After the installation the SID will be xxxxxxxC.

A wirewrap tool and some wirewrap wire are required.

The installation requires the addition of two jumpers:-
Slot 1 B82 to Slot 11 CJ1 and Slot 11 CJ1 to Slot 12 CJ1

There should be NO jumpers in slot 10 B84 and B85. This addresses the CMC at F20000.

There is an error [at least one!] in the user guide. On page 4-3 there is an incorrect diagram of the backplane pin layout. Use the 11750 black book page 206 instead.

MS750H only requires +5B, +5, and +2.5 volts. Values for current consumption are in the user guide.

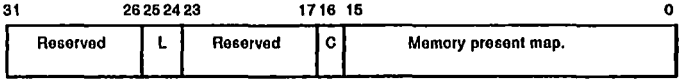
The system must be configured with a minimum of 8MBytes of memory. The L0022 will flag a configuration error without BOTH M7199's. The M8750 arrays are optional.

The functionality of the L0022 is the same as the previous CMC's [Comet Memory Controller] the only addition being the 4MB array support. It uses the same boot roms. See user guide figure 2-2 for a layout of the module. Notice the main difference is that a "MAD" gate-array replaces a "MAP" gate-array.

The upgrade instructions don't mention the need to get the customer to do an AUTOGEN as in the VAX/VMS system managers guide. The possible pitfalls with AUTOGEN are manifold and severe. You should stress this to the customer and leave HIM [or her] to it. To confirm the memory is all present and correct just bring VMS up and type $SHOW MEMORY this should always reflect the actual memory, regardless of the state of AUTOGEN. VMS will only make full use of the memory after an AUTOGEN.

3.1.1.3 Register differences.

The only register difference is some extra functionality in CSR2 F20008.



The memory present map has 16 bits, two bits for each possible array.

Array	0	1	2	3	4	5	6	7
BITS	0+1	2+3	4+5	6+7	8+9	10+11	12+13	14+15

These bits are decoded as follows

MSB	LSB	Meaning
0	0	No memory present
0	1	M7199 4MB
1	0	M8750 1MB
1	1	Illegal

Bits 25 and 24 (marked L) are decoded as follows.

Bit 25	Bit 24	Meaning
0	0	L0011
0	1	L0016
1	0	Unused
1	1	L0022

Bit 16 (marked C) is the Cold/Warm start bit

Bit 16	Meaning
0	Memory contents valid. Try warm restart
1	Memory contents invalid. Don't do warm restart

3.1.1.4 Physical address location.

Address Range				Array	Slot
00000000	to	003FFFFF	0-4MByte	1st	11
00400000	to	007FFFFF	4-8MByte	2nd	12
00800000	to	008FFFFF	8-9MByte	3rd	13
00900000	to	009FFFFF	9-10MByte	4th	14
00A00000	to	00AFFFFF	10-11MByte	5th	15
00B00000	to	00BFFFFF	11-12MByte	6th	16
00C00000	to	00CFFFFF	12-13MByte	7th	17
00D00000	to	00DFFFFF	13-14MByte	8th	18

3.1.1.5 Diagnostics.

The Micro-diagnostic revisions that support the MS750H and also L0003-YA are:-
[These are available from VAXPAX release 24]

ECKAA	8.7	Micmon
ECKAC	8.0	MIC micro-diagnostic
ECKAM	3.0	CPU cluster and memory diagnostic.
EVKAA	10.1	VAX hardcore
EVKAM	5.0	User mode memory diagnostic.

3.1.2 PCS Micro-code

When a 11/750 is powered up it has rev 5F (95 decimal) CPU micro-code. The current latest revision of CPU micro-code is rev 68 (104 decimal). The lowest supported revision of CPU micro-code was rev 62 (98 decimal) for non CI based systems or rev 63 (99 decimal) for CI based systems. VMS 5.2 onwards needs 68 (104 decimal). If your 11/750 is running with low rev micro-code you may suffer from any one or more of the following symptoms.

- Translation Buffer parity errors
- Fatal Bugcheck UCODEREV (CI based systems only)
- CI750 reporting "Memory System Errors" caused by CMI "Read Lock Timeout"
- CI750 "Data Structure Errors type B or type C"
- System hangs when using DEBUGGER

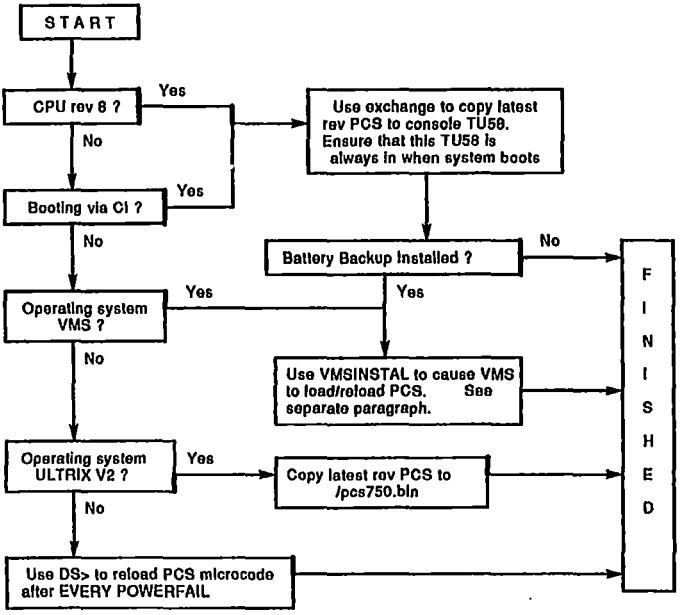
Refer to Figure 3–1 to decide how the micro-code should be loaded in any particular configuration. Once loaded the MICRO CODE will remain until powered off, or reloaded.

- If you need to copy the latest revision of PCS750.BIN from your VAXPAX diagnostic tape to the console TU58 then use the following command.

```
$ EXCHANGE COPY/REPLACE SYS$MAINTENANCE:PCS750.BIN CSA1:/TRANSFER=BLOCK
```

- If you want VMS to load the PCS microcode for you then you can either get the files from diagnostic TU58 #3 (VAX 11750 micro-patch BE-T538E-ME or later) or from a VAXPAX diagnostic tape. If you use the TU58 then you use @SYS$UPDATE:VMSINSTAL or @SYS$UPDATE:VMSUPDATE to install the PCS micro-code, (which one you need depends on the revision of the TU58). If you want to use the VAXPAX diagnostic tape to load the

Figure 3–1: How to update 11750 PCS microcode



micro-code then copy PCS*.* from the tape to sys$maintenance:, then issue the following commands.

```
$ SET DEF SYS$MAINTENANCE
$ DEFINE SYS$KIT SYS$MAINTENANCE
$ @PCS750KIT
```

Whether you use TU58 #3 or the Diagnostic distribution of PCS you will be prompted to answer a number of questions about your configuration. The most important of these is "Do you have battery backup?" if you say yes to this then a device called WDA0 will be created every time you boot the system. This device is used to reload the microcode after a powerfail.

After you finish the installation check that there is one and only one command in the system startup command file to load the PCS micro-code.

If a customer wishes to obtain a copy of the PCS750 micro-code TU58 then they can order it through the SDC. The part number is ZD029-CG. This includes the tape and a set of installation instructions.

- **NOTE:** that, although VAXPAX 34 was the last to officially support '750s, rev 68 (104 decimal) PCS micro-code came on VAXPAX 36.

3.2 11750 Machine Checks

Figure 3–2 is a diagram of the stack after an 11/750 machine check. The following points should be borne in mind.

1. If you have a summary parameter of 5 then the rest of the stack contains very little useful information. The PC at the bottom of the stack will be close to the PC at the time of failure, the rest of the stack is meaningless! Write bus timeouts with no other symptoms can be very difficult to fix!!

2. A summary parameter of 2 is the most common, you get this for any sort of translation buffer, cache or memory error. It is important to decode the other registers to decide which of these you have.

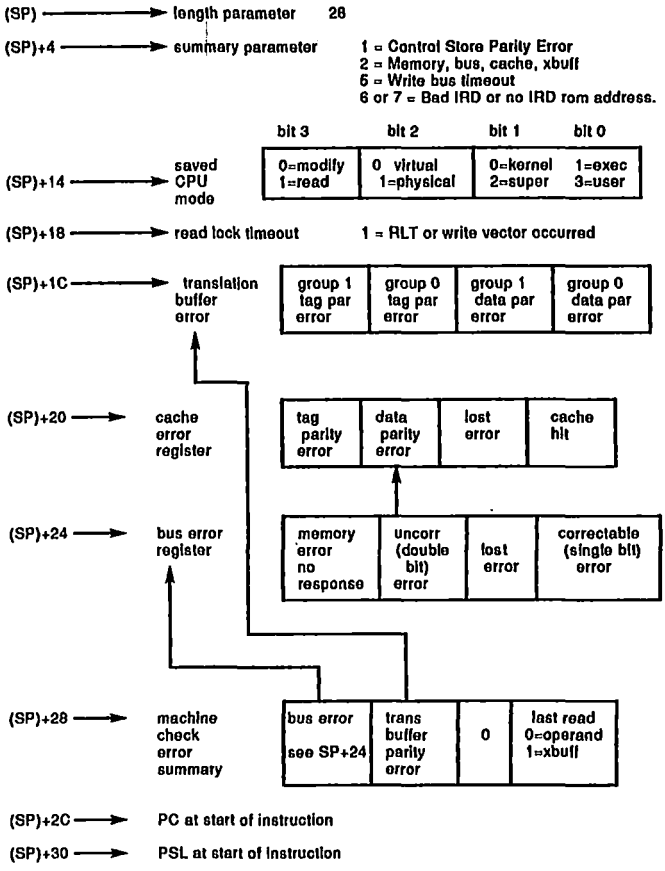
   - If you have a value of 4 or 5 in the cache error register and 0 in the translation buffer error register then you have a cache parity error, **YOU CAN HAVE A MACHINE CHECK CAUSED BY A CACHE PARITY ERROR EVEN WHEN THE REGISTER SAYS THAT YOU DIDN'T HAVE A CACHE HIT**

   - If you have a value of 1, 2, 4 or 8 in the Translation buffer error register then you have had a translation buffer parity error. Check that your 11/750 has at least rev 98 of the PCS micro-code before you replace an L0003 for this symptom.

   - If you have a value of 8 in the bus error register then you have had a memory timeout. The failing virtual address may be a memory or an I/O address. Use the output from `SYSGEN> SHOW /UNIBUS` to see if the failing virtual address is a unibus device.

   - If you have a value of 4 in the bus error register then you have had either a double bit error from memory OR a cache parity error, look in the cache parity error register to determine which.

Figure 3–2: 11750 Machine Check Stack Logout



3.3 Diagnostics

3.3.1 Micro-diagnostics

On some 11/750's micro-MIC or micro-DPM may fail with various intermittent symptoms. The only cure for this is to install a jumper on the CPU backplane whilst you are running micro-diagnostics.

SLOT 5 pin B44	to	SLOT 5 pin B48
control store address bit 13	to	ground

This failure is most commonly seen on 11/750's with floating point accelerators but any 11/750 can display these symptoms. It is best to install the jumper before you run any 11/750 micro-diagnostic.

Don't forget to remove the jumper when the micro-diagnostics have finished. Otherwise VMS will not boot!!

3.3.2 Macro-diagnostics

3.3.2.1 ECCBA Unibus adapter diagnostic.

The unibus adapter diagnostic expects to find a UET (M9313) on the end of the first unibus **ONLY** . The DW750 second unibus has UET functionality on the adapter itself and if you terminate the second unibus with a UET the diagnostic gets very unhappy. If you want to thoroughly test a unibus then you can use a PMK04 unibus exerciser. On the second unibus the PMK04 can simply be connected instead of the unibus terminator. On the first unibus you need to open the PMK04 up and remove it's terminator and install the UET instead. To connect the PMK04 use the following commands.

```
DS> ATTACH DW750 HUB DW0
DS> ATTACH UBE   DW0 UBA0 770000 510
DS> ATTACH UBE   DW0 UBB0 770020 514
DS> SELECT DW0
DS> SELECT UBA0
DS> SELECT UBB0
DS> SET FLAG TRACE
DS> RUN ECCBA
```

3.4 Writeboot

WRITEBOOT is a utility which does a directory lookup for a file and writes the file header information into block 0 of the disk. This enables the 11750 boot roms (which don't understand directories) to find the bootfile. For VMS this bootfile is VMB.EXE, for diagnostics it is ECSAA.EXE.

If the bootfile is moved then it is necessary to run writeboot again, otherwise the system will not be able to reboot. When you run writeboot it will prompt you for the following information about your bootfile.

Filename	VBN	Load Address	Description
VMB.EXE	1	200	VMS Primary bootstrap
EVKAA.EXE	2	200	Hardcore tests
ECKAL.EXE	2	200	Translation Buffer and Cache diagnostic
ECSAA.EXE	2	10000	Diagnostic Suprervisor
BOOT58.EXE	1	C000	Console program

3.5 CMI Arbitration Levels

When adding CMI options on to an 11750 it is important to set the CMI arbitration levels correctly. Setting these levels incorrectly can cause subtle and intermittent symptoms.

The options which can be installed on the CMI are

DW750	L0010	Second Unibus	Highest Priority
RH750	L0007	Massbus	
CI750	L0009	CI	
DR750	L0014	Parallel i/f	Lowest Priority

The Arbitration priority level is selected by jumpers on the CPU backplane. See the 11750 black book page 202, or the metal backplane cover on any 11750 for a diagram showing how to set these jumpers to any particular arbitration level.

There are three possible arbitration levels,

ARB3	Highest Priority	pin 62 to 64		
ARB2		pin 60 to 62	pin 63 to 64	
ARB1	Lowest Priority	pin 60 to 62	pin 61 to 63	pin 64 to 66

There are a number of rules which determine Arbitration levels.

- You should only use ARB2 if ARB3 is also in use. Only use ARB1 if all three option slots are occupied.
- If you have a DW750 then it is **ALWAYS** at ARB3. This is hardwired on the module and cannot be changed. You can only have ONE DW750 on the 11750 (making a total of two unibuses).
- You can have one, two or three RH750s. These should be at higher priority than any DR750 or CI750 options.
- You can only have one CI750, you cannot have a CI750 and a DR750. The CI750 should be at a lower priority than any other CMI option.
- You can have a maximum of two DR750s. If you have a DR750 then you are not allowed to have a CI750. The DR750 should be at a lower priority than any other CMI option.

Arbitration levels for some typical configurations are . . .

DW750 at ARB3, CI750 at ARB2
DW750 at ARB3, RH750 at ARB2, CI750 at ARB1
DW750 at ARB3, DR750 at ARB1
DW750 at ARB3, RH750 at ARB2, RH750 at ARB1
RH750 at ARB3, CI750 at ARB2
RH750 at ARB3, RH750 at ARB2, CI750 at ARB1

3.6 Accessing Unibus Addresses

It is often useful to be able to read or write a Unibus device register from the console of a halted system. Some uses are obvious, such as examining the SA register of a UDA50 when the system won't boot from an RA drive. Other uses are less obvious, such as the easy way to troubleshoot a faulty line printer by depositing a character and a carriage return in its data buffer. (This eliminates all queues, device characteristics . . . .

To convert a unibus address into an address that can be used at the 11750 console first convert the OCTAL address into HEX. Then add FC0000. (Or F80000 for the second Unibus). When you use this address from the console you must specify that you wish to do a WORD operation. 32 bit transfers on the unibus tend to be unsuccessful.

Table 3–1: 11750 Console Physical Addresses of common Unibus Options

Device	Octal Address	Physical Address DW0	DW1
DEUNA	774510	FFF948	FBF948
LP11	777514	FFFF4C	FBFF4C
RK06/7	777440	FFFF20	FBFF20
RL01/2	774400	FFF900	FBF900
TU80/TS11	772520	FFF550	FBF550
TU81/TK50	774500	FFF940	FBF940
UDA50	772150	FFF468	FBF468
UET	772140	FFF460	FBF460
	760000	FFE000	FBE000
	760100	FFE040	FBE040
	760110	FFE048	FBE048

So to deposit the letter A followed by a FORM FEED to a printer, and then check the CSR.

```
>>> D/P/W 41 FFFF4E
>>> D/P/W B FFFF4E
>>> E/P/W FFFF4C
```

3.7 Console tape generation (old factflash)

At Welwyn, the WELUNI system can be used to produce console tapes. The TU58 drive's are mounted to the side of the RL02, in the expansion cab. Put a write enabled cassette into drive 0.

Login to WELUNI and use CONSCOPY as shown:

1. $ set def sys$update
2. $ @conscopy
3. Answer questions as follows:
   - Which CPU kit do you want to build? 750
   - Do you want to SAVE or RESTORE your console TU58?: RESTORE
   - Enter file name of virtual disk [default SYS$DISK:CONSOLE.DSK]: <CR>
   - Do you want log messages as files are copied? [Y/N, default Yes]: <CR>
   - Enter console device drive (DDCU:): DDA0:
   - Put your console TU58 into drive DDA0:, and type <RETURN> when ready: <CR>
4. Wait (some time!) for the message "The RESTORE of your console TU58 is complete."
5. You can now remove the cassette and logout.