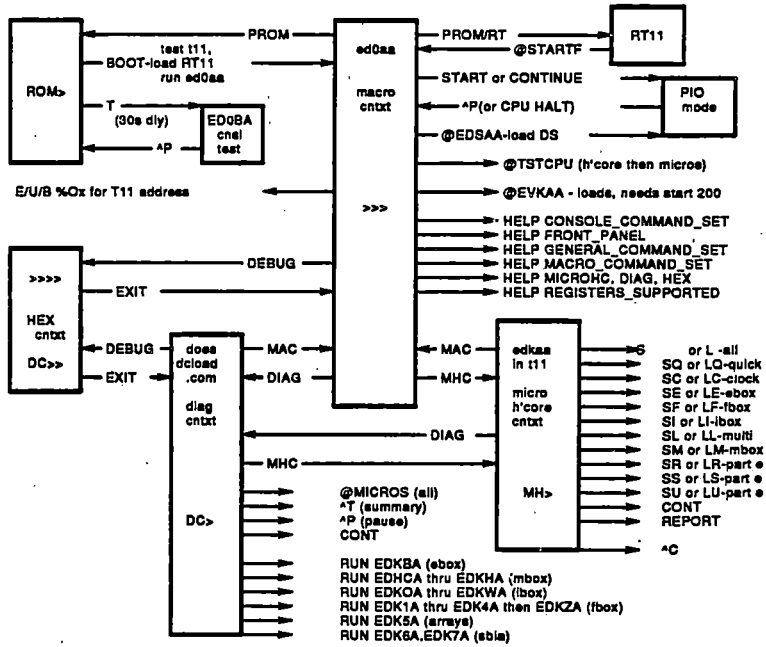
Chapter 5
8600/8650

5.1 reference information

Figure 5–1: Console Contexts



5.1.1 8600/8650 Differences

	8600	8650
	KA86-AD	KA86-BD
SID	04xxxxxx	048xxxxx
Jumper J9, P17 to P18	IN	OUT

5.1.2 Module Utilisation

	8600	8650†		
		Memory Slots		
9	L0222	same	-MTM-	memory terminator
1-8	L0200	revD1	-MEM-	4mB array (MS86-BA)
1-8	L0226	same	"	4mB array (MS86-AA)
1-8	L0225	same	"	16mB array (MS86-CA)
1-8	L0235	same	"	64mB array (MS86-DA)
5/8	L9200	same	- -	load module (>slot 5/8 unless occupied, not needed if L0225 fitted)
		CPU slots		
18	L0220	L0230	-MCC-	mbox cache control
17	L0205	revE1	-MAP-	mbox address path
16	L0204	revF1	-MCD-	mbox cache data
15	L0208	same	-IBD-	ibox instr data path
14	L0206	revH1	-IDP-	ibox data path
13	L0207	same	-ICA-	ibox control A
12	L0214	same	-ICB-	ibox control B
11	L0217	L0231	-CLK-	clock
10	L0209	same	-EDP-	ebox data path
9	L0219	same	-EBE-	ebox wbus registers
8	L0212	revH1	-FBA-	fbox adder (L0223=term module)
7	L0213	same	-FBM-	fbox multi (L0218=jumper module)
6	L0211	revE1	-EBD-	ebox control 2 (rev F is ECO not FCO)
5	L0210	same	-EBC-	ebox control 1
4	L0216	same	-CSB-	ebox control store B
3	L0215	same	-CSA-	ebox control store A
2	L0201	revF1	-CSL-	console
1	Spare			
		ABUS slots		
35	L0203	same	-SBA-	abus interface
24	L0202	same	-SBS-	sbi interface
1	L0224	same	-STM-	sbia terminator

† 8650 shows new module or minimum revision

5.1.2.1 8600/8650 kit

- The L0230 and L0231 are kept in the "8650" kit in logistics.
- The 16Mb and 64Mb arrays have 8xSMU's. The SMUs are in the 8650 kit,
- The module resealing labels are in one of the large boxes.
- A set of cables, airflow and temperature sensors are in box 6.
- The City has cables in kit#289, modules must be ordered individually.
- KIT 284 contains console software, drawings and fiche.

5.1.2.2 Rare part numbers

- The 16Mb SMU was 54-16500-AA but became 54-16500-AB (to be the same as the VAX-8800), the 64Mb SMU is 54-17052-AA.
- Filter 12-14045-06
- Module Door Lock 12-21423-01

5.1.3 8600 to 8650 upgrade

5.1.3.1 General

The materials required to upgrade a VAX 8600 kernel to a VAX 8650 kernel vary, dependent on the revision of the logic.

Field Service is informed by the sales representative that a system audit is required for the customer's system. Field Service then goes to the customer site to obtain the necessary system audit information as laid out on the audit sheet. At the same time Field Service verifies the VAX 8600 system is reliable.

Following the audit, Field Service will inform the sales representative to order the required Upgrade Kit (861UP-AA and 861UP-BA, if required) plus the appropriate number of memory array modules (MS86-AA). When the customer receives the Upgrade kits, Field Service will then schedule the installation to upgrade the system. VMS4.3 must be installed prior to the upgrade and a release 6 Console pack needs to be available. A thorough system checkout completes the installation of the VAX 8650 Upgrade kit. Finally, Field Service will pack up the old material and remove it from the customer site.

5.1.3.2 Upgrade kit breakdown

Upgrade Kit 861UP-AA comprises a L0230(new MCC) and L0231(new CLK), this kit will always be required.

Pre-requisite Kit 861UP-BA is required if L0204<revF1 OR L0205<revE1 OR L0206<revH1 OR L0211<revE1 OR L0212<revH1.

Memory Array Kit MS86-AA is needed for each L0200<revD1 in existing configuration. Rev D1 arrays are stamped on front edge of metal stiffener and the DC109's are marked "pass 5".

5.2 Notes for installation engineers

5.2.1 Configuration notes

No neutral wire is needed for 8600. >>>SHOW POWER should give a ground current reading of about 80mA. Note that some external comms equipment connected to DMZ32 can cause this to be high, a way to overcome this is to isolate the FCC panel from the chassis. The symptom could be EMM problems, this is o/k after KA86 eco 3.

If 3 phase not in correct sequence, blower goes backward. Air still comes out but not very powerfully. The part number for the 3 phase power receptacle is 12-19321-02.

BA11A can take 4xDMZ32, 1xDMF32, 1xDEUNA, this can be altered but there are restrictions above normal rules :-

- These modules total 320 watts, this limit must not be exceeded
- Options over 40 watts must have empty adjacent slot on component side.

Speedy 399 - vaxstuff gives 8600 configuration rules. Unibus on DW2 cannot be extended due to BG lines crossed. This will be fixed at some time, ECO 70-19197 MR002 lists wire changes to overcome this problem. QBUS & UNIBUS & EMM & CONSOLE/RDC cables at cpu backplane - the red stripe is on the top edge and cable comes out of left-hand side of Berg plug.

Part numbers for SBI expansion cabinet cables.
SBI cable is 17-00087-04.
ACDCLO cable to SBI terminator from J7 is 70-15632-00.
+/-5V cable to SBI terminator from J9 is 70-15630-00.
Remote cable to 869 from J8 is 70-08288-0E

5.2.1.1 SBI cables - to expand

The left-hand column of pins is for SBI0, the right-hand for SBI1.
The 5" cables (17-00326-02) between ABUS and IO backplanes are for SBI1.
The 2.5" cables (17-00327-01) are for SBI0.
The cables (17-00327-01) that join the cpu backplane to the memory and i/o backplanes are NOT interchangeable with SBI cables.
UNIBUS cables have caused much confusion, there are at least two styles of bundling the 3 cables (70-20540-15 is the 8600 set, 70-14246-15 was one of the 780 sets). The bottom line is that M9014 J3 goes to the lowest on the 8600 backplane (for some reason this end of the cable is labelled J15 or J18 on 8600 style), M9014 J2 goes to the middle (label=J14 or J17), M9014 J1 goes to the top (label=J13 or J16)
The old BA11K is not supported on 86x0's, it will work o/k except there is a power-up sequencing problem.

5.2.2 RDC/CONSOL hitlist

RDC problems? Look at pcb behind RTY/CTY outlets, there should be jumpers on W1, W2, W3 only. These are parallel with and closest to top edge. Counting from BERG they go W4-W3-W2-W1.

If no RDC you must insert loopback connector (12-15336-00), else the line continually interrupts. The same thing happens due to long or unterminated RDC cables generating noise which results in ROM> prompt or ?TTYERR at power up.

To allow RDC to log in when console already in use, include *SYSGEN> CONNECT OPA1:* in systartup file (VMS4.2 Release Notes say use *CONNECT CONSOLE/REMOTE*).

If modem is 300 baud, edit the RL02 file LOAD.COM to include SET TERM commands (not sure if need *$set term/perm/speed=300 opa1:* in systartup.com as well but it can't harm it).

VSR package is needed to print a formatted snapshot by onsite engineer, but RHM is needed so RDC can "reliably" copy a snapshot to Viables for analysis by software tool (VSA)

RDC cable part number. Installations tell me BC05D-25 is a good number, cables book says BC22F-25 replaces this.

From Nov 86 the console software includes a protocol check on connection thru the RDC port. This means you can no longer plug a terminal directly into this port.

5.3 Notes for A/R engineers

5.3.1 Hit List

ERRSNAP.COM must be in SYS$SPECIFIC:[SYSERR] - not SYS$COMMON - fixed in VMS4.2 else you don't copy snapshot to system disk. We've found that this keeps getting deleted on-site so I put a copy onto the RL02.

Restart switch must be set RESTART-BOOT to get a crash dump on pathological halts (ie KAF 1B) like Interrupt Stack Invalid. SYS$MANAGER:SYSTARTUP.COM must include

```
$MCR SYSGEN
CONNECT CONSOLE/REMOTE    !to allow RDC to login to vms
CONNECT CONSOLE           !to allow access to RL02 under vms
EXIT
```

Do a >>>SHOW UCODE to find versions of microcode. VSR software must be installed to allow engineer to print a snapshot.

To install the VSR software:-

```
$ EXCHANGE
EXCHANGE> COPY CSA1:VSRCOP.COM *.*
EXCHANGE> EXIT
$ @VSRCOP
```

To run the VSR software:-

```
$ SET DEF SYS$ERRORLOG
$ @VSRSETUP
```

This will give you some information, the end result being that you just type *$ VSR*. Then get a hard copy of ERRSNAP.REG. If SFBYTECOUNT=58 in ESCRATCH 17, then you will have a machine check situation to analyze. Normally you would use the System Fault Isolation Guide, but there is a utility to help you; do a *$ RUN VSRISO* and this will point you to the relevant scenario in the SFI guide.

RHM software must be installed to allow RDC to analyse a snapshot, even if the customer doesn't want RHM as such the software is needed for this. There must be a backup of the console RL02. All systems are delivered with a console pack (no diags) and a scratch pack. You can copy a console pack (with diags) to both these packs.

5.3.2 RL02 drive maintenance

The RL02 is a prime example where an ounce of PM can prevent a ton of hassle.

Clean foam filter behind RL02 front panel

Check you have an alloy shield covering the top of the sector transducer. This is on the baseplate in front of the spindle. The shield prevents "pack degradation", which could be a major problem on the 8600 because the pack is always in the drive.

Check the cleanliness of the heads. They can be cleaned by powering off the drive (remember to switch off the CVT to remove power from the drive and the BA11 simultaneously), then gently pull heads forward onto a texpad wrapped on a wand. If heads appear excessively dirty check that they are retracting on a power fail !

The RL02 will be maintained using the option swap philosophy remember that it must be set for 110 volts, there is a voltage selector on the rear of the RL02.

RL02 pocket service guide is EK-RL012-PG-005

There are LOTS of tech-tips on RL01/RL02 !!!

EDKAX/SEC:RL02 purports to test the drive with a scratch pack

The micro-hardcore now does a test using the diagnostic pack

5.3.3 RL02 file maintenance

This section outlines how we maintain the diagnostic packs in the North London District.

We normally get the RL over the network and then "tailor" some files to give us the latest revisions available. Copies of the latest packs are kept at Welwyn in the Datadoc media cabinet and at Borehamwood in the 8600 Kit. Because releases and updates are frequent these packs will not be fitted on site every time there is a change.

Engineers will be notified when a release is mandatory.

Sometimes we will put the latest release on a site if we think it will fix a problem. Experience has shown that later releases have better module callout on micro diagnostics.

Our copies differ slightly from the rest of the world. The DEFBOO.COM file automatically gives you some help. By doing >>>*SHOW NOTES.DAT/A* you can get a list of the help files available. >>>*SHOW ALTERS.DAT/A* gives a list of the changes from the standard release. The VSR files are also on our copy.

5.3.4 Making a new RL02 console pack

First use BACKUP to copy the saveset from magtape onto the system disk.

```
e.g. $ MOUNT/FOR MUA0:
     $ BACKUP MUA0:CONSOL.BCK *.*
```

- You will now have a virtual disk called CONSOLE.DSK on your system disk. The second stage is to use EXCHANGE to copy site specific files from the existing console to the virtual disk. Obviously DEFBOO.COM will be one of these but watch out for customers who write their own file to boot standalone backup (STBBOO.COM seems to be the favourite name).

```
e.g. SMCR SYSGEN
     SYSGEN> CONNECT CONSOLE
     SYSGEN> EXIT
     $ EXCHANGE
     EXCHANGE> MOUNT/VIRTUAL FE: CONSOLE.DSK
     EXCHANGE> COPY CSA1:DEFBOO.COM FE:*.*
     EXCHANGE> COPY CSA1:STBBOO.COM FE:*.*
     EXCHANGE> EXIT
```

- The third stage is to use *@SYS$UPDATE:CONSCOPY* to restore to a new console pack from the virtual disk. Finally install the VSR files thus:-

```
     $ SET DEFAULT SYSSERRORLOG:
     $ EXCHANGE
     EXCHANGE> COPY CSA1:VSRCOP.COM *.*
     EXCHANGE> EXIT
     $ @VSRCOP
```

Don't forget you must go right back to a power fail to load in any new microcode from this new pack.

```
**********************************************************************
* Engineers will be advised of the current status of these RL02's *
*  by factflash which should be kept at the end of this chapter.  *
**********************************************************************
```

5.4 Notes for troubleshooting

5.4.1 General

SET CLOCK NORMAL is the only command to force use of normal crystal, do not use SET CLOCK 50.

To boot a system with a duff TOY BBU, remove J18 at BBU, jumper A0203 to A0204 (L0201 CSL module).

VMS hung at IPL15 is a symptom of DD11 needing twisted pairs on SACK

If getting airflow warnings check wire crimps at sensors.

Use YELLOW/SILVER (+L07032-02) seal to re-seal a good module
Use RED/SILVER (+L07032-01) seal on broken modules for repair

The L0223 (FPA substitute module) has 8 jumpers, 2 of which must be OUT, as per drawing FTM3 else Micro Hard Core fails.

New machines (and swap kit) have the Rev E CLK module. This conflicts with the release 5 RL02 which has CLKC03.CDF, if you fit a Rev E CLK module you need CLKE01.CDF and the file CONFIG.DAT must be edited to point at the one to use. The latest console holds both the .CDF files and software will edit the CONFIG file then reboot if it discovers a mismatch.

5.4.2 Front End Cab

The RLV12 uses +12v generated on the M9403 from +15 in the BA11 PSU. This module has a fuse and a potentiometer, check pin B01D2.

RL02/BA11 must NOT be switched off individually else CVT overdrives the one left switched on, this has been fixed by an FCO.

The power supply in the front end BA11 is special (not the same as a 1144), its a H7140-CA which runs the fans slower than normal for quietness, this is the reason for the load restrictions.

A new supply for the BA11 (H7204-BA) will be phased in, this is sometimes referred to as a ELEM. The H7204-BA is the 120v version, if you can't get one then a H7204-BB (the 240v version) can be easily converted; just unplug P11 from J13, turn it over, and plug it back into J11 (don't forget to change the label!)

When troubleshooting a H7204-BA, there should be 3 green LEDS to say all is o/k. If all 3 are out, check power input, replace H7203 then replace whole H7204. If an individual LED is out replace individual regulator (H7203, H7216-A or H7217). There is a scarce book called "BA11-A Mounting box with H7204-B Power Supply User's Guide" EK-H7204-UG which contains all the info.

If you are 'upgrading' to a H7204-BA, this needs at least .75A loading on the -15V so a load module (M9049) may be needed in slot 1F of first backplane The new supply also uses a different fan assembly (part number 70-22115-01, if you can get it!)

5.4.3 Memory

5.4.3.1 Address map

These big numbers make it difficult to identify an array from a physical address.

```
In steps of 1mB :-
                  00000000-000FFFFF is first  1mB
                  00100000-001FFFFF is second 1mB
                  00200000-002FFFFF is third  1mB
                  00300000-003FFFFF is fourth 1mB  etc.
In steps of 4mB :-
                  00000000-003FFFFF is first  4mB
                  00400000-007FFFFF is second 4mB
                  00800000-00BFFFFF is third  4mB
                  00C00000-00FFFFFF is fourth 4mB  etc.
In steps of 16mB :-
                  00000000-00FFFFFF is first  16mB
                  01000000-01FFFFFF is second 16mB
                  02000000-02FFFFFF is third  16mB
                  03000000-03FFFFFF is fourth 16mB  etc.
```

5.4.3.2 Load modules

L9200 load module for memory power supply, 2 needed if fewer than 5 arrays, 1 needed if 5, 6 or 7 arrays present. Use slot 5 & 8.

5.4.3.3 16mB modules

The 16mB arrays consist of a L0225(motherboard) and eight 54-16500-AA or -AB's (daughter boards - also called SMU's). Put 16mB boards before 4mB boards. Maximum configuration is 4x16mB plus 1x4mB. Diagnostics and VMS4.3 call out the failing SMU where applicable.

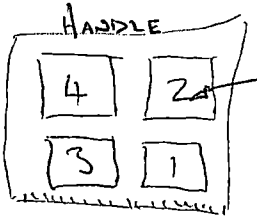
The SMU part number 54-16500-AA has been replaced with a lower-power version, 54-16500-BA. Both versions are interchangeable, on the L0225, and can be mixed. VMS V4.3 or greater will put the array type code in MSTAT2 < 27:24>, but do not expect a machine check logout or snapshot file to contain valid information in this field. This chart pertains directly to information that ERRFMT has got its hands on, i.e. an ERRLOG entry. If you are getting your register data from a machine check logout or snapshot file, just take the fork, when you get to it, which says the array-type-code information is valid.

5.4.3.4 Memory Fault Isolation

Figure 5–2: Physical Layout of SMU's

SMU8	SMU5	SMU3
SMU7	SMU4	SMU2
SMU6		SMU1

64 MEG



54-16052-AA

Figure 5–3: New Memory Fault Isolation flowchart.

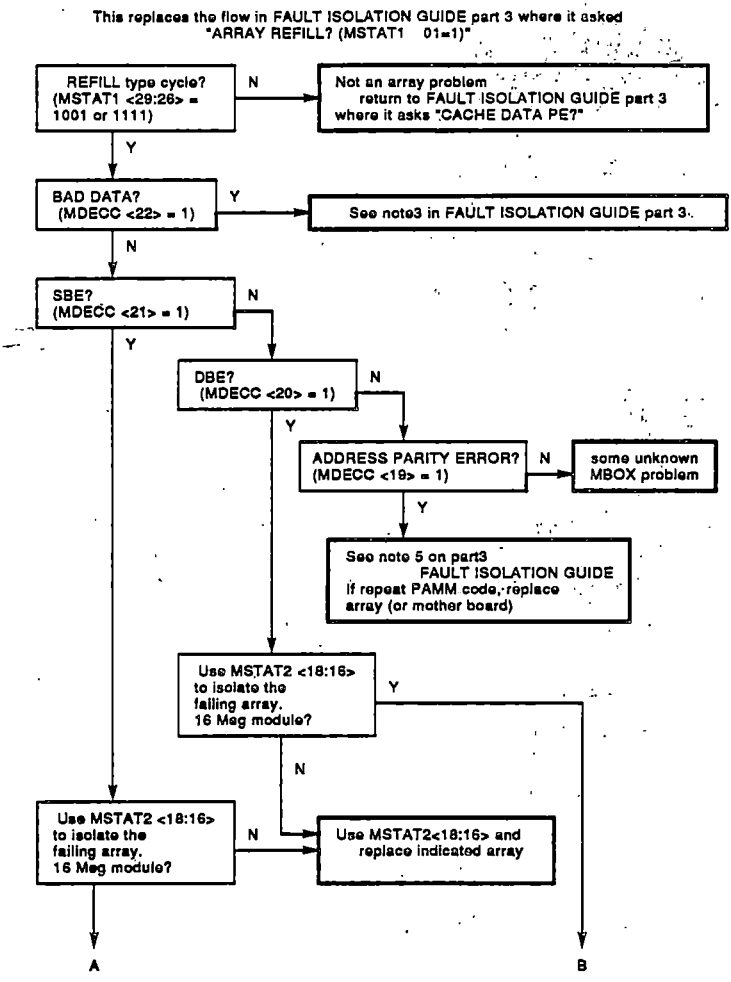
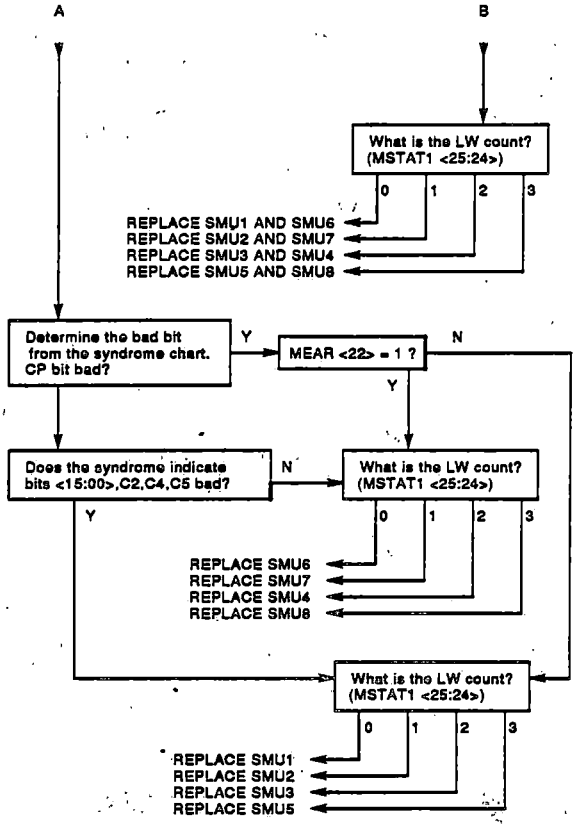


Figure 5–3 Cont'd. on next page

Figure 5–3 (Cont.): New Memory Fault Isolation flowchart



Syn-	70	6666665555544444333332222211111	4 2 1 0 0 0 0
drome	07	6543213265465432654326543654321	0 0 0 4 2 1 0
Bad	BA	3322222222221111111110000000000	C C C C C C C
Bit	DP	1098765432109876543210987654321 0	6 5 4 3 2 1 P

Note: The syndromes shown are in "OCTAL" and are contained in MDECC <14:09>

5.4.4 RL02 boot troubleshooting flow

There are some good flows in the 8600/8650 Maintenance Guide, however not everyone has the latest copy and the information is a bit heavy if you haven't seen it for sometime.

POWER-ON	If all the circuit breakers are good, the outside regulators (K and L) come on first
CHECK MODULE KEY LOOPS	See EMM/CLK module LEDS if this fails
SWITCH ON REGULATOR A	This is the second from the right and provides +5v to the EMM and CSL which causes 2 things to happen in parallel
1. EMM INIT FLOW	The EMM does self-test, initialises itself, then waits for the CSL to tell it what to do
2. CSL INIT FLOW	The CSL does some self-testing, uses the lights to show its progress
PRINT PROM BANNER	Either "VAX 8600" or the PROM revision
MORE SELF-TESTING	Errors will now be reported on the terminal
RING BELL	The PROM pauses here to allow the engineer to type a character, aborting the sequence and going to PROM>
QBUS TEST	The PROM checks out access to the QBUS and some functionality. A failure at this point with zeroes in the RL registers is probably due to the +12v missing
BOOT THE RL02	READY should flicker as the software is read
PRINT NOTICE.TXT	Typically, revisions in a box of stars
PRINT "Initializing"	The console program explores its environment etc.
PRINT "Initializing power system"	The CSL starts talking to the EMM which should have been waiting for a command. The EMM will be told to switch on the rest of the regulators and the CSL will check its all good. The command file CLOCK.COM will be executed here
PRINT "Initializing CPU"	The command file LOAD.COM is executed. This sets up the cpu to run macro programs. The end of LOAD.COM causes the configuration printout
PRINT ">>>"	

5.4.5 ED0BA console diagnostic

Needs an RL02 for testing DMA reads. Console module (L0201) revision must match ED0BA version. L0201 rev E01 needs ED0BA V34 or V35. L0201 rev F needs ED0BA V36 (I've seen V36 work on rev E2).

5.4.6 Diagnostic problems

MHC gives intermittent failures calling out L0207 V$5204 & V$5274
Micros will give "INVALID DSM ALIVE BYTE" if you specify an excessive pass count ("excessive" seems to be as low as 30)
Check GUIDE.MEM to run micros on clock margins.
EDK5A always needs an array in slot 0. ESCRATCH 11 may be set to not test specified arrays.
EDK6A gives MBOX PARITY ERROR, hit CNTRL*T* to see if in test 26
EDK6A needs a good array in slot 1
EDK6A gives "DSM alive error" in test 20 on 8600's.
EDK6A fails in TEST 9 if SBI FAIL/DEAD is set.
EDK6A/EDK7A are both needed to run to test an SBIA. ESCRATCH 34 must be set to 101 if you've got 2 SBIA's.
EDK7A may be set up to test the new interlock logic on the new DW780 module.

Never use "write" under EVSBA, it corrupts the RL02
EVKAE gives "TOY count not proceeding correctly" on 8600's

5.4.7 Hardware problems

EMM shutdown codes 1 & 5 never get displayed.
DMZ32 intermittently fails self test on power up. Latest news is to disable the self-test anyway.
EMM AC I/P MODULE FAULT on cold start - use H7170-A rev D
CPIOBUFERR + SBI TO + UNEXRDDATA + DW led's=277 - use M8273 rev D
RH780 multiple transmitter - use M8275 rev J1/J2
DR780 "read data timeouts" when system busy - use M8297-YA
RL02 ready light flashes - use CVT 30-23959-02 rev F1
Unibus t/o's,SBI read data t/o's,data lates - use L0203 rev C1
CLK revE module gives BADREG on SHOW REG due to new layout

5.4.8 ECO Index

KA86-002	EQ-01382-01	speedy 407	CI path failures
quick check	Ferrite doughnuts on black cables to bulkhead		
KA86-003	EQ-01386-01	speedy 416	comms errors in FEC
quick check	Strap LH (& RH) hole 53 to backplane ground		
KA86-004	EQ-01406-01	speedy 424	comms errors in unibus cab
quick check	Rear slide brackets bolted directly to frame		
KA86-005	EQ-01407-01	speedy 425	Air muffler falls off
quick check	air muffler box should be REV B		
KA86-006	EQ-01408-01	speedy 434	RDC panel violates RS232
quick check	assembly should be REV B1, see label on metalwork		
KA86-007	EQ-01409-01	speedy 439	Several cpu fixes
quick check	ICA becomes rev J1, ICB becomes rev H1		
KA86-008	EQ-01432-xx	speedy 453	Safety issue on mains connector
KA86-009	EQ-01430-01	speedy 453	brings L0220(MCC) to rev L1 or L2
KA86-010	EQ-01439-01	speedy 470	CVT causing over-voltage
new CVT is rev H, fit if old CVT has no CB at back, or it goes overvoltage when RL or BA switched off			
KA86-011	EQ-01449-01	speedy 470	RL02 cable chaffing on strut, also 'non-lock' for FEC and BA11 restraint

Associated FCO's which will help you.

EQ-01490-01	KA86 kit	brings L0211 to rev F to allow CONTROL&P
EQ-01511-01	KA86 kit	brings L0208 to rev F to stop IDRAM PEs
EQ-01339-01	DW780	M8271 should be F1 or F2
EQ-?????	DW780	M8273 should be D
EQ-01422-01	CI780	brings roms/microcode to rev 7
EQ-01457-01	DMZ32	stops unibus problems
EQ-01492-01	TU81	for backup problems

5.4.9 Tech-tip index (8600 in first column - 8650 in second)

01- Load module placing.
02- Filter under modules.
03- Don't alter load on CVT also BA11 led is not connected.
04- EDK6A needs array in slot 8.
05- BBU failure workaround.
06- Module door foam strips not holding modules in, fit more!
07- Need loopback on comms line if not connected to RDC.
08- BBU input cord falls out, fit retaining bracket.
09- Inter bay mains cable, date code must be >511.
10- RL02 cable strain relief.
11-01 Diag.Super rev 10.x bug.
12-02 Module cover fastener = 12-21423-01
13-03 V9 console assumes FCO#7
14-04 VMS 4.7 needs VMB 4.7

5.4.9.1 TECHTIPS generated by country support

01 General (all in this document anyway!)
02 Module packaging
03 No neutral required, check ground current about 70
04 W1,2,3 on RDC panel
05 extra blocks in snapshot file
06 recommended installation test procedure