Chapter 6

Preventive Maintenance

The preventive maintenance program for the CM-5 and the CM-5 Scale 3 is intended to expose incipient hardware faults in a controlled setting, reducing the likelihood of failures occurring while user code is executing. There are separate maintenance protocols to be performed at the daily and weekly intervals; see Table 6. The daily procedure involves examining logs; no diagnostics tests are run on a daily basis unless the logs indicate a problem. The weekly procedure involves running diagnostic tests.

At semi-annual intervals, a Thinking Machines Corporation field service engineer will perform preventive mechanical maintenance, such as

- cleaning fans and glass
- checking LEDs
- adjusting voltages
- checking for loose power connections
- testing the air flow sensors and temperature sensors
- rotating in spare boards
- verifying that the environment sensor boards and circuitry are functioning correctly

Note that this chapter does not cover preventive maintenance for Sun systems and consoles; please refer to the appropriate Sun documentation.

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Table 6. Preventive Maintenance Schedule.

Interval	Procedure	Environment	Reference
Daily	Review operating system error logs.	(n/a)	Section 6.1.
	Review SDA error log.	**sdacc**	Section 6.2.
	Review DataVault error log.	**dvdiag**	Section 6.2.
	Monitor environment sensor board's status panel.	(n/a)	Section 6.3.
Weekly	Run JTAG groups.	**cmdiag**	Section 6.4.
	Run functional groups.	**cmdiag**	Section 6.4.
	Run system verifiers.	**ts-daemon**	Section 6.4.

6.1 Reviewing Operating System Error Logs

Each day the system is used, use the **tail** command to check the two operating system error logs on the system control processor:

- **/var/adm/messages**

  /var/adm/messages is the standard UNIX facility for logging operating system error messages. Notify Thinking Machines Customer Support of anomalous messages. In particular, look for signs of SDA or NI device driver problems.

  For instance, listed below are some messages typical of those logged by **/var/adm/messages** when there is a problem with the SDA:

```
syscon# tail /var/adm/messages
May  5 10:33:48 getafix vmunix: dv000b: block 9830912
(9830912 abs): read: missing interrupt - attempting recovery
May  5 10:33:53 getafix vmunix: dvintr: IOP_ERROR error: 5
for iopq 0xfd80a0a8
May  5 10:35:58 getafix vmunix: iop0: missing interrupt for
refnum 0x72, at 1761
19 after 120 sec.
May  5 10:35:58 getafix vmunix: dv000b: block 7864736
(7864736 abs): read: missing interrupt - attempting recovery
```

(con't)

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```
May  5 10:36:03 getafix vmunix: dvintr: IOP_ERROR error: 5
for iopq 0xfd80a1b8
May  5 10:38:08 getafix vmunix: iop0: missing interrupt for
refnum 0x73, at 1762
49 after 120 sec.
May  5 10:38:08 getafix vmunix: dv000b: block 15729312
(15729312 abs): read: missing interrupt - attempting
recovery
May  5 10:38:13 getafix vmunix: dvintr: IOP_ERROR error: 5
for iopq 0xfd80a2c8
May  5 10:40:18 getafix vmunix: iop0: missing interrupt for
refnum 0x74, at 1763
```

- **/var/adm/ts-daemon.log**

  /var/adm/ts-daemon.log records timesharing daemon activity, including crashes. Notify Customer Support of any **ts-daemon** failures.

  Here are some messages typical of those logged by **/var/adm/ts-daemon.log**:

```
syscon# tail /var/adm/ts-daemon.log
Waiting for PN's to sync up.
Returned from PN's syncing up.
Parsed and downloaded IOBA configuration for vmunix.
IOBA_init: 1 data vaults configured successfully.
SBC driver not present; No parallel UNIX kernel heap allocated.
*** Finished Startup.  Ready for users. ***
IOM_get_config: new SDA device (index 0), reloading tables.
SDA_init: paritybuf @0xf84000e8, maxlen 0x100000
SDA_init: 2 SDA devices configured successfully.
ACCOUNT: root /tmp_mnt/proj/filename 13, 545148 4
```

6.2 Reviewing I/O Device Error Logs

Each day the system is used, check the I/O device error logs:

- To examine the DataVault's log files, use the **tail** command (or use **rdlog** from within **dvdiag**) to look at *dv_hostname*.**error_log** and *dv_hostname*.**daemon_tracelog** (a log of the automatic sparing and healing operations). Both files reside in **/usr/spool/cm**. Notify Customer Support of anomalous messages or **dv_daemon** crashes.

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- SDA logs

  The SDA message-logging facility records hardware failures (fatal errors) that were detected by the SCSI disk control circuitry. Report any error message to Thinking Machines Customer Support.

  Each SDA logical device locally maintains one or more separate error-reporting/program-tracing logs. The messages in those log(s) reflect only the operations executed on that logical device.

  To read the log messages for a particular logical device, use the following SDACC commands:

  1. Invoke the SDACC by executing the **/usr/etc/sdacc** command:

     ```
     syscon# /usr/etc/sdacc
     <LD -1, CAB -1, BP -1, SLOT -1, SCN NI -1, DISK ID -1 -1>:
     ```

  2. Select the logical device for which you want to read the log messages. To do this, execute the **sld** (**select-logical-device**) command, which takes one argument, *logical_device_number*. *logical_device_number* is the number relative to the logical device's position in **sda.install**, specified during the bringup procedure (Section 2.7.2).

     ```
     <LD -1, CAB -1, BP -1, SLOT -1, SCN NI -1, DISK ID -1 -1>:
     sld logical_device_number
     ```

  3. To read the logical device's log(s), execute the **rlog** (**read-log**) command. By default, the log's error messages and trace messages are written to **stdout**; if you supply a *filename* argument, the log's contents are written to the specified file (for more information about the **rlog** command, see Chapter 13). A sample log message (an error message that should be

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reported to Thinking Machines Customer Support) is shown below.

```
<LD -1, CAB -1, BP -1, SLOT -1, SCN NI -1, DISK ID -1 -1>:
rlog
rlog
************************************************************
SCN CONTROLLER: Cabinet 0, Backplane 0, Slot 0, NI 0
PARENT, CHILD COMMAND IDS: 66, 66
LOG LEVEL: 0x04000000 (ERROR)
SOURCE FILE NAME: Line 185 in ../scn_cmd_verify_disk.c
LOG MESSAGE:
Capacity data was unavailable for disk 0 on interface 1
in logical device 1 for IOCP NI 0.
************************************************************
```

4. To return to the UNIX shell, enter **quit** at the **sdacc** prompt.

In addition to providing an interface for reading SDA logs, **sdacc** provides commands for clearing and dumping logs; see Section 6.2.1. **sdacc** also provides a pair of filters for controlling the types of trace messages that will be recorded and displayed, which is discussed in Chapter 13.

6.2.1 Dumping and Clearing SDA Logs

When an SDA log fills, it overwrites trace messages, starting at the beginning of the file. It does not overwrite error messages and warnings. (If the file completely fills with error messages and warnings, the log stops accepting new messages.) If you see a **LOG FULL** message when reading a log, you should dump or clear the log to make room for new messages, using the **sdacc** program.

It is usually a good practice to dump an SDA log to a file, rather than simply clearing it, to preserve messages you may want to analyze more closely. After entering the SDACC environment by executing **sdacc**, first select the log(s) for a particular SDA logical device using the **sld** command, and then use the command **dlog** *filename* to dump the log to a file, with the output file specified by *filename.*

If you have no further interest in the log contents, simply clear it with **clog**.

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For more information about dumping and clearing the logs, see Chapter 13.

6.3 Monitoring the Environment Sensor Board's Status Panel

Each day (or so) that the CM-5 or Scale 3 is on, check each cabinet's environment sensor board's status panel to be sure the cabinets' power supplies are operating correctly and that the air flow and temperature in and around the machine is within specification. In a Scale 3, the sensor board's status panel is located in the back of the cabinet, between the SDA backplane and the PN backplane; in a CM-5 cabinet, the sensor board is in the same bay as the power supplies, near the upper PDU.

NOTE

As of this writing, CM-5 and Scale 3 systems in the field are just beginning to be upgraded with this new environmental sensor board; your system may not yet contain this board.

The environment sensor board collects the output of various environmental monitoring devices throughout the Scale 3 and CM-5 and gives a visible indication of whether the machine's environment is in or out of specification. When all monitored environmental conditions are within specification, the magnetic indicators are cleared (black), the green LEDs are on, and the red LEDs are off:

- The magnetic indicators — fault-sensor indicators — show the status of the air-flow and temperature sensor inputs. If there is a faulty input, the machine or cabinet will shut off automatically. The status panel indicates which sensor was the cause of the shutdown by changing the related indicator from black to bright green. Figure 26 lists the input represented by each indicator.

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- Scale 3 only: The green and red LEDs show the status of the DC OK circuits within the sensor board. These circuits monitor the the DC OK signals from each of the Scale 3's individual power supplies.

  - The green LED represents the current state of the DC OK signal: on = good.

  - The red LED represents the past state — since the last reset of the panel — of the DC OK signal: on = bad.

  For instance, if both the green and red LED are on for any power supply, they indicate that although that power supply is currently working, it did fail at some point since the last panel reset. This could point out an intermittent power supply or simply mean that someone had shut off that supply (to replace a board, for example) and forgot to reset the sensor panel after turning the power supply back on.

  Figure 26 lists the power supply represented by each LED.

- CM-5 (other than Scale 3): Only one green LED is visible on a CM-5 cabinet's status panel. This LED indicates that there is power going to the environment sensor board itself.

- The reset switch, located on the right side of the status panel, clears the faulty sensor indicators and, for the Scale 3, the past-state indicators (the red LEDs) .

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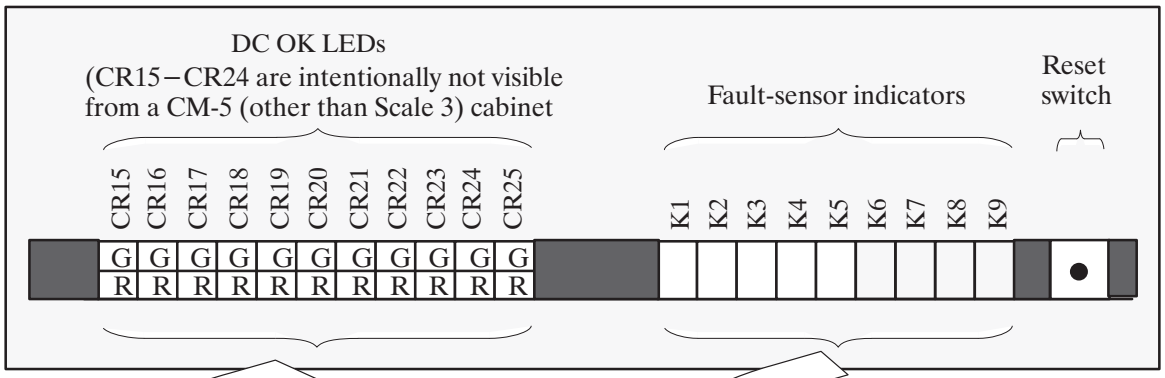

	Manu-facturer	Power supply
CR15	Astec	PN backplane, +5V
CR16	not used (always green)	
CR17	Power One	SDA backplane, +5V
CR18	Power One	SDA backplane, +2V
CR19	Power One	SDA backplane, +12V
CR20	Power One	Network backplane, +5V
CR21	Power One	Network backplane, +2V
CR22	not used (always green)	
CR23	Uni Power	PN backplane, +2V
CR24	Uni Power	CPDK
CR25	CM-5: Power to sensor board itself	
	Scale3: not used (always green)	

	Scale3	CM-5 device cabinet	CM-5 network cabinet
K1	ambient temp	ambient temp	ambient temp
K2	airflow	epv7 airflow	left-bay* air
K3	cab't temp	epv3 airflow	middle-bay* air
K4	not used	DR-left* air	right-bay* air
K5	not used	DR-right* air	not used
K6	– – – not currently used – – –		
K7	– – – not currently used – – –		
K8	– – – not currently used – – –		
K9	– – – not currently used – – –		

* *left, right, middle*, are as you are looking at the sensor board status panel.

Figure 26. The status panel of the CM-5 and Scale 3 sensor board (side view). Not all CR*xx* LEDs and K*x* indicators are visible to an administrator — they may be intentionally hidden by sheet metal — because some are not used on all cabinet models.

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6.4 Weekly Test Procedure

6.4.1 Initial Conditions

This procedure is based on the assumption that the following conditions are in effect:

- You have exclusive use of the system.
- **jtagserver** and **cmsa-server** are running.
- **ts-daemon** is not running on any partition.
- An entry in **/etc/cm/configuration/hardware.install** shows the CP on which **JTAG_SERVER** is running.
- An entry in **/etc/cm/configuration/hardware.install** shows the CP on which **cmsa-server** is running.
- **CMDIAG_PATH** is set explicitly to the pathname of the directory in which the JTAG library is located (usually **/usr/diag/cmdiag**).
- The final system verification procedure requires a file system to be mounted.

The test sequence consists of three phases:

- running the JTAG test suite appropriate for your system
- running an abbreviated functional test suite
- running system verifiers to confirm that the system is ready to be returned to regular service

6.4.2 Procedure Steps

The weekly procedure steps are described below.

1. Log in as root.
2. Verify that no partition is active.

   ```
   syscon# /usr/etc/cmpartition list -l
   ```

   If any partition is listed as **ACTIVE**, run **cmpartition stop** on its partition manager.

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3. Change directory to **/usr/diag/cmdiag** and execute **cmdiag** on the entire machine; that is, do not specify the **-p** option.

```
syscon# cd /usr/diag/cmdiag
syscon# cmdiag
<CM-DIAG>
```

4. From the **<CM-DIAG>** prompt, execute the **list-groups** command and take note of the JTAG test groups that are listed in the output: **JTAG-CLKDN**, **JTAG-CLKBUF**, **JTAG-CN**, etc. (The **list-groups** output is a customized list of the groups appropriate to run on your CM-5 system.) Run these JTAG test groups, using the syntax shown below as a reference.

```
<CM-DIAG> rgroups m JTAG-CLKDN JTAG-CLKBUF JTAG-CN ...
<CM-DIAG>
```

   If a failure is reported, notify Thinking Machines Customer Support. If all tests pass, go on to step 5.

5. Exit from **cmdiag**. Reset the system by executing **cmreset** on the system control processor and **cmreset -s** on each of the other CPs and IOCPs in the system.

```
<CM-DIAG> quit
syscon# /usr/etc/cmreset
syscon# rsh CP_name_or_IOCP_name \
/usr/etc/cmreset -s
```

6. If your CM-5 includes an SDA and/or one or more IOBAs, run diagnostics that test their connections to the rest of the CM-5 hardware, as explained below. If your CM-5 system includes neither SDA nor IOBA hardware, go on to step 7.

   First, unmount the SDA file systems.

   Next, create a partition with four contiguous PNs — be sure to specify the **-iop** switch to **cmpartition create** to include the appropriate I/O processor(s) in the partition (for more information, see Section 3.2.2 in Chapter 3). For example,

```
syscon# /usr/etc/cmpartition create \
-pn_range first_pn-first_pn+3 { [-iop sda_NI(s) ] \
[-iop IOBA_NI(s)] * }
```


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a. Invoke **cmdiag**, specifying the **-p** switch, and run the test groups **PN**, **dr**, **global**, **combine**, and **broadcast:**

```
syscon# cmdiag -p PM_hostname
<CM-DIAG> rgroups m PN dr global combine \
broadcast
<CM-DIAG>
```

If a failure is reported, notify Customer Support. If all tests pass, go on to step 6b.

b. If your system includes an SDA, run the **SDA** test group, as shown below. If your CM-5 does not have SDA hardware, go on to step 6c.

```
<CM-DIAG> rgroups m SDA
<CM-DIAG>
```

If a failure is reported, notify Customer Support. If all tests pass, go on to step 6c.

c. If your system includes one or more IOBAs, run the IOBA test groups **IOP-CNTRL**, **IOP-BUF**, **IOP-CHNL**, and **IOP-SYS**, as shown below. If your CM-5 does not have IOBA hardware, go on to step 6d.

```
<CM-DIAG> rgroups m IOP-CNTRL IOP-BUF \
IOP-CHNL  IOP-SYS
<CM-DIAG>
```

If a failure is reported, notify Customer Support. If all tests pass, go on to step 6d.

d. Exit out of the **cmdiag** environment:

```
<CM-DIAG> quit
syscon#
```

7. Delete the 4-PN partition (if one was created in step 6) and create a partition that includes all processing nodes in the system. (Do not use the **-iop** switch to **cmpartition create**.)

```
syscon# /usr/etc/cmpartition delete
syscon# /usr/etc/cmpartition create \
-pn_range first_pn-last_pn
```


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8. Invoke **cmdiag**, using the **-p** option, and run the test groups **PN**, **dr**, **global**, **combine**, and **broadcast**:

```
syscon# cmdiag -p PM_hostname
<CM-DIAG> rgroups m PN dr global combine broadcast
<CM-DIAG> quit
syscon#
```

   If a failure is reported, notify Customer Support. If all tests pass, go on to step 9.

9. If your CM-5 includes an SDA and/or one or more IOBAs, and if you ran diagnostics on them in step 6, you must reboot these devices at this point in the PM procedure.

   a. Reset all the IOBA and SDA backplanes by executing **cmreset** on the system control processor and **cmreset -s** on each other CP and IOCP.

```
syscon# /usr/etc/cmreset
syscon# rsh CP/IOCP_name /usr/etc/cmreset -s
syscon# rsh CP/IOCP_name /usr/etc/cmreset -s
...
```

   b. If your system includes one or more IOBAs, reboot each by executing **/usr/etc/io_cold_boot** once from the system CP:

```
syscon# /usr/etc/io_cold_boot
syscon#
```

      Usually, no switches to **io_cold_boot** are required; for more information, see Section 2.6 in Chapter 2.

   c. If your CM-5 system includes an SDA, bring it and its file systems back up by following the procedure in Section 2.7.

10. Start the timesharing daemon on the partition created in step 7. Then run the hardware portion (specified via the **-h** switch) of **dvtest5-vu** (for systems with vector units) or **dvtest5-sparc** (for systems without vector units). Include on the command line the switch **-g 64,64**. For example, for a CM-5 with vector units, enter

```
syscon# /usr/etc/cmpartition start -cmd ts-daemon
syscon# /usr/local/etc/dvtest5-vu -h -g 64,64
```

   If **dvtest5** fails, notify Customer Support. If it passes, restore the system to its original configuration.

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