USER'S GUIDE
AC-T089B-MC

Configurable Diagnostic System Package

For SGB

Diagnostic Engineering, Merrimack

B. DUP11 Loopback test: 2 Through parameters entered during the
Modem loopback testing can be selected. If neither were selected, it
but the letter will still be typed
Local Modem Loopback Testing: A special cable has been installed to al
transmit signal to put the modem in local loop back mode for cable and
Cable Loopback Testing. If Cable Loopback was selected, you must suppl
the end of the cable.

G. DZ11 device testing. Controller and single line errors are recorded on th

If a DZ11 or DUP11 fails, the testing continues. However, the fact that
have failed is indicated on the console terminal. The following indicates
internal loop testing but passed local modem loop back testing

ZYXWVUTSRQPONMLKJI
0HGFEDCBA@ (The "0" indicates the first device)

The above condition would be printed if the DUP11 was set to a vector ad
specified in the configuration table. The next example indicates a failur
internal and local modem loop back

ZYXWVUTSRQPONMLKJI
1H
1GFEDCBA@ (The "1" indicates the second device)

The next example shows the printout that would occur if the first and th

ZYXWVUTSRQPONMLKJIHG.
0
2FEDCBA@
(The "0" indicates the first device and the "2" indicates the third devic

F. Line clock testing. This verifies that the clock is operational

E. First device boot ROM CRC check. This test calculates the CRC on the
verifies that it matches the CRC stored in the ROM

D. Diagnostic testing complete

C. Printed to maintain the sequence of the alphabet

B. The TU58 monitor is in the process of writing the status table containin
If any TU58 error occurs control will be transferred to the first boot RO
acters will not be printed.

A. Indicates the transfer of control to the first device boot ROM (normally
will bring up the customer operating system software

(space)*. This is the revision level of the diagnostic package. Refer to Appe
sion level and the changes made to each revision. Appendix D a
verifying the revision level in the event the diagnostic does not

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APPENDIX B

CONFIGURATOR PROGRAM DIALOGUE

The program will identify itself by printing "CDSP Configurator Progra[m ...]
bles required to run from the TU58. The program will then print "Loadin[g ...]
the TU58. After the tables are loaded the configurator will ask questions a[...]
gured. Answers are either "YES/NO", octal numbers, or selecting the de[...]
riage return "<CR>". All inputs are terminated with a carriage return.

The DZ11 and DUP11 device and vector addresses used in the prompts a[...]
number of devices, and according to the UNIBUS floating address and vect[...]
of multiple devices, the address and vectors must be sequential.

The following is an example dialog

1) **Boot the RA80 after running diagnostics? (Y/N, <CR>=Y).**
(This question in conjunction with question 2 allows field service to cont[...]
"no" answer is For Field Service Use ONLY.)

2) **Boot the TU58 after running diagnostics? (Y/N, <CR>=Y).**

3) **Do you want to answer the configuration questions again? (Y/N, [...]**
(This question allows the user to change the parameters of ques[...]
reanswering all the questions.)

4) **Enter CPU type. (11/44=1, 11/24=2, <CR>=11/44).**

5) **Select memory type installed in each CPU backplane position for t[...]
pending on answer to 4) system configuration
A = MS11-MB 256KB ECC memory, Module: M8722-B*
(MS11-LD, M7891-D? 256 KB parity memory if 11/24)
B = MS11-PB, (1024KB) ECC memory, Module: M8743-B*
C = No memory installed in this slot.**

**CPU Backplane slot #09 (03 if 11/24)
CPU Backplane slot #10 (04 if 11/24)
CPU Backplane slot #11 (05 if 11/24)
CPU Backplane slot #12 (06 if 11/24)**
At least one memory type must have been selected or the user will [...]

6). **Is there a UDA50 on the target system? (Y/N, <CR>=Y).**
(If the answer to this question is "N" the next 3 questions are skipp[ed ...]

7) **Enter the UDA50 device address in octal. (<CR>=172150).**

8) **Enter the UDA50 vector address in octal. (<CR>=154).**

9). **How many RA80's on the UDA50? (OCTAL, <CR>=1).**
(Two RA80's can be connected to one UDA50.)

10) **How many DUP11's on the target system? (OCTAL, <CR>=1).**
(Maximum of 16 allowed.)

Table of Contents

11) Enter the first DUP11 device address in octal (<CR>=160340)
(Addresses are sequential)

12) Enter the first DUP11 vector address in octal. (<CR>=310)
(Vectors are sequential)

13) Each DUP installed in the system can be individually selected to run th
the prompt for running the test is answered positively,("Y"), you still h
of external loopback.
1 = Cable loopback. (H325 test connector).
2 = Modem Local Loopback. The special cable. 70-19083-25 must be in
the modem to perform this type of testing
If the prompt is answered ("N"), Internal loopback will be performed
not be needed for testing).
Perform loopback testing for DUP11 #xx? (Y/N, <CR>=Y)
(repeated for each DUP xx= DUP number)
Enter 1 for Cable or 2 for modem loopback.
(This question only asked if loopback testing selected)

11). How many DZ11's on the target system? (OCTAL, <CR>=3)
(Maximum of 16 allowed.)

15). Enter the first DZ11 device address in octal. (<CR>=160110)
(Addresses are sequential)

16). Enter the first DZ11 vector address in octal. (<CR>=320)
(Vectors are sequential)

After the above questions have been answered the program will print a c

For example:

(see next page)

INTRODUCTION

The SGB system comes with its own Self Test Package. This package allows the user to verify that the SGB system is operating properly. Built into this package is the ability to configure the number of devices, and type of CPU supported in this diagnostic package. This document describes the Self Test Package. It is divided into three sections:

1. Normal Operation
2. System Fault Indication
3. Test Package Configuration Procedure

COMPONENTS:

The SGB System Test Software Package consists of three parts:

1. ROM diagnostics that will provide basic CPU and memory tests before booting, (reading in) the TU58 tape. (The TU58 cartridge is normally left installed in a drive in the user's system)
2. The TU58 monitor will load and run extensive CPU, memory, and device diagnostics. Test coverage limited to all accessible hardware that requires no external operator setup.
3. Customer system software boot. Upon completion of the testing, the RA80 (disk) will be addressed and the system software will be loaded and started.

The kit number containing the TU58 and this document is: ZJ351-RG

The ROM part numbers are:

1. 23-973\9-00
2. 23-974\9-00
3. 23-975\9-00

The TU58 part number is:

BE-T091B-MC

EVENT INDICATIONS:

System component test completion is indicated by printing the alphabet in reverse order on the console terminal. Each major test results in a character being printed on one line, starting with the letter "Z" and ending with "A". In the event of a failure the last letter printed will indicate where the failure has occurred.

OPTION	BUS ADDRESS	VECTOR	
CPU TYPE = 11/44			
Cache Enabled			
TU58-EB	176500	300	
OPTION	BUS ADDRESS	VECTOR	LOOPBA
DUP11	160050	310	CA
DUP11	160060	320	MO
DZ11	160120	330	
DZ11	160130	340	
DZ11	160140	350	
UDA50	172150	154	
Number of RA80's = 1			
OPTION	CSR ADDRESS	VECTOR	SLOT
MS11-MB	172100	114	0
Empty Slot Number: 10			
Empty Slot Number: 11			
Empty Slot Number: 12			

To verify that the configuration is correct and write the file on the T
questions:

13). **Is this configuration correct? (Y/N):**
(If the answer to this question is "N" the program will clear the curre
start all over with question number 1.)

14). **Write configuration on master tape in drive X? (Y/N):**
(Where "X" is equal to 0 or 1. If the answer to this question is "Y" the
ten to block 2 on the tape and outputs continue at question number 20
printed. NOTE: If the master tape is configured, the program stops (
"Operation Complete".)

15) **The Configurator Program was loaded off the Master tape in drive "
Master tape is in that drive. Type a carriage return when ready.**
(This prompt is used to notify the user that switching tapes during
could cause the Master to be destroyed. If the tapes were swapped
would destroy the Master and never notify the user via an error. Th
tapes.)

DEVICE ISOLATION AND SYSTEM CONFIGURATIONS

The following table lists the Field Replaceable Unit (FRU), to which the test package will isolate failures.

- 11/44 and 11/24 CPU with two on board SLU's (console and TU58) and M9312 Boot type ROM.
- MS11 up to four memory modules. MS11-PB for 11/44 and 11/24. MS11-MB for 11/44 and MS11-LD for 11/24.
- DZ11-8 line asynchronous multiplexer communications option. (may vary per system I max).
- DUP11 single channel medium speed synchronous serial line communications option with local loopback thru the modem. Loopback can also be achieved by using a cable loopback connector.
- UDA50 disk controller which interfaces the unibus with up to 2 standard disk interface disk drives. The UDA50 contains self test diagnostics in microcode.
- RA80 disk drive contains self-test diagnostics in microcode.
- TU58 256kbyte drive tape mass storage device. Contains self test diagnostics in microcode.
- Console interface.

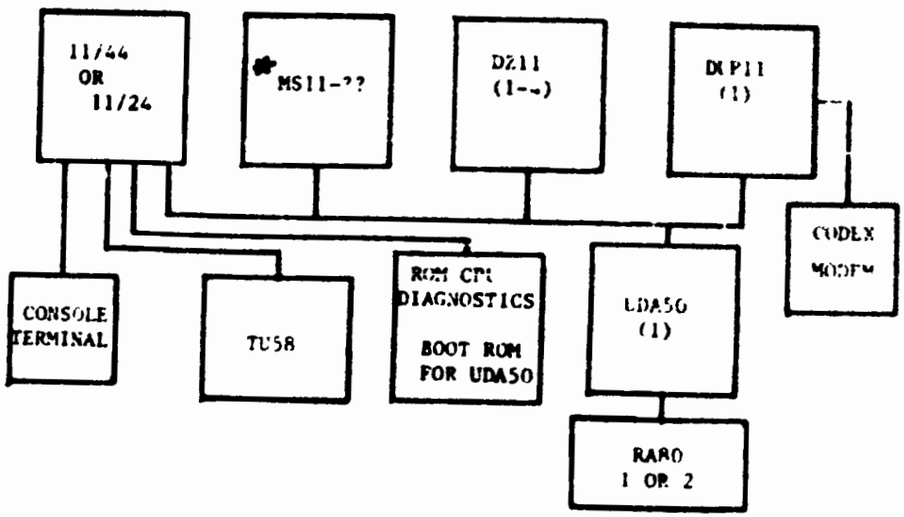


Figure 1.0 System Block Diagram

PDP 11/44 has MS11-MB MOS memory.
PDP 11/24 has MS11-LD MOS memory.
PDP 11/44 and 11/24 may have MS11-PB MOS memory.

16). Loading Data from Master tape for copy to drive X
(Indication to the user to account for the access to the ...

17). winding ...
(New tapes should be wound and rewound to retension the tape ... to notify the user of the process.)

18). rewinding ...
(Notification to the user of the rewind in progress.)

19). Load a write enabled cartridge into drive 1 and type a carriage return

20). Copy in process.
(No prompt is required.)

21). Operation complete.
(No prompt is required. If the master tape was configured this is the ... gram will just execute a self branch.)

22). Do you want to make another tape? (Y/N).
(If the answer to this question is "Y" the next question is printed. If ... gram will print "Operation complete" and then execute a self branch ... not be asked if a master tape was configured.

23). Will the next tape have the same configuration table as the last tape? ...
(If the answer is "Y", prompt number 16 will be printed and continue ... as desired. If the answer is "N", the configuration table will be cleared ... with question number 1.)

SECTION 1

NORMAL OPERATION

The test package is intended to be used prior to booting the system software. This is accomplished by installing a configured tape cartridge in either drive and booting the system. Standard MoB systems have the special MoB ROMs installed to perform some testing and then boot the TU58. The following is an example of the printout on the console of a PDP11/24 after running the diagnostics error free:

ZY\002000000W\UTSRQPONMLKJIHGFEDCB\B

The number printed between "\" and "W", (octal) will have the value of the last memory address found plus 2. This is printed from the CPU diagnostic ROM.

To run the diagnostics on the RA80, the RUN/STOP switch on the front of the drive MUST be in the RUN position (pushed in). If the switch is not in the RUN position the diagnostics will fail in the RA80 testing and the operating system software will not be booted.The port select switches must also have one port selected (A or B).

When the DZ11's are tested, data is sent to the USERS TERMINALS. This will cause random characters to be printed on any devices connected to the DZ11. If this is not desirable any devices connected to the DZ11's should not be powered on during the testing.

To bypass the self-test diagnostics remove any TU58 cartridges from the drives 0 and 1. If no tape is found the RA80 will be booted.

\VMS/+ TU58 tape cartridge can be booted by replacing the MoB tape cartridge with the \VMS/+ tape.

SECTION 2

SYSTEM FAULT INDICATION

System failures are divided into two categories. These are "Fatal Errors" and "Soft Errors". Fatal Errors are classed as faults that would prevent the MoB system software from operating successfully. Soft Errors are recorded on the TU58 diagnostic cartridge for the operating system to review. If a Soft Error occurs, testing continues. It is also indicated on the console terminal as an indication to the user.

The following is an example of a Fatal Error indication:

ZY\WV\UTSRQPONM
ERROR

APPENDIX C

CONFIGURATOR PROGRAM ERRORS

The following is a list of errors printed in response to improper user respo
The first list is the input or operation errors that will loop on the question b
is corrected. The error message printed is in "quotes" and the explana
(parenthesis)

CONFIGURATOR INPUT OR OPERATION ERRORS

- **"Maximum number of devices exceeded."**
  (1 or 2 for the number of RA80's or 1 to 20 octal for the number of DZ
- **"Not an octal number"**
  (Number response contained an 8 or a 9.)
- **"Invalid Response"**
  (Response does not mean anything i.e. numbers or punctuation in
  question.)
- **"No Defaults Allowed. Please input proper response."**
  (printed if a question that does not have a default answer was not giv
- **"***No memory selected. Please select the correct amount of memory"**
  (This is typed if the user typed "C" as memory choice for all four memo
  ory slot must have memory.)
- **"Invalid device address"**
  (Device address typed in by the user was not within the valid octal r
- **"Invalid vector address"**
  (Vector address typed in by the user was not within the valid octal ra
- **"Load a WRITE enabled MASTER tape into drive X and type carriag**
  (This message is printed when the Master tape was selected to be conf
  has been removed. "X" is equal to a 0 or a 1.)
- **"Load a write PROTECTED MASTER tape in drive X and type a car**
  (This is printed when a blank tape is to be configured and the Master
  is equal to a 0 or a 1.)
- **"Please type a "Y" or "N" followed by a carriage return"**
  (This is printed if the first character of the response to a "Yes" no
  prompt was anything except a "Y", "y", "N", "n" or a "carriage return". The
  reprinted after this message.)
- **"Cartridge write protected."**
  (This error could occur for question 15 or 16. The cartridge has a w
  recording. Move the switch in the direction of the arrow. If the switc
  tridge away.)
- **"No cartridge in drive X."**
  (Where X = 0 or 1. The program will not continue until cartridge i
  will be reprinted.)

This example indicates a data or addressing failure in the third memory module.

The following is an example of a Soft Error indication:

ZYXWVUTSRQPONMLKJI
0IIGFEDCBA@ (The "0" indicates the first device.)

This example indicates a failure while testing the first DUP11. Note that testing continues to completion

FATAL ERRORS

- CPU failures consisting of: Instructions, Stack processing, etc.
- Memory failures including Cache and memory management. ECC or parity memory logic.
- UDA50 disk controller failures, microdiagnostic and maintenance.
- RA80 disk drive failures, microdiagnostic and maintenance.
- System console interface failures. (Limited to internal loop and bit function failures)
- All other errors not "soft".

SOFT ERRORS

- DZ11 failures. This includes everything from dead lines to nonexistent devices. The failure will be indicated on the console but the testing will continue and the system software will be booted
- DUP11 failures. This also includes everything from dead lines to nonexistent devices. The failure will be indicated on the console but the testing will continue and the system software will be booted
- Data blocks read off the TU58 with retries

Refer to Appendix A for detailed subtest descriptions

It must be noted that a CATASTROPHIC ERROR could cause the entire system to hang or print the "ERROR" message during any of the testing.

CONFIGURATOR FATAL ERRORS

- **"Fatal TU58 error"**
  (This message is printed if any error occurs concerning the TU58 after r present and write protect. If a data check error occurs this message is FATAL ERROR. Execution of the program stops.
- **"Data check error on drive X"**
  (Where X = 0 or 1. This is a FATAL ERROR. This message indicates a read or write verify operation. Since the problem could be with the me user is notified of the drive in error. After printing this message the P and execution is stopped.)

APPENDIX B

REVISION NUMBERS

When the testing is completed, the last letter is printed ("A") followed by sion level. The following example shows this:

ZYXWVUTSRQPONMLKJIHGFEDCBA B

The letter B in this case corresponds to the following number that is u tracking:

Media identifier = 0 (V5.0BB0)

A Previous revision of this test package used numbers instead of letters software typing:
ZYXWVUTSRQPONMLKJIHGFEDCBA 3

The revision level of the MSCP self test package can be verified without run can be done by following the procedure for "Reconfiguring A Configured T tor program prints "Loading tables . . . and after the tables are loaded the revision letter of that package.

Example:
CDSP Configurator Program
loading tables ...
Version: B
This program.....(text continues)

SECTION 3

TEST PACKAGE CONFIGURATION PROCEDURE

The configurator program allows selecting the number of devices, address and vector, and type of CPU supported in this diagnostic package. The configuration information is then written onto the tape. The tape could be for this system or another system. The program supports using one tape as a master and copying the configured diagnostic to another cartridge if two TU58 drives are available on the system.

CONFIGURING A TAPE:

The following are the steps required to invoke the configurator program.

1. Install the SGB test cartridge in the TU58, drive zero.
2. Boot the SGB system test tape using the SGB boot ROMs or any standard TU58 boot.
3. The program will identify itself and prompt for information.

If the tape has not been configured, the configurator program is invoked automatically after printing the letter "D". If the letter "T" is printed after the letter "D" refer to the section, "Reconfiguring A Configured Tape."

For detailed descriptions and examples of the Configurator program prompts, refer to Appendix B.

HARDWARE REQUIREMENTS:

The configurator program requires a minimum of the following to configure tapes:

- PDP11/44 or PDP11/24 CPU
- 64 kB MOS Memory
- TU58 tape drive

If the configurator is going to be used to copy the master tape onto new cartridges, the system must have 2 TU58 drives available.

Appendix E

PDP 11/44 Switch/Jumper Configuration

To select the PDP11/44 to boot, or power up, to the second device bootstrap ties selected, the switches must be set on the CPU modules as follows:

- To enable power-up boot, CPU control S1 must be closed ("on"). This M7095 module.
- To enable the internal booting of the PDP11/44 (as opposed to a M93 E28-2 must be closed, ("on"). This switch is located on the M7096 modul
- To enable the upper address bits to boot to the selected device ROM (773XXXX), UBI switch E28-1 must be open, ("off"). This switch is locat
- The lower 3 digits of the boot address must be set to the second device R 201. The switch settings on the UBI E28-3 thru E28-10 are as follows: S1 S5 thru S8, and S10 = "OFF" - "0". This yields a boot address of 773 cated on the M7096 module. Consult sheet 1 of 11 of the M7096 module in a table of switch settings, or PDP11/44 system user guide chapter 3.

RECONFIGURING A CONFIGURED TAPE:

1 Boot the tape using the SLU boot ROMs or any standard TU 58 boot. (The diagnostic will print the reverse alphabet and start testing)

2 AFTER the letter "S" is printed and BEFORE the letter "I" is printed, halt the processor. The time span between these characters is greater that 1 minute.

3. Next, start the program running at address 2000 octal. (using ODT). This will invoke the configurator program and the tape can be reconfigured. For a description of ODT refer to the system users guide

4. The program will then print "initializing ....". The program has to initialize the TU58 controller because it was in the process of reading the diagnostic package off the tape. This operation takes about 20 seconds

5 The configurator program will then identify itself and prompt for input. Refer to Appendix B for detailed descriptions.

The following is a list of jumper and switch configurations that are requir
the TU 58 tape drive. The jumper and switch configuration tables are loca
M7098 module in the customer print set

Jumpers

- W3 installed indicating that the TU 58 receiver error bits are enabled in
register, bits 12 15
- W4 installed, allows the reading of the receiver error bits (or bits 1 to
receiver buffer.
- W10 installed, indicating that the TU 58 transmitter status register bits
be set and cleared.
- W11 removed, indicating that the TU 58 parity detection and generation
error bit will remain cleared
- W12 and W13 removed, indicating that the character length for the TU

Switches

- To set the TU 58 receiver and transmitter speed to 9600 baud set the follo
to "OFF" and switches E7 2 5 to "ON"
- Set switch E7 7 to "OFF" for 2 stop bits at 8 bits character
- To enable the internal decode of the TU 58 address switch E79 1 must b
- To set a TU 58 vector of 300 the following switches are set E79 3 6
"ON".
- To set a TU 58 address of 776500 the following switches are set
E79 1,6,8,9,10 to "OFF"

SECTION 4

STATUS TABLE DEFINITIONS

The status table containing a record of soft errors that occur during the testing is stored in block 1 on the TU 58 cartridge. This information can be read by the operating system after startup. After reading the information the operating system must initialize the status table by writing the identification code in the first word. (2 bytes) onto block 1 on the TU 58. This resets the soft error information to zero for the next diagnostic run.

The following are the definitions of each word in the status block.

WORD 0:

This contains the MAINDEC identification code. The value is 11102 octal. This transforms to 2 ASCII characters "BB". After the operating system has read the status block this word must be written. (2 byte transfer) to initialize the the status block. If this operation is not performed and the diagnostics were not invoked on the next boot, it would appear to the operating system that the diagnostics had been run.

WORD 1:

The high byte contains a "null". (000 octal) and the low byte contains the revision number. Refer to Appendix D for the revision number. This corresponds to the revision number printed after the letter "A" before the operating system is booted.

WORD 2:

This is the MAINDEC completion code. When this word is zero it indicates that the diagnostics were not run or the status table could not be written onto the tape. This word containing a 100000 octal, indicates diagnostics have run with no soft errors detected. A 200 octal in this location indicates soft errors. To determine what devices failed, the rest of the words in the status table must be examined.

Some of the following status words are represented by a "bit mask". A "1" octal in this location indicates the first device in error. A "7" octal in this location points to third device. A "5" octal indicates the first and third device have errors. A "100000" octal points to the sixteenth device failed. Any bit set in these words sets word 2 to 200 octal, indicating a soft error.

WORD 3:

This location contains the bit mask of the failing DLP11. This 16 bit word allows the logging of up to 16 DLP11's in error.

WORD 4:

This location contains the bit mask of the failing DLP11 loop back test. These bits correspond to the 16 DLP11's in word 3.

WORD 5:

This location contains TU 58 soft error information. The low byte of this word contains the drive number on which the soft error occurred. This can be a zero or a one. If the high byte contains a zero this indicates no soft errors. If the high byte contains a one, this indicates read operations were successful, but with retries. This indicates dirty heads or a worn cartridge.

Appendix F

PDP 11/24 Switch/Jumper Configuration.

To select the PDP 11/24 to boot or power up to the second device bootstrap ROM selected, the jumpers on the CPU module, (M7133) must be set up as follows:

- Jumper W2 in, for boot on power up from power fail.
- Jumper W3 out, disallowing a halt instruction to be executed in kernal mode and an error occurs in the CPU diagnostic ROM during testing, the console ODT.
- Jumper W11 in, Boot address on power up to 165000 (console ROM) then Map module indicating boot to second device.

To select the PDP 11/24 to start execution at the second boot device the [illegible] Module, (M7131) must be set up as follows:

- To select the 11/24 to boot a device, set S1="OFF" at location [illegible].
- To select the boot ROMs readable, set S2="ON" at location [illegible]. To allow MAINDEC boot ROMs the boot ROMs must be readable. The MAINDEC boot ROMs verification before transferring control to the second boot ROM. If a [illegible] will stop.
- The lower 8 bits of address 17[illegible] must equal 201 to point to the second [illegible] 3 thru [illegible] 10 as follows: S1 and S9 = "1" = "ON" S3 S5 thru S8

The TU 58 is connected to the second serial Line Unit (SLU) on the 11/24 [illegible] figure the switches and jumpers on the CPU module (M7133) as follows:

- Set baud rate 2 to 9600 baud. Switch pack E15 settings S1 thur S4.
- Set the baud rate selection of transmit and receive of SLU 2 to baud rate and jumpers W1 W9 W11, and W13 out.
- To disable parity detection of SLU 2, remove jumper W7.

WORD 6:

This location contains the bit mask of the failing DZ11. This 16 bit word allows the logging of up to 16 DZ11's in error. If the error is associated with a line number(s), the line number(s) indicated in words 7 through 15 one word for each line No line failures indicate a controller failure

WORD 7:

Bit mask of line 0 failures. These bit positions correspond to the bit mask of the failing device in word 6.

WORD 8:

Bit mask of line 1 failures. These bit positions correspond to the bit mask of the failing device in word 6.

WORD 9:

Bit mask of line 2 failures. These bit positions correspond to the bit mask of the failing device in word 6.

WORD 10:

Bit mask of line 3 failures. These bit positions correspond to the bit mask of the failing device in word 6.

WORD 11:

Bit mask of line 4 failures. These bit positions correspond to the bit mask of the failing device in word 6.

WORD 12:

Bit mask of line 5 failures. These bit positions correspond to the bit mask of the failing device in word 6.

WORD 13:

Bit mask of line 6 failures. These bit positions correspond to the bit mask of the failing device in word 6.

WORD 14:

Bit mask of line 7 failures. These bit positions correspond to the bit mask of the failing device in word 6.

WORD 15:

Checksum of the last 11 words. This is done as a simple addition. No overflow is saved or added.

Appendix G

SGB Boot ROM Installation for PDP-11 24 and 11 44.

The following table calls out the socket location of the SGB and UDA50 and the PDP11 44 These ROMs MUST be installed in these locations for p

UDA50 ROM NUMBER	PDP11 44M709x	PD
23-767 V900	E48	

SGP ROM NUMBER	PDP11 44M709x	PD
23-972 V900	(WAS) E49	
23-973 V900	E50	
23-974 V900	E50	
23-975 V900	E49	

replaced by 23-975 V900

APPENDIX A

EVENT CODE DESCRIPTIONS TEST DEFINITIONS

This diagnostic package is divided into subtests that exercise the various components of the system. In the event of a failure the last letter printed will indicate the test being performed when the failure occurred. This supplies repair personnel with information corresponding to a Field Replaceable Unit. (FRU)

NOTE

Because no characters are printed before the console interface internal loop tests are done, any console interface failure or internal register data path failure would look the same. Also, any console interface failure that could not be detected in internal loop could result in no characters being printed to the console terminal.

The characters "ZYXWV" are printed from the diagnostic ROMs. Before the TU 58 is booted, the ROM portion of the diagnostic package checks at a minimum, the basic CPU instruction set and lower memory. Control is transferred to the CPU diagnostic ROM to take advantage that testing and then control is returned to boot the TU 58. The remainder of the ROM validates the load path from the TU 58 and the presence of a valid boot block in block zero on the tape cartridge. If a valid boot block is not found or no cartridge is present control is transferred to the boot ROM for the first device.

BOOT POWER-UP: Internal register DATA PATH and CONSOLE INTERFACE tests

Z: ROM sequence verification test. The ROMs for this diagnostic package must be installed in the Boot ROM sockets for devices 2, 3, and 1

NOTE

The ROM diagnostics for the SGB system are stored on three 64 word ROMs. These ROMs must be installed correctly for the diagnostics to execute. The First ROM is installed in the second device ROM socket in the PDP-11/44 and 11/24 CPU. The other two ROMs are located in the device three and four sockets for sequential execution. If these ROMs are not in the correct order the testing stop after printing the letter "Z". If the first ROM is not in the correct socket, no characters will be printed.

Y: Single operand instructions and condition code test

X: Control is transferred to the PDP 11/44 or 11/24 CPU diagnostic ROM. This tests the basic instruction set and some of memory. The difference in the amount of memory tested is noted below

The PDP 11/24 diagnostic ROM tests all available memory and prints the memory size. (last address + 2) before returning to the SGB ROM. The PDP 11/44 only tests the lower 56KB of memory. The following is an example of the character print out for a 11/24 with 512 K bytes of memory.

ZYX023000000WVUTSRQPONMLKJIHGFEDCBA*B* *Indicates no errors on a 11/24 system*

ZYXWVUTSRQPONMLKJIHGFEDCBA*B* *Indicating no errors on this 11/44*

PDP-11/44 Diagnostic ROM Failures

In the case of being hung on this character with the CPU run light on, the 4 l
mine the exact nature of the failure to get to the individual CPU board in
procedure for halting the CPU to find the failing test in the CPU instruc

1) Place the DC OFF LOC AL LOC AL DISABLE STANDBY switch in th

2) Type a control P, (^P) to get the console prompt:
CONSOLE

3) Type a H followed by a carriage return to halt the CPU. The following
terminal:
CONSOLE
.H
177707 165XXX
Where XXX comprises the failing address of the test

The following table lists the test number, failing address, factor XXX, an
PDP-11/44 CPU:

TEST#	ADDRESS	TEST DESCRIPTION
01	070	Branch always.
02	106	CLR mode 0, BMI, BVS, BHI, BLT, BLOS
03	122	DEC mode 0, BPL, BEQ, BGE, BLE.
04	131	ROR mode 0 BVC, BHIS, BNE.
05	172	Internal register and data path test
06	202	ROL mode 0, BHI, BLT
07	220	ADD INC, COM mode 0 BCS, BLT
10	240	ROR, DEC, BIS, ADD mode 0 BLO
11	260	COM, BIC, mode 0 BGT BLE.
12	302	SWAB, CMP, BIT, and BNE, BGT
13	302	MOVB, SOB CLR, TST, and BPL, BNE
13	312	BPL failed
13	331	SOB, CLR, or TST failed
11	331	JSR, RTS, JMP
11	346	JSR failed
11	356	stack failure.
11	366	RTS failed
11	100	RTI failed
11	106	JMP failed

W. TU58 boot routine. This routine looks for a valid boot block on the TU58 cartridge. First drive zero is tested then drive one.

V. Indicates that a valid boot block has been loaded into memory. The ROM will now transfer control to that loaded program. The loaded program could be the remainder of the diagnostics or any other valid boot such as VVDP+

If TU58 errors are encountered after the printing of the letter "U" and before printing the letter "T", control will be transferred to the first device boot ROM (normally the RA80 boot ROM).

U. This letter indicates that the loaded boot program is running in memory and the TU58 tape monitor is in the process of loading the configuration tables off the tape into memory.

T. Indicates configured system present and start of comprehensive CPU tests.

S. Lower memory testing. These tests are performed on memory for which memory management is not required and with cache disabled.

R. Cache testing. For PDP-11/24 or PDP-11/44 without Cache installed the Cache testing is skipped, but the letter is printed.

Q. Memory management testing. This consists of dual addressing and register bit testing.

P. Memory sizing testing. The amount of memory responding in the system is matched against the amount indicated in the configuration table.

In the case of only 2 banks of memory in the configuration all the characters for memory testing will be printed to maintain the sequence.

O. Testing first memory module

N. Testing second memory module(if present).

M. Testing third memory module(if present).

L. Testing fourth memory module(if present).

K. UDA50 controller testing. This test invokes the UDA50 microdiagnostics and verifies successful completion.

J. RA80 disk drive testing. This test invokes the RA80 microdiagnostics and verifies successful completion.

In the event of a RA80 failure, the drive number is printed on the next line. The error indication is printed on the following line. The next example shows the indication of drive one causing a fatal error

```
ZYVWVUTSRQPONMLKJ
1 (The "1" indicates the second drive.)
ERROR
```

I. DL11 device testing. Functional testing in bit stuff mode only

The following tests will print the message ERROR and then halt. They with cache off and then cache on. These tests exercise memory from 1k t... is procedure to find the failing area in the memory tests.

1) Place the DC OFF LOCAL LOCAL DISABLE STANDBY switch in the

2) Type a control P. (^P) to get the console prompt (CONSOLE).

3) Type a "E 7 6" followed by a carriage return to get the halt PC. The foll... on the terminal:

```
CONSOLE
...E 7 6
17777707 165\\\
```

Where \\\ comprises the failing address of the test

The following table lists the test number, failing address factor \\\ and ... PDP11/44 PC.

TEST#	\\\	TEST DESCRIPTION
15	\\\	Test main memory from virtual 1k to 21kW
15	526	Memory data error
15	550	Memory data error
16	\\\	Test main memory from virtual 1k to 21kW with cache enabled
16	634	Data error
16	652	Cache did not reference the memory bit
16	666	Cache parity error
16	702	Trap to vector 1 occurred - check stac...

H. DUP11 Loopback testing. Through parameters entered during the configuration program Cable or Modem loopback testing can be selected. If neither were selected, this test will not be performed, but the letter will still be typed
Local Modem Loopback Testing. A special cable has been installed to allow the DUP11 secondary transmit signal to put the modem in local loop back mode for cable and modem front end testing
Cable Loopback Testing. If Cable Loopback was selected, you must supply a BC25 test connector to the end of the cable.

G. DZ11 device testing. Controller and single line errors are recorded on the TU58

If a DZ11 or DUP11 fails, the testing continues. However, the fact that one or many of the devices have failed is indicated on the console terminal. The following indicates that the first DUP11 failed internal loop testing but passed local modem loop back testing

ZYXWVUTSRQPONMLKJI
0HGFEDCBA@ (The "0" indicates the first device.)

The above condition would be printed if the DUP11 was set to a vector address other than what was specified in the configuration table. The next example indicates a failure in the second DUP11 on internal and local modem loop back

ZYXWVUTSRQPONMLKJI
II
HGFEDCBA@ (The "1" indicates the second device.)

The next example shows the printout that would occur if the first and third DZ11 were to fail.

ZYXWVUTSRQPONMLKJIHG
0
2FEDCBA@
(The "0" indicates the first device and the "2" indicates the third device.)

F. Line clock testing. This verifies that the clock is operational

E. First device boot ROM. CRC check. This test calculates the CRC on the first device boot ROM and verifies that it matches the CRC stored in the ROM

D. Diagnostic testing complete

C. Printed to maintain the sequence of the alphabet.

B. The TU58 monitor is in the process of writing the status table containing the test results onto tape. If any TU58 error occurs control will be transferred to the first boot ROM and the rest of the characters will not be printed

A. Indicates the transfer of control to the first device boot ROM (normally the RX80 boot ROM). This will bring up the customer operating system software.

(space)*. This is the revision level of the diagnostic package. Refer to Appendix D for the current revision level and the changes made to each revision. Appendix D also indicates the method of verifying the revision level in the event the diagnostic does not complete.

PDP-11/24 Diagnostic ROM Features

In the case of being hung on this character with the CPU run light on, the
mine the exact nature of the failure to get to the individual CPU board in
procedure for halting the CPU to find the failing test in the CPU instruct

1) Place the DC OFF LOCAL LOCAL DISABLE, STANDBY switch in

2) Type "BREAK" to get the console prompt

The PDP11/24 for the SAB systems is strapped to disallow the execution
mode. The execution of a halt instruction causes a trap to location 10 in m
sets up the stack. (R6) and location 10 to point to location 12 where a branc
the CPU halted the stack can be examined to determine the failure area
to get the failing "PC"

3) Type a "171" followed by a carriage return to get the halt PC. The fo
the terminal.
171 165\\\
Where \\\ comprises the failing address of the test

APPENDIX B

CONFIGURATOR PROGRAM DIALOGUE

The program will identify itself by printing "CDSP Configurator Program". It will then load the tables required to run from the TU58. The program will then print "Loading Tables" before accessing the TU58. After the tables are loaded the configurator will ask questions about the system to be configured. Answers are either "YES NO", octal numbers, or selecting the default by just typing a carriage return "<CR>". All inputs are terminated with a carriage return, "<CR>".

The DZ11 and DUP11 device and vector addresses used in the prompts are calculated based on the number of devices, and according to the UNIBUS floating address and vector assignments. In the case of multiple devices, the address and vectors must be sequential.

The following is an example dialog

1) **Boot the RA80 after running diagnostics? (Y/N,<CR>=Y).**
(This question in conjunction with question 2 allows field service to continuously run diagnostics. A *"no" answer is For Field Service Use ONLY.*)

2) **Boot the TU58 after running diagnostics? (Y/N,<CR>=Y).**

3) **Do you want to answer the configuration questions again ? (Y/N,<CR>=Y).**
(This question allows the user to change the parameters of question 1 or 2 for a system without reanswering all the questions)

4) **Enter CPU type. (11/44=1, 11/24=2, <CR>=11/44).**

5) **Select memory type installed in each CPU backplane position for this PDP-11/44(or 11/24 depending on answer to 4) system configuration.**
A = MS11-MB 256KB ECC memory, Module: M8722-B?
(MS11-LD, M7891-D? 256 KB parity memory if 11/24)
B = MS11-PB, (1024KB) ECC memory, Module: M8743-B?
C = No memory installed in this slot.

CPU Backplane slot #09 (03 if 11/24)
CPU Backplane slot #10 (04 if 11/24)
CPU Backplane slot #11 (05 if 11/24)
CPU Backplane slot #12 (06 if 11/24)
At least one memory type must have been selected or the user will be asked the question again.

6) **Is there a UDA50 on the target system? (Y/N, <CR>=Y).**
(If the answer to this question is "N" the next 3 questions are skipped.)

7) **Enter the UDA50 device address in octal. (<CR>=172150).**

8) **Enter the UDA50 vector address in octal. (<CR>=154).**

9) **How many RA80's on the UDA50? (OCTAL, <CR>=1).**
(Two RA80's can be connected to one UDA50.)

10) **How many DUP11's on the target system? (OCTAL, <CR>=1).**
(Maximum of 16 allowed.)

The following table lists the failing address [illegible]
diagnostic ROM

ADDRESS	TEST DESCRIPTION
116	This error is caused by trapping to location 4 at any time first 4k of memory. The program does access to some this time
150	A failure with either the base instruction set or the EIS Hybrid or the CPU board. (M7133)
552	Memory system failure. First suspect the memory then the memory divide the contents of PAR0 (172312) by 200 octa
701	A data error has occurred in the console SLU

12) Enter the first DUP11 device address in octal (<CR>=160050).
(Addresses are sequential)

Enter the first DUP11 vector address in octal. (<CR>=310).
(Vectors are sequential)

13) Each DUP installed in the system can be individually selected to run the external loopback test. If the prompt for running the test is answered positively.("Y"), you will be prompted for which type of external loopback.
1 = Cable loopback. (H325 test connector).
2 = Modem Local Loopback. The special cable, 70-19303-25 must be installed from the DUP11 to the modem to perform this type of testing.
If the prompt is answered ("N"), Internal loopback will be performed. (The cable or modem will not be needed for testing).
Perform loopback testing for DUP11 #xx? (Y/N, <CR>=Y).
(repeated for each DUP xx DUP number)
Enter 1 for Cable or 2 for modem loopback.
(This question only asked if loopback testing selected)

14) How many DZ11's on the target system? (OCTAL, <CR>=3).
(Maximum of 16 allowed)

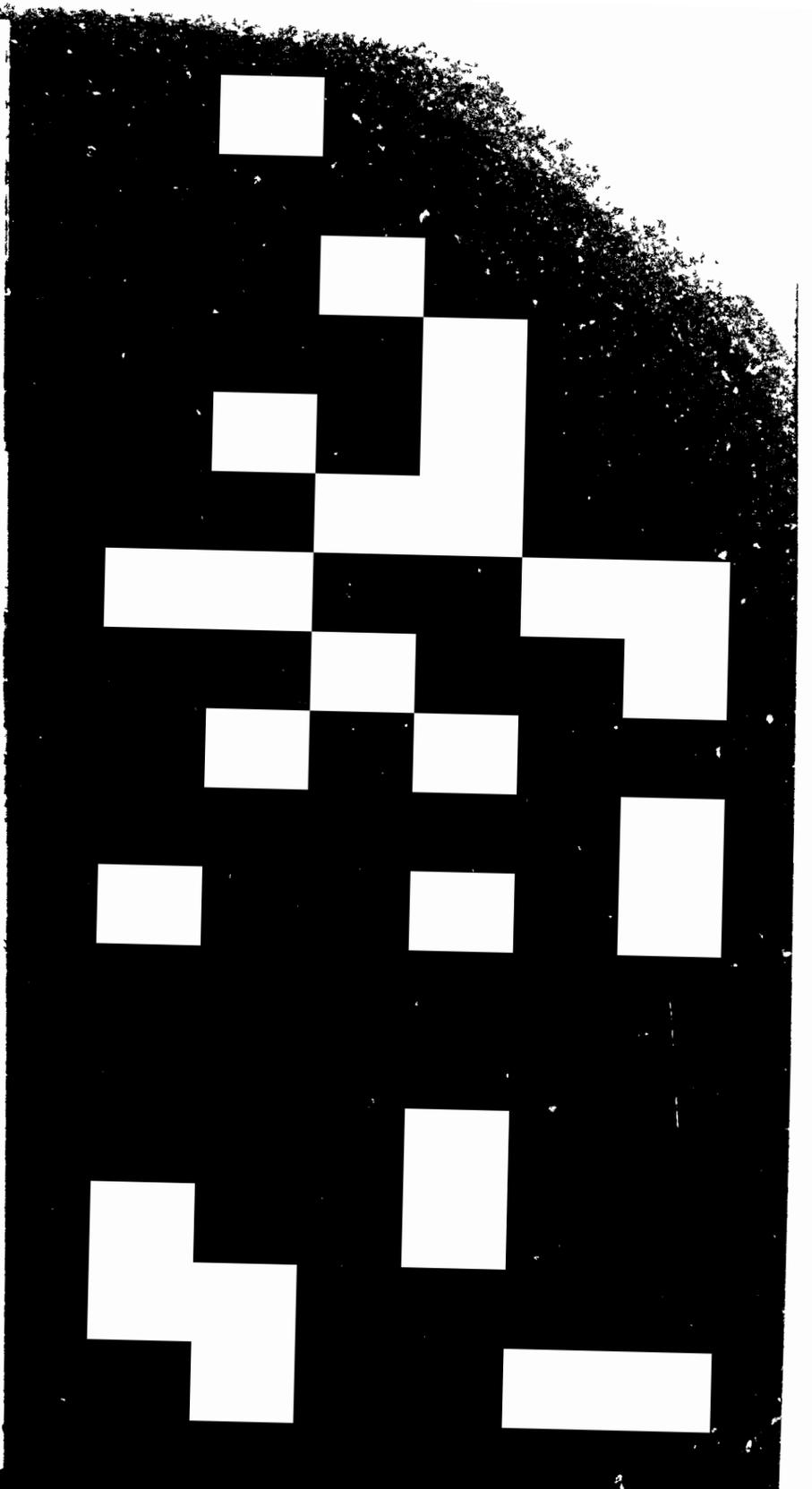
15) Enter the first DZ11 device address in octal. (<CR>=160110).
(Addresses are sequential)

16) Enter the first DZ11 vector address in octal. (<CR>=320).
(Vectors are sequential)

After the above questions have been answered the program will print a configuration table.

For example:

(see next page)



OPTION	BUS ADDRESS	VECTOR			
CPU TYPE = 11/44					
Cache Enabled					
TU58-EB	176500	300			
OPTION	BUS ADDRESS	VECTOR	LOOPBACK TEST		
DUP11	160050	310	CABLE		
DUP11	160060	320	MODEM		
DZ11	160120	330			
DZ11	160130	340			
DZ11	160140	350			
UDA50	172150	154			
Number of RA80's - 1					
OPTION	CSR ADDRESS	VECTOR	SLOT NUMBER	MODULE	
MS11-MB	172100	114	08	M8722-B?	
Empty Slot Number: 10					
Empty Slot Number: 11					
Empty Slot Number: 12					

To verify that the configuration is correct, and write the file on the TU58, answer the following questions.

13) **Is this configuration correct? (Y/N).**
(If the answer to this question is "N" the program will clear the current configuration table and start all over with question number 1.)

14) **Write configuration on master tape in drive X? (Y/N).**
(Where "X" is equal to 0 or 1. If the answer to this question is "Y" the configuration table is written to block 2 on the tape and outputs continue at question number 20. Else, the next status note is printed "NOTE: If the master tape is configured, the program stops. (branch self) after printing "Operation Complete".)

15) **The Configurator Program was loaded off the Master tape in drive "X". Please verify that the Master tape is in that drive. Type a carriage return when ready.**
(This prompt is used to notify the user that switching tapes during the configuration process could cause the Master to be destroyed. If the tapes were swapped the configurator program would destroy the Master and never notify the user via an error. This would produce 2 useless tapes.)

16) **Loading Data from Master tape for copy to drive X ....**
(Indication to the user to account for the access to the Master tape "X" is equal to 0 or 1)

17) **winding ....**
(New tapes should be wound and rewound to retension the tape This message and the next is used to notify the user of the process)

18) **rewinding ....**
(Notification to the user of the rewind in progress)

19). **Load a write enabled cartridge into drive 1 and type a carriage return. <CR> when ready.**

20) **Copy in process.**
(No prompt is required)

21) **Operation complete.**
(No prompt is required If the master tape was configured, this is the end of the operation. Program will just execute a self branch)

22). **Do you want to make another tape? (Y/N).**
(If the answer to this question is "Y" the next question is printed. If the answer is "N" the program will print "Operation complete" and then execute a self branch NOTE. This question will not be asked if a master tape was configured

23) **Will the next tape have the same configuration table as the last tape" (Y/N).**
(If the answer is "Y", prompt number 16 will be printed and continue for as many duplicate tapes as desired. If the answer is "N", the configuration table will be cleared and the program will start with question number 1)

APPENDIX C

CONFIGURATOR PROGRAM ERRORS

The following is a list of errors printed in response to improper user responses or hardware failures. The first list is the input or operation errors that will loop on the question being asked until the input is corrected. The error message printed is in "quotes" and the explanation of the errors are in (parenthesis).

CONFIGURATOR INPUT OR OPERATION ERRORS

- **"Maximum number of devices exceeded."**
  (1 or 2 for the number of RA80's or 1 to 20 octal for the number of DZ11's or DL P11's.)

- **"Not an octal number."**
  (Number response contained an 8 or a 9.)

- **"Invalid Response"**
  (Response does not mean anything, i.e. numbers or punctuation in response to a yes or no question.)

- **"No Defaults Allowed. Please input proper response."**
  (printed if a question that does not have a default answer was not given an answer).

- **"***No memory selected. Please select the correct amount of memory***"**
  (This is typed if the user typed "C" as memory choice for all four memory slots. At least one memory slot must have memory.)

- **"Invalid device address"**
  (Device address typed in by the user was not within the valid octal range of 160000 to 177770.)

- **"Invalid vector address"**
  (Vector address typed in by the user was not within the valid octal range of 300 to 774.)

- **"Load a WRITE enabled MASTER tape into drive X and type carriage return when ready."**
  (This message is printed when the Master tape was selected to be configured and the Master tape has been removed. "X" is equal to a 0 or a 1.)

- **"Load a write PROTECTED MASTER tape in drive X and type a carriage return when ready."**
  (This is printed when a blank tape is to be configured and the Master tape has been removed. "X" is equal to a 0 or a 1.)

- **"Please type a "Y" or "N" followed by a carriage return"**
  (This is printed if the first character of the response to a "yes", "no", or "carriage return please" prompt was anything except a "Y", "N", or a "carriage return". The prompt last printed will be re-printed after this message.)

- **"Cartridge write protected."**
  (This error could occur for question 15 or 16. The cartridge has a write protect switch to allow recording. Move the switch in the direction of the arrow. If the switch is missing, throw the cartridge away.)

- **"No cartridge in drive X."**
  (Where X = 0 or 1. The program will not continue until cartridge is installed. The last prompt will be re-printed.)

CONFIGURATOR FATAL ERRORS

- **"Fatal TU58 error"**
  (This message is printed if any error occurs concerning the TU58 after the initial check for tape present and write protect. If a data check error occurs this message is printed after it. This is a FATAL ERROR. Execution of the program stops.

- **"Data check error on drive X"**
  (Where X = 0 or 1. This is a FATAL ERROR. This message indicates a data check error during a read or write verify operation. Since the problem could be with the master, or the new tape, the user is notified of the drive in error. After printing this message the Fatal TU58 error is printed and execution is stopped.)

APPENDIX D

REVISION NUMBERS

When the testing is completed, the last letter is printed. ("X") followed by a space and then the revision level. The following example shows this.

ZYXWVUTSRQPONMLKJIHGFEDCBA B

The letter B in this case corresponds to the following number that is used by S.D.C. for revision tracking.

Media identifier = CKSGBB0

A Previous revision of this test package used numbers instead of letters. It can be identified by the software typing:
ZYXWVUTSRQPONMLKJIHGFEDCBA 3

The revision level of the SGB self test package can be verified without running the diagnostics. This can be done by following the procedure for "Reconfiguring A Configured Tape". After the configurator program prints "loading tables ...", and after the tables are loaded, the configurator will print the revision letter of that package.

Example:
CDSP Configurator Program
loading tables ...
  Version: B
This program.....(text continues)

Appendix E

PDP 11 44 Switch Jumper Configuration

To select the PDP 11 44 to boot or power up. to the second device boot-strap ROM with CPU diagnostics selected the switches must be set on the CPU modules as follows:

- To enable power-on boot CPU control S1 must be closed. ("on") This switch is located on the M7095 module

- To enable the internal booting of the PDP-11 44. (as opposed to a M9312 or M9301) UBI switch E28 2 must be closed. ("on") This switch is located on the M7098 module.

- To enable the upper address bits to boot to the selected device ROM. (upper 3 digits of address 773\\\) UBI switch E28 1 must be open. ("off") This switch is located on the M7098 module.

- The lower 3 digits of the boot address must be set to the second device ROM The lower 3 digits are 201 The switch settings on the UBI E28 3 thru E28 10 are as follows S1. and S9 = "ON" = "1". S3. S5 thru S8. and S10 = "OFF" = "0". This yields a boot address of 773201 These switches are located on the M7098 module. Consult sheet A 11 of the M7098 module in the customer print set for a table of switch settings. or PDP 11 44 system user guide chapter 3.

The following is a list of jumper and switch configurations that are required for proper operation of the TU58 tape drive. The jumper and switch configuration tables are located on sheet h3 10 of the M7098 module in the customer print set.

Jumpers

- W9 installed, indicating that the TU58 receiver error bits are enabled in the TU58 receiver buffer register, bits 12 15.
- W1 installed, allows the reading of the receiver error bits, esr bits 15:12 of the console terminal receiver buffer.
- W10 installed, indicating that the TU58 transmitter status register break bit, (bit 0) is enabled to be set and cleared.
- W11 removed, indicating that the TU58 parity detection and generation is disabled and the parity error bit will remain cleared.
- W12 and W13 removed, indicating that the character length for the TU58 is 8 bits.

Switches

- To set the TU58 receiver and transmitter speed to 9600 baud set the following switches E7 1,3,4,6 to "OFF" and switches E7 2,5 to "ON".
- Set switch E7 7 to "OFF" for 2 stop bits at 8 bits character.
- To enable the internal decode of the TU58 address switch E79-1 must be "ON".
- To set a TU58 vector of 300 the following switches are set. E79-3,6,7,8 to "OFF" and E79-4,5 to "ON"
- To set a TU58 address of 776500 the following switches are set E79-1,2,3,5,7 to "ON" and E79-6,9,10 to "OFF"

Appendix F

PDP 11 24 Switch Jumper Configuration.

To select the PDP 11 21 to boot or power up to the second device bootstrap ROM with CPU diagnostics selected, the jumpers on the CPU module, (M7133) must be set up as follows:

- Jumper W2 in, for boot on power up from power fail.
- Jumper W3 out, disallowing a halt instruction to be executed in kernal mode. If this jumper is left in and an error occurs in the CPU diagnostic ROM during testing, the CPU will halt and enter console ODT
- Jumper W11 in. Boot address on power up to 165000. Console ROM then reads switches on Unibus Map module indicating boot to second device.

To select the PDP 11 21 to start execution at the second boot device the switches on the Unibus Map Module, (M7131) must be set up as follows:

- To select the 11 21 to boot a device, set S1="OFF" at location E58.
- To select the boot ROMs readable, set S2="ON" at location E58. To allow proper operation of the SoB boot ROMs the boot ROMs must be readable. The SoB boot ROMs perform a ROM sequence verification before transferring control to the second boot ROM. If a timeout occurs the testing will stop.
- The lower 8 bits of address 173VVV must equal 201 to point to the second boot device. Set switches E58 3 thru E58 10 as follows: S1 and S9 = "1" = "ON", S3, S5 thru S8 and S10 = "OFF" = "0"

The TU 58 is connected to the second serial Line Unit, (SLU) on the 11 21. For proper operation configure the switches and jumpers on the CPU module, (M7133) as follows:

- Set baud rate 2 to 9600 baud. Switch pack E135 settings: S1 thur S3 = "OFF", S4 = "ON"
- Set the baud rate selection of transmit and receive of SLU 2 to baud rate 2. Jumpers W10 W12 in and jumpers W1,W9,W11, and W13 out
- To disable parity detection of SLU 2, remove jumper W7.

Appendix G

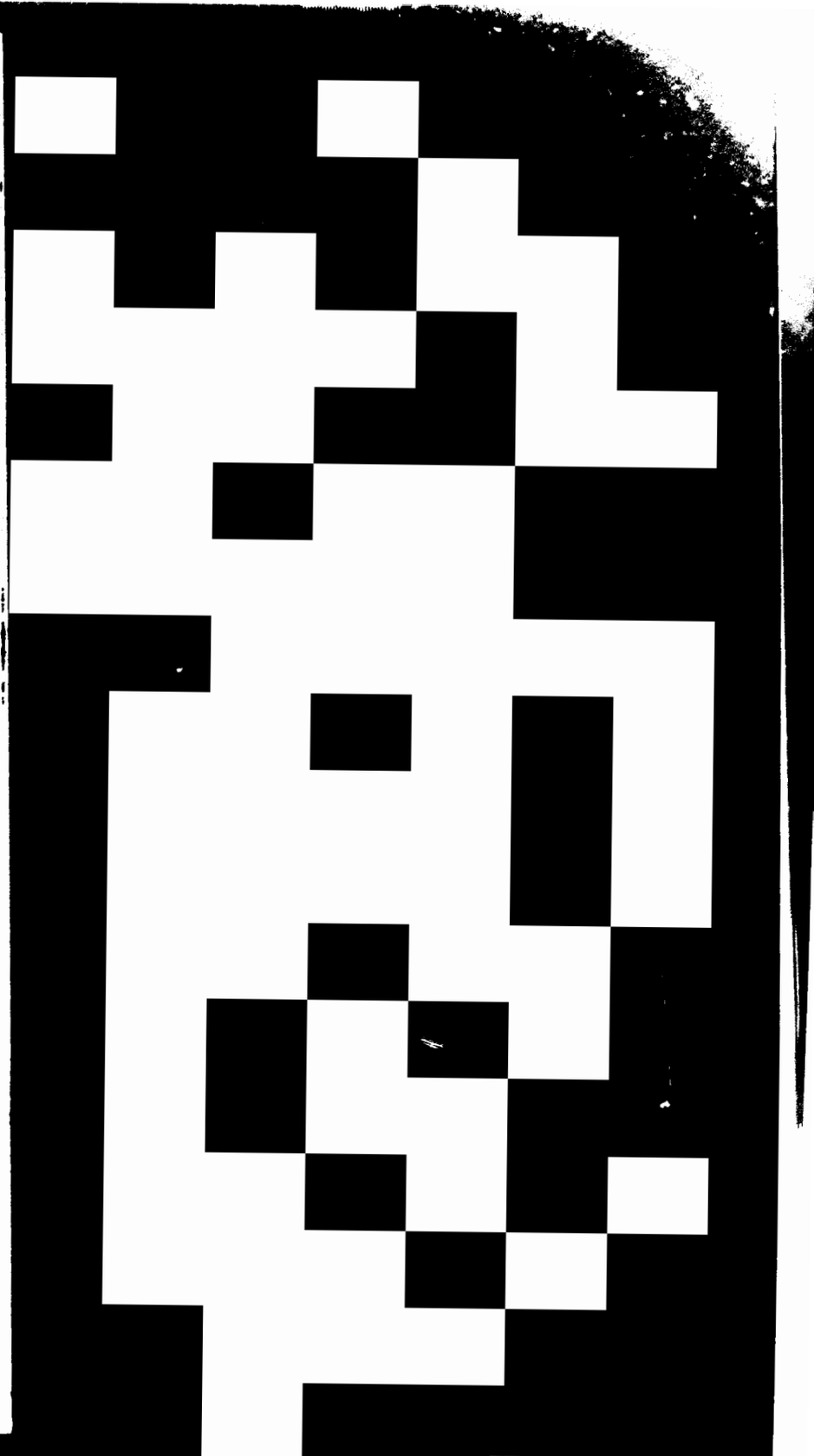
SGB Boot ROM installation for PDP-11 24 and 11 44.

The following table sets out the socket location of the SGB and UDA50 boot ROMs for the PDP-11 24 and PDP-11 44. These ROMs MUST be installed in these locations for proper operation.

UDA50 ROM NUMBER	PDP-11 44 M7098	PDP-11 24 M7131
23072A900	E18	E75

SGB ROM NUMBER	PDP-11 44 M7098	PDP-11 24 M7131
23972A900	(WAS) E19	N/A
23973A900	E50	E82
23974A900	E59	E83
23975A900	E19	E89

replaced by 23975A900



Appendix H

PDP-11/44 Diagnostic ROM Failures

In the case of being hung on this character with the CPU run light on the CPU can be halted to determine the exact nature of the failure to get to the individual CPU board in error. The following is the procedure for halting the CPU to find the failing test in the CPU instruction tests.

1) Place the DC OFF LOCAL LOCAL DISABLE STANDBY switch in the LOCAL position.

2) Type a control P. (^P) to get the console prompt.
CONSOLE

3) Type a H followed by a carriage return to halt the CPU. The following will be displayed on the terminal.
CONSOLE
H
17777707 165\\\
Where \\\ comprises the failing address of the test

The following table lists the test number, failing address factor, \\\ and test description for the PDP-11/44 CPU.

TEST#	ADDRESS	TEST DESCRIPTION
01	070	Branch always.
02	106	CLR mode 0, BMI, BVS, BHI, BLT, BLOS.
03	122	DEC mode 0, BPL, BEQ, BGE, BLE.
04	134	ROR mode 0, BVC, BHIS, BNE.
05	172	Internal register and data path test
06	202	ROL mode 0, BBC, BLT.
07	220	ADD, INC, COM mode 0, BCS, BLE
10	240	ROR, DEC, BIS, ADD mode 0, BLO.
11	260	COM, BIC, mode 0, BGT, BLE.
12	302	SWAB, CMP, BIT, and BNE, BGT.
13	302	MOVB, SOB, CLR, TST, and BPL, BNE
13	312	BPL failed.
13	334	SOB, CLR, or TST failed.
14	334	JSR, RTS, JMP.
14	346	JSR failed.
14	356	stack failure.
14	366	RTS failed.
14	400	RTI failed.
14	406	JMP failed.

The following tests will print the message "ERROR" and then halt. These tests are the memory test with cache off and then cache on. These tests exercise memory from 1k to 21kW. The following is the procedure to find the failing area in the memory tests.

1) Place the [0] OFF LOCAL LOCAL DISABLE STANDBY switch in the LOCAL position.

2) Type a control P. (^P) to get the console prompt: CONSOLE

3) Type a "L 7 6" followed by a carriage return to get the halt PC. The following will be displayed on the terminal:
CONSOLE
.E 7 6
177777 165\\\
Where \\\ comprises the failing address of the test.

The following table lists the test number, failing address factor, \\\ and test description for the PDP 11 81 CPU.

TEST#	ADDRESS	TEST DESCRIPTION
15	\\\	Test main memory from virtual 1k to 21kW
15	526	Memory data error.
15	570	Memory data error.
16	\\\	Test main memory from virtual 1k to 21kW with cache enabled.
16	631	Data error.
16	652	Cache did not reference the memory bit.
16	666	Cache parity error.
16	702	Trap to vector 1 occurred - check stack for origin.

Appendix I

PDP-11 24 Diagnostic ROM Failures

In the case of boots hung on this character with the CPU run light on, the CPU can be halted to determine the exact nature of the failure to get to the individual CPU board in error. The following is the procedure for halting the CPU to find the failing test in the CPU instruction tests.

1) Place the DC OFF LOCAL LOCAL DISABLE STANDBY switch in the LOCAL position.

2) Type "BREAK" to get the console prompt.

The PDP 11/24 for the SoB systems is strapped to disallow the execution of halt instructions in kernal mode. The execution of a halt instruction causes a trap to location 10 in memory. The SoB boot ROM sets up the stack (R6) and location 10 to point to location 12 where a branch self will be executed. With the CPU halted the stack can be examined to determine the failure area. Use the following procedure to get the failing "PC".

3) Type a "171" followed by a carriage return to get the halt PC. The following will be displayed on the terminal.
171 165\\\
Where \\\ comprises the failing address of the test.

The following table lists the failing address factor. (\\\) and test description for the PDP-11/24 CPU diagnostic ROM

ADDRESS	TEST DESCRIPTION
116	This error is caused by trapping to location 4 at any time prior to executing the memory test on the first 4k of memory. The program does accesses to some of the memory management registers during this time.
150	\ failure with either the base instruction set or the EIS instruction set. First suspect the DCF11-\ Hybrid or the CPU board. (M7133).
562	Memory system failure. First suspect the memory then the KTF11-\. To locate the failing bank of memory divide the contents of PAR0 (172312) by 200 octal then multiply by 4.
704	\ data error has occurred in the console SLU.