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DOBMA.P11

6/10/76

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DOBMAA.P11 MAINDEC-11-DOBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

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IDENTIFICATION

PRODUCT CODE:	MAINDEC-11-DOBMA-A-D
PRODUCT NAME:	UNIVERSAL RESTART ROM LOADER
DATE RELEASED:	21 DECEMBER 1975
MAINTAINER:	DIAGNOSTIC GROUP

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1. ABSTRACT

THIS MAINDEC CONSISTS OF FOUR PROGRAMS. THE TWO MAIN PROGRAMS ARE PROGRAM ONE AND PROGRAM FOUR. THESE PROGRAMS WILL BE DISCUSSED LATER.

THE PURPOSE OF THIS DIAGNOSTIC IS TO VERIFY THE DATA IN THE ROM, MAKE SURE ALL ADDRESS WILL CAUSE A TIME OUT TRAP WHEN WRITTEN INTO (EXCEPT THE TRAP VECTORS: 173024, 173224) AND ALERT THE OPERATOR AS TO WHAT THE OFFSET ADDRESS WOULD BE IF A SELECTED BUTTON IS PUSHED.

THE SEDM SYSTEM HAS SPECIAL ROM DATA -- USES BM873YS -- WHICH MUST BE INPUTED TO THE PROGRAM BY THE USER FOR THE DIAGNOSTIC TO VERIFY THE BM873YS CONTENTS.

NOTE: FOR NORMAL CONFIGURATIONS: THE ONLY PROGRAMS NECESSARY FOR ACCEPTANCE OF THE BM873 ARE PROGRAMS ONE AND FOUR. PROGRAM TWO IS NECESSARY FOR "NON-STANDARD" SETUPS AND IS A MAINTAINCE TOOL. PROGRAM THREE IS ALSO JUST FOR MAINTAINCE AID.

2. REQUIRMENTS

2.1 EQUIPMENT

ANY PDP-11 FAMILY CPU
UNIVERSAL RESTART LOADER
TELETYPE OR EQUIVALENT (OPTIONAL)
LINE PRINTER (OPTIONAL)
AT LEAST 4K OF MEMORY.

2.2 STORAGE

THIS PROGRAM RESERVES THE RIGHT TO USE ALL OF THE FIRST 4K EXCEPT WHERE BOOTSTRAP LOADER AND ABSOLUTE LOADER RESIDE.

3. LOADING PROCEDURE

THE PROGRAM MAY BE LOADED LIKE ANY OTHER PROGRAM SUCH AS: PAPER TAPE, DECTAPE MAGTAPE, DISK, ETC. MOST COMMON WILL BE THROUGH PAPER TAPE BY THE USE OF ABSOLUTE LOADER.

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4. STARTING PROCEDURE

4.1 CONTROL SWITCH SETTINGS

SWITCH 01 CLEARED INDICATES ONLY FIRST 128
WORDS TO BE CHECKED.
SET INDICATES EXTENDED 128. WORDS
ARE TO BE CHECKED IN WHICH CASE
PROGRAM 2 MUST BE RUN FIRST.
WHEN RUNNING ON BMB73YB, BMB73YC, OR BMB73YD, 256 WORDS
ARE AUTOMATICALLY CHECKED.

4.2 STARTING ADDRESS

STARTING ADDRESS 000200
RESTART ADDRESS 000210

4.3 OPERATOR ACTION

4.3.1 FOR NORMAL OPERATION (WITHOUT EXTENDED 128 WORDS)

EITHER A) ONLY IF THERE IS NO TTY-----

1. LOAD ADDRESS 000200
2. CLEAR CONSOLE SWITCHES
3. SET SW06=1, SW00=1
4. PRESS START

PROGRAM WILL HALT AT ADDRESS 010124 TO ENQUIRE
WHICH PROGRAM TO BE RUN

5. CLEAR CONSOLE SWITCHES
6. SET SW05=1, SW04=1
7. SET---- EITHER SW00=1 IF PROG 1 TO BE RUN
OR SW01=1 IF PROG 2 TO BE RUN
OR SW01=1, SW00=1 IF PROG 3 TO BE RUN
OR SW02=1 IF PROG 4 TO BE RUN

8. PRESS CONTINUE
9. NOW, AND ONLY NOW, SET SW15=1, SW11=1 (OPTIONAL)
AND SW06=1
OTHERS MAY STAY UP

IF THERE IS NO ERROR, PROG 1, 3 AND 4 WILL RUN FOR
APPROX. FIVE MINUTES; AT THE END OF WHICH THERE WILL
BE "5" (OCTAL) ON THE DISPLAY LIGHTS FOR
COUPLE OF SECONDS AND THEN PROG WILL HALT AT ADDRESS
252 FOR END OF PASS.
PRESS CONTINUE TO PROCEED WITH THIS PROGRAM.

PROGRAM 2 HAS NO END PASS; BUT WILL HALT AT COMPLETION.
HIT CONTINUE TO PROCEED IN THIS PROGRAM.

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PROGRAM WILL HALT AT ADDRESS 015556 IF THERE IS ANY ERRORR
IN ANY OF THE PROGRAMS.

TO DETERMINE TYPE OF ERROR:

OBSERVE CONTENTS OF TABLE STARTING AT LOCATION 017400.
THERE ARE THREE DIFFERENT TYPES OF TABLES FOR FOUR
DIFFERENT TYPES OF ERRORS.
THEY ARE ARRANGED AS BELOW:

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THE FOLLOWING MESSAGE ADDRESSES ARE:
016314 EMO
016356 EM1
016415 EM2
016462 EM3

THIS TABLE IS FOR COMPARISON ERROR

017400	I I I	PC	I I I
017402	I I I	ADDR OF MSG	I I I
017404	I I I	ROM ADDR	I I I
017406	I I I	SOFT ADDR	I I I
017410	I I I	EXP DATA	I I I
017412	I I I	FOUND DATA	I I I

THIS TABLE IS FOR "WRITING ROM FAILED TO TRAP" AND "FATAL TRAP" TYPE OF ERROR

017400	I I I	PC	I I I
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017402	I	ADDR OF MSG	I
	I		I
	I		I
017404	I	ROM ADDR	I
	I		I
	I		I
017406	I	0	I
	I		I
	I		I
017410	I	0	I
	I		I
	I		I
017412	I	0	I
	I		I
	I		I

; THIS TABLE IS FOR "UNEXPECTED TRAP" TYPE OF ERROR

017400	I	PC	I
	I		I
	I		I
017402	I	ADDRESS OF MESSAGE	I
	I		I
	I		I
017404	I	ROM ADDR	I
	I		I
	I		I
017406	I	PC OF TRAP	I
	I		I
	I		I
017410	I	0	I
	I		I
	I		I
017412	I	0	I
	I		I
	I		I

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HOW TO LOOK IN TO THE TABLE:

10. LOAD ADDRESS 017400
 11. PRESS EXAMINE
CONTENT OF THIS LOCATION IS---PC OF THE DETECTED ERROR.
 12. PRESS EXAMINE
CONTENT IS ---ADDRESS OF MESSAGE
 13. PRESS EXAMINE
CONTENT IS -- ROM ADDRESS
- THEN CONTINUE LIKE ABOVE FOLLOWING THE TABLE

TO PROCEED WITH THE PROGRAM GO BACK TO STEP 1.

OR B) ----IF THERE IS A TTY :

1. LOAD STARTING ADDRESS (000200)
2. SET SWITCHES AS PER 5.1.1 (NORMAL ALL SWITCHES DOWN)
3. PRESS START SWITCH AND RELEASE.
4. DEVICE VERSION.

WHEN PROGRAM IS STARTED FOR THE FIRST TIME THE FOLLOWING
WILL BE PRINTED OUT:

"DEVICE VERSION
BM873-Y"

THE OPERATOR WILL THEN SPECIFY THE VERSION BEING RUN.

BM873-Y* IS ANY NON-STANDARD VERSION.

NOTE: PROGRAM TWO MUST BE RUN FIRST.

BM873-YA REPLACES M792-YA, MR11-DB, M792-YH

BM873-YB MASSBUS

BM873-YC DDCHP BOOTSTRAP ROM

BM873-YD KL10 (PDP-11) 256 BOOTSTRAP ROM

5. THEN TYPE IN NUMBER OF PROGRAM TO BE RUN (NORMALLY PROGRAM 1 AND 4)
6. HITTING CONTROL "G" WHILE PROGRAM IS RUNNING WILL CAUSE A RESTART.
YOU MAY THEN INPUT DIFFERENT PROGRAM NUMBER.

NOTE: RESTARTS AT ADDRESS 200 WILL GO TO STEP 5 ABOVE.
RESTARTS AT ADDRESS 210 WILL GO TO STEP 3 ABOVE.

4.3.2 IF YOU WISH TO TEST THE EXTENDED 128. WORDS THIS IS THE
PROCEDURE:

(NOT NEEDED FOR NORMAL TESTING OF BM873YB, BM873YC, OR BM873YD)

1. LOAD STARTING ADD. 000200
2. SET SW01=1
3. SET HALT ENABLE SW AND SINGLE CYCLE SW UP
4. HIT START SWITCH AND RELEASE.
5. RUN PROGRAM 2 FOR ONE PASS.
6. NOW ANY PROGRAM MAY BE RUN.

NOTE: VISUAL INSPECTION OF EXTENDED DUMP
IS YOUR RESPONSIBILITY. THAT DATA WAS
PLACED INTO SOFTWARE TABLE FOR TEST COMPARISON.

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5. OPERATING PROCEDURE

5.1.1 SWITCH SETTINGS (APPLICABLE IN ALL PROGRAMS)

SW15 = 1 OR UP ... HALT ON ERROR

SW13 = 1 OR UP ... INHIBIT ERROR PRINT OUT

SW12 = 1 OR UP ... INHIBIT ALL PRINT OUT/ BELL ON ERROR.

SW11 = 1 OR UP ... INSTEAD OF EXERCISING EACH ADDRESS 10X DO IT 1X.

SW09 = 1 OR UP ... LOOP WITH CURRENT ADDRESS

SW08 = 1 OR UP ... GOTO BEGINNING OF CURRENT PROGRAM ON ERROR

SW06 = 1 OR UP ... HALT ON END OF PASS

6. ERRORS

6.1 ERROR PRINT OUT

ALL ERRORS WILL HAVE A PRINT OUT. IF IT WAS A COMPARISON ERROR; THE ROM ADDRESS, SOFT ADDRESS, EXPECTED DATA (FROM SOFTWARE MAP), AND THE FOUND DATA WILL BE PRINTED OUT. IF IT WAS A "NO TRAP WHEN WRITTEN" ERROR; THE ADDRESS WILL BE PRINTED OUT. IF IT WAS AN "UNEXPECTED TRAP " WHEN READING ROM THE ADDRESS WILL BE PRINTED .

ALSO INFORMATION RELATING TO ALL ERRORS ARE STORED IN CORE STARTING AT LOCATION 017400-----
REFER TO SECTION 4.3.1

6.2 ERROR RECOVERY

1. ITS A GOOD IDEA TO LEAVE SW15=1 WHILE TEST RUNS TO PREVENT A RUN AWAY ERROR FROM GOING WILD IF YOU LEAVE THE CPU.
2. IN AN ERROR; SET SW09=1(LOOP ON THIS ADDR.) AND SET SW 13=1(DELETE ERROR PRINT OUT). IF CPU IS HALTED; HIT CONTINUE.
3. NOW THE PROGRAM IS RUNNING AND YOU MAY SCOPE IT.

7. RESTRICTIONS

7.1 STARTING RESTRICTIONS

SEE SECTION 4.

7.2 OPERATING RESTRICTIONS

- 7.2.1 IF OPERATING ON 11/45; AND JUMPER HAS BEEN CUT FOR A POWER FAIL TO GOTO ADDRESS 173200;
***** A POWER FAIL MUST NOT HAPPEN WHILE PRG IS RUNNING *****
- 7.2.2 IF YOU WISH PROGRAM TO TEST YOUR EXTENDED 128. WORDS; YOU MUST START AS PER SECTION 4 AND THEN
***** RUN PROGRAM 2 FIRST AND VISUALLY VERIFY DATA.****
(NOT APPLICABLE TO BM873YB, BM873YC, OR BM873YD)
- 7.2.3 YOU MAY NOT ALTER THE SOFTWARE MAP UNLESS--
***** YOU KNOW WHAT YOU ARE DOING *****
- 7.2.4 THE ROM ADDRESS MUST START AT 173000 AND BE AT LEAST 128 WORDS LONG. (256 FOR THE BM873YB, BM873YC, OR BM873YD)

8. MISCELLANEOUS

8.1 EXECUTION TIME

PROGRAM ONE WILL PASS AT APPROX. FIVE MINS.
PROGRAM TWO HAS NO END PASS; BUT WILL HALT AT COMPLETEION
HIT CONTINUE TO PROCEED IN THIS PROGRAM.
PROGRAM THREE (RUN) WILL PASS APPROX. FIVE MINS.
PROGRAM FOUR WILL PASS APPROX. FIVE MINS

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9. PROGRAM DESCRIPTION

9.1 PROGRAM 1

PROGRAM 1 WILL VERIFY THE DATA IN THE ROM AND THE VERIFY THAT WRITING THE ROM WILL TRAP OUT (EXCEPT THE VECTORS) EACH ADDRESS IS REFERENCED FIVE TIMES IN A ROW BEFORE UPDATING TO THE NEXT ADDRESS.
IF SW00 WAS UP WHEN START WAS HIT, THE EXTENDED 128 WORDS WILL BE CHECKED.
256 WORDS WILL BE CHECKED AUTOMATICALLY IF BMB73YB, BMB73YC, OR BMB73YD IS TESTED.

9.2 PROGRAM 2

PROGRAM 2 WILL DUMP THE CONTENTS OF THE ROM ONTO THE TTY (OR LINE PRINTER IF SW07=1). NOTE NO VERIFICATION OF ANY KIND IS PERFORMED ON THE DATA. (AN ERROR WILL OCCUR IF A TRAP IS ENCOUNTERED WHILE READING) YOU MUST INSPECT THE DATA YOUR SELF. IF SW00 WAS UP WHEN START WAS HIT THE EXTENDED 128. WORDS WILL BE PRINTED.
256 WORDS WILL BE PRINTED IF BMB73YB, BMB73YC, OR BMB73YD IS SELECTED
NOTE: IF SW 07=1 PRINTING WILL BE DONE ON THE LINE PRINTER IF IT EXISTS.

9.3 PROGRAM 3

PROGRAM 3 IS THE SAME AS PROGRAM ONE EXCEPT THAT THE USER HAS THE ABILITY TO ALTER THE SOFTWARE MAP, LIST OR PRINT THE SOFTWARE MAP, AND RUN THE PROGRAM.
NOTE THAT IF YOU ALTER THE MAP BE CAREFULL OF WHAT YOU CHANGE.
FOR THE COMMANDS TO BE USED SEE TOP OF PROGRAM 3 IN THIS LISTING

9.4 PROGRAM 4

PROGRAM 4 CHECKS THE OFFSET ADDRESS WHEN THE SIMULATED PUSHING OF A BUTTON IS DONE BY THE SOFTWARE. ON THE FIRST PASS THE OFFSET IS TYPED OUT FOR YOU TO VERIFY (NOTE: THE PROGRAM HAS NO WAY OF KNOWING WHAT THE OFFSET WILL BE). AFTER THE DATA IS TYPED OUT IT IS STORED AWAY IN CORE. WHEN THE FIRST PASS IS FINISHED THE PROCESS IS REPETED ONLY NO TYPE OUT IS PERFORMED, AND THE DATA IN CORE IS COMPARED TO THE DATA FOUND AT THE ROM.

DURING THIS TEST "WRITING" THE ROM IS PERFORMED. THE VECTORS (173024,173224) ARE "WRITTEN" AND ARE **NOT** EXPECTED TO TRAP. AN ERROR MESSAGE WILL BE REPORTED IF A TRAP IS DISCOVERED.

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9.5 CONTROL "G"

HITTING CONTROL "G" WILL GO TO THE BEGINING OF THE PROGRAM AND ASK FOR PROGRAM NUMBER.

9.6 THIS PROGRAM IS "XXDP AND ACT-11" COMPATIBLE;
AT PRESENT TIME IF IN CHAIN MODE UNDER ACT-11 OR
XXDP THE PROGRAM AUTOMATICALLY DETERMINES IF THE ROM IS
BM873YA OR YB, YC, OR YD BY COMPARING THE 1ST WORD IN ROM WITH THE
EXPECTED WORD. THE DIAGNOSTIC THEN RUNS
PROGRAM 1 AND PROGRAM 4 BEFORE ENTERING THE MONITOR.

9.7 ELECTRICAL PREQUISITES (HARDWARE)

9.7.1 THIS OPTION MUST BE ON THE CPU SIDE OF ANY BUS BUFFERS.

9.7.2 NPR CYCLES ARE NOT PERMITTED DURING THE POWER UP TRAP SEQUENCE.

9.7.3 ACLO AND DCLO MUST BE AVAILABLE AT BACKPLANE
PINS "CV1" AND "CN1" RESPECTIVELY. THIS WIRING IS NOT
PROVIDED ON THE "SPC" SLOTS OF THE 11/15, 11/20, 11/35,
11/40, AND THE DD11-A; IT IS PROVIDED ON THE 11/05, AND
11/45, ALSO ON THE DD11-B. IF FURTHER INFORMATION IS NEEDED
CONSULT THE BM873 MANUAL FOR HELP.
NOTE: THE DIAGNOSTIC RUNNING WITHOUT ANY INTERFERANCE FROM
THE USER HAS NO WAY OF CHECKING THE PRESENTS OF THE
"ACLO" AND "DCLO" SIGNALS ON THE OPTION.

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;REGISTER DEFINITIONS

000000	R0=%0	:GENERAL REGISTER
000001	R1=%1	:GENERAL REGISTER
000002	R2=%2	:GENERAL REGISTER
000003	R3=%3	:GENERAL REGISTER
000004	R4=%4	:GENERAL REGISTER
000005	R5=%5	:GENERAL REGISTER
000006	SP=%6	:PROCESSOR STACK POINTER
000007	PC=%7	:PROGRAM COUNTER

;LOCATION EQUIVALENCIES

177570	SWR=177570	:CONSOLE SWITCH REGISTER
177570	LIGHTS=177570	:PDP-11/45 DISPLAY REGISTER
177776	PS=177776	:PROCESSOR STATUS WORD
001200	STACK=1200	:START OF PROCESSOR STACK

;INSTRUCTION DEFINITIONS

005746	PUSH1SP=5746	:DECREMENT PROCESSOR STACK 1 WORD
005726	POP1SP=5726	:INCREMENT PROCESSOR STACK 1 WORD
010046	PUSHR0=10046	:SAVE R0 ON STACK
012600	POPR0=12600	:RESTORE R0 FROM STACK
024646	PUSH2SP=24646	:DECREMENT STACK TWICE
022626	POP.SP=22626	:INCREMENT STACK TWICE
	.EQUIV EMT,HLT	:BASIC DEFINITION OF ERROR CALL

BIT15=100000
 BIT14=40000
 BIT13=20000
 BIT12=10000
 BIT11=4000
 BIT10=2000
 BIT9=1000
 BIT8=400
 BIT7=200
 BIT6=100
 BIT5=40
 BIT4=20
 BIT3=10
 BIT2=4
 BIT1=2
 BIT0=1

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580 ;TRAPCATCAER FOR ILLEGAL INTERRUPTS
581 .=0
582 000000 000002 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
583 000002 000000 HALT ;EXAMINE STACK TO FIND CAUSE
584 000004 000006 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
585 000006 000000 HALT ;EXAMINE STACK TO FIND CAUSE
586 000010 000012 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
587 000012 000000 HALT ;EXAMINE STACK TO FIND CAUSE
588 000014 000016 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
589 000016 000000 HALT ;EXAMINE STACK TO FIND CAUSE
590 000020 000022 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
591 000022 000000 HALT ;EXAMINE STACK TO FIND CAUSE
592 000024 000026 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
593 000026 000000 HALT ;EXAMINE STACK TO FIND CAUSE
594 000030 000032 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
595 000032 000000 HALT ;EXAMINE STACK TO FIND CAUSE
596 000034 000036 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
597 000036 000000 HALT ;EXAMINE STACK TO FIND CAUSE
598 000040 000042 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
599 000042 000000 HALT ;EXAMINE STACK TO FIND CAUSE
600 000044 000046 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
601 000046 000000 HALT ;EXAMINE STACK TO FIND CAUSE
602 000050 000052 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
603 000052 000000 HALT ;EXAMINE STACK TO FIND CAUSE
604 000054 000056 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
605 000056 000000 HALT ;EXAMINE STACK TO FIND CAUSE
606 000060 000062 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
607 000062 000000 HALT ;EXAMINE STACK TO FIND CAUSE
608 000064 000066 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
609 000066 000000 HALT ;EXAMINE STACK TO FIND CAUSE
610 000070 000072 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
611 000072 000000 HALT ;EXAMINE STACK TO FIND CAUSE
612 000074 000076 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
613 000076 000000 HALT ;EXAMINE STACK TO FIND CAUSE
614 000100 000102 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
615 000102 000000 HALT ;EXAMINE STACK TO FIND CAUSE
616 000104 000106 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
617 000106 000000 HALT ;EXAMINE STACK TO FIND CAUSE
618 000110 000112 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
619 000112 000000 HALT ;EXAMINE STACK TO FIND CAUSE
620 000114 000116 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
621 000116 000000 HALT ;EXAMINE STACK TO FIND CAUSE
622 000120 000122 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
623 000122 000000 HALT ;EXAMINE STACK TO FIND CAUSE
624 000124 000126 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
625 000126 000000 HALT ;EXAMINE STACK TO FIND CAUSE
626 000130 000132 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
627 000132 000000 HALT ;EXAMINE STACK TO FIND CAUSE
628 000134 000136 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
629 000136 000000 HALT ;EXAMINE STACK TO FIND CAUSE
630 000140 000142 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
631 000142 000000 HALT ;EXAMINE STACK TO FIND CAUSE
632 000144 000146 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
633 000146 000000 HALT ;EXAMINE STACK TO FIND CAUSE
634 000150 000152 .+2 ;UNEXPECTED TRAP TO THIS LOCATION
635 000152 000000 HALT ;EXAMINE STACK TO FIND CAUSE

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636	000154	000156	.+2	:UNEXPECTED TRAP TO THIS LOCATION
637	000156	000000	HALT	:EXAMINE STACK TO FIND CAUSE
638	000160	000162	.+2	:UNEXPECTED TRAP TO THIS LOCATION
639	000162	000000	HALT	:EXAMINE STACK TO FIND CAUSE
640	000164	000166	.+2	:UNEXPECTED TRAP TO THIS LOCATION
641	000166	000000	HALT	:EXAMINE STACK TO FIND CAUSE
642	000170	000172	.+2	:UNEXPECTED TRAP TO THIS LOCATION
643	000172	000000	HALT	:EXAMINE STACK TO FIND CAUSE
644	000174	000176	.+2	:UNEXPECTED TRAP TO THIS LOCATION
645	000176	000000	HALT	:EXAMINE STACK TO FIND CAUSE
646	000200	000202	.+2	:UNEXPECTED TRAP TO THIS LOCATION
647	000202	000000	HALT	:EXAMINE STACK TO FIND CAUSE
648	000204	000206	.+2	:UNEXPECTED TRAP TO THIS LOCATION
649	000206	000000	HALT	:EXAMINE STACK TO FIND CAUSE
650	000210	000212	.+2	:UNEXPECTED TRAP TO THIS LOCATION
651	000212	000000	HALT	:EXAMINE STACK TO FIND CAUSE
652	000214	000216	.+2	:UNEXPECTED TRAP TO THIS LOCATION
653	000216	000000	HALT	:EXAMINE STACK TO FIND CAUSE
654	000220	000222	.+2	:UNEXPECTED TRAP TO THIS LOCATION
655	000222	000000	HALT	:EXAMINE STACK TO FIND CAUSE
656	000224	000226	.+2	:UNEXPECTED TRAP TO THIS LOCATION
657	000226	000000	HALT	:EXAMINE STACK TO FIND CAUSE
658	000230	000232	.+2	:UNEXPECTED TRAP TO THIS LOCATION
659	000232	000000	HALT	:EXAMINE STACK TO FIND CAUSE
660	000234	000236	.+2	:UNEXPECTED TRAP TO THIS LOCATION
661	000236	000000	HALT	:EXAMINE STACK TO FIND CAUSE
662	000240	000242	.+2	:UNEXPECTED TRAP TO THIS LOCATION
663	000242	000000	HALT	:EXAMINE STACK TO FIND CAUSE
664	000244	000246	.+2	:UNEXPECTED TRAP TO THIS LOCATION
665	000246	000000	HALT	:EXAMINE STACK TO FIND CAUSE
666	000250	000252	.+2	:UNEXPECTED TRAP TO THIS LOCATION
667	000252	000000	HALT	:EXAMINE STACK TO FIND CAUSE
668	000254	000256	.+2	:UNEXPECTED TRAP TO THIS LOCATION
669	000256	000000	HALT	:EXAMINE STACK TO FIND CAUSE
670	000260	000262	.+2	:UNEXPECTED TRAP TO THIS LOCATION
671	000262	000000	HALT	:EXAMINE STACK TO FIND CAUSE
672	000264	000266	.+2	:UNEXPECTED TRAP TO THIS LOCATION
673	000266	000000	HALT	:EXAMINE STACK TO FIND CAUSE
674	000270	000272	.+2	:UNEXPECTED TRAP TO THIS LOCATION
675	000272	000000	HALT	:EXAMINE STACK TO FIND CAUSE
676	000274	000276	.+2	:UNEXPECTED TRAP TO THIS LOCATION
677	000276	000000	HALT	:EXAMINE STACK TO FIND CAUSE
678	000300	000302	.+2	:UNEXPECTED TRAP TO THIS LOCATION
679	000302	000000	HALT	:EXAMINE STACK TO FIND CAUSE
680	000304	000306	.+2	:UNEXPECTED TRAP TO THIS LOCATION
681	000306	000000	HALT	:EXAMINE STACK TO FIND CAUSE
682	000310	000312	.+2	:UNEXPECTED TRAP TO THIS LOCATION
683	000312	000000	HALT	:EXAMINE STACK TO FIND CAUSE
684	000314	000316	.+2	:UNEXPECTED TRAP TO THIS LOCATION
685	000316	000000	HALT	:EXAMINE STACK TO FIND CAUSE
686	000320	000322	.+2	:UNEXPECTED TRAP TO THIS LOCATION
687	000322	000000	HALT	:EXAMINE STACK TO FIND CAUSE
688	000324	000326	.+2	:UNEXPECTED TRAP TO THIS LOCATION
689	000326	000000	HALT	:EXAMINE STACK TO FIND CAUSE
690	000330	000332	.+2	:UNEXPECTED TRAP TO THIS LOCATION
691	000332	000000	HALT	:EXAMINE STACK TO FIND CAUSE

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692	000334	000336	.+2	:UNEXPECTED TRAP TO THIS LOCATION
693	000336	000000	HALT	:EXAMINE STACK TO FIND CAUSE
694	000340	000342	.+2	:UNEXPECTED TRAP TO THIS LOCATION
695	000342	000000	HALT	:EXAMINE STACK TO FIND CAUSE
696	000344	000346	.+2	:UNEXPECTED TRAP TO THIS LOCATION
697	000346	000000	HALT	:EXAMINE STACK TO FIND CAUSE
698	000350	000352	.+2	:UNEXPECTED TRAP TO THIS LOCATION
699	000352	000000	HALT	:EXAMINE STACK TO FIND CAUSE
700	000354	000356	.+2	:UNEXPECTED TRAP TO THIS LOCATION
701	000356	000000	HALT	:EXAMINE STACK TO FIND CAUSE
702	000360	000362	.+2	:UNEXPECTED TRAP TO THIS LOCATION
703	000362	000000	HALT	:EXAMINE STACK TO FIND CAUSE
704	000364	000366	.+2	:UNEXPECTED TRAP TO THIS LOCATION
705	000366	000000	HALT	:EXAMINE STACK TO FIND CAUSE
706	000370	000372	.+2	:UNEXPECTED TRAP TO THIS LOCATION
707	000372	000000	HALT	:EXAMINE STACK TO FIND CAUSE
708	000374	000376	.+2	:UNEXPECTED TRAP TO THIS LOCATION
709	000376	000000	HALT	:EXAMINE STACK TO FIND CAUSE
710	000400	000402	.+2	:UNEXPECTED TRAP TO THIS LOCATION
711	000402	000000	HALT	:EXAMINE STACK TO FIND CAUSE
712	000404	000406	.+2	:UNEXPECTED TRAP TO THIS LOCATION
713	000406	000000	HALT	:EXAMINE STACK TO FIND CAUSE
714	000410	000412	.+2	:UNEXPECTED TRAP TO THIS LOCATION
715	000412	000000	HALT	:EXAMINE STACK TO FIND CAUSE
716	000414	000416	.+2	:UNEXPECTED TRAP TO THIS LOCATION
717	000416	000000	HALT	:EXAMINE STACK TO FIND CAUSE
718	000420	000422	.+2	:UNEXPECTED TRAP TO THIS LOCATION
719	000422	000000	HALT	:EXAMINE STACK TO FIND CAUSE
720	000424	000426	.+2	:UNEXPECTED TRAP TO THIS LOCATION
721	000426	000000	HALT	:EXAMINE STACK TO FIND CAUSE
722	000430	000432	.+2	:UNEXPECTED TRAP TO THIS LOCATION
723	000432	000000	HALT	:EXAMINE STACK TO FIND CAUSE
724	000434	000436	.+2	:UNEXPECTED TRAP TO THIS LOCATION
725	000436	000000	HALT	:EXAMINE STACK TO FIND CAUSE
726	000440	000442	.+2	:UNEXPECTED TRAP TO THIS LOCATION
727	000442	000000	HALT	:EXAMINE STACK TO FIND CAUSE
728	000444	000446	.+2	:UNEXPECTED TRAP TO THIS LOCATION
729	000446	000000	HALT	:EXAMINE STACK TO FIND CAUSE
730	000450	000452	.+2	:UNEXPECTED TRAP TO THIS LOCATION
731	000452	000000	HALT	:EXAMINE STACK TO FIND CAUSE
732	000454	000456	.+2	:UNEXPECTED TRAP TO THIS LOCATION
733	000456	000000	HALT	:EXAMINE STACK TO FIND CAUSE
734	000460	000462	.+2	:UNEXPECTED TRAP TO THIS LOCATION
735	000462	000000	HALT	:EXAMINE STACK TO FIND CAUSE
736	000464	000466	.+2	:UNEXPECTED TRAP TO THIS LOCATION
737	000466	000000	HALT	:EXAMINE STACK TO FIND CAUSE
738	000470	000472	.+2	:UNEXPECTED TRAP TO THIS LOCATION
739	000472	000000	HALT	:EXAMINE STACK TO FIND CAUSE
740	000474	000476	.+2	:UNEXPECTED TRAP TO THIS LOCATION
741	000476	000000	HALT	:EXAMINE STACK TO FIND CAUSE
742	000500	000502	.+2	:UNEXPECTED TRAP TO THIS LOCATION
743	000502	000000	HALT	:EXAMINE STACK TO FIND CAUSE
744	000504	000506	.+2	:UNEXPECTED TRAP TO THIS LOCATION
745	000506	000000	HALT	:EXAMINE STACK TO FIND CAUSE
746	000510	000512	.+2	:UNEXPECTED TRAP TO THIS LOCATION
747	000512	000000	HALT	:EXAMINE STACK TO FIND CAUSE

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748	000514	000516	.+2	:UNEXPECTED TRAP TO THIS LOCATION
749	000516	000000	HALT	:EXAMINE STACK TO FIND CAUSE
750	000520	000522	.+2	:UNEXPECTED TRAP TO THIS LOCATION
751	000522	000000	HALT	:EXAMINE STACK TO FIND CAUSE
752	000524	000526	.+2	:UNEXPECTED TRAP TO THIS LOCATION
753	000526	000000	HALT	:EXAMINE STACK TO FIND CAUSE
754	000530	000532	.+2	:UNEXPECTED TRAP TO THIS LOCATION
755	000532	000000	HALT	:EXAMINE STACK TO FIND CAUSE
756	000534	000536	.+2	:UNEXPECTED TRAP TO THIS LOCATION
757	000536	000000	HALT	:EXAMINE STACK TO FIND CAUSE
758	000540	000542	.+2	:UNEXPECTED TRAP TO THIS LOCATION
759	000542	000000	HALT	:EXAMINE STACK TO FIND CAUSE
760	000544	000546	.+2	:UNEXPECTED TRAP TO THIS LOCATION
761	000546	000000	HALT	:EXAMINE STACK TO FIND CAUSE
762	000550	000552	.+2	:UNEXPECTED TRAP TO THIS LOCATION
763	000552	000000	HALT	:EXAMINE STACK TO FIND CAUSE
764	000554	000556	.+2	:UNEXPECTED TRAP TO THIS LOCATION
765	000556	000000	HALT	:EXAMINE STACK TO FIND CAUSE
766	000560	000562	.+2	:UNEXPECTED TRAP TO THIS LOCATION
767	000562	000000	HALT	:EXAMINE STACK TO FIND CAUSE
768	000564	000566	.+2	:UNEXPECTED TRAP TO THIS LOCATION
769	000566	000000	HALT	:EXAMINE STACK TO FIND CAUSE
770	000570	000572	.+2	:UNEXPECTED TRAP TO THIS LOCATION
771	000572	000000	HALT	:EXAMINE STACK TO FIND CAUSE
772	000574	000576	.+2	:UNEXPECTED TRAP TO THIS LOCATION
773	000576	000000	HALT	:EXAMINE STACK TO FIND CAUSE
774	000600	000602	.+2	:UNEXPECTED TRAP TO THIS LOCATION
775	000602	000000	HALT	:EXAMINE STACK TO FIND CAUSE
776	000604	000606	.+2	:UNEXPECTED TRAP TO THIS LOCATION
777	000606	000000	HALT	:EXAMINE STACK TO FIND CAUSE
778	000610	000612	.+2	:UNEXPECTED TRAP TO THIS LOCATION
779	000612	000000	HALT	:EXAMINE STACK TO FIND CAUSE
780	000614	000616	.+2	:UNEXPECTED TRAP TO THIS LOCATION
781	000616	000000	HALT	:EXAMINE STACK TO FIND CAUSE
782	000620	000622	.+2	:UNEXPECTED TRAP TO THIS LOCATION
783	000622	000000	HALT	:EXAMINE STACK TO FIND CAUSE
784	000624	000626	.+2	:UNEXPECTED TRAP TO THIS LOCATION
785	000626	000000	HALT	:EXAMINE STACK TO FIND CAUSE
786	000630	000632	.+2	:UNEXPECTED TRAP TO THIS LOCATION
787	000632	000000	HALT	:EXAMINE STACK TO FIND CAUSE
788	000634	000636	.+2	:UNEXPECTED TRAP TO THIS LOCATION
789	000636	000000	HALT	:EXAMINE STACK TO FIND CAUSE
790	000640	000642	.+2	:UNEXPECTED TRAP TO THIS LOCATION
791	000642	000000	HALT	:EXAMINE STACK TO FIND CAUSE
792	000644	000646	.+2	:UNEXPECTED TRAP TO THIS LOCATION
793	000646	000000	HALT	:EXAMINE STACK TO FIND CAUSE
794	000650	000652	.+2	:UNEXPECTED TRAP TO THIS LOCATION
795	000652	000000	HALT	:EXAMINE STACK TO FIND CAUSE
796	000654	000656	.+2	:UNEXPECTED TRAP TO THIS LOCATION
797	000656	000000	HALT	:EXAMINE STACK TO FIND CAUSE
798	000660	000662	.+2	:UNEXPECTED TRAP TO THIS LOCATION
799	000662	000000	HALT	:EXAMINE STACK TO FIND CAUSE
800	000664	000666	.+2	:UNEXPECTED TRAP TO THIS LOCATION
801	000666	000000	HALT	:EXAMINE STACK TO FIND CAUSE
802	000670	000672	.+2	:UNEXPECTED TRAP TO THIS LOCATION
803	000672	000000	HALT	:EXAMINE STACK TO FIND CAUSE

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860                                     ;INDIRECT POINTERS TO TELETYPE VECTORS AND REGISTERS
861
862 001200 177514 LPTCSR: 177514
863 001202 177516 LPTDBR: 177516
864 001204 177560 TKCSR: 177560 ; TELETYPE KEYBOARD CONTROL REGISTER
865 001206 177562 TKDBR: 177562 ; TELETYPE KEYBOARD DATA BUFFER
866 001210 177564 TPCSR: 177564 ; TELEPRINTER CONTROL REGISTER
867 001212 177566 TPDBR: 177566 ; TELEPRINTER DATA BUFFER
868 001214 000060 TKVEC: 60 ; TELETYPE KEYBOARD VECTOR
869 001216 000200 TKLVL: 200 ; PRIORTIY =4
870 001220 000064 TPVEC: 64 ; TELETYPE PRINTER VECTOR
871 001222 000200 TPLVL: 200 ; PRIORITY =4
872
873                                     ;PROGRAM CONTROL PARAMETERS
874
875 001224 000000 RETURN: 0 ; SCOPE ADDRESS FOR LOOP ON TEST
876 001226 000000 NEXT: 0 ; ADDRESS OF NEXT TEST TO BE EXECUTED
877 001230 000000 LOCK: 0 ; ADDRESS FOR LOCK ON CURRENT DATA
878 001232 000000 ICOUNT: 0 ; NUMBER OF ITERATIONS THAT CURRENT TEST WILL BE EXECUTED
879 001234 000000 LPCN1: 0 ; NUMBER OF ITERATIONS COMPLETED
880 001236 000000 TSTNO: 0 ; NUMBER OF TEST IN PROGRESS
881 001240 000000 PASCNT: 0 ; NUMBER OF PASSES COMPLETED
882 001242 000000 ERRCNT: 0 ; TOTAL NUMBER OF ERRORS
883 001244 000000 LSTERR: 0 ; PC OF LAST ERROR CALL
884
885                                     ;PROGRAM VARIABLES
886
887 001246 000000 TEMP1: 0 ; TEMPORARY STORAGE
888 001250 000000 TEMP2: 0 ; TEMPORARY STORAGE
889 001252 000000 TEMP3: 0 ; TEMPORARY STORAGE
890 001254 000000 TEMP4: 0 ; TEMPORARY STORAGE
891 001256 000000 TEMPS: 0 ; TEMPORARY STORAGE
892 001260 000000 SAVR0: 0 ; R0 STORAGE
893 001262 000000 SAVR1: 0 ; R1 STORAGE
894 001264 010000 SAVR2: 0 ; R2 STORAGE
895 001266 010000 SAVR3: 0 ; R3 STORAGE
896 001270 010000 SAVR4: 0 ; R4 STORAGE
897 001272 010000 SAVR5: 0 ; R5 STORAGE
898 001274 000000 SAVSP: 0 ; STACK POINTER STORAGE
899 001276 000000 SAVPC: 0 ; PROGRAM COUNTER STORAGE
  
```

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900
901                ;PROGRAM CONTROL FLAGS
902
903 001300      000      INIFLG: .BYTE 0      ;PROGRAM INITIALIZATION FLAG
904 001301      000      STFLG:  .BYTE 0      ;TEST START FLAG
905 001302      000      ERRFLG: .BYTE 0      ;ERROR OCCURED FLAG
906 001303      000      LOKFLG: .BYTE 0      ;LOCK ON CURRENT TEST FLAG
907              000000  SY=0
908
909                ;DEFINITIONS FOR TRAP SUBROUTINE CALLS
910                ;POINTERS TO SUBROUTINES CAN BE FOUND
911                ;IN THE TABLE IMMEDIATLY FOLLOWING THE DEFINITIONS
912
913                ;*****
914                ;*****
915 001304      TRPTAB:
916              104400  SCOP1=TRAP+0      ;CALL TO LOOP ON CURRENT DATA HANDLER
917 001304      015022      .SCOP1
918              104401  TYPE=TRAP+1      ;CALL TO TELETYPE OUTPUT ROUTINE
919 001306      015040      .TYPE
920              104402  SAVOS=TRAP+2      ;CALL TO REGISTER SAVE ROUTINE
921 001310      016122      .SAVOS
922              104403  RESOS=TRAP+3      ;CALL TO REGISTER RESTORE ROUTINE
923 001312      016162      .RESOS
924              104404  CONVRT=TRAP+4     ;CALL TO DATA OUTPUT ROUTINE
925 001314      015616      .CONVRT
926              104405  CNVRT=TRAP+5     ;CALL TO DATA OUTPUT ROUTINE WITHOUT CR/LF.
927 001316      015622      .CNVRT
928              104406  KEY.TO.R2=TRAP+6  ;CALL TO GET CHAR, ECHO IT, PUT IT IN R2,CLR BIT 7
929 001320      014500      .KEY.TO.R2
930
931                ;*****
932                ;*****

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933
934      .=1400
935 001400 MAP.YA:
936      ;THE FOLLOWING IS A REPRODUCTION
937      ;OF THE ROM PROGRAM FOR BM873YA.
938      ;IT IS HERE FOR COMPARISON TO
939      ;ACTUAL ROM AND FOR REFERENCE.
940      ;173000 . =173000      ;STARTING ADDRESS FOR BOOTSTRAP
941      ;THIS LOADER IS DESIGNED FOR THE RESTART MODULE M873.
942      ;IT FUNCTIONALLY REPLACES THE FOLLOWING ROMS:
943      ;M792-YA - PAPER TAPE BOOTSTRAP FOR PC11, KL11
944      ;MR11-DB BULK STORAGE BOOTSTRAP ROM
945      ;M792-YH TALL CASSETTE BOOTSTRAP ROM
946      ;
947      ;
948      ;
949      ;
950      ;
951      ;
952      ;
953      ;
954      ;
955      ;
956      ;
957 001400 010702 ;173000 010702  ;STARTING LOCATION FOR RF11 DISK
958 001402 000464 ;173002 000464  RF11:  MOV PC,R2      ;SET POINTER TO PARAMETER LISTS
959 001404 177462 ;173004 177462  ;BR OTHER      ;TRANSFER TO SERVICE ROUTINE
960 001406 000005 ;173006 000005  ;.WORD 177462 ;DEVICE WORD COUNT ADDRESS
961      ;
962      ;
963 001410 010702 ;173010 010702  ;THIS IS THE STARTING LOCATION FOR THE RK11 CONTROLLER
964 001412 000460 ;173012 000460  RK11:  MOV PC,R2      ;SET POINTER TO PARAMETER LIST
965 001414 177406 ;173014 177406  ;BR OTHER      ;TRANSFER TO SERVICE ROUTINE
966 001416 000005 ;173016 000005  ;.WORD 177406 ;DEVICE WORD COUNT REGISTER
967      ;
968      ;
969      ;
970 001420 013707 ;173020 013707  ;THIS IS A SPARE STARTING LOCATION. IT TRANSFERS TO ADDRESS
971 001422 177570 ;173022 177570  ;CONTAINED IN THE SWITCH REGISTER.
972      ;NOTE 773024 AND 773224 ARE DEPENDENT ON OFFSET IN DIODES FOR LINE 1
973      ;
974      ;
975 001424 173000 ;173024 173000  ;THIS IS THE POWER UP VECTOR REQUIRED FOR DEVICE AND
976 001426 000340 ;173026 000340  POWER:  .WORD RF11 ;ADDRESS OF FIRST LOCATION IN ROM
977      ;
978      ;
979 001430 010702 ;173030 010702  ;THIS IS THE STARTING ADDRESS FOR TC11 (DECTAPE) CONTROLLER.
980 001432 000426 ;173032 000426  TC11:  MOV PC,R2      ;SET UP POINTER TO PARAMETER LIST
981 001434 177344 ;173034 177344  ;BR TAPES      ;AND TRANSFER TO FIRST ROUTINE
982 001436 004003 ;173036 004003  ;.WORD 177344 ;DEVICE WORD COUNT ADDRESS
983 001440 100000 ;173040 100000  ;.WORD 4003 ;FIND PREVIOUS BLOCK COMMAND
984 001442 024000 ;173042 024000  ;.WORD 100000 ;USED AS DONE INDICATOR
985 001444 000445 ;173044 000445  ;.WORD 24000 ;USED AS ERROR INDICATOR/TEST FLAG
986 001446 000005 ;173046 000005  ;BR OTHERX    ;THEN TRANSFER TO NEXT ROUTINE
987      ;
988      ;
989      ;THIS IS THE START LOCATION FOR TM11 MAGTAPE CONTROLLER

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989 001450 010702 :173050 010702 TM11: MOV PC,R2 ;SET POINTER TO PARAMETER LIST
990 001452 000416 :173052 000416 BR TAPES ;AND TRANSFER TO FIRST ROUTINE
991 001454 172524 :173054 172524 .WORD 172524 ;DEVICE BYTE/RECORD COUNT REGISTER
992 001456 060017 :173056 060017 .WORD 60017 ;DEVICE REWIND COMMAND
993 001460 000200 :173060 000200 .WORD 200 ;DEVICE DONE FLAG
994 001462 100000 :173062 100000 .WORD 100000 ;DEVICE ERROR FLAG BIT
995 001464 000413 :173064 000413 BR TAPESX ;THEN TRANSFER TO NEXT SERVICE RTN
996 001466 060011 :173066 060011 .WORD 60011 ;DEVICE FORWARD SPACE COMMAND
997 001470 000200 :173070 000200 .WORD 200 ;SAME AS ABOVE
998 001472 100000 :173072 100000 .WORD 100000 ;SAME AS ABOVE
999 001474 000431 :173074 000431 BR OTHERX ;THEN TRANSFER TO READ/TRANSFER ROUTINE
1000 001476 060003 :173076 060003 .WORD 60003 ;DEVICE READ COMMAND
1001
1002 ;THIS IS THE START LOCATION FOR THE RP11 CONTROLLER
1003 001500 010702 :173100 010702 RP11: MOV PC,R2 ;SET POINTER TO PARAMETER LIST
1004 001502 000424 :173102 000424 BR OTHER ;TRANSFER TO TRANSFER ROUTINE
1005 001504 176716 :173104 176716 .WORD 176716 ;DEVICE WORD COUNT REGISTER
1006 001506 000005 :173106 000005 .WORD 5 ;DEVICE READ COMMAND
1007
1008 ;THIS IS THE TAPE DEVICE SERVICE ROUTINE.
1009 001510 010200 :173110 010200 TAPES: MOV R2,R0 ;GET ADDRESS OF PARAMETER LIST
1010 001512 005720 :173112 005720 TST (R0)+ ;SKIP TWO WORDS FIRST TIME
1011 001514 000005 :173114 000005 TAPESX: RESET ;RESET ALL DEVICES
1012 001516 005720 :173116 005720 TST (R0)+ ;SKIP OVER BRANCH INSTRUCTION
1013 001520 016201 :173120 016201 MOV 2(R2),R1 ;THEN GET DEVICE WORD/BYTE COUNT ADDRESS
1014 001522 000002 :173122 000002
1015 001524 005311 :173124 005311 DEC R1 ;AND SET TO -1
1016 001526 012041 :173126 012041 MOV (R0)+,-(R1) ;AND THEN ISSUE COMMAND TO DEVICE
1017 001530 031011 :173130 031011 TAPWAT: BIT R0,R1 ;WAIT FOR DEVICE COMPLETION
1018 001532 001776 :173132 001776 BEQ TAPWAT ;BY HANGING IN LOOP
1019 001534 005720 :173134 005720 TST (R0)+ ;AND THEN SKIP DONE FLAG
1020 001536 032041 :173136 032041 BIT (R0)+,-(R1) ;THEN TEST FOR ERROR
1021 001540 001063 :173140 001063 BNE ERROR ;THERE IS ONE
1022 001542 000110 :173142 000110 RETURN: JMP R0 ;AND TRANSFER TO FOLLOWING INSTRUCTION
1023
1024 ;THIS IS THE STARTING ADDRESS FOR RC11 DISK CONTROLLERS
1025 001544 010702 :173144 010702 RC11: MOV PC,R2 ;SET UP POINTER TO PARAMETER LIST
1026 001546 000402 :173146 000402 BR OTHER ;TRANSFER TO SERVICE RTN
1027 001550 177450 :173150 177450 .WORD 177450 ;DEVICE WORD COUNT REGISTER
1028 001552 000005 :173152 000005 .WORD 5 ;DEVICE READ INSTRUCTION
1029
1030 ;THIS ROUTINE PERFORMS THE ACTUAL TRANSFER TO MEMORY OF DATA
1031 001554 010200 :173154 010200 OTHER: MOV R2,R0 ;SET POINTER TO LIST IN R0
1032 001556 005720 :173156 005720 TST (R0)+ ;SKIP TWO WORDS FIRST TIME.
1033 001560 005720 :173160 005720 OTHERX: TST (R0)+ ;SKIP PAST BR INSTRUCTION
1034 001562 000005 :173162 000005 RESET ;REST THE WORLD
1035 001564 016201 :173164 016201 MOV 2(R2),R1 ;OBTAIN DEVICE WORD COUNT ADDRESS
1036 001566 000002 :173166 000002
1037 001570 012711 :173170 012711 MOV #-1000,R1 ;THEN OBTAIN LARGE WORD COUNT
1038 001572 177000 :173172 177000
1039 001574 011041 :173174 011041 OTHWAT: MOV R0,-(R1) ;AND PUT COMMAND TO DEVICE
1040 001576 105711 :173176 105711 TSTB R1 ;WAIT FOR DONE FLAG
1041 001600 100376 :173200 100376 BPL OTHWAT ;BY HANGING IN LOOP
1042 001602 005711 :173202 005711 TST R1 ;THEN TEST FOR ERROR
1043 001604 100441 :173204 100441 BMI ERROR ;GOT PROBLEMS
1044 001606 005007 :173206 005007 CLR PC ;AND TRANSFER TO ZERO
  
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1045
1046
1047 001610 012704 ;173210 012704 ;THIS IS THE STARTING ADDRESS FOR THE PC11 PAPER TAPE CONTROLLER
1048 001612 177560 ;173212 177560 KL11: MOV #177560,R4 ;OBTAIN DEVICE ADDRESS
1049 001614 000440 ;173214 000440 BR CKDEV ;AND TRANSFER TO READER SERVICE ROUTINE
1050
1051
1052 ;THIS IS THE CASSETTE DEVICE COMMAND TABLE
1053 001616 017640 ;173216 240 TABLE: .BYTE 240 ;COMPARE WORD NOT A COMMAND
1054 ;173217 037 .BYTE 37 ;ILBS+RWD+GO
1055 001620 002415 ;173220 015 .BYTE 15 ;SPACE FORWARD BLOCK+GO
1056 ;173221 005 .BYTE 5 ;READ+GO
1057 001622 112024 ;173222 024 .BYTE 24 ;READ+ILBS
1058 ;173223 224 .BYTE 224 ;READ+ILBS+END FLAG
1059 ;NOTE 773024 AND 773224 ARE DEPENDENT ON OFFSET IN DIODES FOR LINE 1
1060
1061 ;THIS IS AN ADDITIONAL POWER VECTOR ADDRESS REQUIRED BY DEVICE
1062 001624 173000 ;173224 173000 POWER2: .WORD RF11 ;ADDRESS OF BEGINNING OF BOOTSTRAP
1063 001626 000340 ;173226 000340 .WORD 340 ;PRIORITY LEVEL 7
1064
1065 ;THIS IS THE STARTING ADDRESS FOR THE CASSETTE DEVICE #0
1066 001630 005004 ;173230 005004 CBOOT: CLR R4 ;LOAD DEVICE NUMBER 0 IN R4
1067 001632 012700 ;173232 012700 RESTX: MOV #177500,R0 ;GET DEVICE ADDRESS
1068 001634 177500 ;177500
1069 001636 000005 ;173236 000005 RESTRT: RESET ;ISSUE RESET INSTRUCTION
1070 001640 010410 ;173240 010410 MOV R4,AR0 ;LOAD DEVICE WITH UNIT NUMBER
1071 001642 012701 ;173242 012701 MOV #TABLE,R1 ;GET FUNNY TABLE OF INSTRUCTIONS
1072 001644 173216 ;173244 173216
1073 001646 012702 ;173246 012702 MOV #375,R2 ;AND LOAD UP TRANSFER COUNTER
1074 001650 000375 ;173250 000375
1075 001652 112103 ;173252 112103 LOOP1: MOVB (R1)+,R3 ;THE LOAD UP COMPARATOR
1076 001654 112110 ;173254 112110 MOVB (R1)+,AR0 ;LOAD DEVICE REGISTER WITH COMMAND
1077 001656 100407 ;173256 100407 BMI DONE
1078 001660 130310 ;173260 130310 LOOP2: BITB R3,AR0 ;HAS COMMAND COMPLETED
1079 001662 001776 ;173262 001776 BEQ LOOP2 ;NO, WAIT
1080 001664 105202 ;173264 105202 INCB R2 ;THEN INCREMENT ADDRESS CTR
1081 001666 100772 ;173266 100772 BMI LOOP1 ;IF NEGATIVE, GET COMMAND
1082 001670 116012 ;173270 116012 MOVB 2(R0),AR2 ;AND STORE DATA AWAY
1083 001672 000002 ;173272 000002
1084 001674 000771 ;173274 000771
1085 001676 005710 ;173276 005710 DONE: BR LOOP2 ;GO GET ANOTHER BYTE
1086 001700 100756 ;173300 100756 TST AR0 ;ANY DEVICE ERRORS
1087 001702 005002 ;173302 005002 BMI RESTRT ;YES, RETRY
1088 001704 120312 ;173304 120312 CLR R2 ;CLEAR COMPARE ADDRESS AND TRANSFER ADDRESS
1089 001706 001377 ;173306 001377 CMPB R3,AR2 ;IT MUST BE 240
1090 001710 000112 ;173310 000112 BNE +0 ;NO, THERE WAS AN ERROR
1091 ERROR: JMP AR2 ;NORMAL CASSETTE AND ERROR FOR BULK STORAGE
1092
1093 ;THIS IS THE STARTING LOCATION FOR THE PC11 CONTROLLER
1094 001712 012704 ;173312 012704 PC11: MOV #177550,R4 ;LOAD DEVICE ADDRESS
1095 001714 177550 ;173314 177550
1096 001716 000005 ;173316 000005 CKDEV: RESET ;KILL ALL DEVICE ACTION
1097 001720 012701 ;173320 012701 MOV #160000,R1 ;THEN SET UP MEMORY TEST LIMITS
1098 001722 160000 ;173322 160000
1099 001724 012702 ;173324 012702 MOV #6,R2 ;AND SET UP POINTER TO TIMEOUT LOCATION
1100 001726 000006 ;173326 000006
1101 001730 012712 ;173330 012712 MOV #340,AR2 ;AND SET UP VECTOR TO RETURN TO NEXT

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1101	001732	000340	:173332	000340		
1102	001734	010742	:173334	010742	MOV PC, -(R2)	;SAVE THE PC
1103	001736	012706	:173336	012706	MOV #24, SP	;AND LOAD UP STACK POINTER
1104	001740	000024	:173340	000024		
1105	001742	010441	:173342	010441	MOV R4, -(R1)	;AND LOOK FOR END OF MEMORY
1106	001744	040601	:173344	040601	BIC SP, R1	;THEN DROP TO XX7752
1107	001746	010111	:173346	010111	MOV R1, @R1	;AND STORE IN ITSELF
1108	001750	011102	:173350	011102	MOV @R1, R2	;THEN LOAD ADDRESS FOR DATA INSERTION
1109	001752	005214	:173352	005214	INC @R4	;AND START DEVICE
1110	001754	105714	:173354	105714	TSTB @R4	;THEN WAIT FOR CHARACTER AVAILABLE
1111	001756	100376	:173356	100376	BPL RDRWAT	;HANGING THERE IF NECESSARY
1112	001760	116412	:173360	116412	MOVB 2(R4), @R2	;STORE AWAY DATA BYTE
1113	001762	000002	:173362	000002		
1114	001764	005211	:173364	005211	INC @R1	
1115	001766	120227	:173366	120227	CMPB R2, #375	;HAS BRANCH OFFSET BEEN STORED
1116	001770	000375	:173370	000375		
1117	001772	001366	:173372	001366	BNE LOOP	;NO
1118	001774	105222	:173374	105222	INCB (R2)+	;YES, ALL DONE
1119	001776	END.YA:				
1120	001776	000142	:173376	000142	JMP -(R2)	;THEN TRANSFER TO RTN

1121 ; BM873B BOOTSTRAP MACY11 27(655) 1-OCT-74 14:50 PAGE 1

1122 ;
 1123 ; DATE: AUG 23, 1974

1124 002000 MAP.YB:
 1125 ; THE FOLLOWING IS A REPRODUCTION
 1126 ; OF THE ROM PROGRAM FOR BM873YB.
 1127 ; IT IS HERE FOR COMPARISON TO THE
 1128 ; ACTUAL ROM AND FOR REFERENCE

1129 ;
 1130 ;
 1131 ; THIS IS THE LOADER TO REPLACE THE FOLLOW
 1132 ; M792-YA PAPER TAPE BOOTSTRAP ROM
 1133 ; M711-DB BULK STORAGE BOOTSTRAP ROM
 1134 ; M792-YH TAII CASSETTE BOOTSTRAP ROM
 1135 ; RM873A COMBINATION OF ABOVE ROMS
 1136 ;

1137 ;
 1138 ; PREPHERIAL EXTERNAL PAGE REGISTERS ASSIGNMENTS:
 1139 ;

1140	177462	RFWC=	177462	;	WORD COUNT REG. FOR RF1
1141	177406	RKWC=	177406	;	WORD COUNT REG. FOR RK1
1142	177344	TCWC=	177344	;	WORD COUNT REG. FOR TC1
1143	172524	TMWC=	172524	;	BYTE/RECORD COUNT FOR T
1144	176716	RPWC=	176716	;	WORD COUNT REG. FOR RP1
1145	177450	RCWC=	177450	;	WORD COUNT REG. FOR RC1
1146	177560	KLCS=	177560	;	CONTROL REG. FOR KL11
1147	177500	TACS=	177500	;	CONTROL REG. FOR TAI1 C
1148	177550	PCCS=	177550	;	CONTROL REG. FOR PC11
1149	172440	TUCS=	172440	;	CONTROL STATUS REG. 1
1150	172442	TUWC=	TUCS+2	;	TU16 WORD COUNT REG.

1151				;	
1152	176300	RHCSA=	176300	;	CONTROLLER REG. 1 FOR R
1153	176302	RHWCA=	RHCSA+2	;	
1154	172040	RSCSA=	172040	;	CONTROLLER REG.1 FOR RH.
1155	172042	RSWCA=	RSCSA+2	;	
1156	176700	RPCSA=	176700	;	CONTROLLER REG. 1 FOR R
1157	176702	RPWCA=	RPCSA+2	;	

1158 ; FUNCTION VALUE FOR PREPHERALS:
 1159 000005 RFREAD= 5 ; READ FUNCTION
 1160 004003 RNUM= 4003 ; REVERSE AND IDENTIFY BL
 1161 060017 TMRWD= 60017 ; REWIND AND SET 800 BPI
 1162 060011 TMFWD= 60011 ; FORWARD RECORD COMMAND
 1163 060003 TMREAD= 60003 ; TM11 READ
 1164 000011 DRCLR= 11 ; DRIVE CLEAR
 1165 000071 RHREAD= 71 ; RH11 READ COMMAND
 1166 000021 RHRST= 21 ; READ IN PRESET
 1167 000031 TUSPAC= 31 ; SPACE FORWARD COMMAND F
 1168 040000 TUTAPE= 40000 ; TAPE BIT IN RH11/RHDT R
 1169 001300 TUMODE= 1300 ; 800 BPI NORMAL MODE FOR
 1170 001000 FCE= 1000 ; FRAME COUNT ERROR BIT

1171 ; CONSOLE SWITCH REG.
 1172 177570 CSW= 177570

1173 ;
 1174 ;
 1175 ; ONLY THE LOW BYTE OF CONSOL SWITCH REGISTER IS
 1176 ; SELECT THE UNIT NUMBER OF THE DEVICE TO BOOT FR

B03

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1177
1178
1179
1180
1181
1182 002000 000405 :173000 000405 :THIS IS THE STARTING ADDRESS FOR RH11/RS03/04 D
1183 002002 010703 :173002 010703 RHRSA: BR 1$ :ENTRY FOR SELECTING UNI
1184 002004 113737 :173004 113737 RHRSB: MOV PC,R3 :ENTRY TO SELECT UNITS
1185 002006 177570 :173006 177570 MOVB 2#CSW,2#RSCSA+10;LOAD UNIT # INS
1186 002010 172050 :173010 172050
1187 002012 000401 :173012 000401 BR 2$
1188 002014 010703 :173014 010703 1$: MOV PC,R3
1189 002016 012700 :173016 012700 2$: MOV #RSCSA,R0;SET CONTROL STATUS REG
1190 002020 172040 :173020 172040
1191 002022 000526 :173022 000526 BR RHCOMM
1192
1193
1194 002024 173000 :173024 :THIS IS THE AUTO LOAD VECTOR
1195 002026 000340 :173026 000340 .WORD RHRSA
1196
1197
1198 002030 000412 :173030 000412 :THIS IS THE STARTING ADDRESS FOR RK11 CONTROLLE
1199 002032 010703 :173032 010703 RK11A: BR 2$ :ENTRY TO SELECT UNIT 0
1200 RK11B: MOV PC,R3 :ENTRY TO SELECT ALL UNI
1201 002034 113705 :173034 113705 MOVB 2#CSW,R5;SET POINTER TO PARAMETE
1202 002036 177570 :173036 177570
1203 002040 052705 :173040 052705 BIS #10,R5 ;SET POSITION BIT
1204 002042 000010 :173042 000010
1205 002044 006105 :173044 006105 1$: ROL R5 ;SHIFT UNIT # TO BIT 13-
1206 002046 103376 :173046 103376 BCC 1$ :KEEP GOING
1207 002050 010537 :173050 010537 MOV R5,2#RKWC+4;MOVE IN TO RKDA REGI
1208 002052 177412 :173052 177412
1209 002054 000401 :173054 000401 BR 3$ :SKIP NEXT INSTRUCTION
1210 002056 010703 :173056 010703 2$: MOV PC,R3 :SAVE ERROR RETRY ADDRESS
1211 002060 010702 :173060 010702 3$: MOV PC,R2
1212 002062 000546 :173062 000546 BR OTHERA
1213 002064 177406 :173064 177406 .WORD RKWC
1214 002066 000005 :173066 000005 .WORD RFREAD
1215
1216
1217 002070 010703 :173070 010703 :THIS IS THE STARTING ADDRESS FOR TC11 (DECTAPE)
1218 002072 010702 :173072 010702 TC11: MOV PC,R3 ;SAVE ERROR RETRY ADDRESS
1219 002074 000570 :173074 000570 BR TAPES
1220 002076 177344 :173076 177344 .WORD TCWC
1221 002100 000005 :173100 000005 .WORD RFREAD
1222 002102 004003 :173102 004003 .WORD RNUM
1223 002104 100000 :173104 100000 .WORD 100000 :DONE MASK
1224 002106 024000 :173106 024000 .WORD 24000 :ERROR MASK
1225
1226
1227
1228
1229 002110 010703 :173110 010703 :TM11 STARTING ADDRESS
1230 002112 012737 :173112 012737 TM11: MOV PC,R3 :SAVE ERROR RETRY ADDRESS
1231 002114 060017 :173114 060017 MOV #TMRWIND,2#TMWC-2;REWIND TAPE
1232 002116 172522 :173116 172522
  
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DOBMA MACY11 27(732) 22-SEP-76 14:43 PAGE 28
 DOBMAA.P11 MAINDEC-11-DOBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

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1233 002120 010702 :173120 010702      MOV      PC,R2
1234 002122 000555 :173122 000555      BR       TAPES
1235 002124 172524 :173124 172524      .WORD   TMWC
1236 002126 060003 :173126 060003      .WORD   TMRD      ;TM11 READ COMMAND
1237 002130 060011 :173130 060011      .WORD   TMFWD     ;TM11 FORWARD RECORD COM
1238 002132 000200 :173132 000200      .WORD   200      ;DONE MASK
1239 002134 100000 :173134 100000      .WORD   100000   ;ERROR MASK
1240
1241      :
1242      :THIS IS THE STARTING ADDRESS FOR RF11 CONTROLLE
1242 002136 010703 :173136 010703      RF11:  MOV      PC,R3      ;SAVE ERROR RETRY ADDRESS
1243 002140 010702 :173140 010702      MOV      PC,R2      ;SET POINTER TO PARAMETE
1244 002142 000516 :173142 000516      BR       OTHERA     ;GO TO COMMON SERVICE RO
1245      :ASSUME UNIT 0
1246 002144 177462 :173144 177462      .WORD   RFWC      ;DEVICE WORD COUNT REGIS
1247 002146 000005 :173146 000005      .WORD   RFREAD    ;READ COMMAND
1248
1249      :
1250      :THIS IS THE STARTING ADDRESS FOR RH/TU16/TM02
1250 002150 010703 :173150 010703      TU16:  MOV      PC,R3      ;SAVE ERROR RETRY ADDRESS
1251 002152 012700 :173152 012700      MOV      #TUCS,RO ;GET CONTROL STATUS WORD
1252 002154 172440 :173154 172440
1253 002156 012710 :173156 012710      TU16RE: MOV      #RHPRST,(RO);REWIND TAPE CLEAR E
1254 002160 000021 :173160 000021
1255 002162 012760 :173162 012760      MOV      #TUMODE,32(RO);SET 800 BPI NORMA
1256 002164 001300 :173164 001300
1257 002166 000032 :173166 000032
1258 002170 012760 :173170 012760      MOV      #-1,6(RO);LOAD FRAME COUNT
1259 002172 177777 :173172 177777
1260 002174 000006 :173174 000006
1261 002176 012710 :173176 012710      MOV      #TUSPAC,(RO);SPACE FORWARD
1262 002200 000031 :173200 000031
1263 002202 105760 :173202 105760      IS:    TSTB     12(RO)
1264 002204 000012 :173204 000012
1265 002206 100375 :173206 100375      BPL     IS      ;KEEP LOOPING
1266 002210 000433 :173210 000433      BR      RHCOMM
1267
1268      :
1269      :THIS IS THE STARTING ADDRESS FOR RC11 CONTROLLE
1269 002212 010703 :173212 010703      RC11:  MOV      PC,R3
1270 002214 010702 :173214 010702      MOV      PC,R2      ;ASSUME UNIT 0
1271 002216 000470 :173216 000470      BR       OTHERA
1272 002220 177450 :173220 177450      .WORD   RCWC
1273 002222 000005 :173222 000005      .WORD   RFREAD
1274
1275      :
1276      :THIS IS THE AUTO LOAD VECTOR
1276 002224 173000 :173224 173000      .WORD   RHSA
1277 002226 000340 :173226 000340      .WORD   340
1278
1279      :
1280      :THIS IS THE STARTING ADDRESS FOR RH11 DEVICE CO
1281      :NOTE: IF TM02/TU16 SHOULD BE SELECTED. THE VAL
1282      :IN CONSOL SWITCH REGISTER IS THE POSITIO
1283      :ON THE RH11 INSTEAD OF THE UNIT # ON TU1
1284      :THE SLAVE UNIT # (# ON TU16) SHOULD STIL
1285 002230 000405 :173230 000405      RH11A: BR       IS      ;ENTRY TO SELECT UNIT 0
1286 002232 010703 :173232 010703      RH11B: MOV      PC,R3      ;ENTRY TO SELECT ALL UNI
1287 002234 113737 :173234 113737      MOV     #CSW,#RHCSA+10;LOAD UNIT # INS
1288 002236 177570 :173236 177570

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D03

DOBMA MACY11 27(732) 22-SEP-76 14:43 PAGE 29
 DOBMAA.P11 MAINDEC-11-DOBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

1289	002240	176310	: 173240	176310			
1290	002242	000401	: 173242	000401		BR	25
1291	002244	010703	: 173244	010703	15:	MOV	PC,R3
1292	002246	012700	: 173246	012700	25:	MOV	#RHCSA,R0
1293	002250	176300	: 173250	176300			
1294	002252	032760	: 173252	032760	RPCOMN:	BIT	#TUTAPE,26(R0);TAPE UNIT?
1295	002254	040000	: 173254	040000			
1296	002256	000026	: 173256	000026			
1297	002260	001336	: 173260	001336		BNE	TU16RE ;YES. GO TO TAPE LOGIC
1298	002262	012710	: 173262	012710		MOV	#RHPRST,(R0);RESET DRIVE
1299	002264	000021	: 173264	000021			
1300	002266	012760	: 173266	012760		MOV	#14000,32(R0);SET 16 BIT FORMAT
1301	002270	014000	: 173270	014000			
1302	002272	000032	: 173272	000032			
1303	002274	012710	: 173274	012710		MOV	#DRCLR,(R0);CLEAR DRIVE ERROR
1304	002276	000011	: 173276	000011			
1305							: (GENERATED IF R503/04
1306	002300	005720	: 173300	005720	RHCOMN:	TST	(R0)+ ;MOVE TO WORD COUNT ADDR
1307	002302	010037	: 173302	010037		MOV	R0,#2 ;FAKE CALLING SEQUENCE
1308	002304	000002	: 173304	000002			
1309	002306	012737	: 173306	012737		MOV	#RHREAD,#4
1310	002310	000071	: 173310	000071			
1311	002312	000004	: 173312	000004			
1312	002314	005002	: 173314	005002		CLR	R2 ;FOR FLAG AND POINTER TO
1313	002316	000430	: 173316	000430		BR	OTHERA
1314						LSB	
1315							
1316							: THIS IS THE STARTING ADDRESS FOR RH11/RP04 DISK
1317	002320	000405	: 173320	000405	RHRPA:	BR	15 ;ENTRY FOR SELECT UNIT 0
1318	002322	010703	: 173322	010703	RHRPB:	MOV	PC,R3 ;ENTRY TO SELECT ALL UNI
1319	002324	113737	: 173324	113737		MOVB	#CSW,#RPCSA+10;LOAD UNIT # INS
1320	002326	177570	: 173326	177570			
1321	002330	176710	: 173330	176710			
1322	002332	000401	: 173332	000401		BR	25
1323	002334	010703	: 173334	010703	15:	MOV	PC,R3
1324	002336	012700	: 173336	012700	25:	MOV	#RPCSA,R0
1325	002340	176700	: 173340	176700			
1326	002342	000743	: 173342	000743		BR	RPCOMN
1327							
1328							: ENTRY TO BRANCH TO THE PC SELECTED BY CONSOL SW
1329	002344	013707	: 173344	013707	CSRGO:	MOV	#CSW,PC
1330	002346	177570	: 173346	177570			
1331							
1332							
1333							
1334							: THIS IS THE STARTING ADDRESS FOR RP11 CONTROLLE
1335	002350	000405	: 173350	000405	RP11A:	BR	15 ;ENTRY TO SELECT UNIT 0
1336	002352	010703	: 173352	010703	RP11B:	MOV	PC,R3 ;ENTRY TO SELECT ALL UNI
1337	002354	113705	: 173354	113705		MOVB	#CSW,R5
1338	002356	177570	: 173356	177570			
1339	002360	000305	: 173360	000305		SWAB	R5 ;GET UNIT # INTO HIGH BY
1340	002362	000402	: 173362	000402		BR	35
1341	002364	010703	: 173364	010703	15:	MOV	PC,R3
1342	002366	005005	: 173366	005005		CLR	R5
1343	002370	010702	: 173370	010702	35:	MOV	PC,R2
1344	002372	000403	: 173372	000403		BR	OTHER

E03

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1345 002374 176716 :173374 176716 .WORD RPWC
1346 002376 000005 :173376 000005 .WORD RFREAD
1347
1348 002400 005005 :173400 005005 OTHERA: CLR R5 ;SET TO UNIT 0
1349 002402 010200 :173402 010200 OTHER: MOV R2,R0 ;R0 POINT AT WORD COUNT
1350 002404 005720 :173404 005720 TST (R0)+ ;POINT TO PARAMETER LIST
1351 002406 012001 :173406 012001 MOV (R0)+,R1 ;MOVE WORD COUNT ADDRESS
1352 002410 012711 :173410 012711 MOV #-256,*2,(R1);LOAD WORD COUNT
1353 002412 177000 :173412 177000
1354 002414 051005 :173414 051005 BIS (R0),R5 ;COMBINE UNIT # WITH COM
1355 002416 010541 :173416 010541 MOV R5,-(R1);LOAD READ COMMAND
1356 002420 032711 :173420 032711 BIT #100200,(R1);CHECK FOR ERROR AND
1357 002422 100200 :173422 100200
1358 002424 001775 :173424 001775 BEQ #-4 ;WAIT UNTIL COMPLETE
1359 002426 100012 :173426 100012 BPL IS ;NO ERROR
1360 002430 005702 :173430 005702 TST R2 ;WAS IT CALLED BY MASS B
1361 002432 001024 :173432 001024 BNE AGAIN ;NO, ERROR
1362 002434 032761 :173434 032761 BIT #TUTAPE,26(R1);IS TU16?
1363 002436 040000 :173436 040000
1364 002440 000026 :173440 000026
1365 002442 001420 :173442 001420 BEQ AGAIN ;NO, ERROR
1366 002444 022761 :173444 022761 CMP #FCE,14(R1);ARE WE READ A SHORT
1367 002446 001000 :173446 001000
1368 002450 000014 :173450 000014
1369 002452 001014 :173452 001014 BNE AGAIN ;SOME OTHER ERROR
1370 002454 005007 :173454 005007 IS: CLR PC ;O.K.
1371
1372 ;
1373 002456 010200 :173456 010200 ;THIS IS THE TAPE DEVICE SERVICE ROUTINE
1374 002460 005720 :173460 005720 TAPES: MOV R2,R0 ;GET THE ADDRESS OF THE
1375 002462 012001 :173462 012001 TST (R0)+ ;STEP TO LAST COMMAND
1376 002464 005311 :173464 005311 MOV (R0)+,R1 ;GET THE WORD COUNT ADDR
1377 002466 005720 :173466 005720 DEC (R1) ;SET UP TO ADVANCE 1 REC
1378 002470 012041 :173470 012041 TST (R0)+ ;MOVE R0 TO FIRST COMMAND
1379 002472 031011 :173472 031011 MOV (R0)+,-(R1);LOAD COMMAND REG.
1380 002474 001776 :173474 001776 BIT (R0),(R1);DONE?
1381 002476 005720 :173476 005720 BEQ -2 ;NO, KEEP LOOPING
1382 002500 031041 :173500 031041 TST (R0)+ ;YES, CHECK FOR ERROR
1383 002502 001736 :173502 001736 BIT (R0)-,(R1);ANY ERROR?
1384 002504 000005 :173504 000005 BEQ OTHERA ;NO ERROR- TRY TO READ
1385
1386 002506 000113 :173506 000113 AGAIN: RESET
1387
1388 ;
1389 002510 012704 :173510 012704 ;THIS IS THE STARTING ADDRESS FOR PC11 PAPER TAP
1390 002512 177560 :173512 177560 KL11: MOV #KLCS,R4;OBTAIN CONTROL REG.
1391 002514 000443 :173514 000443 BR CKDEV ;AND TRANSFER TO READER
1392
1393 ;
1394 ;
1395 ;
1396 002516 .BYTE 240 :173516 240 ;CASSETTE TAPE DEVICE COMMAND TABLE
1397 002517 .BYTE 037 :173517 037 TABLE: .BYTE 240 ;COMPARE WORD NOT A COMM
1398 002520 .BYTE 015 :173520 015 .BYTE 37 ;ILBS+RWD+GO
1399 002521 .BYTE 005 :173521 005 .BYTE 15 ;SPACE FORWARD BLOCK+GO
1400 002522 .BYTE 024 :173522 024 .BYTE 5 ;READ
; .BYTE 24 ;READ +ILBS
  
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1401 002523 .BYTE 224 ;173523          224          .BYTE 224          ;READ+ILBS+END FLAG
1402
1403
1404 002524 000404 ;173524 000404 CBOOTA: BR 1$ ;SELECT UNIT 0
1405 002526 113704 ;173526 113704 CBOOTB: MOVB 3#CSW,R4;SELECT UNITS
1406 002530 177570 ;173530 177570
1407 002532 000304 ;173532 000304 SWAB R4
1408 002534 000401 ;173534 000401 BR RESETX
1409 002536 005004 ;173536 005004 1$: CLR R4
1410 002540 012700 ;173540 012700 RESETX: MOV #TACS,R0;GET CONTROL REG.
1411 002542 177500 ;173542 177500
1412 002544 000005 ;173544 000005 RESTRT: RESET
1413 002546 010410 ;173546 010410 MOV R4,(R0);SELECT UNIT
1414 002550 012701 ;173550 012701 MOV #TABLE,R1
1415 002552 173516 ;173552 173516
1416 002554 012702 ;173554 012702 MOV #375,R2 ;LOAD TRANSFER COUNTER
1417 002556 000375 ;173556 000375
1418 002560 112103 ;173560 112103 MOVB (R1)+,R3;LOAD COMPARATOR
1419 002562 112110 ;173562 112110 LOOP1: MOVB (R1)+,(R0);LOAD COMMAND
1420 002564 100407 ;173564 100407 BMI DONE
1421 002566 130310 ;173566 130310 LOOP2: BITB R3,(R0);COMMAND COMPLETE?
1422 002570 001776 ;173570 001776 BEQ LOOP2 ;NO. WAIT
1423 002572 105202 ;173572 105202 INCB R2 ;INCREMENT ADDRESS CTR.
1424 002574 100772 ;173574 100772 BMI LOOP1 ;IF (-), GET COMMAND
1425 002576 116012 ;173576 116012 MOVB 2(R0),(R2);STORE DATA
1426 002600 000002 ;173600 000002
1427 002602 000771 ;173602 000771
1428 002604 005710 ;173604 005710 DONE: BR LOOP2 ;GET ANOTHER BYTE
1429 002606 100756 ;173606 100756 TST (R0);ANY ERROR?
1430 002610 005002 ;173610 005002 BMI RESTRT ;YES, RETRY
1431 002612 120312 ;173612 120312 CLR R2 ;CLEAR COMPARE ADDRESS
1432 002614 001377 ;173614 001377 CMPB R3,(R2);IT MUST BE 240
1433 002616 000112 ;173616 000112 BNE ERROR: JMP (R2)
1434
1435
1436 002620 012704 ;173620 012704 PC11: MOV #PCCS,R4
1437 002622 177550 ;173622 177550
1438 002624 000005 ;173624 000005 CKDEV: RESET
1439 002626 012701 ;173626 012701 MOV #160000,R1;SET UP MEMORY TEST LI
1440 002630 160000 ;173630 160000
1441 002632 012702 ;173632 012702 MOV #6,R2 ;SET UP POINTER TO TIME0
1442 002634 000006 ;173634 000006
1443 002636 012712 ;173636 012712 MOV #340,(R2);SET UP VECTOR TO RETUR
1444 002640 000340 ;173640 000340
1445 002642 010742 ;173642 010742 MOV PC,-(R2);SAVE PC
1446 002644 012706 ;173644 012706 MOV #24,SP ;LOAD UP STACK POINTER
1447 002646 000024 ;173646 000024
1448 002650 010441 ;173650 010441 MOV R4,-(R1);LOOK FOR END OF MEMORY
1449 002652 040601 ;173652 040601 BIC SP,R1 ;THEN DROP TO XX752
1450 002654 010111 ;173654 010111 MOV R1,(R1);AND STORE IN ITSELF
1451 002656 011102 ;173656 011102 LOOP: MOV (R1),R2
1452 002660 005214 ;173660 005214 INC (R4);START DEVICE
1453 002662 105714 ;173662 105714 RDRWAT: TSTB (R4);WAIT
1454 002664 100376 ;173664 100376 BPL RDRWAT
1455 002666 116412 ;173666 116412 MOVB 2(R4),(R2);SAVE THE DATA
1456 002670 000002 ;173670 000002
  
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G03

DOBMA MACY11 27(732) 22-SEP-76 14:43 PAGE 32
DOBMAA.P11 MAINDEC-11-DOBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

1457	002672	005211	:173672	005211	INC	(R1)		
1458	002674	120227	:173674	120227	CMPB	R2,#375		
1459	002676	000375	:173676	000375				
1460	002700	001366	:173700	001366	BNE	LOOP	:NO	
1461	002702	105222	:173702	105222	INCB	(R2)+	:YES	
1462	002704	000142	:173704	000142	JMP	-(R2)		
1463	002706	000000	:173706	000000				: THIS AREA IS UNUSED
1464	002710	000000	:173710	000000				: THIS AREA IS UNUSED
1465	002712	000000	:173712	000000				: THIS AREA IS UNUSED
1466	002714	000000	:173714	000000				: THIS AREA IS UNUSED
1467	002716	000000	:173716	000000				: THIS AREA IS UNUSED
1468	002720	000000	:173720	000000				: THIS AREA IS UNUSED
1469	002722	000000	:173722	000000				: THIS AREA IS UNUSED
1470	002724	000000	:173724	000000				: THIS AREA IS UNUSED
1471	002726	000000	:173726	000000				: THIS AREA IS UNUSED
1472	002730	000000	:173730	000000				: THIS AREA IS UNUSED
1473	002732	000000	:173732	000000				: THIS AREA IS UNUSED
1474	002734	000000	:173734	000000				: THIS AREA IS UNUSED
1475	002736	000000	:173736	000000				: THIS AREA IS UNUSED
1476	002740	000000	:173740	000000				: THIS AREA IS UNUSED
1477	002742	000000	:173742	000000				: THIS AREA IS UNUSED
1478	002744	000000	:173744	000000				: THIS AREA IS UNUSED
1479	002746	000000	:173746	000000				: THIS AREA IS UNUSED
1480	002750	000000	:173750	000000				: THIS AREA IS UNUSED
1481	002752	000000	:173752	000000				: THIS AREA IS UNUSED
1482	002754	000000	:173754	000000				: THIS AREA IS UNUSED
1483	002756	000000	:173756	000000				: THIS AREA IS UNUSED
1484	002760	000000	:173760	000000				: THIS AREA IS UNUSED
1485	002762	000000	:173762	000000				: THIS AREA IS UNUSED
1486	002764	000000	:173764	000000				: THIS AREA IS UNUSED
1487	002766	000000	:173766	000000				: THIS AREA IS UNUSED
1488	002770	000000	:173770	000000				: THIS AREA IS UNUSED
1489	002772	000000	:173772	000000				: THIS AREA IS UNUSED
1490	002774	000000	:173774	000000				: THIS AREA IS UNUSED
1491	002776	END.YB:						
1492	002776	000000	:173776	000000				: THIS AREA IS UNUSED

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 DOBMAA.P11 MAINDEC-11-DOBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

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1493 003000 MAP.YC:
1494 ;THE FOLLOWING 1000 LOCATIONS ARE
1495 ;A REPRODUCTION OF THE ROM PROGRAM
1496 ;FOR THE BM873YC. THE FIRST 400 LOCATIONS
1497 ;ARE AN EXACT COPY OF THE BM873YA. THE
1498 ;REMAINING 400 LOCATIONS ARE
1499 ;THE DDCMP BOOTSTRAP ROM PROGRAM.
1500 ;IT IS HERE FOR COMPARISON TO
1501 ;ACTUAL ROM AND FOR REFERENCE.
1502 ;173000 .=173000 ;STARTING ADDRESS FOR BOOTSTRAP
1503 ;THIS LOADER IS DESIGNED FOR THE RESTART MODULE M873.
1504 ;IT FUNCTIONALLY REPLACES THE FOLLOWING ROMS:
1505 ;M792-YA - PAPER TAPE BOOTSTRAP FOR PC11,KL11
1506 ;MR11-DB BULK STORAGE BOOTSTRAP ROM
1507 ;M792-YH TA11 CASSETTE BOOTSTRAP ROM
1508 ;REGISTER DEFINITIONS
1509 R0= %0
1510 R1= %1
1511 R2= %2
1512 R3= %3
1513 R4= %4
1514 R5= %5
1515 SP= %6
1516 PC= %7
1517 SR= 177570 ;PROCESSOR SWITCH REGISTER
1518 ;STARTING LOCATION FOR RF11 DISK
1519 003000 010702 ;173000 010702 RF11: MOV PC,R2 ;SET POINTER TO PARAMETER LISTS
1520 003002 000464 ;173002 000464 BR OTHER ;TRANSFER TO SERVICE ROUTINE
1521 003004 177462 ;173004 177462 .WORD 177462 ;DEVICE WORD COUNT ADDRESS
1522 003006 000005 ;173006 000005 .WORD 5 ;DEVICE READ INSTRUCTION
1523 ;THIS IS THE STARTING LOCATION FOR THE RK11 CONTROLLER
1524 003010 010702 ;173010 010702 RK11: MOV PC,R2 ;SET POINTER TO PARAMETER LIST
1525 003012 000460 ;173012 000460 BR OTHER ;TRANSFER TO SERVICE ROUTINE
1526 003014 177406 ;173014 177406 .WORD 177406 ;DEVICE WORD COUNT REGISTER
1527 003016 000005 ;173016 000005 .WORD 5 ;DEVICE READ INSTRUCTION
1528 ;THIS IS A SPARE STARTING LOCATION. IT TRANSFERS TO ADDRESS
1529 ;CONTAINED IN THE SWITCH REGISTER.
1530 003020 013707 ;173020 013707 TRANSR: MOV #SR,PC ;GO TO INDICATED LOCATION
1531 003022 177570 ;173022 177570
1532 ;NOTE 773024 AND 773224 ARE DEPENDENT ON OFFSET IN DIODES FOR LINE 1
1533 ;THIS IS THE POWER UP VECTOR REQUIRED FOR DEVICE AND
1534 003024 173000 ;173024 173000 POWER: .WORD RF11 ;ADDRESS OF FIRST LOCATION IN ROM
1535 003026 000340 ;173026 000340 .WORD 340 ;PROCESSOR STATUS LEVEL 7
1536 ;THIS IS THE STARTING ADDRESS FOR TC11 (DECTAPE) CONTROLLER.
1537 003030 010702 ;173030 010702 TC11: MOV PC,R2 ;SET UP POINTER TO PARAMETER LIST
1538 003032 000426 ;173032 000426 BR TAPES ;AND TRANSFER TO FIRST ROUTINE
1539 003034 177344 ;173034 177344 .WORD 177344 ;DEVICE WORD COUNT ADDRESS
1540 003036 004003 ;173036 004003 .WORD 4003 ;FIND PREVIOUS BLOCK COMMAND
1541 003040 100000 ;173040 100000 .WORD 100000 ;USED AS DONE INDICATOR
1542 003042 024000 ;173042 024000 .WORD 24000 ;USED AS ERROR INDICATOR/TEST FLAG
1543 003044 000445 ;173044 000445 BR OTHERX ;THEN TRANSFER TO NEXT ROUTINE
1544 003046 000005 ;173046 000005 .WORD 5 ;DEVICE READ COMMAND
  
```

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1550
1551 003050 010702 ;173050 010702
1552 003052 000416 ;173052 000416
1553 003054 172524 ;173054 172524
1554 003056 060017 ;173056 060017
1555 003060 000200 ;173060 000200
1556 003062 100000 ;173062 100000
1557 003064 000413 ;173064 000413
1558 003066 060011 ;173066 060011
1559 003070 000200 ;173070 000200
1560 003072 100000 ;173072 100000
1561 003074 000431 ;173074 000431
1562 003076 060003 ;173076 060003
1563
1564
1565 003100 010702 ;173100 010702
1566 003102 000424 ;173102 000424
1567 003104 176716 ;173104 176716
1568 003106 000005 ;173106 000005
1569
1570
1571 003110 010200 ;173110 010200
1572 003112 005720 ;173112 005720
1573 003114 000005 ;173114 000005
1574 003116 005720 ;173116 005720
1575 003120 016201 ;173120 016201
1576 003122 000002 ;173122 000002
1577 003124 005311 ;173124 005311
1578 003126 012041 ;173126 012041
1579 003130 031011 ;173130 031011
1580 003132 001776 ;173132 001776
1581 003134 005720 ;173134 005720
1582 003136 032041 ;173136 032041
1583 003140 001063 ;173140 001063
1584 003142 000110 ;173142 000110
1585
1586
1587 003144 010702 ;173144 010702
1588 003146 000402 ;173146 000402
1589 003150 177450 ;173150 177450
1590 003152 000005 ;173152 000005
1591
1592
1593 003154 010200 ;173154 010200
1594 003156 005720 ;173156 005720
1595 003160 005720 ;173160 005720
1596 003162 000005 ;173162 000005
1597 003164 016201 ;173164 016201
1598 003166 000002 ;173166 000002
1599 003170 012711 ;173170 012711
1600 003172 177000 ;173172 177000
1601 003174 011041 ;173174 011041
1602 003176 105711 ;173176 105711
1603 003200 100376 ;173200 100376
1604 003202 005711 ;173202 005711

; THIS IS THE START LOCATION FOR TM11 MAGTAPE CONTROLLER
TM11: MOV PC,R2 ;SET POINTER TO PARAMETER LIST
      BR TAPES ;AND TRANSFER TO FIRST ROUTINE
      .WORD 172524 ;DEVICE BYTE/RECORD COUNT REGISTER
      .WORD 60017 ;DEVICE REWIND COMMAND
      .WORD 200 ;DEVICE DONE FLAG
      .WORD 100000 ;DEVICE ERROR FLAG BIT
      BR TAPESX ;THEN TRANSFER TO NEXT SERVICE RTN
      .WORD 60011 ;DEVICE FORWARD SPACE COMMAND
      .WORD 200 ;SAME AS ABOVE
      .WORD 100000 ;SAME AS ABOVE
      BR OTHERX ;THEN TRANSFER TO READ/TRANSFER ROUTINE
      .WORD 60003 ;DEVICE READ COMMAND

; THIS IS THE START LOCATION FOR THE RP11 CONTROLLER
RP11: MOV PC,R2 ;SET POINTER TO PARAMETER LIST
      BR OTHER ;TRANSFER TO TRANSFER ROUTINE
      .WORD 176716 ;DEVICE WORD COUNT REGISTER
      .WORD 5 ;DEVICE READ COMMAND

; THIS IS THE TAPE DEVICE SERVICE ROUTINE.
TAPES: MOV R2,R0 ;GET ADDRESS OF PARAMETER LIST
      TST (R0)+ ;SKIP TWO WORDS FIRST TIME
TAPESX: RESET ;RESET ALL DEVICES
      TST (R0)+ ;SKIP OVER BRANCH INSTRUCTION
      MOV 2(R2),R1 ;THEN GET DEVICE WORD/BYTE COUNT ADDRESS

      DEC R1 ;AND SET TO -1
      MOV (R0)+,-(R1) ;AND THEN ISSUE COMMAND TO DEVICE
TAPWAT: BIT R0,R1 ;WAIT FOR DEVICE COMPLETION
      BEQ TAPWAT ;BY HANGING IN LOOP
      TST (R0)+ ;AND THEN SKIP DONE FLAG
      BIT (R0)+,-(R1) ;THEN TEST FOR ERROR
      BNE ERROR ;THERE IS ONE
RETURN: JMP R0 ;AND TRANSFER TO FOLLOWING INSTRUCTION

; THIS IS THE STARTING ADDRESS FOR RC11 DISK CONTROLLERS
RC11: MOV PC,R2 ;SET UP POINTER TO PARAMETER LIST
      BR OTHER ;TRANSFER TO SERVICE RTN
      .WORD 177450 ;DEVICE WORD COUNT REGISTER
      .WORD 5 ;DEVICE READ INSTRUCTION

; THIS ROUTINE PERFORMS THE ACTUAL TRANSFER TO MEMORY OF DATA
OTHER: MOV R2,R0 ;SET POINTER TO LIST IN R0
      TST (R0)+ ;SKIP TWO WORDS FIRST TIME.
OTHERX: TST (R0)+ ;SKIP PAST BR INSTRUCTION
      RESET ;REST THE WORLD
      MOV 2(R2),R1 ;OBTAIN DEVICE WORD COUNT ADDRESS

      MOV #-1000,R1 ;THEN OBTAIN LARGE WORD COUNT

      MOV R0,-(R1) ;AND PUT COMMAND TO DEVICE
OTHWAT: TSTB R1 ;WAIT FOR DONE FLAG
      BPL OTHWAT ;BY HANGING IN LOOP
      TST R1 ;THEN TEST FOR ERROR

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 DDBMAA.P11 MAINDEC-11-DDBMA-A BM873

UNIVERSAL RESTART LOADER DIAGNOSTIC.

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1605 003204 100441 ;173204 100441 BMI ERROR ;GOT PROBLEMS
1606 003206 005007 ;173206 005007 CLR PC ;AND TRANSFER TO ZERO
1607
1608 ;THIS IS THE STARTING ADDRESS FOR THE PC11 PAPER TAPE CONTROLLER
1609 003210 012704 ;173210 012704 KL11: MOV #177560,R4 ;OBTAIN DEVICE ADDRESS
1610 003212 177560 ;173212 177560
1611 003214 000440 ;173214 000440 BR CKDEV ;AND TRANSFER TO READER SERVICE ROUTINE
1612
1613 ;
1614 ;THIS IS THE CASSETTE DEVICE COMMAND TABLE
1615 003216 017640 ;173216 240 TABLE: .BYTE 240 ;COMPARE WORD NOT A COMMAND
1616 ;173217 037 .BYTE 37 ;ILBS+RWD+GO
1617 003220 002415 ;173220 015 .BYTE 15 ;SPACE FORWARD BLOCK+GO
1618 ;173221 005 .BYTE 5 ;READ+GO
1619 003222 112024 ;173222 024 .BYTE 24 ;READ+ILBS
1620 ;173223 224 .BYTE 224 ;READ+ILBS+END FLAG
1621 ;NOTE 773024 AND 773224 ARE DEPENDENT ON OFFSET IN DIODES FOR LINE 1
1622
1623 ;THIS IS AN ADDITIONAL POWER VECTOR ADDRESS REQUIRED BY DEVICE
1624 003224 173000 ;173224 173000 POWER2: .WORD RF11 ;ADDRESS OF BEGINNING OF BOOTSTRAP
1625 003226 000340 ;173226 000340 .WORD 340 ;PRIORITY LEVEL 7
1626
1627 ;THIS IS THE STARTING ADDRESS FOR THE CASSETTE DEVICE #0
1628 003230 005004 ;173230 005004 CBOOT: CLR R4 ;LOAD DEVICE NUMBER 0 IN R4
1629 003232 012700 ;173232 012700 RESTX: MOV #177500,R0 ;GET DEVICE ADDRESS
1630 003234 177500 ;173234 177500
1631 003236 000005 ;173236 000005 RESTRT: RESET ;ISSUE RESET INSTRUCTION
1632 003240 010410 ;173240 010410 MOV R4, R0 ;LOAD DEVICE WITH UNIT NUMBER
1633 003242 012701 ;173242 012701 MOV #TABLE,R1 ;GET FUNNY TABLE OF INSTRUCTIONS
1634 003244 173216 ;173244 173216
1635 003246 012702 ;173246 012702 MOV #375,R2 ;AND LOAD UP TRANSFER COUNTER
1636 003250 000375 ;173250 000375
1637 003252 112103 ;173252 112103 LOOP1: MOVB (R1)+,R3 ;THE LOAD UP COMPARATOR
1638 003254 112110 ;173254 112110 MOVB (R1)+,R0 ;LOAD DEVICE REGISTER WITH COMMAND
1639 003256 100407 ;173256 100407 BMI DONE
1640 003260 130310 ;173260 130310 LOOP2: BITB R3,R0 ;HAS COMMAND COMPLETED
1641 003262 001776 ;173262 001776 BEQ LOOP2 ;NO, WAIT
1642 003264 105202 ;173264 105202 INCB R2 ;THEN INCREMENT ADDRESS CTR
1643 003266 100772 ;173266 100772 BMI LOOP1 ;IF NEGATIVE, GET COMMAND
1644 003270 116012 ;173270 116012 MOVB 2(R0),R2 ;AND STORE DATA AWAY
1645 003272 000002 ;173272 000002
1646 003274 000771 ;173274 000771 DONE: BR LOOP2 ;GO GET ANOTHER BYTE
1647 003276 005710 ;173276 005710 TST R0 ;ANY DEVICE ERRORS
1648 003300 100756 ;173300 100756 BMI RESTRT ;YES, RETRY
1649 003302 005002 ;173302 005002 CLR R2 ;CLEAR COMPARE ADDRESS AND TRANSFER ADDRESS
1650 003304 120312 ;173304 120312 CMPB R3,R2 ;IT MUST BE 240
1651 003306 001377 ;173306 001377 BNE +0 ;NO, THERE WAS AN ERROR
1652 003310 000112 ;173310 000112 ERROR: JMP R2 ;NORMAL CASSETTE AND ERROR FOR BULK STORAGE
1653
1654 ;THIS IS THE STARTING LOCATION FOR THE PC11 CONTROLLER
1655 003312 012704 ;173312 012704 PC11: MOV #177550,R4 ;LOAD DEVICE ADDRESS
1656 003314 177550 ;173314 177550
1657 003316 000005 ;173316 000005 CKDEV: RESET ;KILL ALL DEVICE ACTION
1658 003320 012701 ;173320 012701 MOV #160000,R1 ;THEN SET UP MEMORY TEST LIMITS
1659 003322 160000 ;173322 160000
1660 003324 012702 ;173324 012702 MOV #6,R2 ;AND SET UP POINTER TO TIMEOUT LOCATION
  
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DDBMA MACY11 27(732) 22-SEP-76 14:43 PAGE 36
 DDBMAA.P11 MAINDEC-11-DDBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

1661	003326	000006	::173326	000006		
1662	003330	012712	::173330	012712	MOV #340, R2	; AND SET UP VECTOR TO RETURN TO NEXT
1663	003332	000340	::173332	000340		
1664	003334	010742	::173334	010742	MOV PC, -(R2)	; SAVE THE PC
1665	003336	012706	::173336	012706	MOV #24, SP	; AND LOAD UP STACK POINTER
1666	003340	000024	::173340	000024		
1667	003342	010441	::173342	010441	MOV R4, -(R1)	; AND LOOK FOR END OF MEMORY
1668	003344	040601	::173344	040601	BIC SP, R1	; THEN DROP TO XX7752
1669	003346	010111	::173346	010111	MOV R1, R1	; AND STORE IN ITSELF
1670	003350	011102	::173350	011102	LOOP: MOV R1, R2	; THEN LOAD ADDRESS FOR DATA INSERTION
1671	003352	005214	::173352	005214	INC R4	; AND START DEVICE
1672	003354	105714	::173354	105714	RDRWAT: TSTB R4	; THEN WAIT FOR CHARACTER AVAILABLE
1673	003356	100376	::173356	100376	BPL RDRWAT	; HANGING THERE IF NECESSARY
1674	003360	116412	::173360	116412	MOVB 2(R4), R2	; STORE AWAY DATA BYTE
1675	003362	000002	::173362	000002		
1676	003364	005211	::173364	005211	INC R1	
1677	003366	120227	::173366	120227	CMPB R2, #375	; HAS BRANCH OFFSET BEEN STORED
1678	003370	000375	::173370	000375		
1679	003372	001366	::173372	001366	BNE LOOP	; NO
1680	003374	105222	::173374	105222	INCB (R2)+	; YES, ALL DONE
1681	003376	000142	::173376	000142	JMP -(R2)	; THEN TRANSFER TO RTN

; THE FOLLOWING 400 LOCATIONS ARE
 ; A REPRODUCTION OF THE DDCMP BOOT-
 ; STRAP ROM. IT IS HERE FOR COM-
 ; PARISON TO THE ACTUAL ROM AND
 ; FOR REFERENCE.

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VERSION 01

STUART WECKER 01/22/75

DIGITAL EQUIPMENT CORPORATION
 COMPUTER NETWORK FACILITIES
 DOWN-LINE LOADING PROGRAM

THIS PROGRAM LOADS COMPUTER MEMORY FROM DATA SENT OVER
 A DATA COMMUNICATIONS LINK. IT SENDS AND RECEIVES
 MESSAGES IN DDCMP BOOT FORMAT. THE PRIMARY BOOT ONLY

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 DDBMAA.P11 MAINDEC-11-DDBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

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1773      :      000001 $STADR=1           ;STATION ADDR
1774      :      177570 $SWR=177570        ;SWITCH REGISTER ADDR
1775      :      000226 $SYN=226          ;SYNC CHARACTER
1776      :      000220 $DLE=220         ;DDCMP DLE CHARACTER
1777      :      000400 $STRIP=400
1778      :
1779      :
1780      :      THE STACK IS USED AS FOLLOWS:
1781      :      STACK-2:FOR JSR TO GET ROUTINE
1782      :      STACK-4:TEMP FOR CRC CALCULATION
1783      :
1784      :      START OF BOOT PROGRAM
1785      :
1786      :      START1-DEVICE UNIT 0-NORMAL CONFIGURATION
1787      :      START2-USE SWITCH REG AS DEVICE DISPLACEMENT
1788      :      I.E. #0-0,#1-10,#2-20
1789      :
1790 003400 012700 : 173400 012700 START1: MOV (PC)+,R0 ;NON ZERO VALUE TO R0
1791 003402 005000 : 173402 005000 START2: CLR R0 ;CLEAR R0
1792 003404 000005 : 173404 000005 RESET ;RESET SYS, MEM MGT, ETC...
1793 003406 012706 : 173406 012706 MOV #17776,SP ;STACK AT 4K-2
1794 003410 017776 : 173410 017776
1795      :
1796      :
1797      :      FIND THE DU-11 IN THE FLOATING ADDRESS SPACE
1798      :
1798 003412 010702 : 173412 010702 MOV PC,R2 ;CURRENT PC
1799 003414 062702 : 173414 062702 ADD #DEVTAB-. ,R2 ;DEVICE TABLE ADDR
1800 003416 000360 : 173416 000360
1801 003420 012703 : 173420 012703 MOV #6,R3 ;TRAP PS ADDR
1802 003422 000006 : 173422 000006
1803 003424 005013 : 173424 005013 CLR (R3) ;CLEAR NEW PS
1804 003426 010243 : 173426 010243 MOV R2,-(R3) ;TABLE ADDR TO LOC 4
1805 003430 160313 : 173430 160313 SUB R3,(R3) ;SUB TO TRAP RTN
1806 003432 005303 : 173432 005303 DEC R3 ;LEAVE CNT 3 FOR LOOP
1807 003434 012701 : 173434 012701 MOV #160010,R1 ;START SEARCH ADDR
1808 003436 160010 : 173436 160010
1809 003440 005711 : 173440 005711 DEVLOP: TST (R1) ;IS DEVICE THERE
1810 003442 111204 : 173442 111204 MOV#B (R2),R4 ;DEVICE INCREMENT TO R3
1811 003444 060401 : 173444 060401 ADD R4,R1 ;UPDATE TO NEXT DEVICE
1812 003446 005201 : 173446 005201 INC R1 ;INCREMENT MODULO
1813 003450 040401 : 173450 040401 BIC R4,R1 ;CLEAR EXCESS
1814 003452 005703 : 173452 005703 TST R3 ;TEST FOR DONE
1815 003454 001371 : 173454 001371 BNE DEVLOP ;NOT YET
1816 003456 005700 : 173456 005700 TST R0 ;TEST SWITCH REG USE
1817 003460 001002 : 173460 001002 BNE SNDREQ ;NO SWITCH REG
1818 003462 063701 : 173462 063701 ADD @#$SWR,R1 ;ADD SWR VALUE
1819 003464 177570 : 173464 177570
1820      :
1821      :
1822      :      SET UP DEVICE FOR OUTPUT
1823      :
1823 003466 012711 : 173466 012711 SNDREQ: MOV #6,(R1) ;DATA TERM RDY AND REQ TO SEND
1824 003470 000006 : 173470 000006
1825 003472 012761 : 173472 012761 MOV #36000+$SYN,2(R1) ;SET SYNC REGISTER
1826 003474 036226 : 173474 036226
1827 003476 000002 : 173476 000002
1828      :
  
```

1829	003500	032711	;	173500	032711	L3:	BIT	#20000,(R1)	;	TEST CLEAR TO SEND
1830	003502	020000	;	173502	020000					
1831	003504	001775	;	173504	001775		BEQ	L3	;	NOT YET
1832	003506	022121	;	173506	022121		CMP	(R1)+,(R1)+	;	MOVE PTR TO XMIT TSR
1833	003510	052711	;	173510	052711		BIS	#20,(R1)	;	TURN SEND ON
1834	003512	000020	;	173512	000020					
1835										
1836										
1837										
1838	003514	010700	;	173514	010700		MOV	PC,R0	;	CURRENT PC
1839	003516	062700	;	173516	062700		ADD	#RQMSG-,R0	;	REQUEST MSG ADDR
1840	003520	000230	;	173520	000230					
1841	003522	012704	;	173522	012704		MOV	#RQMSG-RQMSG,R4	;	COUNT
1842	003524	000026	;	173524	000026					
1843	003526	112061	;	173526	112061	L4:	MOVB	(R0)+,2(R1)	;	CHAR TO XMIT REGISTER
1844	003530	000002	;	173530	000002					
1845	003532	105711	;	173532	105711	L5:	TSTB	(R1)	;	DONE YET ?
1846	003534	100376	;	173534	100376		BPL	L5	;	NO
1847	003536	005304	;	173536	005304		DEC	R4	;	DECREMENT COUNT
1848	003540	001372	;	173540	001372		BNE	L4	;	ONCE MORE
1849	003542	042711	;	173542	042711		BIC	#20,(R1)	;	DROP SEND
1850	003544	000020	;	173544	000020					
1851	003546	024141	;	173546	024141		CMP	-(R1),-(R1)	;	RESET PTR TO RCV CSR
1852										
1853										
1854										
1855			;	173550						
1856	003550	042711	;	173550	042711	GETPGM:	BIC	#20,(R1)	;	CLEAR SEARCH SYNC
1857	003552	000020	;	173552	000020					
1858	003554	012711	;	173554	012711		MOV	#422,(R1)	;	SET FOR CLEAR AND STRIP SYNC
1859	003556	000422	;	173556	000422					
1860	003560	005003	;	173560	005003		CLR	R3	;	CLEAR CRC VALUE
1861										
1862										
1863										
1864	003562	012700	;	173562	012700		MOV	#1,R0	;	LOAD HDR AT LOC. 1
1865	003564	000001	;	173564	000001					
1866	003566	012704	;	173566	012704		MOV	#8.,R4	;	BLOCK COUNT
1867	003570	000010	;	173570	000010					
1868	003572	004767	;	173572	004767		JSR	PC,GET	;	GET HEADER
1869	003574	000060	;	173574	000060					
1870	003576	005703	;	173576	005703		TST	R3	;	CHECK HEADER CRC
1871	003600	001363	;	173600	001363		BNE	GETPGM	;	NO GOOD
1872	003602	123727	;	173602	123727		CMPB	@#6,#\$STADR	;	CHECK FOR MY ADDR
1873	003604	000006	;	173604	000006					
1874	003606	000001	;	173606	000001					
1875	003610	001357	;	173610	001357		BNE	GETPGM	;	NOT MINE
1876	003612	123727	;	173612	123727		CMPB	@#1,#\$DLE	;	IS THIS A DLE MSG
1877	003614	000001	;	173614	000001					
1878	003616	000220	;	173616	000220					
1879	003620	001322	;	173620	001322		BNE	SNDREQ	;	NO, ASK FOR ONE
1880										
1881										
1882										
1883	003622	013704	;	173622	013704		MOV	@#2,R4	;	DATA FIELD LENGTH
1884	003624	000002	;	173624	000002					

```

1885 003626 042704 :173626 042704 BIC #140000,R4 ;MASK OFF S,F BITS
1886 003630 140000 :173630 140000
1887 003632 122424 :173632 122424 CMPB (R4)+,(R4)+ ;ADD 2 FOR CRC
1888 003634 005000 :173634 005000 CLR R0 ;LOAD INTO LOCATION 0
1889 003636 004767 :173636 004767 JSR PC,GET1 ;GET DATA BLOCK
1890 003640 000014 :173640 000014
1891 003642 005703 :173642 005703 TST R3 ;CHECK DATA FIELD CRC
1892 003644 001310 :173644 001310 BNE SNDREQ ;NO GOOD
1893 003646 105713 :173646 105713 TSTB (R3) ;CHECK CODE IN LOC 0
1894 003650 001306 :173650 001306 BNE SNDREQ ;NOT PROGRAM LOAD
1895 003652 000137 :173652 000137 JMP #06 ;TRANSFER TO SECONDARY PGM
1896 003654 000006 :173654 000006
1897
1898
1899
1900
1901
1902 003656 105711 :173656 105711 GET:
1903 003660 100376 :173660 100376 GET1:
1904 003662 042711 :173662 042711 TSTB (R1) ;IS DEVICE DONE YET
1905 003664 000400 :173664 000400 BPL GET ;NOT YET
1906 003666 116110 :173666 116110 BIC #SSTRIP,(R1) ;NO STRIP SYNC
1907 003670 000002 :173670 000002 MOVB 2(R1),(R0) ;STORE IT
1908
1909
1910
1911
1912
1913 003672 012705 :173672 012705 ; CRC CALCULATION ROUTINE
1914 003674 000010 :173674 000010 ;
1915 003676 112002 :173676 112002 ; POLY=120001 ;CRC-16 POLYNOMIAL
1916 003700 000241 :173700 000241 ;
1917 003702 006003 :173702 006003 ;
1918 003704 103003 :173704 103003 ;
1919 003706 006002 :173706 006002 ;
1920 003710 103003 :173710 103003 ;
1921 003712 000410 :173712 000410 ;
1922 003714 006002 :173714 006002 ;
1923 003716 103006 :173716 103006 ;
1924 003720 012746 :173720 012746 ;
1925 003722 120001 :173722 120001 ;
1926 003724 040316 :173724 040316 ;
1927 003726 042703 :173726 042703 ;
1928 003730 120001 :173730 120001 ;
1929 003732 052603 :173732 052603 ;
1930 003734 005305 :173734 005305 ;
1931 003736 001360 :173736 001360 ;
1932 003740 005304 :173740 005304 ;
1933 003742 001345 :173742 001345 ;
1934 003744 000207 :173744 000207 ;
1935
1936
1937
1938 003746 113226 :173746 113226 ;
1939 003750 113226 :173750 113226 ;
1940 003752 002220 :173752 002220 ;

```

SECONDARY PROGRAM REQUEST MSG

```

RQMSG: .BYTE $SYN,$SYN,$SYN,$SYN
       .BYTE $DLE,4,0,0,0,1

```

1941	003754	000000	:173754	000000		
1942	003756	000400	:173756	000400		
1943	003760	050055	:173760	050055	.BYTE	55,120
1944	003762	001010	:173762	001010	.BYTE	10
1945					.BYTE	2
1946	003764	000001	:173764	000001	.BYTE	\$STADR
1947					.BYTE	0
1948	003766	030242	:173766	030242	.BYTE	242,60
1949					NOTE: NODEV AND DEVTAB MUST BE IN THIS ORDER	
1950					DO NOT SEPARATE THEM	
1951						
1952					.EVEN	
1953	003770	122243	:173770	122243	NODEV: CMPB	(R2)+, -(R3)
1954	003772	000002	:173772	000002	RTI	:INC PTR-DEC CNT
1955						:RETURN FROM TRAP
1956					RQMSGE:	:END OF MSG-USE JUNK AS PADS
1957	003774	007407	:173774	007407	DEVTAB: .BYTE	7
1958					.BYTE	17
1959	003776	END.YC:				
1960	003776	003407	:173776	003407	.BYTE	7
1961					.BYTE	7
1962			:174000		END:	
1963				173400	.END	START1

1964 004000
1965
1966
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MAP.YD:
:THE FOLLOWING IS A REPRODUCTION
:OF THE ROM PROGRAM FOR BMB73YD.
:IT IS HERE FOR COMPARISON TO THE
:ACTUAL ROM AND FOR REFERENCE
:BMB73-YD
:BMB73-YD.P11

- KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 1

: This code is to be blasted into pROMs on the BMB73-YD board.
: Written by David M. Rosenberg October 1974
: REGISTER DEFINITIONS

: 000000 R0=%0 ;GENERAL PURPOSE REGISTER 0
: 000001 R1=%1 ;GENERAL PURPOSE REGISTER 1
: 000002 R2=%2 ;GENERAL PURPOSE REGISTER 2
: 000003 R3=%3 ;GENERAL PURPOSE REGISTER 3
: 000004 R4=%4 ;GENERAL PURPOSE REGISTER 4
: 000005 R5=%5 ;GENERAL PURPOSE REGISTER 5
: 000006 SP=%6 ;STACK POINTER (REGISTER R6)
: 000007 PC=%7 ;PROGRAM COUNTER (REGISTER R7)

;SYMBOL DEFINITIONS

: 177776 PS=177776 ;PROCESSOR STATUS REGISTER
: 177570 SWR=177570 ;FRONT PANEL SWITCH REGISTER
: 000000 PR0=0#40 ;PRIORITY LEVEL 0
: 000040 PR1=1#40 ;PRIORITY LEVEL 1
: 000100 PR2=2#40 ;PRIORITY LEVEL 2
: 000140 PR3=3#40 ;PRIORITY LEVEL 3
: 000200 PR4=4#40 ;PRIORITY LEVEL 4
: 000240 PR5=5#40 ;PRIORITY LEVEL 5
: 000300 PR6=6#40 ;PRIORITY LEVEL 6
: 000340 PR7=7#40 ;PRIORITY LEVEL 7
: 000001 BIT0=000001
: 000002 BIT1=000002
: 000004 BIT2=000004
: 000010 BIT3=000010
: 000020 BIT4=000020
: 000040 BIT5=000040
: 000100 BIT6=000100
: 000200 BIT7=000200
: 000400 BIT8=000400
: 001000 BIT9=001000
: 002000 BIT10=002000
: 004000 BIT11=004000
: 010000 BIT12=010000
: 020000 BIT13=020000
: 040000 BIT14=040000
: 100000 BIT15=100000

E04

DDBMA MACY11 27(732) 22-SEP-76 14:43 PAGE 43
 DDBMAA.P11 MAINDEC-11-DDBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

```

2015 ;BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 3
2016 ;BM873-YD.P11 BUTTON #1 - BOOTSTRAP USING THE PDP-11 SWITCH REGISTER
2017
2018
2019 ; 173000 ROMORG = 173000 ;Set ROM origin to 773000
2020 ; 173000 . =ROMORG ;BM873-YD occupies 773000-773777
2021
2022 004000 033727 ;173000 033727 BUTON1: BIT @#SWR,#BIT0 ;Is rightmost bit on?
2023 004002 177570 ;173002 177570
2024 004004 000001 ;173004 000001
2025 004006 001010 ;173006 001010 BNE LOWBIT ;If the bit is on, branch
2026 004010 013707 ;173010 013707 MOV @#SWR,PC ;Jump to the address in the switch register
2027 004012 177570 ;173012 177570
2028 ;without having touched any of R0 - R6
2029
2030 004014 111704 ;173014 111704 BUTON3: MOVB (PC),R4 ;R4 = 1 indicates that button #3 was pressed
2031 004016 005001 ;173016 005001 CLR R1 ;Set unit number to zero
2032 004020 005005 ;173020 005005 CLR R5 ;Clear "logical switch register"
2033 004022 000424 ;173022 000424 BR TCBOOT ;Do a default boot strap from DECTape
2034
2035 004024 173000 ;173024 173000 .WORD ROMORG,PR7
2036 004026 000340 ;173026 000340
2037
2038 004030 013701 ;173030 013701 LOWBIT: MOV @#SWR,R1 ;R1 is a copy of the switch register
2039 004032 177570 ;173032 177570
2040 004034 106301 ;173034 106301 ASLB R1 ;Left-align speed field in right byte
2041 004036 122701 ;173036 122701 CMPB #16*20,R1 ;Is the speed 16 or 17?
2042 004040 000340 ;173040 000340
2043 004042 101404 ;173042 101404 BLOS UNITNO ;If speed is 16 or 17, branch
2044 004044 122701 ;173044 122701 CMPB #3*20,R1 ;Is the speed 0, 1, or 2?
2045 004046 000060 ;173046 000060
2046 004050 101001 ;173050 101001 BHI UNITNO ;If the speed is 0, 1, or 2, branch
2047 004052 005001 ;173052 005001 CLR R1 ;Speed was 3-15; set unit number = 0
2048 004054 000301 ;173054 000301 UNITNO: SWAB R1 ;Move unit number to bits 0-2
2049
2050 ; It is possible to manually set the desired bootstrap unit number
2051 ; into the rightmost three bits of R1, set the PDP-11 front panel
2052 ; switch register, and then jump into the ROM code at this point.
2053
2054 004056 042701 ;173056 042701 BIC #7,R1 ;Isolate unit number in R1
2055 004060 177770 ;173060 177770
2056 004062 013705 ;173062 013705 MOV @#SWR,R5 ;R5 is now the "logical switch register"
2057 004064 177570 ;173064 177570
2058 004066 005004 ;173066 005004 CLR R4 ;R4 = 0 indicates that button #1 was pressed
2059 004070 105705 ;173070 105705 TSTB R5 ;Should we boot from DECTape or RH11/RP04?
2060 004072 100507 ;173072 100507 BMI RPBOOT ;If bit 7 was one, branch off to the RH11/RP04
2061 ;Otherwise, fall through to the DECTape
  
```

F04

2062 ;BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 4
 2063 ;BM873-YD.P11 DECTAPE BOOTSTRAP AND DUMP ROUTINES

```

2064      ;          177344 TCMC      =          177344      ;TC11 DECTape word count register
2065      ;          000001 TCGO      =          1          ;TC11 "GO" bit
2066      ;          000002 TCRNUM     =          1*2        ;TC11 "read block number" function
2067      ;          000004 TCREAD     =          2*2        ;TC11 "read data" function
2068      ;          000014 TCWRIT     =          6*2        ;TC11 "write data" function
2069      ;          004000 TCREV      =          4000       ;Move DECTape in reverse direction
2070
2071      ;
2072      ;
2073      ;          000400 TCBWDC     =          1D256       ; Bootstrap (from DECTape) Parameters
2074      ;          000000 TCBEND     =          0          ;Word count for the secondary bootstrap
2075      ;                                     ;Which end of the DECTape (0 = front; 1 = back)
2076
2077      ;          070000 TCDWDC     =          1D28672     ; Dump (to DECTape) Parameters
2078      ;          000001 TCDEND     =          1          ;Word count for the core dump to DECTape
2079      ;                                     ;Which end of the DECTape (0 = front; 1 = back)
2080
2081      ;          000024 TCRTY      =          1D20        ; General (Bootstrap and Dump) DECTape Parameter
2082      ;                                     ;Number of retries in case of error
2083
2084 004074 012700 ;173074 012700 TCBOOT: MOV      #<TCBEND*TCREV>!TCREAD!TCGO,R0 ;Set up data-transfer command
2085 004076 000005 ;173076 000005
2086 004100 012702 ;173100 012702 MOV      #-TCBWDC,R2 ;Set word count to 256 (512 bytes)
2087 004102 177400 ;173102 177400
2088 004104 012703 ;173104 012703 MOV      #<<1-TCBEND>*TCREV>!TCRNUM!TCGO,R3 ;Set up position command
2089 004106 004003 ;173106 004003
2090 004110 000301 ;173110 000301 SWAB    R1 ;Bring unit number into the left byte
2091 004112 050103 ;173112 050103 BIS     R1,R3 ;Put unit number into positioning command
2092 004114 050100 ;173114 050100 BIS     R1,R0 ;Put unit number into data-transfer command
2093 004116 012701 ;173116 012701 TCSTRT: MOV   #TCWC,R1 ;R1 now points to TC11 word count register
2094 004120 177344 ;173120 177344
2095 004122 012706 ;173122 012706 TLOOP: MOV   #TCRTY,SP ;Initialize retry count in SP
2096 004124 000024 ;173124 000024
2097 004126 005705 ;173126 005705 TCBGIN: TST   R5 ;Test "indefinite retry" bit
2098 004130 100404 ;173130 100404 BMI     TCRSET ;Branch if "indefinite retry" is enabled
2099 004132 005306 ;173132 005306 DEC     SP ;Decrement retry count
2100 004134 100002 ;173134 100002 BPL     TCRSET ;Branch if retry count not exhausted
2101 004136 000000 ;173136 000000 TCHALT: HALT ;Retry count is exhausted for DECTape operation
2102 004140 000770 ;173140 000770 BR      TLOOP ;He pressed "CONTINUE", so try again
2103 004142 000005 ;173142 000005 TCRSET: RESET ;Stop anything in progress, for next try
2104 004144 010341 ;173144 010341 MOV     R3,-(R1) ;Initiate DECTape positioning operation
2105 004146 005711 ;173146 005711 TCAWAIT: TST  (R1) ;Test for an "ERROR"
2106 004150 100376 ;173150 100376 BPL     TCAWAIT ;Loop until an "ERROR" is detected
2107 004152 005721 ;173152 005721 TST     (R1)+ ;Make R1 point to the word count register
2108 004154 005761 ;173154 005761 TST     -4(R1) ;Is the error "ENDZONE"?
2109 004156 177774 ;173156 177774
2110 004160 100362 ;173160 100362 BPL     TCBGIN ;If not, branch back to try again
2111 004162 010211 ;173162 010211 MOV     R2,(R1) ;Set up word count for data-transfer
2112 004164 010041 ;173164 010041 MOV     R0,-(R1) ;Initiate the data-transfer operation
2113 004166 105711 ;173166 105711 TCDONE: TSTB (R1) ;Test for "DONE"
2114 004170 100376 ;173170 100376 BPL     TCDONE ;Loop until the "DONE" bit sets
2115 004172 005721 ;173172 005721 TST     (R1)+ ;Was an "ERROR" detected?
2116 004174 100754 ;173174 100754 BMI     TCBGIN ;If so, branch back and try again
2117 004176 005741 ;173176 005741 TST     -(R1) ;Make R1 point to the command register
  
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GO4

DBMA MACY11 27(732) 22-SEP-76 14:43 PAGE 45
DBMAA.P11 MAINDEC-II-DDRMA-A BMB73

UNIVERSAL RESTART LOADER DIAGNOSTIC.

2118	004200	105011	:173200	105011	CLRB	(R1)	;Stop all DECTape motion
2119	004202	122700	:173202	122700	CMPB	#TCREAD!TCGO,RO	;Was this a "normal read" operation?
2120	004204	000005	:173204	000005			
2121	004206	001001	:173206	001001	BNE	TCSTOP	;If not, go stop
2122	004210	000137	:173210	000137	GOTO0: JMP	2(PC)+	;Jump to PDP-11 location zero
2123	004212	000000	:173212	000000	TCSTOP: HALT		;Successful completion of a "non-read" operation
2124	004214	000776	:173214	000776	BR	TCSTOP	;So that pressing "CONTINUE" won't go anywhere

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2125      ;BM873-YD      - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 5
2126      ;BM873-YD.P11  DECTAPE BOOTSTRAP AND DUMP ROUTINES
2127
2128 004216 010037 ;173216 010037 TCDUMP: MOV      RO,2#ROTOR7      ;Save RO in PDP-11 memory location 40
2129 004220 000040 ;173220 000040
2130 004222 000402 ;173222 000402          BR      TCCONT          ;Branch around required interrupt vector
2131
2132 004224 173000 ;173224 173000          .WORD  ROMORG,PR7
2133 004226 000340 ;173226 000340
2134
2135 004230 010700 ;173230 010700 TCCONT: MOV      PC,RO          ;Use RO for a subroutine return address
2136 004232 000410 ;173232 000410          BR      REGSAV          ;Go to the "Register Saving" subroutine
2137 004234 012700 ;173234 012700          MOV      #<TCDEND*TCREV>!TCWRT!TCGO,RO ;Set up (write) transfer command
2138 004236 004015 ;173236 004015
2139 004240 012702 ;173240 012702          MOV      #-TCDWDC,R2      ;Set word-count to 28K words
2140 004242 110000 ;173242 110000
2141 004244 012703 ;173244 012703          MOV      #<<1-TCDEND>*TCREV>!TCRNUM!TCGO,R3 ;Set up position command
2142 004246 000003 ;173246 000003
2143 004250 005005 ;173250 005005          CLR      R5              ;Clear "indefinite retry" bit
2144 004252 000721 ;173252 000721          BR      TCSTRT          ;Branch into DECTape routine
2145
2146
2147
2148
2149      ; The following subroutine is used to save the PDP-11 general registers
2150      ; in PDP-11 memory locations 40-57.
2151
2152      ; The calling sequence is as follows:
2153      ;
2154      ;
2155      ;
2156      ;
2157 004254 010137 ;173254 010137 REGSAV: MOV      R1,2#ROTOR7+2 ;Save R1 in memory location 42
2158 004256 000042 ;173256 000042
2159 004260 012701 ;173260 012701          MOV      #ROTOR7+4,R1    ;R1 now points to memory location 44
2160 004262 000044 ;173262 000044
2161 004264 010221 ;173264 010221          MOV      R2,(R1)+        ;Save R2 in memory location 44
2162 004266 010321 ;173266 010321          MOV      R3,(R1)+        ;Save R3 in memory location 46
2163 004270 010421 ;173270 010421          MOV      R4,(R1)+        ;Save R4 in memory location 50
2164 004272 010521 ;173272 010521          MOV      R5,(R1)+        ;Save R5 in memory location 52
2165 004274 010621 ;173274 010621          MOV      SP,(R1)+        ;Save SP in memory location 54
2166 004276 010021 ;173276 010021          MOV      RO,(R1)+        ;Save PC in memory location 56
2167 004300 000160 ;173300 000160          JMP      2(RO)           ;Return to the calling routine
2168 004302 000002 ;173302 000002
2169

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2170 :BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17)
2171 :BM873-YD.P11 RH11/RPO4 BOOTSTRAP AND DUMP ROUTINES
2172
2173
2174 : 176700 RPCS1 = 176700 ;Address of RH11/RPO4 Control & Status register 1
2175 : 000002 RPWC = 2 ;Offset to RH11/RPO4 Word Count register
2176 : 000006 RPDA = 6 ;Offset to RH11/RPO4 Track & Sector Address register
2177 : 000010 RPCS2 = 10 ;Offset to RH11/RPO4 Control & Status register 2
2178 : 000012 RPDS = 12 ;Offset to RH11/RPO4 Drive Status register
2179 : 000032 RPOF = 32 ;Offset to RH11/RPO4 Offset register (CONTAINING FMT22)
2180 : 000034 RPDC = 34 ;Offset to RH11/RPO4 Desired Cylinder register
2181
2182 : 040000 RPTRE = BIT14 ;"Transfer Error" bit in RPCS1
2183 : 020000 RPMCPE = BIT13 ;"Massbus Control Bus Parity Error" bit in RPCS1
2184 : 004000 RPDVA = BIT11 ;"Drive Available" bit in RPCS1
2185 : 100000 RPATA = BIT15 ;"Attention Active" bit in RPDS
2186 : 040000 RPERR = BIT14 ;"Composite Error" bit in RPDS
2187 : 010000 RPFMT = BIT12 ;"FMT22" (16-bit words) bit in RPOF
2188
2189 : 000021 RPPRST = 21 ;Read-in Preset
2190 : 000061 RPWRIT = 61 ;Write Data
2191 : 000071 RPREAD = 71 ;Read Data
2192
2193 : 000000 RPBfmt = 0 ;Bootstrap format (0 = 18-bit words; 2 = 16-bit words)
2194 : 000400 RPBWDC = 400 ;Word count for the secondary bootstrap from the RPO4
2195 : 000626 RPBCYL = 626 ;Bootstrap cylinder number
2196 : 000000 RPBTRK = 0 ;Bootstrap track number
2197 : 000000 RPBsCT = 0 ;Bootstrap sector number
2198
2199 : 000000 RPDFMT = 0 ;Dump format (0 = 18-bit words; 2 = 16-bit words)
2200 : 070000 RPDWDC = 70000 ;Word count for the core dump to the RPO4
2201 : 000631 RPDcYL = 631 ;Dump cylinder number
2202 : ; The following two assignments put the dump at the very end of the cylinder
2203 : 000015 RPDTRK = 15 ;Dump track number
2204 : 000010 RPDsCT = 10 ;Dump sector number
2205
2206
2207
2208 004304 111704 :173304 111704 BUTON2: MOVB (PC),R4 ;R4 = 5 indicates that button #2 was pressed
2209 004306 005005 :173306 005005 CLR R5 ;Clear "logical switch register"
2210 004310 005001 :173310 005001 CLR R1 ;Set unit number to zero
2211
2212 004312 012700 :173312 012700 RPB00T: MOV #<RPREAD*400>!<RPBSCT*10>,R0
2213 004314 034400 :173314 034400
2214 004316 012702 :173316 012702 MOV #-RPBWDC,R2
2215 004320 177400 :173320 177400
2216 004322 012703 :173322 012703 MOV #<RPBFMT*40000>!<RPBTRK*2000>!RPBCYL,R3
2217 004324 000626 :173324 000626
2218 004326 050100 :173326 050100 RPSTRT: BIS R1,R0 ;Put the unit number into R0
2219 004330 012701 :173330 012701 MOV #RPCS1,R1 ;Set R1 to the lowest address used by the RH11
2220 004332 176700 :173332 176700
    
```

J04

DOBNA MACY11 27(732) 22-SEP-76 14:43 PAGE 48
 DOBMAA.P11 MAINDEC-11-DOBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

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2221 ;BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 7
2222 ;BM873-YD.P11 RH11/RPO4 BOOTSTRAP AND DUMP ROUTINES
2223
2224 004334 000005 :173334 000005 RPL00P: RESET ;Reset in case of retry
2225 004336 010006 :173336 010006 MOV RO,SP ;Get the unit number into SP
2226 004340 042706 :173340 042706 BIC #1C7,SP ;Isolate the unit number
2227 004342 177770 :173342 177770
2228 004344 010661 :173344 010661 MOV SP,RPCS2(R1) ;Tell the RH11 the unit number
2229 004346 000010 :173346 000010
2230 004350 032711 :173350 032711 BIT #RPDVA,(R1) ;Try to seize this RPO4 unit
2231 004352 004000 :173352 004000
2232 004354 001767 :173354 001767 BEQ RPL00P ;Branch if we haven't seized it
2233 004356 012721 :173356 012721 MOV #RPPRST,(R1)+ ;Do a "Read-In Preset" function
2234 004360 000021 :173360 000021
2235 004362 010306 :173362 010306 MOV R3,SP ;Get the cylinder number into SP
2236 004364 042706 :173364 042706 BIC #1C1777,SP ;Isolate the cylinder number
2237 004366 176000 :173366 176000
2238 004370 010661 :173370 010661 MOV SP,RPDC-2(R1) ;Tell the RPO4 the cylinder number
2239 004372 000032 :173372 000032
2240 004374 010306 :173374 010306 MOV R3,SP ;Get the format bit and track number into SP
2241 004376 100003 :173376 100003 BPL RPCONT ;Branch if 20 sector (18-bit words) format
2242 004400 012761 :173400 012761 MOV #RPFMT,RPOF-2(R1) ;Establish 22 sector (16-bit words) format
2243 004402 010000 :173402 010000
2244 004404 000030 :173404 000030
2245 004406 006206 :173406 006206 RPCONT: ASR SP ;Right align the track
2246 004410 006206 :173410 006206 ASR SP ; number in the left byte
2247 004412 105006 :173412 105006 CLRB SP ;Clear the right byte
2248 004414 150006 :173414 150006 BISB RO,SP ;Put the sector number into the right byte
2249 004416 106006 :173416 106006 RORB SP ;Right align the
2250 004420 106206 :173420 106206 ASRB SP ; sector number in
2251 004422 106206 :173422 106206 ASRB SP ; the right byte
2252 004424 010661 :173424 010661 MOV SP,RPDA-2(R1) ;Tell the RH11 the track and sector numbers
2253 004426 000004 :173426 000004
2254 004430 010211 :173430 010211 MOV R2,(R1) ;Tell the RH11 the word count
2255 004432 010006 :173432 010006 MOV RO,SP ;Get the function code into SP
2256 004434 105006 :173434 105006 CLRB SP ;Clear the right byte
2257 004436 000306 :173436 000306 SWAB SP ;Right align the function code
2258 004440 010641 :173440 010641 MOV SP,-(R1) ;Tell the RPO4 the function code
2259 004442 105711 :173442 105711 RPDONE: TSTB (R1) ;Test for RH11 "ready"
2260 004444 100376 :173444 100376 BPL RPDONE ;Loop, waiting for RH11 "ready"
2261 004446 032711 :173446 032711 BIT #RPTRE!RPMCPE,(R1) ;Test for RH11 error bits
2262 004450 060000 :173450 060000
2263 004452 001330 :173452 001330 BNE RPL00P ;If error, branch back for retry
2264 004454 032761 :173454 032761 BIT #RPA!A!RPERR,RPDS(R1) ;Test for RPO4 error bits
2265 004456 140000 :173456 140000
2266 004460 000012 :173460 000012
2267 004462 001324 :173462 001324 BNE RPL00P ;If error, branch back for retry
2268 004464 022706 :173464 022706 CMP #RPREAD,SP ;Was the function a "normal read"?
2269 004466 000071 :173466 000071
2270 004470 001250 :173470 001250 BNE TCSTOP ;If not, branch to a HALT instruction
2271 004472 022737 :173472 022737 CMP #000240,#0 ;Was "000240" read into location zero?
2272 004474 000240 :173474 000240
2273 004476 000000 :173476 000000
2274 004500 001643 :173500 001643 BEQ GOT00 ;If so, branch to location zero
2275 004502 000000 :173502 000000 ;"000240" was not read into location zero
2276 004504 000641 :173504 000641 BR GOT00 ;Branch to location zero
  
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DDbMAA.P11 MAINDEC-11-DDbMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

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2277  
2278  
2279 004506 010037 ;173506 010037 RPDUMP: MOV RO,2#ROTOR7 ;SAVE RO IN PDP-11 MEMORY LOCATION "ROTOR7"  
2280 004510 000040 ;173510 000040  
2281 004512 010700 ;173512 010700 MOV PC,RO ;USE RO FOR A SUBROUTINE RETURN ADDRESS  
2282 004514 000657 ;173514 000657 BR REGSAV ;GO TO THE "REGISTER SAVING" SUBROUTINE  
2283 004516 012700 ;173516 012700 MOV #<RPWRIT*400>!<RPDSCT*10>,RO  
2284 004520 030500 ;173520 030500  
2285 004522 012702 ;173522 012702 MOV #-RPDWDC,R2  
2286 004524 110000 ;173524 110000  
2287 004526 012703 ;173526 012703 MOV #<RPDFMT*40000>!<RPDTRK*2000>!RPDCYL,R3  
2288 004530 032631 ;173530 032631  
2289 004532 000676 ;173532 000676 BR RPSTRT  
2290
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2291      ;BM873-YD      - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17)  MACY11 27(657) 18-DEC-74 11:59 PAGE 8
2292      ;BM873-YD.P11  DTE20 DEVICE REGISTER AND BIT DEFINITIONS
2293
2294
2295      ;           174400 DTEBAS=174400      ;BASE OF (FIRST) DTE20 DEVICE REGISTER BLOCK
2296      ;           000040 DTESIZ=000040      ;SPACING BETWEEN CONSECUTIVE DTE20'S
2297      ;           000004 DTEMAX=4           ;MAXIMUM NUMBER OF DTE20'S ON ONE PDP-11
2298
2299
2300      ;           ;OFFSETS FROM THE BASE OF THE DTE20 DEVICE REGISTER BLOCK
2301      ;           ;TO SPECIFIC 10/11 INTERFACE RAM LOCATIONS AND REGISTERS.
2302
2303      ; THE FIRST 12 REGISTERS ARE NOT INITIALIZED BY "INIT" (BECAUSE THEY ARE IN RAMS
2304      ;           000000 DLYCNT=00           ;DELAY COUNT (ADDRESS XXXX00)
2305      ;           000002 DEXWD3=02           ;DEPOSIT OR EXAMINE WORD 3 (ADDRESS XXXX02)
2306      ;           000004 DEXWD2=04           ;DEPOSIT OR EXAMINE WORD 2 (ADDRESS XXXX04)
2307      ;           000006 DEXWD1=06           ;DEPOSIT OR EXAMINE WORD 1 (ADDRESS XXXX06)
2308      ;           000010 TENAD1=10           ;10 ADDRESS WORD 1 FOR DEX (ADDRESS XXXX10)
2309      ;           000012 TENAD2=12           ;10 ADDRESS WORD 2 FOR DEX (ADDRESS XXXX12)
2310      ;           000014 T010BC=14          ;T010 BYTE COUNT (ADDRESS XXXX14)
2311      ;           000016 T011BC=16          ;T011 BYTE COUNT (ADDRESS XXXX16)
2312      ;           000020 T010AD=20          ;T010 PDP11 MEMORY ADDRESS (ADDRESS XXXX20)
2313      ;           000022 T011AD=22          ;T011 PDP11 MEMORY ADDRESS (ADDRESS XXXX22)
2314      ;           000024 T010DT=24         ;T010 PDP11 DATA WORD (ADDRESS XXXX24)
2315      ;           000026 T011DT=26         ;T011 PDP11 DATA WORD (ADDRESS XXXX26)
2316
2317      ; THE LAST 4 REGISTERS ARE INITIALIZED BY "INIT" (BECAUSE THEY ARE IN FLIP-FLOPS
2318      ;           000030 DIAG1=30           ;DIAGNOSTIC WORD 1 (ADDRESS XXXX30)
2319      ;           000032 DIAG2=32           ;DIAGNOSTIC WORD 2 (ADDRESS XXXX32)
2320      ;           000034 STATUS=34         ;10/11 INTERFACE STATUS WORD (ADDRESS XXXX34)
2321      ;           000036 DIAG3=36           ;DIAGNOSTIC WORD 3 (ADDRESS XXXX36)
2322
2323
2324      ; THE FOLLOWING ARE THE ADDRESSES OF THE DTE20 INTERRUPT VECTORS
2325
2326      ;           000774 DTEIV1=774         ;INTERRUPT VECTOR FOR DTE20 #1
2327      ;           000770 DTEIV2=770         ;INTERRUPT VECTOR FOR DTE20 #2
2328      ;           000764 DTEIV3=764         ;INTERRUPT VECTOR FOR DTE20 #3
2329      ;           000760 DTEIV4=760         ;INTERRUPT VECTOR FOR DTE20 #4
2330
2331
2332      ; Bit assignments for various DTE20 registers used by this ROM code
2333
2334      ;           ;BIT ASSIGNMENTS FOR T010BC
2335
2336
2337      ;           100000 INT11=BIT15         ;SET DONE AND INTERRUPT BOTH 10 AND 11
2338
2339      ;           ;BIT ASSIGNMENTS FOR T011BC
2340
2341      ;           100000 INT10=BIT15         ;SET DONE AND INTERRUPT BOTH 10 AND 11
2342      ;           040000 ZSTOP=BIT14        ;STOP ON NULL (ZERO) CHARACTER
2343      ;           020000 T011BM=BIT13       ;Byte size for To-11 byte transfers
2344

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DOBMA MACY11 27(732) 22-SEP-76 14:43 PAGE 51
 DOBMAA.P11 MAINDEC-11-DOBMA-A BMB73

UNIVERSAL RESTART LOADER DIAGNOSTIC.

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2345 ;BMB73-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17)
2346 ;BMB73-YD.P11 DTE20 DEVICE REGISTER AND BIT DEFINITIONS
2347
2348 ;BIT ASSIGNMENTS FOR DIAG2 (WRITE)
2349 ; 000100 DRESET=BIT6 ;PERFORM DIAGNOSTIC CLEAR
2350
2351 ;BIT ASSIGNMENTS FOR DIAG3 (READ)
2352 ; 000020 DUPE=BIT4 ;DATO UNIBUS parity error
2353 ; 000004 DURE=BIT2 ;DATO UNIBUS receive error
2354 ; 000002 NUPE=BIT1 ;NPR UNIBUS parity error
2355
2356 ;BIT ASSIGNMENTS FOR DIAG3 (WRITE)
2357
2358 ; 000020 CDD=BIT4 ;Clear DUPE and DURE error flags
2359 ; 000002 CNUPE=BIT1 ;Clear NUPE error flag
2360 ; 000001 T010BM=BIT0 ;Byte size for To-10 Byte transfer
2361
2362 ;BIT ASSIGNMENTS FOR STATUS (WRITE)
2363
2364 ; 100000 DON10S=BIT15 ;SET T010 DONE
2365 ; 040000 DON10C=BIT14 ;CLEAR T010 DONE
2366 ; 020000 ERR10S=BIT13 ;SET T010 ERROR
2367 ; 010000 ERR10C=BIT12 ;CLEAR T010 ERROR
2368 ; 004000 INT11S=BIT11 ;Ring the PDP-11's doorbell (interrupts the -11)
2369 ; 002000 INT11C=BIT10 ;Stop ringing the PDP-11's doorbell
2370 ; 001000 PERCLR=BIT9 ;CLEAR -11 MEMORY PARITY ERROR
2371 ; 000400 INT10S=BIT8 ;Ring the PDP-10's doorbell (interrupts the -10)
2372 ; 000200 DON11S=BIT7 ;SET T011 DONE
2373 ; 000100 DON11C=BIT6 ;CLEAR T011 DONE
2374 ; 000040 INTRON=BIT5 ;Enable DTE20 interrupts to the -11
2375 ; 000020 EBUSPC=BIT4 ;Clear "EBUS parity error"
2376 ; 000010 INTROF=BIT3 ;Disable the PDP-11 interrupts
2377 ; 000004 EBUSPS=BIT2 ;SET "EBUS parity error"
2378 ; 000002 ERR11S=BIT1 ;SET T011 ERROR
2379 ; 000001 ERR11C=BIT0 ;CLEAR T011 ERROR
2380
2381 ;BIT ASSIGNMENTS FOR STATUS (READ)
2382
2383 ; 100000 T010DN=BIT15 ;T010 DONE
2384 ; 020000 T010ER=BIT13 ;TO 10 ERROR (NPR TIMEOUT OR BUS ERROR)
2385 ; 010000 RAMISO=BIT12 ;RAM word read is all zeros
2386 ; 004000 T011DB=BIT11 ;1 = the PDP11's doorbell is ringing
2387 ; 002000 DXWRD1=BIT10 ;DEPOSIT OR EXAMINE WORD ONE
2388 ; 001000 MPE11=BIT9 ;Parity error within PDP-11 memory
2389 ; 000400 T010DB=BIT8 ;1 = the PDP-10's doorbell is ringing
2390 ; 000200 T011DN=BIT7 ;T011 DONE
2391 ; 000100 EBSEL=BIT6 ;E BUFFER SELECT
2392 ; 000040 NULSTP=BIT5 ;NULL STOP
2393 ; 000020 BPARER=BIT4 ;EBUS parity error
2394 ; 000010 RSTRCT=BIT3 ;This PDP-11 is "RESTRICTED"
2395 ; 000004 DEXDON=BIT2 ;DEPOSIT OR EXAMINE DONE
2396 ; 000002 T011ER=BIT1 ;TO 11 ERROR (NPR TIMEOUT OR BUS ERROR)
2397 ; 000001 INTSON=BIT0 ;DTE20 interrupts (to the -11) are enabled

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The following is the procedure which the KL10 executes in order to dump and/or bootstrap the PDP-11 through the DTE20:

1. Clear the DTE20 and initiate a BM873 button #4 bootstrap operation
 - CONO [SR11B!CL11PT!CLT011!CLT010!PILDEN]
2. Wait to see PDP-11 power fail (AC LOW = true) - CONI [DEAD11] = 1
3. Wait to see PDP-11 power recover (AC LOW = false) - CONI [DEAD11] = 0
4. Wait at least another 150 milliseconds and then clear the reload -11 button
 - CONO [CR11B]
5. Set byte counter to a special code (1365 octal) - DATA0 [1365]
6. Ring PDP-11's doorbell - CONO[T011DB]
7. Wait until "-10 ringing -11's doorbell" is turned off by the -11
 (i.e. until CONI[T011DB] becomes zero).
8. Enable the DTE20 to use PI 0 interrupts
 (i.e. set CONO[PILDEN!PIOENB]).
9. Set up the To-10 byte pointer (in the EPT) for the first 3.5K.
10. Set up the byte counter for the first 3.5K, indicating
 "interrupt -10 only" - DATA0 [1000]
11. Wait for "TO-10 done" or "To-10 error" - CONI [T010DN!T010ER]
12. Note whether there was an error (CONI [T010ER]) and then turn off
 T010DN and T010ER - CONO [CLT010]. If error, go to step 17.
13. If end of 28K, go to step 17.
14. Set up To-10 byte pointer (in the EPT) for the next 3.5K.
15. Set up the byte counter for the next 3.5K indicating
 "interrupt -10 only" (DATA0 [1000]), unless this is the
 last 3.5K (of 28K), in which case indicate "interrupt
 both processors" (DATA0 [T010IB!1000]).
16. Go to step 11.

:BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 1
:BM873-YD.P11 PROCEDURE BY WHICH THE PDP-10 BOOTSTRAPS AND/OR DUMPS THE PDP-11

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- 17. Set up To-11 byte pointer (in the EPT) for "PDP-11 bootstrap".
Note that the first word of this "PDP-11 bootstrap" must be the bit pattern 000240 (a PDP-11 NOP instruction).
- 18. Ring the PDP-11's doorbell - CONO [TO11DB]
- 19. Wait for either TO11DB to go off (CONI[TO11DB] = 0),
or TO10DB to come on (CONI[TO10DB] = 1).
- 20. If no error was noted in step 12, TO11DB should go off (TO10DB coming on indicates a massive screwup).
If an error was noted in step 12, TO11DB going off indicates that the error was "non-fatal" (non-ex-mem or -11 memory parity) and the -11 is proceeding. TO10DB coming on indicates that the error was "fatal" and the -11 is HALTED AT LOCATION 173714. In this latter case the -10 must restart from step 1.
- 21. If TO11DB went off, wait for "To-11 done" or "To-11 error"
- CONI [TO11DN!TO11ER]
- 22. Note whether there was an error - CONI [TO11ER]
- 23. Turn off TO11DN and TO11ER and ring the PDP-11's doorbell
- CONO [TO11DB!CLTO11]
- 24. Wait for either TO11DB to go off (CONI[TO11DB] = 0),
or TO10DB to come on (CONI[TO10DB] = 1).
- 25. TO11DB going off indicates that the PDP-11 found no errors and is transferring control to the code which was just received from the -10. In this case the -10 should start following the protocol of this code.
- 26. TO10DB coming on indicates that the PDP-11 has found an error (or that the first word transmitted wasn't the bit pattern 000240), and the PDP-11 is HALTED AT LOCATION 173766. In this case the -10 must restart from step 1.

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2499 ;BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 1
2500 ;BM873-YD.P11 BUTTON #4 - BOOTSTRAP INITIATED BY THE PDP-10 (THROUGH DTE20)
2501
2502
2503 : 000130 DTECOR = 130 ;Core address into which to store DTE20 regs.
2504 : 000014 DTEREG = 12 ;Number of DTE20 registers to store
2505 : 000400 DTEWDC = 256 ;Word count for secondary bootstrap from the -10
2506 ; ENTER HERE WHEN THE DTE20 PASSES BUTTON #4 (BOOTSTRAP INITIATED
2507 ; BY THE PDP-10, THROUGH THE DTE20)
2508 004534 010037 :173534 010037 BUTON4: MOV RO,2@ROTOR7 ;SAVE RO IN PDP-11 MEMORY LOCATION "ROTOR7"
2509 004536 000040 :173536 000040
2510 004540 010700 :173540 010700 MOV PC,RO ;USE RO FOR A SUBROUTINE RETURN ADDRESS
2511 004542 000644 :173542 000644 BR REGSAV ;GO TO THE "REGISTER SAVING" SUBROUTINE
2512 004544 005005 :173544 005005 CLR R5 ;SET R5 = 0
2513 004546 012501 :173546 012501 MOV (R5)+,R1 ;SAVE LOCATION 0 IN R1
2514 004550 012503 :173550 012503 MOV (R5)+,R3 ;SAVE LOCATION 2 IN R3
2515 004552 012504 :173552 012504 MOV (R5)+,R4 ;SAVE LOCATION 4 IN R4
2516 004554 011500 :173554 011500 MOV (R5),RO ;SAVE LOCATION 6 IN RO
2517 004556 012715 :173556 012715 MOV #PR7,(R5) ;SET UP PRIORITY FOR NON-EX-MEM TRAP
2518 004560 000340 :173560 000340
2519 004562 005745 :173562 005745 10$: TST -(R5) ;SET R5 = 4
2520 004564 012702 :173564 012702 MOV #DTEBAS-DTESIZ,R2
2521 004566 174340 :173566 174340
2522 004570 010715 :173570 010715 MOV PC,(R5) ;STORE ADDRESS FOR NON-EX-MEM TRAP
2523 004572 010506 :173572 010506 MOV R5,SP ;SET STACK POINTER = 4
2524 004574 062702 :173574 062702 11$: ADD #DTESIZ,R2 ;R2 POINTS TO THE NEXT DTE20
2525 004576 000040 :173576 000040
2526 004600 105702 :173600 105702 TSTB R2
2527 004602 100770 :173602 100770 BMI 10$ ;START LOOKING FROM THE BEGINNING AGAIN
2528 004604 032762 :173604 032762 BIT #T011DB,STATUS(R2) ;Is this -10 ringing the -11's doorbell?
2529 004606 004000 :173606 004000
2530 004610 000034 :173610 000034
2531 004612 001770 :173612 001770 BEQ 11$ ;If it is not, go look for another -10
2532 004614 026217 :173614 026217 CMP T010BC(R2),(PC) ;CHECK FOR A CODE (1365) FROM THE PDP-10
2533 004616 000014 :173616 000014
2534 ;INDICATING THAT IT WANTS TO BOOTSTRAP THE -11
2535 004620 001365 :173620 001365 BNE 11$
2536 ; NOTE THAT AT THIS POINT R2 CONTAINS THE ADDRESS OF THE DEVICE REGISTER
2537 ; BLOCK FOR THIS DTE20, THAT R5 = 4, AND THAT SP = 4
2538 004622 005725 :173622 005725 TST (R5)+ ;SET R5 = 6
2539 004624 010015 :173624 010015 MOV RO,(R5) ;RESTORE THE CONTENTS OF LOCATION 6
2540 004626 010445 :173626 010445 MOV R4,-(R5) ;RESTORE THE CONTENTS OF LOCATION 4
2541 004630 010345 :173630 010345 MOV R3,-(R5) ;RESTORE THE CONTENTS OF LOCATION 2
2542 004632 010145 :173632 010145 MOV R1,-(R5) ;RESTORE THE CONTENTS OF LOCATION 0
2543 ; Note: At this time R5 = 0. This fact will be used later.
2544 004634 012700 :173634 012700 MOV #DTECOR,RO ;RO = core address for storing DTE20 registers
2545 004636 000130 :173636 000130
2546 004640 010204 :173640 010204
2547 004642 012420 :173642 012420 7$: MOV R2,R4
2548 004644 022700 :173644 022700 MOV (R4)+,(RO)+ ;Save the next DTE20 register in core
2549 004646 000160 :173646 000160 CMP #<DTEREG*2>+DTECOR,RO ;Have we finished yet?
2550 004650 101374 :173650 101374 BHI 7$ ;Loop until we have finished
  
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2551 ;BM873-YD - KL10 (PDP-11) 256 WORD BOOTSTRAP ROM VERSION 2(17) MACY11 27(657) 18-DEC-74 11:59 PAGE 1
2552 ;BM873-YD.P11 BUTTON #4 - BOOTSTRAP INITIATED BY THE PDP-10 (THROUGH DTE20)
2553 ;
2554 004652 010201 ;173652 010201 MOV R2,R1 ;R1 = DTE20 DEVICE REGISTER BLOCK
2555 004654 062701 ;173654 062701 ADD #DIAG2,R1
2556 004656 000032 ;173656 000032
2557 004660 012721 ;173660 012721 MOV #DRESET,(R1)+ ;DO A "DIAGNOSTIC CLEAR" OF THE DTE20,
2558 004662 000100 ;173662 000100
2559 ; The above operation is necessary to clear the "byte count loaded" flag
2560 ; and simultaneously to turn off "-10 ringing -11's doorbell".
2561 004664 005012 ;173664 005012 CLR (R2) ;SET DTE20 FOR NO DELAY
2562 004666 005062 ;173666 005062 CLR T010AD(R2) ;START WRITING -11 MEMORY INTO THE -10.
2563 004670 000020 ;173670 000020
2564 004672 032711 ;173672 032711 6S: BIT #T011DB,(R1) ;HAS THE -10 RUNG THE -11'S DOORBELL?
2565 004674 004000 ;173674 004000
2566 004676 001775 ;173676 001775 BEQ 6S ;LOOP UNTIL IT HAS.
2567 004700 032762 ;173700 032762 BIT #DUPE!DURE!NUPE,DIAG3(R2) ;"Fatal" error?
2568 004702 000026 ;173702 000026
2569 004704 000036 ;173704 000036
2570 004706 001403 ;173706 001403 BEQ 8S ;Branch if no "fatal" error
2571 004710 012711 ;173710 012711 MOV #T010DB,(R1) ;Signal "fatal" error to the PDP-10
2572 004712 000400 ;173712 000400
2573 004714 000000 ;173714 000000 2S: HALT ;Halt due to "fatal" error
2574 004716 012762 ;173716 012762 8S: MOV #DRESET,DIAG2(R2) ;Reset after possible PDP-11
2575 004720 000100 ;173720 000100
2576 004722 000032 ;173722 000032
2577 ; memory parity error or non-ex-mem error, and also turn off
2578 ; "-10 ringing -11's doorbell".
2579 004724 005062 ;173724 005062 3S: CLR T011AD(R2) ;START INPUTTING AT LOCATION 0
2580 004726 000022 ;173726 000022
2581 004730 012762 ;173730 012762 MOV #INT10!<<-DTEWDC>&7777>,T011BC(R2) ;READ IN 256 WORDS
2582 004732 107400 ;173732 107400
2583 004734 000016 ;173734 000016
2584 004736 032711 ;173736 032711 1S: BIT #T011DB,(R1) ;HAS THE -10 RUNG THE -11'S DOORBELL?
2585 004740 004000 ;173740 004000
2586 004742 001775 ;173742 001775 BEQ 1S ;LOOP UNTIL IT HAS.
2587 004744 132711 ;173744 132711 4S: BITB #T011DN!T011ER,(R1) ;IS THE TRANSMISSION FINISHED?
2588 004746 000202 ;173746 000202
2589 004750 001775 ;173750 001775 BEQ 4S ;LOOP UNTIL IT IS FINISHED
2590 004752 100003 ;173752 100003 BPL 5S ;If "T011DN" isn't on, "T011ER" must be on
2591 004754 022715 ;173754 022715 CMP #000240,(R5) ;Check for bit pattern in location zero
2592 004756 000240 ;173756 000240
2593 004760 001403 ;173760 001403 BEQ 9S ;Unless there is a "NOP" it is an error
2594 004762 012711 ;173762 012711 5S: MOV #T010DB,(R1) ;Signal the -10 that there was an error
2595 004764 000400 ;173764 000400
2596 004766 000000 ;173766 000000 12S: HALT ;This error halt is because either "T011ER"
2597 ; is on, or because the bit pattern read into location zero wasn't "000240".
2598 004770 012762 ;173770 012762 9S: MOV #DRESET,DIAG2(R2) ;Signal the -10 that everything is OK
2599 004772 000100 ;173772 000100
2600 004774 000032 ;173774 000032
2601 004776 END.YD:
2602 004776 000115 ;173776 000115 JMP (R5) ;Jump to location zero
2603 ; 000001 .END
    
```

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DOBMAA.P11 MAINDEC-11-DOBMA-A BMB73 UNIVERSAL RESTART LOADER DIAGNOSTIC.

2604	005000	000177	MAP.YE:	.BLKW	127.
2605	005376	000001	END.YE:	.BLKW	1
2606	005400	000127	MAP.YF:	.BLKW	127
2607	005656	000001	END.YF:	.BLKW	1
2608	005660	000127	MAP.YG:	.BLKW	127
2609	006136	000001	END.YG:	.BLKW	1
2610	006140	000177	MAP.Y:	.BLKW	127.
2611	006536	000001	END.Y:	.BLKW	1
2612	006540	000177	MAP.YX:	.BLKW	127.
2613	007136	000001	END.YX:	.BLKW	1

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2614
2615
2616
2617
2618
2619 007140 005037 010222
2620 007144 005037 010212
2621 007150 012706 001200
2622 007154 013737 177570 010210
2623 007162 005037 015176
2624 007166 005037 001244
2625 007172 005037 000000
2626 007176 012737 007150 014652
2627 007204 012737 000006 000004
2628 007212 005037 000006
2629 007216 005037 014076
2630 007222 005737 000042
2631 007226 001563
2632 007230 013746 000004
2633 007234 012737 010226 000004
2634 007242 005737 173000
2635 007246 000240
2636 007250 012637 000004
2637 007254 023737 001400 173000
2638 007262 001034
2639 007264 013746 000004
2640 007270 012737 007312 000004
2641 007276 005737 173400
2642 007302 000240
2643 007304 012637 000004
2644 007310 000421
2645 007312 022626 655:
2646 007314 012637 000004
2647 007320 012737 001400 010212
2648 007326 012737 001776 010214
2649 007334 012737 173376 010224
2650 007342 012737 000101 015020
2651 007350 000137 010434
2652 007354
2653 007354 023737 002000 173000 645:
2654 007362 001016
2655 007364 012737 002000 010212
2656 007372 012737 002776 010214
2657 007400 012737 173776 010224
2658 007406 012737 000102 015020
2659 007414 000137 010434
2660 007420
2661 007420 023737 003000 173000 695:
2662 007426 001036
2663 007430 013746 000004
2664 007434 012737 007460 000004
2665 007442 023737 003400 173400
2666 007450 001004
2667 007452 012637 000004
2668 007456 000404
2669 007460 022626 765:

```

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*****
INITIALIZATION AND START UP OF PROGRAM.
*****

RESTR: CLR INITFG ; INITIALIZE TO ASK WHICH TYPE
CLR TABLE ; INITIALIZE TO ASK WHICH TYPE
START: MOV #STACK, SP ; SET THE STACK POINTER
MOV SWR, SAVSR1 ; SAVE THE SWITH REGISTER
CLR LPTFLG ; SET FOR NON- LINE PRINTER OUTPUT
CLR LSTERR ; CLEAR ERROR FLG REPORT
CLR J#0 ; SET FOR UNEXPECTED TRAP TO ADD 0
MOV #START, PRG.NO ; GET READY FOR PWR FAIL BEFORE FIRST TEST.
MOV #6, J#4 ; SET TIME OUT TRAP VECTOR
CLR J#6 ; SET TIME OUT STATUS TO 0
CLR FLAG4 ; CLEAR TEST 4 INITIAL FLAG
TST J#42 ; AM I RUNNING UNDER ACT-11??
BEQ CONT ; BR IF #NOT* UNDER ACT-11!!
MOV J#4, -(SP) ; SAV TRAP POINTER
MOV #NOROM, J#4 ; PUT IN A NEW ONE
TST J#173000 ; TRY TO READ THE ROM
NOP ; WAIT FOR POSSIBLE TRAP
MOV (SP)+, J#4 ; IF NO TRAP RESTORE POINTER
CMP MAP.YA, J#173000 ; DOES 1ST WORD COMPARE?
BNE 645 ; CHECK NEXT MAP
MOV J#4, -(SP) ; SAVE LOC 4
MOV #655, J#4 ; SET FOR TIMEOUT
TST J#173400 ; READ FROM 173400
NOP ; IF NO TIMEOUT, NOT YA
MOV (SP)+, J#4 ; RESTORE LOC 4
BR 645
655: CMP (SP)+, (SP)+ ; ADJUST STACK
MOV (SP)+, J#4 ; RESTORE LOC 4
MOV #MAP.YA, TABLE ; 1ST MAP ADDR
MOV #END.YA, ALLEND ; LAST MAP ADDR
MOV #173376, LASTA ; LAST ROM ADDR
MOV #000101, VERSON ; SET ROM TYPE
JMP PRG1 ; START TEST 1
645: CMP MAP.YB, J#173000 ; DOES 1ST WORD COMPARE?
BNE 695 ; CHECK NEXT MAP
MOV #MAP.YB, TABLE ; 1ST MAP ADDR
MOV #END.YB, ALLEND ; LAST MAP ADDR
MOV #173776, LASTA ; LAST ROM ADDR
MOV #000102, VERSON ; SET ROM TYPE
JMP PRG1 ; START TEST 1
695: CMP MAP.YC, J#173000 ; DOES 1ST WORD COMPARE?
BNE 745 ; CHECK NEXT MAP
MOV J#4, -(SP) ; SAVE LOC 4
MOV #765, J#4 ; SET FOR TIMEOUT
CMP MAP.YC+400, J#173400 ; IS IT YC?
BNE 775 ; BR IF NOT YC
MOV (SP)+, J#4 ; RESTORE LOC 4
BR 785 ; YES IT IS A YC
765: CMP (SP)+, (SP)+ ; ADJUST STACK

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 DOBMAA.P11 MAINDEC-11-DOBMA-A BM873

UNIVERSAL RESTART LOADER DIAGNOSTIC.

2670	007462	012637	000004		77S:	MOV	(SP)+,2#4	;RESTORE LOC 4
2671	007466	000416				BR	74S	;CHECK NEXT MAP
2672	007470				78S:			
2673	007470	012737	003000	010212		MOV	#MAP.YC, TABLE	;1ST MAP ADDR
2674	007476	012737	003776	010214		MOV	#END.YC, ALLEND	;LAST MAP ADDR
2675	007504	012737	173776	010224		MOV	#173776, LASTA	;LAST ROM ADDR
2676	007512	012737	000103	015020		MOV	#000103, Verson	;SET ROM TYPE
2677	007520	000137	010434			JMP	PRG1	;START TEST 1
2678	007524				74S:			
2679	007524	023737	004000	173000		CMP	MAP.YD,2#173000	;DOES 1ST WORD COMPARE?
2680	007532	001016				BNE	79S	;CHECK NEXT MAP
2681	007534	012737	004000	010212		MOV	#MAP.YD, TABLE	;1ST MAP ADDR
2682	007542	012737	004776	010214		MOV	#END.YD, ALLEND	;LAST MAP ADDR
2683	007550	012737	173776	010224		MOV	#173776, LASTA	;LAST ROM ADDR
2684	007556	012737	000104	015020		MOV	#000104, Verson	;SET ROM TYPE
2685	007564	000137	010434			JMP	PRG1	;START TEST 1
2686	007570				79S:			
2687	007570	104401	010326			TYPE	,NMATCH	;NOT BM873YA OR B OR C OR D
2688	007574	000000				HALT		
2689	007576	005737	010222		CONT:	TST	INITFG	;IS THIS THE FIRST TIME START UP?
2690	007602	001123				BNE	3S	;BR IF NOT FIRST TIME HERE.
2691	007604	005137	010222			COM	INITFG	;SET THE FLAG
2692	007610	032737	000001	177570		BIT	#SW00, SWR	
2693	007616	001023				BNE	1S	
2694	007620	104401	011016		2S:	TYPE	BM873X	;TYPE THE QUESTION.
2695	007624	105777	171354			TSTB	TKCSR	;WAIT FOR KEY TO BE HIT
2696	007630	100375				BPL	-4	;KEEP WAITING
2697	007632	104406				KEY.TO.R2		;ECHO AND STRIP BIT 7
2698	007634	022702	000052			CMP	#52, R2	;WAS * HIT??
2699	007640	001011				BNE	64S	;BR IF NO
2700	007642	012737	006140	010212		MOV	#MAP.Y., TABLE	;SET FOR START OF TABLE
2701	007650	012737	006536	010214		MOV	#END.Y., ALLEND	;SET END OF TABLE
2702	007656	012737	173376	010224		MOV	#173376, LASTA	;SET LAST ROM ADDR
2703	007664				64S:			
2704	007664	000402				BR	4S	
2705	007666	013702	177570		1S:	MOV	SWR, R2	
2706	007672				4S:			
2707	007672	022702	000101			CMP	#101, R2	;WAS A HIT??
2708	007676	001011				BNE	65S	;BR IF NO
2709	007700	012737	001400	010212		MOV	#MAP.YA, TABLE	;SET FOR START OF TABLE
2710	007706	012737	001776	010214		MOV	#END.YA, ALLEND	;SET END OF TABLE
2711	007714	012737	173376	010224		MOV	#173376, LASTA	;SET LAST ROM ADDR
2712	007722				65S:			
2713	007722	022702	000102			CMP	#102, R2	;WAS B HIT??
2714	007726	001011				BNE	66S	;BR IF NO
2715	007730	012737	002000	010212		MOV	#MAP.YB, TABLE	;SET FOR START OF TABLE
2716	007736	012737	002776	010214		MOV	#END.YB, ALLEND	;SET END OF TABLE
2717	007744	012737	173776	010224		MOV	#173776, LASTA	;SET LAST ROM ADDR
2718	007752				66S:			
2719	007752	022702	000103			CMP	#103, R2	;WAS C HIT??
2720	007756	001011				BNE	67S	;BR IF NO
2721	007760	012737	003000	010212		MOV	#MAP.YC, TABLE	;SET FOR START OF TABLE
2722	007766	012737	003776	010214		MOV	#END.YC, ALLEND	;SET END OF TABLE
2723	007774	012737	173776	010224		MOV	#173776, LASTA	;SET LAST ROM ADDR
2724	010002				67S:			
2725	010002	022702	000104			CMP	#104, R2	;WAS D HIT??

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 DDBMAA.P11 MAINDEC-11-DDBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

2726	010006	001011				BNE	68\$:BR IF NO
2727	010010	012737	004000	010212		MOV	#MAP.YD, TABLE	:SET FOR START OF TABLE
2728	010016	012737	004776	010214		MOV	#END.YD, ALLEND	:SET END OF TABLE
2729	010024	012737	173776	010224		MOV	#173776, LASTA	:SET LAST ROM ADDR
2730	010032				68\$:			
2731	010032	010237	015020			MOV	R2, VERNON	:STORE VERSION TYPE.
2732	010036	005737	010212			TST	TABLE	:HAS A MAP BEEN SELECTED?
2733	010042	001003				BNE	3\$:BR IF OK...
2734	010044	104401	011050			TYPE	, BM.ERR	:TYPE ERROR
2735	010050	000663				BR	2\$:GO AND GET CORRECT MAP.
2736	010052	104401	014234		3\$:	TYPE	, MSG3	:TYPE MESSAGE FOR TEST NUMBER
2737	010056	012704	000002			MOV	#2, R4	:SET FOR MAX 2 INPUTS FROM TTY
2738	010062	005003			X.X.:	CLR	R3	:CLEAR CHAR STORAGE
2739	010064	032737	000001	177570		BIT	#SW00, SWR	
2740	010072	001013				BNE	6\$	
2741	010074	105777	171104		1\$:	TSTB	BTKCSR	:WAIT FOR THE TTY KEY TO BE HIT
2742	010100	100375				BPL	1\$:KEEP WAITING.
2743	010102	104406				KEY.TO.R2		:GO ECHO IT ;STRIP BIT 7 FROM IT
2744	010104	022702	000015			CMP	#15, R2	:WAS IT A CR???
2745	010110	001407				BEQ	2\$:BR IF CR
2746	010112	005304				DEC	R4	:ONE MORE CHAR TO GO BEFOR ERROR
2747	010114	001431				BEQ	3\$:IF R4=0 THEN ERROR
2748	010116	010203				MOV	R2, R3	:MOV THE CHAR TO R3
2749	010120	000765				BR	1\$:GO WAIT FOR ANOTHER CHAR
2750	010122	000000			6\$:	HALT		
2751	010124	013703	177570			MOV	SWR, R3	
2752	010130	022703	000061		2\$:	CMP	#61, R3	:WAS 1 HIT??
2753	010134	001002				BNE	+6	:BR IF NO
2754	010136	000137	010434			JMP	PRG1	:GOTO PRG 1
2755	010142	022703	000062			CMP	#62, R3	:WAS 2 HIT??
2756	010146	001002				BNE	+6	:BR IF NO
2757	010150	000137	011116			JMP	PRG2	:GOTO PRG 2
2758	010154	022703	000063			CMP	#63, R3	:WAS 3 HIT??
2759	010160	001002				BNE	+6	:BR IF NO
2760	010162	000137	012152			JMP	PRG3	:GOTO PRG3
2761	010166	022703	000064			CMP	#64, R3	:WAS 4 HIT??
2762	010172	001002				BNE	+6	:BR IF NO
2763	010174	000137	013410			JMP	PRG4	:GOTO PRG 4
2764	010200	104401	014466		3\$:	TYPE	, M.QM	:NEITHER 1 OR 2 OR 3 OR 4 WAS HIT
2765	010204	000137	007140			JMP	RESTRT	:TYPE "???" GO TO THE BEGINING.
2766	010210	000000			SAVSR1:	0		:SAVE THE SWR HERE.
2767	010212	000000			TABLE:	0		
2768	010214	000000			ALLEND:	0		
2769	010216	006540			EXTMAP:	MAP.YX		
2770	010220	007136			EXTEND:	END.YX		
2771	010222	000000			INITFG:	0		
2772	010224	000000			LASTA:	0		
2773	010226	104401	010236		NOROM:	TYPE	, NOROMS	:TYPE CAN'T FIND A RESPONSE
2774	010232	000000				HALT		:NO LOADER INSTALLED?
2775	010234	000776				BR	.-2	
2776	010236	005015	051124	050101	NOROMS:	.ASCII	<15><12>/TRAP TO 4 ON 1ST READ OF 173000/	
	010277	015	044412	020123		.ASCIZ	<15><12>/IS LOADER INSTALLED?/	
	010326	005015	040503	023516	NMATCH:	.ASCII	<15><12>/CAN'T IDENTIFY LOADER AS YA, YB, YC, OR YD AFTER/	
	010406	005015	046503	020120		.ASCIZ	<15><12>/CMP WITH LOC 173000/	
					.EVEN			

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 DDBMAA.P11 MAINDEC-11-DDBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

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2777
2778
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2781
2782
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2786
2787 010434 012777 014500 170552 PRG1:  MOV      #.KEY.TO.R2,@TKVEC
2788 010442 012777 000100 170534      MOV      #100,@TKCSR      ;SET INTERRUPT ENABLE
2789 010450 012737 010434 014652      MOV      #PRG1,PRG.NO    ;SET FOR PWR FAIL
2790 010456 012737 000500 001232      MOV      #500,ICOUNT    ;DO THIS TEST 500(8) TIMES.
2791 010464 012737 014654 000004 PRG.1:  MOV      #NO.TRAP,@#4    ;SET FOR UNEXPECTED TRAP.
2792 010472 012700 173000      MOV      #173000,R0     ;SET BEGGINING ADDRESS
2793 010476 012737 010522 001230      MOV      #2$,LOCK      ;IF SWD9=1; GOTO 2$ WHEN SCOP1 IS HIT
2794 010504 013704 010212      MOV      TABLE,R4     ;SET START OF MAP
2795 010510 013737 010224 011014      MOV      LASTA, LAST   ;SET LAST ADDRESS
2796 010516 012703 000005      1$:  MOV      #5,R3       ;DO EACH ADDRESS 5 TIMES.
2797 010522 022700 173024      2$:  CMP      #173024,R0   ;DON'T DO THE VECTOR ADD.
2798 010526 001001      BNE      .+4           ;BR IF NOT THE VECTOR ADD.
2799 010530 022024      CMP      (R0)+,(R4)+   ;UPDATE TO NEXT ADDRESS
2800 010532 022700 173224      CMP      #173224,R0   ;DON'T DO THE TRAP VECTORS
2801 010536 001001      BNE      .+4           ;NO THIS ISN'T A TRAP VECTOR.
2802 010540 022024      CMP      (R0)+,(R4)+   ;UPDATE THE POINTERS..
2803 010542 011005      MOV      (R0),R5      ;READ THE ADDRESS
2804 010544 011401      MOV      (R4),R1      ;READ THE SOFTWARE ADDRESS
2805 010546 020105      CMP      R1,R5        ;DO THEY MATCH?
2806 010550 001401      BEQ      .+4           ;BR IF GOOD
2807 010552 104001      HLT      1            ;INCORRECT COMPARISON.
2808 010554 032737 004000 177570      BIT      #BIT11,SWR    ;QUICK PASS.?
2809 010562 001002      BNE      .+6           ;BR IF YES
2810 010564 005303      DEC      R3           ;HAS THAT ADD BEEN READ 5 TIMES?
2811 010566 001355      BNE      2$          ;BR IF NOT 5 TIMES
2812 010570 023700 011014      CMP      LAST,R0     ;WAS LAST ADDRESS CHECKED?
2813 010574 001403      BEQ      .+10        ;BR IF YES
2814 010576 104400      SCOP1      ;LOCK ON THIS ADDRESS?
2815 010600 022024      CMP      (R0)+,(R4)+   ;UPDATE THE POINTERS.
2816 010602 000745      BR      1$           ;CONTINUE THE TEST.
2817 010604 032737 000002 010210      BIT      #BIT1,SAVSR1 ;EXTENDED WORD TO BE CHECKED?
2818 010612 001413      BEQ      3$          ;BR IF NO CHECKING.
2819 010614 022737 173776 011014      CMP      #173776, LAST ;IS ALL THE TEST DONE?
2820 010622 001407      BEQ      3$          ;BR IF YES.
2821 010624 012737 173776 011014      MOV      #173776, LAST ;SET LAST ADDRESS.
2822 010632 013704 010216      MOV      EXTMAP,R4    ;SET EXTENDED MAP.
2823 010636 005720      TST      (R0)+       ;POP POINTER
2824 010640 000726      BR      1$           ;GO DO THE TEST.

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 DDBMAA.P11 MAINDEC-11-DDBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

```

2825          ;TEST THAT WRITTING ROM RESULTS IN A TIME OUT
2826          ;TRAP.
2827
2828 010642 012737 010666 001230 3$:  MOV    #5$,LOCK          ;IF SW09=1 GOTO 5$ WHEN SCOP1 IS HIT
2829 010650 012700 173000          ;SET R0 WITH BASE ADDRESS OF ROM
2830 010654 012737 010716 000004  MOV    #6$,R#4          ;SET FOR TIME OUT TRAP
2831 010662 012703 000005 4$:  MOV    #5$,R3          ;DO EACH ADD 5 TIMES
2832 010666 022700 173024 5$:  CMP    #173024,R0       ;CHECK FOR A TRAP VECTOR
2833 010672 001001          BNE    .+4             ;BR IF NOT VECTOR
2834 010674 005720          TST    (R0)+          ;UPDATE THE REGISTER POINTER
2835 010676 022700 173224  CMP    #173224,R0       ;CHECK FOR THE OTHER VECTOR
2836 010702 001001          BNE    .+4             ;BR IF NOT THE VECTOR
2837 010704 005720          TST    (R0)+          ;UPDATE THE POINTER
2838 010706 012710 177777  MOV    #-1,(R0)        ;WRITE ROM WITH A -1
2839 010712 000240          NOP                    ;WAIT ONE INSTR. TIME
2840 010714 104002          HLT    2              ;WRITING ROM DIDN'T TIME OUT.
2841 010716 012706 001200 6$:  MOV    #STACK,SP       ;RESTORE STACK
2842 010722 032737 004000 177570  BIT    #BIT11,SWR      ;QUICK PASS?
2843 010730 001002          BNE    .+6
2844 010732 005303          DEC    R3             ;DO EACH ADD 5 TIMES
2845 010734 001354          BNE    5$             ;NOT DONE WITH THIS ONE YET.
2846 010736 032737 000002 010210  BIT    #BIT1,SAVSR1   ;EXTENDED 128. WORDS TO BE CHECKED?
2847 010744 001404          BEQ    .+12           ;BR IF NO
2848 010746 022700 173776  CMP    #173776,R0     ;HAVE ALL 256. WORDS BEEN CHECKED?
2849 010752 001407          BEQ    7$             ;BR IF ALL DONE
2850 010754 000403          BR     .+10           ;KEEP GOING
2851 010756 023700 010224  CMP    LASTA,R0       ;ALL DONE??
2852 010762 001403          BEQ    7$             ;HAVE ALL 128. WORDS DONE?
2853 010764 104400          SCOP1                 ;CHECK SW09 FOR FREEZE!!
2854 010766 005720          TST    (R0)+          ;UPDATE TO NEXT ADDRESS
2855 010770 000734          BR     4$             ;GO DO IT AGAIN
2856 010772 005337 001232 7$:  DEC    ICOUNT         ;ITERATION COUNT DONE?
2857 010776 001004          BNE    8$             ;BR IF NOT DONE.
2858 011000 004737 014714  JSR    PC,EOP         ;TYPE END MESSAGE
2859 011004 000137 010434  JMP    PRG1           ;GO DO IT AGAIN.
2860 011010 000137 010464 8$:  JMP    PRG.1          ;GO RESTART.
2861 011014 000000  LAST:  0
2862
2863 011016 005015 042504 044526 BM873X: .ASCII <15><12>/DEVICE VERSION/
      011036 005015 046502 033470 .ASCIZ <15><12>/BM873-Y/
      011050 005015 026052 026101 BM.ERR: .ASCIZ <15><12>/*,A,B,C,D ONLY./
      011072 020040 053040 051105 VERS:  .ASCIZ / VERSION: BM873-Y/
      .EVEN
  
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 DDBMAA.P11 MAINDEC-11-DDBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

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2864
2865
2866 ;PROGRAM 2
2867 ;BLIND READ FROM ROM.
2868 ;THIS PROGRAM WILL DUMP THE CONTENTS OF THE ROM OUT
2869 ;PERFORMING NO CHECKING AT ALL.
2870 ;PLEASE NOTE: NO CHECKING IS DONE.
2871 ;NOTE: HITTING "CONTROL "C"" RESTARTS AT TOP OF PROG.
2872 ;NOTE: IF YOU LEAVE SW07=1: THE DUMP WILL
2873 ;BE MADE ON THE LINE PRINTER
2874 ;IF IT EXISTS.
2875
2876 011116 012737 011116 014652 PRG2: MOV #PRG2,PRG.NO ;SET FOR POWER FAIL
2877 011124 012737 014654 000004 MOV #NO.TRAP,3#4 ;SET FOR UNEXPECTED TRAP TO 4
2878 011132 013737 010224 011014 MOV LASTA, LAST
2879 011140 062737 000002 011014 ADD #2, LAST
2880 011146 105737 177570 TSTB SWR ;IF SW07=1: OUTPUT TABLE ON LPT
2881 011152 100004 BPL .+12 ;IF IT EXISTS. BR IF SW07=0
2882 011154 012737 177777 015176 MOV #-1, LPTFLG ;SET THE LPT FLAG
2883 011162 000402 BR .+6 ;BR TO TEST
2884 011164 005037 015176 CLR LPTFLG ;CLEAR THE LPT FLAG
2885 011170 012700 173000 MOV #173000, RO ;SET RO WITH THE STARTING ROM ADD.
2886 011174 012777 011464 170012 MOV #4$ ,TKVEC ;SET TTY VECTOR FOR CONTROL C
2887 011202 012777 000100 167774 MOV #100 ,TKCSR ;SET TTY KYBD INTERRUPT EN.
2888 011210 013703 010212 MOV TABLE, R3 ;SET POINTER.
2889 011214 104401 011512 TYPE ,DH.2 ;TYPE MESSAGE
2890 011220 104401 011612 TYPE ,DH.2B ;TYPE THE HEADER
2891 011224 012737 000007 001256 1$: MOV #7, TEMPS ;SET COUNTER
2892 011232 011001 MOV (RO), R1 ;READ THE ROM
2893 011234 010037 001252 MOV RO, TEMP3 ;STORE RO
2894 011240 010137 001254 MOV R1, TEMP4 ;STORE R1
2895 011244 022737 006140 010212 CMP #MAP.Y., TABLE ;IF BM873.Y* SELECTED; FILL TABLE
2896 011252 001001 BNE .+4 ;BR IF NOT BM873.Y*
2897 011254 011023 MOV (RO), (R3)+ ;FILL THE TABLE..
2898 011256 005720 TST (RO)+ ;POP THE POINTER
2899 011260 104404 CNVRT ;TYPE AND CONVERT NUMBERS
2900 011262 012132 DT.2 ;IN DATA TABLE 2
2901 011264 011001 7$: MOV (RO), R1 ;STORE ROM DATA
2902 011266 010037 001252 MOV RO, TEMP3 ;STORE ROM ADDRESS
2903 011272 010137 001254 MOV R1, TEMP4 ;PREPARE DATA FOR TYPE OUT
2904 011276 022737 006140 010212 CMP #MAP.Y., TABLE ;IS BM873.Y* SELECTED?
2905 011304 001001 BNE .+4 ;BR IF NO.
2906 011306 011023 MOV (RO), (R3)+ ;FILL THE DATA TABLE
2907 011310 005720 TST (RO)+ ;POP THE POINTER
2908 011312 104405 CNVRT ;TYPE OUT MAP
2909 011314 012144 DT.2A ;USE DATA TABLE 2A
2910 011316 023700 011014 CMP LAST, RO ;HAS THE HIGHEST LIMIT BEEN HIT?
2911 011322 001404 BEQ 2$ ;BR IF ALL DONE.
2912 011324 005337 001256 DEC TEMPS ;DECREASE COUNTER
2913 011330 001355 BNE 7$ ;BR IF NOT 0: KEEP GOING
2914 011332 000734 BR 1$ ;GO TYPE ADDRESS NOW
2915 011334 032737 000002 010210 2$: BIT #BIT1, SAVSR1 ;IS THE EXTENDED 128. WORDS TO BE CHECKED??
2916 011342 001442 BEQ 3$ ;BR IF NO.
2917 011344 012700 173400 MOV #173400, RO ;RESET POINTER OF ROM
2918 011350 013703 010216 MOV EXTMAP, R3 ;SET SOFTWARE MAP POINTER
2919 011354 104401 011725 TYPE ,DH.2A ;TYPE NEW HEADER
  
```

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DOBMA MACY11 27(732) 22-SEP-76 14:43 PAGE 63
 DOBMAA.P11 MAINDEC-11-DOBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

2920	011360	104401	011612			TYPE	DH.2B		:TYPE ADDRESS AND +XX
2921	011364	012737	000007	001256	6\$:	MOV	#7,TEMP5		:SET TYPE OUT COUNTER
2922	011372	011001				MOV	(R0),R1		:READ THE ROM
2923	011374	010037	001252			MOV	RO,TEMP3		:STORE RO
2924	011400	010137	001254			MOV	R1,TEMP4		:STORE R1
2925	011404	012023				MOV	(R0)+,(R3)+		:STORE THE DATA IN SOFTWARE MAP
2926	011406	104404				CONVRT			:TYPE AND CONVERT NUMBERS
2927	011410	012132				DT.2			:IN DATA TABLE 2
2928	011412	011001			8\$:	MOV	(R0),R1		:SAVE THE ROM DATA
2929	011414	010037	001252			MOV	RO,TEMP3		:SAVE THE ROM ADDRESS
2930	011420	010137	001254			MOV	R1,TEMP4		:SET DATA FOR TYPE OUT
2931	011424	104405				CNVRT			:TYPE OUT THE TABLE.
2932	011426	012144				DT.2A			:FIND DATA THROUGH DATA TABLE 2A
2933	011430	012023				MOV	(R0)+,(R3)+		:STORE THE DATA IN SOFTWARE TABLE
2934	011432	022700	174000			CMP	#174000,RO		:HAS THE HIGHEST LIMIT BEEN HIT?
2935	011436	001404				BEQ	3\$:BR IF ALL DONE.
2936	011440	005337	001256			DEC	TEMP5		:DEC TABLE COUNTER
2937	011444	001362				BNE	8\$:BR TO JUST TYPE DATA
2938	011446	000746				BR	6\$:BR TO TYPE ADDRESS
2939	011450	104401	014473		3\$:	TYPE	MCRLF		:DUMP LAST LINE FROM LPT.
2940	011454	005000				CLR	RO		:CLEAR DATA LIGHTS
2941	011456	000000				HALT			:HIT CONTINUE TO PROCEED.
2942	011460	000137	011116			JMP	PRG2		:GOTO PRG 2
2943									:ENTER BY KYBD INTERRUPT.
2944	011464	104406			4\$:	KEY.TO.R2			:ECHO KEY
2945	011466	022702	000003			CMP	#3,R2		:WAS CONTROL C HIT
2946	011472	001006				BNE	5\$:BR IF NO
2947	011474	005037	015176			CLR	LPTFLG		:STOP PRINTING ON LPT
2948	011500	104401	013362			TYPE	MC		:TYPE ↑C
2949	011504	012716	011116			MOV	#PRG2,(SP)		:SET FOR RETURN
2950	011510	000002			5\$:	RTI			:LEAVE THIS ROUTINE
2951									
2952	011512	006414	005012	016412	DH.2:	.ASCII	<14><15><12><12><12><35><37><177><177><177>/BLIND READ OF ROM/		
	011545	015	006412	077577		.ASCII	<15><12><15><177><177>/NOTE: NO CHECKING IS PERFORMED./		
	011612	005015	040412	042104	DH.2B:	.ASCII	<15><12><12>/ADDRESS ADD+00 ADD+02 ADD+04/		
	011654	020040	042101	025504		.ASCII	/ ADD+06 ADD+10 ADD+12 ADD+14 ADD+16/		
	011725	015	005012	054105	DH.2A:	.ASCII	<15><12><12>/EXTENDED 128. WORD ROM DUMP./		
	011764	005015	047503	052116		.ASCII	<15><12>/CONTENTS DUMPED IS PLACED IN THE SOFTWARE/		
	012037	015	046412	050101		.ASCII	<15><12>/MAP. VISUAL INSPECTION OF DATA IS/		
	012102	005015	047531	051125		.ASCII	<15><12>/YOUR RESPONSIBILITY!!/		
					.EVEN				
2953	012132	000002			DT.2:	2			
2954	012134	206	003			.BYTE	206,3		
2955	012136	001252				TEMP3			
2956	012140	006	002			.BYTE	6,2		
2957	012142	001254				TEMP4			
2958									
2959	012144	000001			DT.2A:	1			
2960	012146	006	002			.BYTE	6,2		
2961	012150	001254				TEMP4			

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;PROGRAM 3
;PROGRAM 3 IS THE SAME AS PROGRAM 1 ONLY YOU THE
;USER HAS THE CHANCE TO ALTER THE MAP WHICH IS
;COMPARED TO THE DATA IN THE ROM ADDRESSES
;NOTE THE FOLLOWING COMMANDS:
;
;*D DATA INSERT DATA; HIT LINE FEED TO ESCAPE.
;*R RUN RUN THE PROGRAM
;*L LIST LIST THE SOFTWARE TABLE ON TTY.
;*P PRINT PRINT LISTING OF SOFTWARE TABLE ON LINE PRINTER.
;*A ADDRESS INPUT THE ADDRESS OF THE DATA YOU WANT TO ALTER.
;LINE FEED WHEN IN THE DATA INPUT MODE HIT LINE FEED TO
;ESCAPE TO COMMAND MODE
;CR CARRAGE RETURN- WHEN IN THE DATA INPUT MODE A CARRAGE RETURN
;ZEROS NEXT ADDRESS AND WAITS FOR NEW DATA.
  
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2982 012152 005037 015176 PRG3: CLR LPTFLG ;SET FOR TTY OUTPUT
2983 012156 012737 012152 014652 MOV #PRG3,PRG.NO ;SET FOR POWER FAIL
2984 012164 012777 012224 167022 MOV #ST.VEC,@TKVEC ;SET FOR KEY BOARD INTERUPT
2985 012172 013701 010212 MOV TABLE,R1 ;DEFAULT STARTING ADDRESS TO MAP
2986 012176 010137 013406 MOV R1,ADDRESS ;SAVE THE SOFTWARE ADDRESS
2987 012202 104401 014375 XHOLD: TYPE MASTER ;TYPE AN "*"
2988 012206 012777 000100 166770 MOV #100,@TKCSR ;SET INTERUPT ENABLE FOR TTY
2989 012214 000001 WAIT ;HIT A KEY
2990 012216 000771 BR XHOLD ;GO BACK AN TYPE AN "*"
2991 012220 000001 HOLD: WAIT ;HIT A KEY !!
2992 012222 000776 BR HOLD ;GO BACK AND HIT AGAIN !!
2993 012224 104406 ST.VEC: KEY.TO.R2 ;ECHO CHAR AND STRIP BIT 7
2994 012226 104401 014473 TYPE ,MCRLF ;TYPE A CARRAGE RETURN + LINE FEED
2995 012232 022702 000114 CMP #114,R2 ;WAS AN "L" (LIST) HIT?
2996 012236 001571 BEQ SRV.L ;
2997 012240 022702 000120 CMP #120,R2 ;WAS A "P" (PRINT) HIT?
2998 012244 001563 BEQ SRV.P ;
2999 012246 022702 000104 CMP #104,R2 ;WAS A "D" (DATA) HIT?
3000 012252 001417 BEQ SRV.D ;
3001 012254 022702 000122 CMP #122,R2 ;WAS AN "R" (RUN) HIT?
3002 012260 001002 BNE .+6 ;
3003 012262 000137 013010 JMP SRV.R ;
3004 012266 022702 000101 CMP #101,R2 ;WAS AN "A" (ADDRESS) HIT?
3005 012272 001501 BEQ SRV.A ;
3006 012274 022702 000015 CMP #15,R2 ;WAS CARRAGE RETURN HIT?
3007 012300 001001 BNE .+4 ;
3008 012302 000002 RTI ;GO WAIT FOR VALID CHAR.
3009 012304 104401 014466 TYPE ,M.QM ;TYPE A "?"
3010 012310 000002 RTI ;NEITHER A "L","P","D","R","A",OR CR WAS HIT.
3011 012312 SRV.D:
3012 012312 012777 012344 166674 2$: MOV #4$,@TKVEC ;SET VECTOR FOR DATA INPUT.
3013 012320 013701 013406 MOV ADDRESS,R1 ;RESET ADDRESS POINTER.
3014 012324 010137 001254 MOV R1,TEMP4 ;SET FOR TYPE OUT ROUTINE
3015 012330 104404 CONVRT ;TYPE THE SOFTWARE ADDRESS
3016 012332 013366 DT.3A ;FIND TABLE 3A
3017 012334 005011 CLR (R1) ;ZERO THE ADDRESS AND WAIT FOR DATA
  
```

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DDBMA MACY11 27(732) 22-SEP-76 14:43 PAGE 65
 DDBMAA.P11 MAINDEC-11-DDBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

3018	012336	012716	012220			MOV	#HOLD, (SP)	;SET RETURN (NO "**")
3019	012342	000002				RTI		;GO BACK WAIT FOR KEY TO BE HIT
3020	012344	104406			4\$:	KEY.TO.R2		;ECHO CHAR AND STRIP BIT 7
3021	012346	022702	000015			CMP	#15,R2	;WAS CARRAGE RETURN HIT?
3022	012352	001016				BNE	5\$;NO GO TO 5\$
3023	012354	104401	014476			TYPE	MLF	;TYPE A LINE FEED
3024	012360	005721				TST	(R1)+	;UPDATE THE SOFTWARE ADDRESS
3025	012362	023701	010220			CMP	EXTEND,R1	;IS THE LIMIT EXCEEDED
3026	012366	101440				BLOS	7\$;INPUT LIMIT EXCEEDED!! ERROR.
3027	012370	005011				CLR	(R1)	;ZERO ADDRESS WAIT FOR DATA
3028	012372	010137	001254			MOV	R1,TEMP4	;SAVE THE ADDRESS.
3029	012376	104404				CONVRT		;TYPE THE ADDRESS
3030	012400	013366				DT.3A		;FROM DATA TABLE 3A
3031	012402	010137	013406			MOV	R1,ADDRESS	;SAVE THE ADDRESS FOR GOOD
3032	012406	000002				RTI		;LEAVE HERE.
3033	012410	022702	000012		5\$:	CMP	#12,R2	;WAS A LINE FEED HIT??
3034	012414	001006				BNE	6\$;NO LINE FEED NOT HIT.
3035	012416	012777	012224	166570		MOV	#ST.VEC, @TKVEC	;SET THE KEYBOADD VECTOR
3036	012424	012716	012202			MOV	#XHOLD, (SP)	;WHEN I RETURN TYPE AN "**"
3037	012430	000002				RTI		;LEAVE HERE
3038	012432	032702	000110		6\$:	BIT	#110,R2	;WAS AN OCTAL CHAR HIT?
3039	012436	001014				BNE	7\$;BR IF INVALID CHAR
3040	012440	042702	000260			BIC	#260,R2	;CLEAR ALL BUT LAST 3 BITS
3041	012444	000241				CLC		;CLEAR CPU CARRY BIT
3042	012446	006111				ROL	(R1)	;SHIFT DATA
3043	012450	103406				BCS	8\$;ERROR ??
3044	012452	006111				ROL	(R1)	;SHIFT AGAIN.
3045	012454	103404				BCS	8\$;ERROR ??
3046	012456	006111				ROL	(R1)	;SHIFT ONCE MORE
3047	012460	103402				BCS	8\$;ERROR ??
3048	012462	050211				BIS	R2,(R1)	;SET NEW NUMBER IN ADDRESS
3049	012464	000002				RTI		;LEAVE HERE
3050	012466	005011			8\$:	CLR	(R1)	;CLEAR THE ADDRESS.
3051	012470	104401	014466		7\$:	TYPE	,M.QM	;TYPE A "?"
3052	012474	000002				RTI		
3053								
3054								
3055								
3056								
3057								
3058								
3059	012476	012777	012514	166510	SRV.A:	MOV	#1\$, @TKVEC	;SET KEY BOADR VECTOR
3060	012504	005003				CLR	R3	;R3 WILL HOLD THE SOFTWARE ADDRESS
3061	012506	012716	012220			MOV	#HOLD, (SP)	;SET RETURN FOR NO "**"
3062	012512	000002				RTI		;LEAVE HERE
3063	012514	104406			1\$:	KEY.TO.R2		;ECHO KEY AND CLEAR BIT 7
3064	012516	022702	000015			CMP	#15,R2	;CARRAGE RETURN ?
3065	012522	001416				BEQ	2\$;BR IF YES
3066	012524	032702	000110			BIT	#110,R2	;WAS AN OCTAL NUMBER HIT?
3067	012530	001023				BNE	3\$;INVALID ANSWER
3068	012532	000241				CLC		;CLEAR CPU CARRY BIT
3069	012534	006103				ROL	R3	;SHIFT THE ADDRESS
3070	012536	103420				BCS	3\$;ERROR ??
3071	012540	006103				ROL	R3	;SHIFT AGAIN
3072	012542	103416				BCS	3\$;ERROR ??
3073	012544	006103				ROL	R3	;ONE LAST TIME

```

;YOU ARE HERE BECAUSE YOU HIT AN "A"
;YOU TOLD ME YOU WERE GOING TO INPUT AN ADDRESS.
;SO INPUT THE ADDRESS AND TERMINATE WITH A CARRAGE RETURN.
;OK??
  
```

3074	012546	103414				BCS	3S	:ERROR ??
3075	012550	042702	000260			BIC	#260,R2	:CLEAR UNWANTED BITS
3076	012554	050203				BIS	R2,R3	:PLACE DATA IN R3
3077	012556	000002				RTI		:LEAVE THIS ROUTINE
3078	012560	012716	012202		2S:	MOV	#XHOLD,(SP)	:WHEN RETURNING TYPE AN "*"
3079	012564	012777	012224	166422		MOV	#ST.VEC,3TKVEC	:SET INITIAL VECTOR
3080	012572	010337	013406			MOV	R3,ADDRESS	:SAVE GOOD ADDRESS FOR FUTURE USE
3081	012576	000002				RTI		:LEAVE HERE
3082	012600	005003			3S:	CLR	R3	:ZERO BAD ADDRESS
3083	012602	104401	014473			TYPE	,MCRLF	:TYPE A CR LF
3084	012606	104401	014466			TYPE	,M.QM	:TYPE "??"
3085	012612	000002				RTI		:LEAVE !!
3086								
3087	012614	012737	177777	015176		SRV.P: MOV	#-1,LPTFLG	
3088								:YOU ENTERED HERE BECAUSE YOU HIT "L"
3089								:YOU TOLD ME YOU WANTED A LISTING OF THE SOFTWARE MAP
3090								:SO HERE IT IS.
3091								
3092								
3093	012622					SRV.L:		
3094	012622	013700	010212			MOV	TABLE,R0	:GET SOFTWARE MAP
3095	012626	013737	010214	013306		MOV	ALLEN0,DEAD	:SET DEAD END POINTER
3096	012634	104401	014266			TYPE	,MSG4	:TYPE HEADER
3097	012640	104401	011612			TYPE	,DH.2B	:TYPE ADDRESS ADD+XX
3098	012644	012737	000007	001256	1S:	MOV	#7,TEMP5	:SET COUNTER FOR ACCROSS PAGE
3099	012652	011001				MOV	(R0),R1	:GET DATA
3100	012654	010037	001252			MOV	R0,TEMP3	:GET ADDRESS
3101	012660	010137	001254			MOV	R1,TEMP4	:SET DATA FOR TYPE OUT
3102	012664	005720				TST	(R0)+	:UPDATE ADDRESS POINTER
3103	012666	104404				CONVRT		:TYPE ADDRESS ADD+XX
3104	012670	013374				DT.3B		:USE DATA TABLE 3B
3105	012672	011001			2S:	MOV	(R0),R1	:GET DATA
3106	012674	010037	001252			MOV	R0,TEMP3	:GET ADDRESS
3107	012700	010137	001254			MOV	R1,TEMP4	:SAVE DATA
3108	012704	005720				TST	(R0)+	:UPDATE POINTER
3109	012706	104405				CONVRT		:TYPE DATA
3110	012710	012144				DT.2A		:USE DATA TABLE 2A
3111	012712	013703	013006		3S:	MOV	DEAD,R3	
3112	012716	005723				TST	(R3)+	:UPDATE POINTER
3113	012720	020003				CMP	R0,R3	:LIMIT DONE ??
3114	012722	001404				BEQ	5S	:BR IF YES
3115	012724	005337	001256		4S:	DEC	TEMP5	:DEC DATA COUNTER
3116	012730	001360				BNE	2S	:BR IF MORE DATA TO GO
3117	012732	000744				BR	1S	:TYPE THE ADDRESS
3118	012734				5S:			
3119	012734	032737	000002	010210		BIT	#BIT1,SAVSR1	:EXTENDED SOFTWARE DUMP?
3120	012742	001416				BEQ	6S	:BR IF NO DUMP
3121	012744	005743				TST	-(R3)	:PUSH POINTER
3122	012746	023703	010220			CMP	EXTEND,R3	
3123	012752	001412				BEQ	6S	:BR IF ALL DONE
3124	012754	104401	014332			TYPE	,MSG5	:TYPE EXTENDED MAP:
3125	012760	104401	011612			TYPE	,DH.2B	
3126	012764	13700	010216			MOV	EXTMAP,R0	:SET POINTER
3127	012770	13737	010220	013006		MOV	EXTEND,DEAD	:SET DEAD END POINTER
3128	012776	000722				BR	1S	:DO IT AGAIN SAM.
3129	013000	005037	015176		6S:	CLR	LPTFLG	:SET FOR TTY OUTPUT

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3130 013004 003002
3131 013006 000000
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3138 013010
3139 013010 012777 014500 166176
3140 013016 012777 000100 166160
3141 013024 012737 014654 000004
3142 013032 012737 000500 001232
3143 013040 012700 173000
3144 013044 012737 013070 001230
3145 013052 013704 010212
3146 013056 013737 010224 011014
3147 013064 012703 000005
3148 013070 022700 173024
3149 013074 001001
3150 013076 022024
3151 013100 022700 173224
3152 013104 001001
3153 013106 022024
3154 013110 011005
3155 013112 011401
3156 013114 020105
3157 013116 001401
3158 013120 104001
3159 013122 032737 004000 177570
3160 013130 001002
3161 013132 005303
3162 013134 001355
3163 013136 023700 011014
3164 013142 001403
3165 013144 104400
3166 013146 022024
3167 013150 000745
3168 013152 032737 000002 010210
3169 013160 001413
3170 013162 022737 173776 011014
3171 013170 001407
3172 013172 012737 173776 011014
3173 013200 013704 010216
3174 013204 005720
3175 013206 000726
    
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RTI ;GO BACK HOME.
DEAD: 0
;NOW YOU ARE HERE BECAUSE YOU WANT TO RUN THE PROGRAM
;REMEMBER NOW, YOU SET UP THE MAP.
;ARE YOU SURE YOU TYPED IN THE CORRECT DATA.???
;HERE WE GO

SRV.R:
RUN3: MOV #.KEY.TO.R2,ATKVEC
      MOV #100,ATKCSR ;SET KEYBOARD INTERRUPT ENABLE
      MOV #NO.TRAP,AT#4 ;GET READY FOR UNEXPECTED TRAP
      MOV #500,ICOUNT ;DO TEST 500(8) TIMES
      MOV #173000,R0 ;SET BEGGING ADDRESS
RUN.3: MOV #2$,LOCK ;IF SW09=1; GOTO 2$ WHEN I HIT "SCOPI"
      MOV TABLE,R4 ;SET SOFTWARE RESUTS
      MOV LASTA,LAST ;SET LAST ADDRESS
      MOV #5,R3 ;DO EACH ADDRESS 5 TIMES.
      CMP #173024,R0 ;DON'T DO THE VECTOR ADD.
      BNE .+4 ;BR IF NOT THE VECTOR ADD.
      CMP (R0)+,(R4)+ ;UPDATE TO NEXT ADDRESS
      CMP #173224,R0 ;IS THIS THE SECOND TRAP VECTOR??
      BNE .+4 ;BR IF NOT VECTOR
      CMP (R0)+,(R4)+ ;UPDATE THE POINTERS !!
      MOV (R0),R5 ;READ THE ADDRESS
      MOV (R4),R1 ;READ THE SOFTWARE ADDRESS
      CMP R1,R5 ;DO THEY MATCH?
      BEQ .+4 ;BRANCH IF OK
      HLT 1 ;INCORRECT COMPARISON.
      BIT #BIT11,SWR ;QUICK PASS.
      BNE .+6 ;BR IF YES
      DEC R3 ;HAS THAT ADD BEEN READ 10 TIMES?
      BNE 2$ ;BR IF NOT 10 TIMES
      CMP LAST,R0 ;WAS LAST ADDRESS CHECKED?
      BEQ .+10 ;BR IF YES
      SCOPI ;LOCK ON THIS ADDRESS?
      CMP (R0)+,(R4)+ ;UPDATE THE POINTERS.
      BR 1$ ;CONTINUE THE TEST.
      BIT #BIT1,SAVSRI ;EXTENDED WORD TO BE CHECKED?
      BEQ 3$ ;BR IF NO CHECKING.
      CMP #173776,LAST ;IS ALL THE TEST DONE?
      BEQ 3$ ;BR IF YES.
      MOV #173776,LAST ;SET LAST ADDRESS.
      MOV EXTMAP,R4 ;SET EXTENDED MAP.
      TST (R0)+ ;POP POINTER
      BR 1$ ;GO DO THE TEST.
    
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3176                                     :TEST THAT WRITING ROM RESULTS IN A TIME OUT
3177                                     ;TRAP.
3178
3179 013210 012700 173000 3S:   MOV   #173000,RO      ;SET BASE ADDRESS
3180 013214 012737 013234 001230  MOV   #5S,LOCK      ;IF SW09=1: GOTO 5S AT SCOP1
3181 013222 012737 013264 000004  MOV   #6S,#4        ;TIME OUT TRAP: GOTO 6S
3182 013230 012703 000012 4S:   MOV   #10,R3      ;DO EACH ADD 10 TIMES
3183 013234 022700 173024 5S:   CMP   #173024,RO    ;IS THIS AT THE TRAP VECTOR
3184 013240 001001          BNE   .+4            ;BR IF NO
3185 013242 005720          TST   (RO)+          ;UPDATE POINTER
3186 013244 022700 173224  CMP   #173224,RO    ;IS THIS AT THE SECOND TRAP VECTOR
3187 013250 001001          BNE   .+4            ;BR IF NO
3188 013252 005720          TST   (RO)+          ;UPDATE THE POINTER
3189 013254 012710 177777  MOV   #-1,(RO)     ;WRITE ROM WITH A -1
3190 013260 000240          NOP                    ;WAIT ONE INSTR. TIME
3191 013262 104000          HLT                    ;WRITING ROM DIDN'T TIME OUT.
3192 013264 012706 001200 6S:   MOV   #STACK,SP     ;RESTORE STACK
3193 013270 032737 004000 177570  BIT   #BIT11,SWR    ;QUICK PASS?
3194 013276 001002          BNE   .+6            ;BR IF YES
3195 013300 005303          DEC   R3            ;DO EACH ADD 10 TIMES
3196 013302 001354          BNE   5S            ;NOT DONE WITH THIS ONE YET.
3197 013304 032737 000002 010210  BIT   #BIT1,SAVSRI ;IS THE EXTENDED 128. WORDS TO BE TESTED??
3198 013312 001404          BEQ   .+12           ;BR IF NO
3199 013314 022700 173776  CMP   #173776,RO    ;IS THE EXTENDED LIMIT BEEN TESTED?
3200 013320 001407          BEQ   7S            ;IF YES; GOTO 7S
3201 013322 000403          BR    .+10          ;IF NO; KEEP GOING.
3202 013324 023700 010224  CMP   LASTA,RO     ;ALL DONE??
3203 013330 001403          BEQ   7S            ;IF YES; GOTO 7S
3204 013332 104400          SCOP1              ;GO CHECK SW09: (FREEZE !!)
3205 013334 005720          TST   (RO)+          ;UPDATE TO NEXT ADDRESS
3206 013336 000734          BR    4S            ;GO DO IT AGAIN
3207 013340 005337 001232 7S:   DEC   ICOUNT        ;CHECK ITERATION COUNT
3208 013344 001004          BNE   8S            ;MORE TO GO
3209 013346 004737 014714  JSR   PC,EOP        ;GO TO END OF PASS ROUTINE
3210 013352 000137 013010  JMP   RUN3          ;GO DO TEST AGAIN
3211 013356 000137 013040 8S:   JMP   RUN.3
3212
3213 013362 041536 000      MC:   .ASCIZ  /1C/
3214          013366          .EVEN
3215 013366 000001          DT.3A: 1
3216 013370 006 002      .BYTE 6,2
3217 013372 001254          TEMP4
3218 013374 000002          DT.3B: 2
3219 013376 006 003      .BYTE 6,3
3220 013400 001252          TEMP3
3221 013402 006 002      .BYTE 6,2
3222 013404 001254          TEMP4
3223 013406 000000          ADDRESS: 0
3224
    
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E06

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3225
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3238 013410 012777 014500 165576 PRG4:  MOV      #.KEY.TO.R2,@TKVEC
3239 013416 012777 000100 165560      MOV      #100,@TKCSR
3240 013424 012737 013410 014652      MOV      #PRG4,PRG.NO      ;SET FOR POWER FAIL
3241 013432 005037 001244      CLR      LSTERR            ;PREPARE ERROR CONDITIONS
3242 013436 012706 001200      MOV      #STACK,SP        ;SET THE STACK POINTER
3243 013442 012737 020000 001232      MOV      #20000,ICOUNT    ;SET ITERATION COUNT TO 20000(8)
3244 013450 005737 014076      TST      FLAG4            ;HAVE I BEEN HERE BEFOR??
3245 013454 001073      BNE      TAG.A            ;BR IF NOT FIRST TIME HERE.
3246 013456 005137 014076      COM      FLAG4            ;SET THE FLAG
3247 013462 012705 000002      MOV      #2,R5            ;SET R5 FOR SWITCH 1
3248 013466 012704 014066      MOV      #LOC1,R4         ;SET STORAGE LOCATION
3249 013472 012737 014654 000004      MOV      #NO.TRAP,@#4     ;SET FOR TIME OUT TRAP
3250 013500 012737 000001 001252      MOV      #1,TEMP3        ;SET FOR MESSAGE ON CHANNEL NO.
3251 013506 104401 014100      1S:    TYPE      ,MCHAN    ;TYPE MESSAGE ABOUT CHANNEL
3252 013512 104405      CNVRT    DT.4A           ;GOTO TYPE AND CONVERT ROUTINE
3253 013514 014220      DT.4A           ;CONVERT DATA TABLE 4A
3254 013516 104401 014114      TYPE      ,MACTV        ;TYPE REST OF MESSAGE
3255 013522 104401 014127      2S:    TYPE      ,MADD1    ;TYPE ADDRESS MESSAGE
3256 013526 012700 173024      MOV      #173024,RO
3257 013532 005037 173024      CLR      @#173024
3258 013536 010537 173024      MOV      R5,@#173024     ;WRITE ROM WITH SWITCH
3259 013542 000240      NOP
3260 013544 012706 001200      3S:    MOV      #STACK,SP    ;WAIT ONE INSTR. TIME
3261 013550 012700 173024      MOV      #173024,RO      ;SET THE STACK POINTER
3262 013554 012737 014654 000004      MOV      #NO.TRAP,@#4    ;SET FOR ERROR MESSAGE
3263 013562 013737 173024 001254      MOV      @#173024,TEMP4  ;SET FOR NO MORE TRAPS
3264 013570 104405      CNVRT    DT.4B           ;READ THE ADDRESS
3265 013572 014226      DT.4B           ;TYPE OUT AND CONVERT
3266 013574 013724 173024      MOV      @#173024,(R4)+  ;DATA TABLE 4B
3267 013600 104401 014163      TYPE      ,MADD2        ;STORE THE INFORMATION FOUND
3268 013604 012700 173224      MOV      #173224,RO      ;TYPE THE SECOND ADDRESS MSG
3269 013610 013737 173224 001254      MOV      @#173224,TEMP4  ;SET FOR ERROR CONDITION.
3270 013616 104405      CNVRT    DT.4B           ;STORE ROM DATA
3271 013620 014226      DT.4B           ;CONVERT AND TYPE
3272 013622 005237 001252      INC      TEMP3           ;DATA TABLE 4B
3273 013626 000241      CLC
3274 013630 006105      ROL      R5              ;GET READY FOR NEXT SWITCH SETTING
3275 013632 022705 000040      CMP      #40,R5          ;CLEAR THE CARRY BIT
3276 013636 001323      BNE      1S              ;UPDATE R5
3277 013640 000137 013410      JMP      PRG4            ;ALL SIMULATED SWITCHS DONE?
3278
3279 013644 012703 000002      TAG.A: MOV      #2,R3      ;BR IF NOT ALL DONE
3280 013650 012704 014066      MOV      #LOC1,R4       ;JMP AND DO TEST AGAIN WITH OUT TYPE OUT
;SIMULATE SWITCH 1
;GET LOCATION WHERE DATA IS STORED

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3281	013654	012737	014654	000004	15:	MOV	#NO.TRAP,0#4	;PREPARE FOR TIME OUT TRAP
3282	013662	005037	173024			CLR	0#173024	
3283	013666	010337	173024			MOV	R3,0#173024	;WRITE THE ROM
3284	013672	000240				NOP		;WAIT ONE INSTR. TIME
3285	013674	012706	001200		25:	MOV	#STACK,SP	;SET THE STACK POINTER.
3286	013700	012737	014654	000004		MOV	#NO.TRAP,0#4	;SET FOR NO MORE TRAPS.
3287	013706	012700	173024			MOV	#173024,R0	;SET FOR ERROR MESSAGE
3288	013712	011401				MOV	(R4),R1	;SET FOR COMPARISON
3289	013714	013705	173024			MOV	0#173024,R5	;GET THE DATA FROM THE ROM
3290	013720	020105				CMP	R1,R5	;IS THE DATA THE SAME??
3291	013722	001401				BEQ	.+4	;BR IF GOOD DATA.
3292	013724	104001				HLT	1	;ERROR. DATA READ FIRST TIME NOT THE SAME
3293	013726	012700	173224			MOV	#173224,R0	;SET FOR ERROR MESSAGE
3294	013732	013705	173224			MOV	0#173224,R5	;READ THE ROM
3295	013736	020105				CMP	R1,R5	;IS THE DATA THE SAME?
3296	013740	001401				BEQ	.+4	;BR IF GOOD DATA
3297	013742	104001				HLT	1	;ERROR. DATA NOT THE SAME AS BEFORE.
3298	013744	005724				TST	(R4)+	;UPDATE DATA POINTER.
3299	013746	000241				CLC		;CLEAR THE CARRY BIT
3300	013750	006103				ROL	R3	;UPDATE THE SIMULATED SWITCH SETTING
3301	013752	022703	000040			CMP	#40,R3	;HAVE ALL SETTING BEEN DONE
3302	013756	001336				BNE	15	;BR IF NOT DONE
3303	013760	005337	001232			DEC	ICOUNT	;ITERATION COUNT DONE
3304	013764	001327				BNE	TAG.A	;BR IF NOT DONE
3305	013766	012737	177777	173224		MOV	#-1,0#173224	;WRITE SECOND TRAP VECTOR WITH -1
3306	013774	005037	173024			CLR	0#173024	;ZERO THE FIRST VECTOR
3307	014000	012700	173024			MOV	#173024,R0	;SET FOR TYPE OUT IF ERROR
3308	014004	013701	014066			MOV	LOC1,R1	;SET FOR TYPE OUT ROUTINE
3309	014010	013705	173024			MOV	0#173024,R5	;SAME AS ABOVE
3310	014014	020105				CMP	R1,R5	;IS DEFAULT LINE SELECTED =TO LINE 1
3311	014016	001401				BEQ	.+4	;BR IF DEFAULT EQUALS LINE 1
3312	014020	104001				HLT	1	;DATA NOT EQUAL TO LINE 1
3313	014022	012737	177777	173024		MOV	#-1,0#173024	;WRITE A -1 TO FIRST VECTOR
3314	014030	005037	173224			CLR	0#173224	;ZERO SECOND VECTOR
3315	014034	012700	173224			MOV	#173224,R0	;SET FOR TYPE OUT IF ERROR
3316	014040	013701	014066			MOV	LOC1,R1	;GET DATA
3317	014044	013705	173224			MOV	0#173224,R5	;READ ROM
3318	014050	020105				CMP	R1,R5	;IS LINE 1 DEFAULT LINE
3319	014052	001401				BEQ	.+4	;BR IF OK
3320	014054	104001				HLT	1	;ERROR LINE 1 NOT DEFAULT LINE
3321	014056	004737	014714			JSR	PC,EOP	;TYPE END MESSAGE.
3322	014062	000137	013410			JMP	PRG4	;GOTO PROGRAM 4 AGAIN
3323								
3324	014066	000000				LOC1:	0	
3325	014070	000000				LOC2:	0	
3326	014072	000000				LOC3:	0	
3327	014074	000000				LOC4:	0	
3328	014076	000000				FLAG4:	0	

3329	014100	005015	041412	040510	MCHAN:	.ASCIZ <15><12><12>/CHANNEL /		
	014114	041501	044524	040526	MACTV:	.ASCIZ/ACTIVATED./		
	014127	015	040412	042104	MADD1:	.ASCIZ <15><12>/ADDRESS 773024 CONTAINS: /		
	014163	015	040412	042104	MADD2:	.ASCIZ <15><12>/ADDRESS 773224 CONTAINS: /		
		014220			.EVEN			
3330	014220	000001			DT.4A:	1		
3331	014222	002	002		.BYTE	2,2		
3332	014224	001252			TEMP3			
3333	014226	000001			DT.4B:	1		
3334	014230	006	002		.BYTE	6,2		
3335	014232	001254			TEMP4			
3336								
3337	014234	005015	051120	043517	MSG3:	.ASCIZ <15><12>/PROGRAM NO. (1,2,3,4) /		
	014266	006414	016412	077437	MSG4:	.ASCIZ <14><15><12><35><37><177><177><177>/SOFTWARE MAP IS AS FOLLOWS:/		
	014332	005015	020012	054105	MSG5:	.ASCIZ <15><12><12>/ EXTENDED SOFTWARE MAP FOLLOWS./		
	014375	015	025012	000	MASTER:	.ASCIZ <15><12>*/		
	014401	007	006407	042412	M.END:	.ASCIZ <7><7><15><12>/END PASS BM873-Y/		
	014426				MFAIL:			
	014426	005015	053520	020122		.ASCII <15><12>/PWR UP AFTER/		
	014444	005015	042522	046101		.ASCIZ <15><12>/REAL PWR FAIL/		
	014464	000044			M.DOL:	.ASCIZ /\$/		
	014466	005015	037477	000	M.QM:	.ASCIZ <15><12>/??/		
	014473	015	000012		MCRLF:	.ASCIZ <15><12>		
	014476	000012			MLF:	.ASCIZ <12>		
					.EVEN			
3338	014500				.KEY.TO.R2:			
3339	014500	017702	164502		MOV	@TKDBR,R2		;READ THE TTY KYBD BUFFER
3340	014504	105777	164500		TSTB	@TPCSR		;PRINTER READY??
3341	014510	100375			BPL	-4		;BR IF NOT READY.
3342	014512	010277	164474		MOV	R2,@TPDBR		;ECHO INPUTTED CHARACTER
3343	014516	042702	000200		BIC	#BIT7,R2		;CLEAR BIT 7 FOR A SEVEN BIT CHAR.
3344	014522	022702	000007		CMP	#7,R2		;WAS CNTR "G" HIT?
3345	014526	001005			BNE	1\$;NO!
3346	014530	000005			RESET			;CLEAR THE WORLD
3347	014532	005037	177776		CLR	PS		
3348	014536	000137	007150		JMP	START		;GO TO TEST
3349	014542	000002			RTI			;LEAVE HERE
3350								

H06

DDBMA MACY11 27(732) 22-SEP-76 14:43 PAGE 72
 DDBMAA.P11 MAINDEC-11-DDBMA-A BMB73 UNIVERSAL RESTART LOADER DIAGNOSTIC.

3351	014544	005037	001244		.PFAIL: CLR	LSTERR	
3352	014550	013746	000004		MOV	@#4,-(SP)	
3353	014554	012737	014604	000004	MOV	#15,@#4	
3354	014562	005737	173000		TST	@#173000	: IS THIS PF REAL?
3355	014566	000240			NOP		: TRAP IS CAUSED BY LOADER
3356	014570	012737	014614	000024	MOV	#PWR.UP,@#24	: ITS REAL. PREPARE FOR PWR 'JP
3357	014576	012637	000004		MOV	(SP)+,@#4	
3358	014602	000000			HALT		
3359	014604	022626			IS: POP.SP		
3360	014606	012637	000004		MOV	(SP)+,@#4	
3361	014612	000000			HALT		: HARDWARE ERROR. BOOT DIDN'T FORCE
3362					: HIGH ADDR LINES		AND LOAD BUTTON WAS ACTIVATED
3363	014614	012737	014544	000024	PWR.UP: MOV	#.PFAIL,@#24	
3364	014622	012706	001200		MOV	#STACK,SP	
3365	014626	005000			CLR	RO	: SET DELAY
3366	014630	062700	000001		ADD	#1,RO	: WAIT FOR TTY
3367	014634	001375			BNE	-.4	:
3368	014636	104401	014426		TYPE	MFAIL	: TYPE FAILED.
3369	014642	005037	177776		CLR	PS	: SET STATUS TO ZERO
3370	014646	000177	000000		JMP	@PRG.NO	
3371	014652	000000			PRG.NO: 0		
3372	014654				NO. TRAP:		
3373	014654	011637	014712		MOV	(SP),XSTORE	
3374	014660	032716	100000		BIT	#BIT15,(SP)	
3375	014664	001410			BEQ	IS	
3376	014666	011600			MOV	(SP),RO	
3377	014670	104004			HLT	4	
3378	014672	012706	001200		MOV	#STACK,SP	
3379	014676	005037	177776		CLR	PS	
3380	014702	000177	177744		JMP	@PRG.NO	
3381	014706	104003			IS: HLT	3	
3382	014710	000002			RTI		
3383	014712	000000			XSTORE: 0		
3384							

3385	014714	012700	000062		EOP:	MOV	#50.,R0
3386	014720	000005			2\$:	RESET	
3387	014722	005300				DEC	R0
3388	014724	001375				BNE	2\$
3389	014726	032737	000100	177570		BIT	#SW06,SWR
3390	014734	001402				BEQ	1\$
3391	014736	004737	000250			JSR	PC,EOPHLT
3392	014742	005037	001244		1\$:	CLR	LSTERR
3393	014746	005037	015176			CLR	LPTFLG
3394	014752	104401	014401			TYPE	,M.END
3395	014756	104401	015020			TYPE	,VERSON
3396	014762	013701	000042			MOV	#42,R1
3397	014766	001413				BEQ	X1
3398	014770	022737	010434	014652		CMP	#PRG1,PRG.NO
3399	014776	001002				BNE	.+6
3400	015000	000137	013410			JMP	PRG4
3401	015004	004711			LOGIC:	JSR	PC,(R1)
3402	015006	000240				NOP	
3403	015010	000240				NOP	
3404	015012	000240				NOP	
3405	015014	000240				NOP	
3406	015016	000207			X1:	RTS	PC
3407	015020	000101			VERSON:	101	

;SEVEN BIT ASCII FOR DEFAULT "A"

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3408
3409
3410 ;CHECK FOR FREEZE ON CURRENT DATA
3411
3412 015022 032737 001000 177570 .SCOP1: BIT #SW09,SWR
3413 015030 001402 BEQ 1$
3414 015032 013716 001230 MOV LOCK,(SP)
3415 015036 000002 1$: RTI
3416
3417 ;TELETYPE OUTPUT ROUTINE
3418
3419 015040 013737 000004 001000 .TYPE: MOV @#4,@#1000
3420 015046 010537 001002 MOV R5,@#1002
3421 015052 017605 000000 MOV @ (SP),R5
3422 015056 062716 000002 ADD #2,(SP)
3423 015062 032737 010000 177570 1$: BIT #SW12,SWR
3424 015070 001013 BNE 3$
3425 015072 105715 TSTB (R5)
3426 015074 001411 BEQ 3$
3427 015076 005737 015176 TST LPTFLG
3428 015102 001014 BNE 4$
3429 015104 105777 164100 2$: TSTB @TPCSR
3430 015110 100375 BPL 2$
3431 015112 112577 164074 MOVB (R5)+,@TPDBR
3432 015116 000761 BR 1$
3433 015120 013737 001000 000004 3$: MOV @#1000,@#4
3434 015126 013705 001002 MOV @#1002,R5
3435 015132 000002 RTI
3436 015134 012737 015152 000004 4$: MOV #5$,@#4
3437
3438 015142 005777 164032 TST @LPTCSR
3439 015146 000240 NOP
3440 015150 000404 BR 6$
3441 015152 005037 015176 5$: CLR LPTFLG
3442 015156 022626 POP.SP
3443 015160 000740 BR 1$
3444 015162 105777 164012 6$: TSTB @LPTCSR
3445 015166 100375 BPL 6$
3446 015170 112577 164006 MOVB (R5)+,@LPTDBR
3447 015174 000732 BR 1$
3448 015176 000000 LPTFLG: 0
3449
3450 ;ERROR HANDLER
3451
3452 015200 005037 015176 .HLT: CLR LPTFLG
3453 015204 032737 010000 177570 BIT #SW12,SWR
3454 015212 001406 BEQ XBX
3455 015214 105777 163770 TSTB @TPCSR
3456 015220 100003 BPL XBX
3457 015222 112777 000207 163762 MOVB #207,@TPDBR
3458 015230 032737 020000 177570 XBX: BIT #SW13,SWR
3459 015236 001140 BNE HALTS
3460 015240 021637 001244 CMP (SP),LSTERR
3461 015244 001404 BEQ 1$
3462 015246 011637 001244 MOV (SP),LSTERR
3463 015252 105037 001302 CLRB ERRFLG
    
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DDBMA MACY11 27(732) 22-SEP-76 14:43 PAGE 75
 DDBMAA.P11 MAINDEC-11-DDBMA-A BMB73 UNIVERSAL RESTART LOADER DIAGNOSTIC.

3464	015256	104402					15:	SAV05		
3465	015260	011605						MOV	(SP),R5	
3466	015262	162705	000002					SUB	#2,R5	
3467	015266	012702	017400					MOV	#ERRST,R2	
3468	015272	010522						MOV	R5,(R2)+	
3469	015274	011504						MOV	(R5),R4	
3470	015276	011537	015614					MOV	(R5),TEMP6	
3471	015302	006304						ASL	R4	
3472	015304	061504						ADD	(R5),R4	
3473	015306	006304						ASL	R4	
3474	015310	042704	177001					BIC	#177001,R4	
3475	015314	062704	016256					ADD	#.ERRTAB,R4	
3476	015320	011422						MOV	(R4),(R2)+	
3477	015322	012437	015416					MOV	(R4)+,ERRMSG	
3478	015326	012437	015430					MOV	(R4)+,DATAHD	
3479	015332	011437	015534					MOV	(R4),DATABP	
3480	015336	105737	001302					TSTB	ERRFLG	
3481	015342	001403						BEQ	TYPMSG	
3482	015344	005737	015534					TST	DATABP	
3483	015350	001030						BNE	TYPDAT	
3484	015352	104401						TYPMSG:	TYPE	
3485	015354	016246							MERRPC	
3486	015356	104405							CNVRT	
3487	015360	015606							ERTABCI	
3488	015362	104401							TYPE	
3489	015364	011072							VERS	
3490	015366	105777	163616					TSTB	@TPCSR	
3491	015372	100375						BPL	-4	
3492	015374	113777	015020	163610				MOVB	VERSION,@TPDBR	
3493	015402	104401						TYPE		
3494	015404	014473						MCRLF		
3495	015406	112737	177777	001302				MOVB	#-1,ERRFLG	
3496	015414	104401						TYPE		
3497	015416	000000						ERRMSG:	0	
3498	015420	005737	015430					TST	DATAHD	
3499	015424	001402						BEQ	TYPDAT	
3500	015426	104401						TYPE		
3501	015430	000000						DATAHD:	0	
3502	015432	005737	015534					TYPDAT:	TST	
3503	015436	001437							DATABP	
3504	015440	013722	001260					BEQ	RESREG	
3505	015444	022737	104002	015614				MOV	SAVR0,(R2)+	
3506	015452	001424						CMP	#104002,TEMP6	
3507	015454	022737	104003	015614				BEQ	6\$	
3508	015462	001416						CMP	#104003,TEMP6	
3509	015464	013722	001270					BEQ	5\$	
3510	015470	013722	001262					MOV	SAVR4,(R2)+	
3511	015474	013722	001272					MOV	SAVR1,(R2)+	
3512	015500	022737	104001	015614				MOV	SAVR5,(R2)+	
3513	015506	001406						CMP	#104001,TEMP6	
3514	015510	022737	104004	015614				BEQ	6\$	
3515	015516	001402						CMP	#104004,TEMP6	
3516	015520	013722	014712					BEQ	6\$	
3517	015524	005022						MOV	XSTORE,(R2)+	
3518	015526	005022						5\$:	(R2)+	
3519	015530	005012						6\$:	(R2)+	
								CLR	(R2)	

;STORE ADDR OF MESGE

;WRITING ROM TIME
;OUT ERROR?
;UNEXPECTED
;TRAP?

3520	015532	104404			CONVRT
3521	015534	000000			DATABP: 0
3522	015536	104403			RESREG: RES05
3523	015540	005737	177570		HALTS: TST SWR
3524	015544	100005			BPL EXITER
3525	015546	010046			PUSHRO
3526	015550	016600	000002		MOV 2(SP),RO
3527	015554	000000			HALT
3528	015556	012600			POPPO
3529	015560	005237	001242		EXITER: INC ERRCNT
3530	015564	032737	000400	177570	BIT #BIT8,SWR
3531	015572	001404			BEQ 1\$
3532	015574	012706	001200		MOV #STACK,SP
3533	015600	000177	177046		JMP @PRG.NO
3534	015604	000002			1\$: RTI
3535	015606	000001			ERTABO: 1
3536	015610	006	002		.BYTE 6,2
3537	015612	001276			SAVPC
3538	015614	000000			TEMP6: .WORD 0
3539					
3540					;CONVERT OCTAL NUMBER TO ASCII AND OUTPUT TO TELEPRINTER
3541					
3542	015616	104401			.CONVR: TYPE
3543	015620	014473			MCRLF
3544	015622	017637	000000	001250	.CNVRT: MOV @ (SP),TEMP2
3545	015630	013737	016720	001246	MOV TEMP,TEMP1
3546	015636	062716	000002		ADD #2,(SP)
3547	015642	010046			MOV RO,-(SP)
3548	015644	010146			MOV R1,-(SP)
3549	015646	010246			MOV R2,-(SP)
3550	015650	010346			MOV R3,-(SP)
3551	015652	010446			MOV R4,-(SP)
3552	015654	010546			MOV R5,-(SP)
3553	015656	013701	001250		MOV TEMP2,R1
3554	015662	012137	016112		MOV (R1)+,WRDCNT
3555	015666	112137	016114		1\$: MOV (R1)+,CHRCNT
3556	015672	112137	016115		MOVB (R1)+,SPACNT
3557	015676	013137	016116		MOV @ (R1)+,BINWRD
3558	015702	105737	016114		TSTB CHRCNT
3559	015706	100007			BPL 7\$
3560	015710	042737	000200	016114	BIC #BIT7,CHRCNT
3561	015716	012737	177777	016120	MOV #-1,XFLAG
3562	015724	000402			BR 2\$
3563	015726	005037	016120		7\$: CLR XFLAG
3564	015732	013704	016116		2\$: MOV BINWRD,R4
3565	015736	113705	016114		MOVB CHRCNT,R5
3566	015742	012700	016720		MOV #TEMP,RO
3567	015746	010403			3\$: MOV R4,R3
3568	015750	042703	177770		BIC #177770,R3
3569	015754	062703	000260		ADD #260,R3
3570	015760	110320			MOVB R3,(R0)+
3571	015762	000241			CLC
3572	015764	006004			ROR R4
3573	015766	000241			CLC
3574	015770	006004			ROR R4
3575	015772	000241			CLC

3576	015774	006004			ROR	R4
3577	015776	005305			DEC	R5
3578	016000	001362			BNE	3\$
3579	016002	012703	016762		MOV	#MDATA,R3
3580	016006	114023		4\$:	MOVB	-(R0),(R3)+
3581	016010	105337	016114		DECB	CHRCNT
3582	016014	001374			BNE	4\$
3583	016016	005737	016120		TST	XFLAG
3584	016022	001403			BEQ	.+10
3585	016024	052737	000006	016762	BIS	#6,MDATA
3586	016032	105737	016115		TSTB	SPACNT
3587	016036	001405			BEQ	6\$
3588	016040	112723	000240	5\$:	MOVB	#240,(R3)+
3589	016044	105337	016115		DECB	SPACNT
3590	016050	001373			BNE	5\$
3591	016052	105013		6\$:	CLRB	(R3)
3592	016054	104401			TYPE	
3593	016056	016762			MDATA	
3594	016060	005337	016112		DEC	WRDCNT
3595	016064	001300			BNE	1\$
3596	016066	013737	001246	016720	MOV	TEMP1,TEMP
3597	016074	012605			MOV	(SP)+,R5
3598	016076	012604			MOV	(SP)+,R4
3599	016100	012603			MOV	(SP)+,R3
3600	016102	012602			MOV	(SP)+,R2
3601	016104	012601			MOV	(SP)+,R1
3602	016106	012600			MOV	(SP)+,R0
3603	016110	000002			RTI	
3604	016112	000000			WRDCNT:	0
3605	016114	000000			CHRCNT:	0
3606		016115			SPACNT=	CHRCNT+1
3607	016116	000000			BINWRD:	0
3608	016120	000000			XFLAG:	0
3609						
3610						;SAVE PC OF TEST THAT FAILED AND RO-R5
3611						
3612	016122	016637	000004	001276	.SAV05:	MOV 4(SP),SAVPC
3613						
3614						;SAVE RO-R5
3615						
3616	016130	010537	001272		SV05:	MOV R5,SAVR5
3617	016134	010437	001270			MOV R4,SAVR4
3618	016140	010337	001266			MOV R3,SAVR3
3619	016144	010237	001264			MOV R2,SAVR2
3620	016150	010137	001262			MOV R1,SAVR1
3621	016154	010037	001260			MOV R0,SAVR0
3622	016160	000002				RTI
3623						
3624						;RESTORE RO-R5
3625						
3626	016162	013700	001260		.RES05:	MOV SAVR0,R0
3627	016166	013701	001262			MOV SAVR1,R1
3628	016172	013702	001264			MOV SAVR2,R2
3629	016176	013703	001266			MOV SAVR3,R3
3630	016202	013704	001270			MOV SAVR4,R4
3631	016206	013705	001272			MOV SAVR5,R5

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3632 016212 000002      RTI
3633                    ; TRAP DISPATCH SERVICE
3634                    ; ARGUMENT OF TRAP IS EXTRACTED
3635                    ; AND USED AS OFFSET TO OBTAIN POINTER
3636                    ; TO SELECTED SUBROUTINE
3637
3638 016214 011646      .TRPSR: MOV      (SP), -(SP)      ; GET PC OF RETURN
3639 016216 162716 000002 SUB      #2, (SP)      ; =PC OF TRAP
3640 016222 017616 000000 MOV      @ (SP), (SP)  ; GET TRP
3641 016226 006316      TRPOK: ASL      (SP)      ; MULTIPLY TRAP ARG BY 2
3642 016230 042716 177001 BIC      #177001, (SP) ; CLEAR UNWANTED BITS
3643 016234 062716 001304 ADD      #.TRPTAB, (SP) ; POINTER TO SUBROUTINE ADDRESS
3644 016240 017616 000000 MOV      @ (SP), (SP)  ; SUBROUTINE ADDRESS
3645 016244 000136      JMP      @ (SP)+      ; GO TO SUBROUTINE
3646 016246 005015 041520 020072 MERRPC: .ASCIZ <15><12>/PC: /
3647 016254 000
3648 016256
3649 016256      .EVEN
3650 016256 000000      .ERRTAB:
3651 016260 000000      0
3652 016262 000000      0
3653 016264 016314      0
3654 016266 016522      EMO
3655 016270 016656      DHO
3656 016272 016356      DTO
3657 016274 016606      EM1
3658 016276 016700      DH1
3659 016300 016415      DT1
3660 016302 016621      EM2
3661 016304 016706      DH2
3662 016306 016462      DT2
3663 016310 016606      EM3
3664 016312 016700      DH1
3665 016314 005015 047522 020115 EMO:  .ASCIZ <15><12>/ROM READ DATA COMPARISON ERROR./
      016356 005015 051127 052111 EM1:  .ASCIZ <15><12>/WRITTING ROM FAILED TO TRAP./
      016415 015 052412 042516 EM2:  .ASCIZ <15><12>/UNEXPECTED TRAP WHILE READING ROM./
      016462 005015 040506 040524 EM3:  .ASCIZ <15><12>/FATAL TRAP. ROM PC ON STACK./
      016522 005015 051040 046517 DHO:  .ASCII <15><12>/ ROM      SOFT/
      016541 015 040412 042104 DH1:  .ASCIZ <15><12>/ADDRESS ADDRESS EXPECTED FOUND /
      016606 005015 042101 051104 DH1:  .ASCIZ <15><12>/ADDRESS /
      016621 015 051012 046517 DH2:  .ASCIZ <15><12>/ROM ADDRESS PC OF TRAP /
      016656
3666 016656 000004      .EVEN
3667 016660 006 003      DTO:  4
      .BYTE 6,3
3668 016662 001260      .BYTE
3669 016664 006 004      SAVRO
3670 016666 001270      .BYTE 6,4
3671 016670 206 003      SAVR4
3672 016672 001262      .BYTE 206,3
3673 016674 006 002      SAVR1
3674 016676 001272      .BYTE 6,2
3675
3676 016700 000001      DT1:  1
3677 016702 206 002      .BYTE 206,2
3678 016704 001260      SAVRO
3679

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DOBMAA.P11 MAINDEC-11-DOBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

3680	016706	000002		DT2:	2	
3681	016710	206	002		.BYTE	206,2
3682	016712	001260			SAVRO	
3683	016714	006	010		.BYTE	6,8.
3684	016716	014712			XSTORE	
3685						
3686	016720	000000		TEMP:	0	
3687		016762			.+.40	
3688	016762	000000		MDATA:	0	
3689		017024			.+.40	
3690	017024			CORMAX:		

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DOBMAA.P11 MAINDEC-11-DOBMA-A BM873 UNIVERSAL RESTART LOADER DIAGNOSTIC.

3691 017400 017400
3692 017400 000020
3693 017400 000001

.=017400
ERRST: .BLKW 20
.END

ADD	2879	3366	3422	3472	3475	3546	3569	3643							
ASL	3471	3473	3641												
BCS	3043	3045	3047	3070	3072	3074									
BEQ	2631	2745	2747	2806	2813	2818	2820	2847	2849	2852	2911	2916	2935	2996	2998
	3000	3005	3065	3114	3120	3123	3157	3164	3169	3171	3198	3200	3203	3291	3296
	3311	3319	3375	3390	3397	3413	3426	3454	3461	3481	3499	3503	3506	3508	3513
	3515	3531	3584	3587											
BIC	3040	3075	3343	3474	3560	3568	3642								
BIS	3048	3076	3585												
BIT	2692	2739	2808	2817	2842	2846	2915	3038	3066	3119	3159	3168	3193	3197	3374
	3389	3412	3423	3453	3458	3530									
BLCS	3026														
BNE	2638	2654	2662	2666	2680	2690	2693	2699	2708	2714	2720	2726	2733	2740	2753
	2756	2759	2762	2798	2801	2809	2811	2833	2836	2843	2845	2857	2896	2905	2913
	2937	2946	3002	3007	3022	3034	3039	3067	3116	3149	3152	3160	3162	3184	3187
	3194	3196	3208	3245	3276	3302	3304	3345	3367	3388	3399	3424	3428	3459	3483
	3572	3582	3590	3595											
BPL	2696	2742	2881	3341	3430	3445	3456	3491	3524	3559					
BR	2644	2668	2671	2704	2735	2749	2775	2816	2824	2950	2855	2883	2914	2938	2990
	2992	3117	3128	3167	3175	3201	3206	3432	3440	3443	3447	3562			
CLC	3041	3068	3273	3299	3571	3573	3575								
CLR	2619	2620	2623	2624	2625	2628	2629	2738	2884	2940	2947	2982	3017	3027	3050
	3060	3082	3129	3241	3257	3282	3306	3314	3347	3351	3365	3369	3379	3392	3393
	3441	3452	3517	3518	3519	3563									
CLRB	3463	3591													
CMP	2637	2645	2653	2661	2665	2669	2679	2698	2707	2713	2719	2725	2744	2752	2755
	2758	2761	2797	2799	2800	2802	2805	2812	2815	2819	2832	2835	2848	2851	2895
	2904	2910	2934	2945	2995	2997	2999	3001	3004	3006	3021	3025	3033	3064	3113
	3122	3148	3150	3151	3153	3156	3163	3166	3170	3183	3186	3199	3202	3275	3290
	3295	3301	3310	3318	3344	3398	3460	3505	3507	3512	3514				
COM	2691	3246													
DEC	2746	2810	2844	2856	2912	2936	3115	3161	3195	3207	3303	3387	3577	3594	
DECB	3581	3589													
EMT	559														
HALT	583	585	587	589	591	593	595	597	599	601	603	605	607	609	611
	613	615	617	619	621	623	625	627	629	631	633	635	637	639	641
	643	645	647	649	651	653	655	657	659	661	663	665	667	669	671
	673	675	677	679	681	683	685	687	689	691	693	695	697	699	701
	703	705	707	709	711	713	715	717	719	721	723	725	727	729	731
	733	735	737	739	741	743	745	747	749	751	753	755	757	759	761
	763	765	767	769	771	773	775	777	779	781	783	785	787	789	791
	793	795	797	799	801	803	805	807	809	811	813	815	817	819	821
	823	825	827	829	831	833	835	837	853	2688	2750	2774	2941	3358	3361
	3527														
INC	3272	3529													
JMP	847	849	2651	2659	2677	2685	2754	2757	2760	2763	2765	2859	2860	2942	3003
	3210	3211	3277	3322	3348	3370	3380	3400	3533	3645					
JSR	2858	3209	3321	3391	3401										
MOV	2621	2622	2626	2627	2632	2633	2636	2639	2640	2643	2646	2647	2648	2649	2650
	2655	2656	2657	2658	2663	2664	2667	2670	2673	2674	2675	2676	2681	2682	2683
	2684	2700	2701	2702	2705	2709	2710	2711	2715	2716	2717	2721	2722	2723	2727
	2728	2729	2731	2737	2748	2751	2787	2788	2789	2790	2791	2792	2793	2794	2795
	2796	2803	2804	2821	2822	2828	2829	2830	2831	2838	2841	2876	2877	2878	2882
	2885	2886	2887	2888	2891	2892	2893	2894	2897	2901	2902	2903	2906	2917	2918
	2921	2922	2923	2924	2925	2928	2929	2930	2933	2949	2983	2984	2985	2986	2988
	3012	3013	3014	3018	3028	3031	3035	3036	3059	3061	3078	3079	3080	3087	3094

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	3095	3098	3099	3100	3101	3105	3106	3107	3111	3126	3127	3139	3140	3141	3142
	3143	3144	3145	3146	3147	3154	3155	3172	3173	3179	3180	3181	3182	3189	3192
	3238	3239	3240	3242	3243	3247	3248	3249	3250	3256	3258	3260	3261	3262	3263
	3266	3268	3269	3279	3280	3281	3283	3285	3286	3287	3288	3289	3293	3294	3305
	3307	3308	3309	3313	3315	3316	3317	3339	3342	3352	3353	3356	3357	3360	3363
	3364	3373	3376	3378	3385	3396	3414	3419	3420	3421	3433	3434	3436	3462	3465
	3467	3468	3469	3470	3476	3477	3478	3479	3504	3509	3510	3511	3516	3526	3532
	3544	3545	3547	3548	3549	3550	3551	3552	3553	3554	3557	3561	3564	3566	3567
	3579	3596	3597	3598	3599	3600	3601	3602	3612	3616	3617	3618	3619	3620	3621
	3626	3627	3628	3629	3630	3631	3638	3640	3644						
MOV8	3431	3446	3457	3492	3495	3555	3556	3565	3570	3580	3588				
NOP	2635	2642	2839	3190	3259	3284	3355	3402	3403	3404	3405	3439			
RESET	3346	3386													
ROL	3042	3044	3046	3069	3071	3073	3274	3300							
ROR	3572	3574	3576												
RTI	2950	3008	3010	3019	3032	3037	3049	3052	3062	3077	3081	3085	3130	3349	3382
	3415	3435	3534	3603	3622	3632									
RTS	855	3406													
SUB	3466	3639													
TRAP	916	918	920	922	924	926	928								
TST	2630	2634	2641	2689	2732	2823	2834	2837	2854	2898	2907	3024	3102	3108	3112
	3121	3174	3185	3188	3205	3244	3298	3354	3427	3438	3482	3498	3502	3523	3583
TSTB	2695	2741	2880	3340	3425	3429	3444	3455	3480	3490	3558	3586			
WAIT	2989	2991													
.ASCII	2776	2863	2952	3337	3665										
.ASCIZ	2776	2863	2952	3213	3329	3337	3646	3665							
.BLKW	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	3692				
.BYTE	903	904	905	906	1396	1397	1398	1399	1400	1401	2954	2956	2960	3216	3219
	3221	3331	3334	3536	3667	3669	3671	3673	3677	3681	3683				
.ENABL	4	512													
.END	3693														
.ENDC	194	199	204	227	232	237	260	265	270	2647	2655	2663	2673	2681	3693
.EQUIV	559														
.EVEN	2776	2863	2952	3214	3329	3337	3648	3665							
.IF	189	194	199	222	227	232	255	260	265	2639	2647	2655	2663	2681	3693
.IRP	916	918	920	922	924	926	928								
.LIST	4	169	173	498	512	918	920	922	924	926	928	930	934	2604	2776
	2863	2952	3329	3337	3665	3693									
.MACRO	4	933													
.NLIST	4	169	173	498	512	918	920	922	924	926	928	930	934	2604	2776
	2863	2952	3329	3337	3665	3693									
.PAGE	50	101	326	362	410	498	531	580	900	1121	1493	1964	2015	2062	2125
	2170	2221	2291	2345	2398	2452	2499	2551	2614	2777	2825	3176	3329		
.REM	5	51	102	271	327	363	411	468	2405	2455					
.REPT	582														
.SBTTL	4														
.TITLE	512														
.WORD	3538														

ERRORS DETECTED: 0
 DEFAULT GLOBALS GENERATED: 0

*,DDBMAA.SEQ/SOL/CRF/PAGNUM=DDBMAA

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DDMA MACY11 27(732) 22-SEP-76 14:43 PAGE 92
DDMAA.P11 CROSS REFERENCE TABLE -- PERMANENT SYMBOLS

RUN-TIME: 15 27 3 SECONDS
RUN-TIME RATIO: 153/46=3.2
CORE USED: 13K (25 PAGES)

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