

2088

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PROGRAM ID	DECK PN	LISTING PN	USER GUIDE BLOCK	COMMENT
001	2589651	N/A	17	MFCU MOD I TAP MODULE
002	2589652	N/A	17	.
003	2589653	N/A	17	.
004	2589654	N/A	17	.
005	2589655	N/A	17	.
006	2589656	N/A	17	.
007	2589657	N/A	17	.
008	2589658	N/A	17	.
009	2589659	N/A	17	.
00A	2589660	N/A	17	.
00B	2589661	N/A	17	.
00C	2589662	N/A	17	.
00D	2589663	N/A	17	.
00E	2589664	N/A	17	.
00F	2589665	N/A	17	.
010	2589666	N/A	17	.
011	2589667	N/A	17	.
012	2589668	N/A	17	.
013	2589669	N/A	17	.
014	2589670	N/A	17	.
021	2589671	N/A	17	MFCU MOD II TAP MODULE
022	2589672	N/A	17	.
023	2589673	N/A	17	.
024	2589674	N/A	17	.
025	2589675	N/A	17	.
026	2589676	N/A	17	.
027	2589677	N/A	17	.
028	2589678	N/A	17	.
029	2589679	N/A	17	.
02A	2589680	N/A	17	.
02B	2589681	N/A	17	.
02C	2589682	N/A	17	.
02D	2589683	N/A	17	.
02E	2589684	N/A	17	.
02F	2589685	N/A	17	.
030	2589686	N/A	17	.
031	2589687	N/A	17	.
032	2589688	N/A	17	.
033	2589689	N/A	17	.
034	2589690	N/A	17	.
060	2589962	N/A	16	5203 TAP MODULE
061	2589963	N/A	16	TAP MODULE
062	2589964	N/A	16	TAP MODULE
063	2589965	N/A	16	TAP MODULE
064	2589966	N/A	16	TAP MODULE
065	2589967	N/A	16	TAP MODULE
066	2589968	N/A	16	TAP MODULE
067	2589969	N/A	16	TAP MODULE
068	2589970	N/A	16	TAP MODULE
069	2589971	N/A	16	TAP MODULE
06A	2589972	N/A	16	TAP MODULE
06C	2589973	N/A	16	TAP MODULE
06E	2589974	N/A	16	TAP MODULE
06F	2589975	N/A	16	TAP MODULE
070	2589976	N/A	16	TAP MODULE
074	7369310	N/A	16	TAP MODULE
075	7369311	N/A	16	TAP MODULE
076	7369312	N/A	16	TAP MODULE
077	7369313	N/A	16	TAP MODULE
078	7369314	N/A	16	TAP MODULE
079	7369315	N/A	16	TAP MODULE
07F	2454574	N/A	16	TAP MODULE
088	2775693	N/A	51	1442 TAP MODULE
089	2775694	N/A	51	TAP MODULE
08A	2775695	N/A	51	TAP MODULE
08B	2775696	N/A	51	TAP MODULE
08C	2775697	N/A	51	TAP MODULE
08D	2775698	N/A	51	TAP MODULE
08E	2775699	N/A	51	TAP MODULE
0CF	259J746	N/A	04	DATA DECK FOR FF7
101	2589981	2589982	15	5471 PRINTER/KEYBOARD
102	2589983	2589984	15	PRINTER/KEYBOARD
103	2589985	2589986	15	PRINTER/KEYBOARD
104	2589987	2589988	15	PRINTER/KEYBOARD
105	2589989	2589990	15	PRINTER/KEYBOARD
10F	2589910	2589911	11	SYSTEM TEST
111	2589928	2589929	14	5475 KEYBOARD
112	2589931	2589932	14	KEYBOARD
11F	2589912	2589913	11	SYSTEM TEST
201	N/A	N/A	22	MLTA CONFIGURE DATA (CREATED BY FE7)
202	2588525	2588526	22	ERAP PCB MLTA
203	2588527	2588528	22	BASIC CHECKOUT
204	2588529	2588530	22	FUNCTIONAL CHECKOUT
205	2588531	2588532	22	MICRO-CODE LOADER
206	2588533	2588534	22	LOOP/WRAP TEST
207	2588535	2588536	22	LINE TEST
20F	2588537	2588538	11	SYSTEM TEST
301	2588794	2588791	18	SIOC FUNCTION TEST WITHOUT CONNECTION
302	2588795	2588792	18	FUNCTION TEST WITH CONNECTION
303	2588796	2588793	18	DATA TRANSFER FUNCTION TEST
351	2552542	2552541	N/A	1255 DIAGNOSTIC
352	2552545	2552544	N/A	DIAGNOSTIC
353	2552548	2552547	N/A	DIAGNOSTIC
35F	2495154	2495153	11	SYSTEM TEST
511	2775681	2775682	51	1442 COMMAND RESPONSE TEST
512	2775683	2775684	51	READ COMMANDS FROM DATA SWITCHES
513	2775685	2775686	51	CARD IMAGE READ AND THRUPTUT TEST
514	2775687	2775688	51	STACKER SELECT TEST
515	2775689	2775690	51	READ EVALUATION AND ADJUSTMENT TEST
51F	2775691	2775692	11	SYSTEM TEST
701	2521877	2521876	N/A	3411 FUNCTION TEST SECTION 1
702	2521879	2521878	N/A	FUNCTION TEST SECTION 2
705	2521881	2521880	N/A	ACAPTER FAULT LOCATER
708	2521883	2521882	N/A	CAPSTAN FAULT LOCATER
70A	2521885	2521884	N/A	SKREW ADJUST
70E	2521887	2521886	N/A	PTE (PROGRAMMABLE TAPE EXERCISER)
70F	2521889	2521888	11	SYSTEM TEST MODULE
710	2521891	2521890	N/A	LOGANAL FORMAT
711	2521893	2521892	N/A	LOGANAL SECTION 1
712	2521895	2521894	N/A	LOGANAL SECTION 2
713	2521897	2521896	N/A	EREP (ERROR RECORDING & EDITING PROGRAM)

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B02	2589703	2589704	19	FUNCTION TEST
B03	2589705	2589706	19	FUNCTION TEST
B04	2589707	2589708	19	FUNCTION TEST
B05	2589709	2589710	19	FUNCTION TEST
B06	2589711	2589712	19	FUNCTION TEST
B09	2589715	2589716	19	ON-LINE REQUESTOR
B0A	2589717	2589718	19	ON-LINE RESPONSE
B0E	2589992	2589993	19	BSCA-1 & 2 TERMINAL STATISTICS
B0F	2589996	2589997	11	BSCA-1 SYSTEM TEST
B30	2588498	2588499	83	3735 EC UPDATE & RESTORATION PROGRAM
B21	7369833	7369834	82	2972 FUNCTION TEST
B22	7369835	7369836	82	FUNCTION TEST
B23	7369837	7369838	82	FUNCTION TEST
B24	7369839	7369840	82	FUNCTION TEST
B25	7369841	7369842	82	FUNCTION TEST
B26	7369843	7369844	82	FUNCTION TEST
B27	7369845	7369846	82	EXERCISER
B71	2588493	2588494	87	3270 PATTERN TEST
B72	2588495	2588496	87	PATTERN TEST
B81	7369821	7369822	19	BSCA-2 FUNCTION TEST
B82	7369823	7369824	19	FUNCTION TEST
B83	7369825	7369826	19	FUNCTION TEST
B84	7369827	7369828	19	FUNCTION TEST
B85	7369829	7369830	19	FUNCTION TEST
B86	7369831	7369832	19	FUNCTION TEST
B8F	2589994	2589995	11	SYSTEM TEST
A01	5129612	5129611	13	5444 FCU LOGIC DIAGNOSTIC
A03	5129625	5129624	13	SEEK TEST
A05	5129629	5129628	13	WRITE DATA
A06	5129631	5129630	13	VERIFY DATA
A07	5129633	5129632	13	READ DIAGNOSTIC
A08	5129635	5129634	13	READ DATA TEST
A09	5129637	5129636	13	WRITE ID AND DISK SELECT
A0A	5129639	5129638	13	SCAN EQUAL
A0B	5129641	5129640	13	SCAN LOW CR EQUAL
A0C	5129643	5129642	13	SCAN HI OR EQUAL
A0D	5129645	5129644	13	SPEED TEST
A0E	5129627	5129626	13	SEEK TEST
A0F	5129651	5129650	11	SYSTEM TEST
B01	5129614	5129613	13	FCU LCGIC
B03	5129647	5129646	13	IPL FORMAT CHECK
B04	5129649	5129648	13	FRIEND TEST
C01	7369101	7369100	24	5445 FCU LOGIC DIAGNOSTIC
C02	7369103	7369102	24	FCU LCGIC DIAGNOSTIC
C04	7369105	7369104	24	SEEK AND READ TEST
C05	7369107	7369106	24	WRITE AND DUAL ACCESS TEST
C81	7369109	7369108	24	5445 FRIENDS TEST
C82	7369111	7369110	24	5445 SPECIAL TESTS
C0F	7369115	7369114	11	5445 SYSTEMS TEST MODULE
DUP	2589943	2589942	09	CARD DUPLICATE PROGRAM
E01	2589950	2589951	16	5203 PRINT FUNCTION TEST
E02	2589952	2589953	16	PRINTER FUNCTION TEST
E03	2589954	2589955	16	PRINTER CHAIN CHAR COUNTER PIP
E04	2589956	2589957	16	PRINTER CYCLE STEAL & HMR ADDR
E05	2589958	2589959	16	PRINTER DATA & IMAGE ADDR. REG.
E06	2589960	2589961	16	PRINTER CHAIN EMITTER TIMING
E07	2589947	2589948	16	PRINTER DUAL CARRIAGE FEATURE
E0A	2589955	2589946	16	ONE CARD RIPPLE PRINT
E0F	2589914	2589915	11	SYSTEM TEST
E11	2588476	2588477	21	1403 ATTACHMENT TEST
E12	2588478	2588479	21	FUNCTION TEST
E13	2588480	2588481	21	CHAR CNT TEST
E14	2588482	2588483	21	CHAIN EMITTER TIMING
E15	2588484	2588485	21	CARRIAGE TIMING & ADJUSTMENT
E16	2588476	2588477	21	HAMMER ADDRESSING AND SENSE
E17	2588488	2588489	21	SPECIAL ATTACHMENT
E18	2588500	2588501	21	1403 SYS CARR DIAG II
E1F	2588490	2588491	11	SYSTEM TEST
ERP	2589747	2589748	03	CARD ERAP
F01	2589731	2589732	17	MFCU FUNCTION TEST
F02	2589733	2589734	17	READ/PUNCH/PRINT TEST
F03	2589735	2589736	17	READ EVAL & ALJ TEST
F05	2589741	2589742	17	KATAKANA RIPPLE PRINT
F0A	2589727	2589725	17	ONE CARD READ CHECK
F0B	2589728	2589726	17	ONE CARD READ ANALYSIS
F0F	2589916	2589917	11	SYSTEM TEST
FE1	2589908	2589909	11	5410 CPU SYSTEM TEST
FE5	2588539	2588540	22	MLTA CUSTOMER PACE MICRO-CODE LOADER
FE6	2588467	2588466	05	MFCU-LESS LSK CHECK CUT
FE7	2588541	2588542	22	MLTA CONFIGURATOR
FE8	2588461	2588462	20	APLD I/O OVERLAY FOR FP6
FE9	2588464	2588465	07	APLD LOADER FOR DCP (TAPE CASSETTE)
FF0	2545600	N/A	22	MLTA MICRO-CODE
FF1	2589904	2589905	11	SYSTEM TEST LOADER
FF2	2589906	2589907	11	SYSTEM TEST SUPERVISOR
FF3	2588450	2588451	04	OVERLAY FOR DISK ERAP (FF7)
FF4	2589722	2589923	12	MASTER TAP
FF5	5129659	5129658	20	5444 DISK INITIALIZER
FF6	5129662	5129661	20	5444 DISK EDITOR
FF7	2589744	2589745	04	DISK ERAP
FF8	2589738	2589739	08	USAGE METER TEST
FF9	7369113	7369112	24	5445 DISK INITIALIZER
FFA	2588454	2588455	10	DISK IPL LOADER
FFB	2588456	2588457	10	DISK DCP LOADER
FFD	5134043	5134042	20	I/O OVER FOR DISK EDITOR
FFE	2775651	2775652	07	APLD LOADER FOR DCP (1442)
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USER'S GUIDE TO THE  
INTEGRATED MAINTENANCE PACKAGE

1.0 PURPOSE: THE PURPOSE OF THIS SECTION IS TO GIVE YOU DETAILED INFORMATION CONCERNING THE SYSTEM/3 INTEGRATED MAINTENANCE PACKAGE (IMP).

2.0 INTRODUCTION: THE INTEGRATED MAINTENANCE PACKAGE CONSISTS OF:

- A. FE EDUCATION COURSES
- B. MAINTENANCE ANALYSIS PROCEDURE (MAP) CHARTS
- C. CE AIDS DESIGNED ESPECIALLY FOR THIS SYSTEM AND THE MST-1 TECHNOLOGY
- D. FE PUBLICATIONS
- E. DIAGNOSTIC PROGRAMS

THIS PACKAGE IS UNIQUE IN THE FACT THAT IT EFFECTIVELY TIES ALL MAINTENANCE EQUIPMENT AND INFORMATION TOGETHER. THIS PACKAGE, WHEN USED CORRECTLY, MAKES DIAGNOSING SYSTEM PROBLEMS SIMPLE, REQUIRES A MINIMUM OF RECALL ON THE PART OF THE CE AND GREATLY REDUCES DIAGNOSTIC TIME.

THE IMP IS PRIMARILY ORIENTED TOWARD FIRST LINE MAINTENANCE PERSONNEL. HOWEVER, SUPPORT PERSONNEL AT ALL ECHELONS WILL ALSO FIND THE IMP USEFUL IN SOLVING DIFFICULT SYSTEM PROBLEMS. THE SYSTEMATIC APPROACH OF THE MAP CHARTS TO PROBLEMS, THE VERSATILITY OF THE MASTER TAP PROGRAM, THE DETAILED TESTING DONE BY THE DIAGNOSTIC PROGRAMS AND THE ADVANCE CE AIDS WILL ASSIST THE SPECIALIST IN RECALLING SYSTEM OPERATION AND IN DIAGNOSING THE PROBLEM.

3.0 INTEGRATED MAINTENANCE PACKAGE:

3.1.0 FE EDUCATION - THE IMP HAS BEEN DESIGNED FOR SIMPLICITY OF USE. HOWEVER, SOME TRAINING IS REQUIRED TO USE IT EFFECTIVELY. THIS TRAINING, PLUS THE TRAINING YOU REQUIRE TO UNDERSTAND SYSTEM OPERATION, AND THE OPERATION AND REPAIR OF VARIOUS I/O DEVICES, HAS BEEN COVERED IN YOUR FE TRAINING CLASS. THIS GUIDE, PLUS THE INTRODUCTIONS AT THE BEGINNING OF EACH SET OF MAP CHARTS WILL ASSIST YOU IN RECALLING SOME OF THE DETAILS PERTINENT TO THE SYSTEM.

3.2.0 MAP CHARTS - THE MAP CHARTS HAVE BEEN DESIGNED TO ISOLATE FAILURES IN THE MINIMUM AMOUNT OF TIME AND WITHOUT ELABORATE TEST EQUIPMENT. THESE CHARTS SHOULD BE USED PRIOR TO TRYING FREE-LANCE METHODS ON A PROBLEM.

THE MAP CHARTS HAVE BEEN STANDARDIZED WHEREVER POSSIBLE. HOWEVER, CLARITY, SIMPLICITY, AND EASE OF USE HAVE BEEN THE OVERRIDING FACTORS IN MAP CHART DESIGN. FOR THESE REASONS THERE WILL BE DIFFERENCES BETWEEN THE MAP CHARTS FOR VARIOUS SYSTEM DEVICES. AN EXPLANATION OF THESE VARIATIONS AND OTHER INFORMATION PERTINENT TO THE CHARTS FOR EACH I/O DEVICE ARE CONTAINED IN THE BRIEF INTRODUCTION AT THE BEGINNING OF EACH SET OF MAP CHARTS. THE INDIVIDUAL INTRODUCTIONS ALSO CONTAIN A SUMMARY OF DIAGNOSTIC PROGRAMS AVAILABLE FOR THE DEVICE AND A SUMMARY OF ALL DIAGNOSTIC HALT ID'S. THIS SUMMARIZED INFORMATION WILL BE BENEFICIAL TO YOU IN YOUR DIAGNOSTIC EFFORTS. MORE DETAILED DESCRIPTIONS OF ALL DIAGNOSTIC PROGRAMS CAN BE FOUND IN THIS GUIDE.

THE FOLLOWING ITEMS MUST BE OBSERVED WHEN USING THE MAP CHARTS:

1. CHECK THE PROBE FOR CORRECT OPERATION.
2. IF THERE IS ANY DOUBT AS TO WHETHER A PROBLEM IS A CPU OR I/O DEVICE PROBLEM ALWAYS GO THROUGH THE SYSTEM STRATEGY CHART. THIS CHART WILL EVENTUALLY DIRECT YOU TO THE FAILING I/O DEVICE. ONCE YOU EXIT TO THE I/O DEVICE, HOWEVER, IT IS ASSUMED THE CPU IS FUNCTIONING PROPERLY.

\*\*\*\*\*  
\* ALWAYS START AT THE SYSTEM STRATEGY CHART UNLESS YOU \*  
\* ARE CERTAIN IT IS AN I/O DEVICE PROBLEM. \*  
\*\*\*\*\*

3. ALWAYS ENTER DEVICE MAP CHARTS AT THE ENTRY CHART.
4. WORK DILIGENTLY AND DOUBLE CHECK YOUR WORK AS YOU GO. IF YOU MAKE A MISTAKE GO BACK TO THE ENTRY CHART TO RESTART. REMEMBER, THE MAPS USE A VERY SYSTEMATIC APPROACH TO ALL PROBLEMS. IF YOU ALTER THIS APPROACH OR BACK UP IN THE MAPS, THEIR ACCURACY CANNOT BE GUARANTEED. IF YOU SUSPECT A HUMAN ERROR WAS MADE IN PROCEEDING THROUGH A CHART (PROBED WRONG PIN, MISREAD DECISION BLOCK, MISINTERPRETED ACTION STATEMENT), NOTE THE PART THE MAP SAYS IS FAILING ON THE FIRST PASS AND GO THRU THE CHARTS A SECOND TIME TO VERIFY THAT YOU HAVE NOT MADE A MISTAKE.
5. ALWAYS INVESTIGATE AUDIBLE NOISES AND OBVIOUS ERRORS BEFORE USING THE MAP CHARTS.
6. IF YOU HAVENT ISOLATED THE PROBLEM WITHIN TWO HOURS, IT IS RECOMMENDED THAT YOU CALL FOR ASSISTANCE.
7. A GLOSSARY OF ABBREVIATIONS AND THEIR MEANINGS IS CONTAINED IN SECTION 4.0. THESE ABBREVIATIONS ARE USED BECAUSE THE SYSTEM DECALS USE THEM, THEY ARE IBM "STANDARDS" OR BECAUSE THEY ARE USED SO FREQUENTLY THROUGHOUT OTHER SYSTEM DOCUMENTS.
8. IF THE MAP CHART EVER FAILS YOU, YOU MAY WISH TO CONSIDER THE FOLLOWING ITEMS DURING YOUR FREE-LANCE EFFORT:
  - A. CHECK FOR SHORTED NETS ON THE BOARDS. PARTICULARLY CHECK FOR LOOSE OBJECTS (E.G. PAPER CLIPS, BITS OF WIRE, DROPS OF SOLDER, ETC.) ON THE BOARD.
  - B. CHECK FOR OPEN LAND PATTERNS ON THE BOARD.
  - C. IF ERRORS ARE HIGHLY INTERMITTENT - CHECK THE POWER SUPPLY ADJUSTMENTS. THIS REQUIRES A METER WITH 1/4% ACCURACY SUCH AS THE WESTON 901 (PN 460879). THESE ARE AVAILABLE AT THE BRANCH OFFICES.
  - D. CHECK POWER CROSS-OVERS COMING FROM THE LAMINAR BUSS TO THE ELECTRONICS BOARDS.
  - E. CHECK FOR LOOSE AND SHORTED SIGNAL AND POWER CABLES.

9. ALL "PROBE" INSTRUCTIONS ARE FOR THE MST PROBE UNLESS THE SLD PROBE IS SPECIFIED.

10. WHEN CARDS ARE CALLED OUT AS THE FAILING UNIT, INSURE THE CARD IS SEATED.

THE ABOVE ITEMS SHOULD BE REVIEWED PERIODICALLY SINCE THEY ARE IMPORTANT TO SUCCESSFUL COMPLETION OF A CALL USING THE MAP CHARTS.

3.3.0 CE AIDS: THE FOLLOWING CE AIDS HAVE BEEN DEVELOPED FOR THIS SYSTEM: (SEE THE 5410 CPU FEMM FOR PICTURES).

3.3.1 CE DIAGNOSTIC PROBE - THIS PROBE IS DESIGNED AS A SUBSTITUTE FOR THE SCOPE IN NORMAL SYSTEM DIAGNOSTIC TECHNIQUES.

THE DIAGNOSTIC PROBE HAS TWO PROBE TIPS, ONE IS FOR PROBING MST-1 SIGNALS AND THE OTHER FOR SLD (SLT) 100/700 SIGNALS. ONLY ONE TIP AT A TIME IS USED. THIS TIP SLIPS OVER THE SIGNAL PIN OF INTEREST AND SUPPORTS THE PROBE.

TWO LAMPS ARE PROVIDED TO INDICATE THE STATUS OF THE LINE BEING PROBED. IF THE LINE HAS AN UP LEVEL THE "UP" INDICATOR WILL BE ON. A DOWN LEVEL WILL CAUSE THE "DOWN" INDICATOR TO LIGHT. A PULSE WILL BE SHOWN AS A FLASH OF ONE OF THE LIGHTS (DEPENDING ON THE POLARITY). A SERIES OF PULSES IS INDICATED BY BOTH LAMPS ON, OR ON ALTERNATELY, DEPENDING ON THE FREQUENCY OF THE PULSES.

EACH INDICATOR LAMP HAS ITS OWN SAMPLING CIRCUITS AND OPERATES INDEPENDENTLY OF THE OTHER LAMP. THUS PULSES WILL BE DETECTED AND DISPLAYED BY THE PROBE. IF A LINE IS ACTIVE, WHEN PROBED, THE APPROPRIATE INDICATOR WILL BE TURNED ON FOR APPROXIMATELY 75 MS. AFTER THIS TIME THE INDICATOR WILL GO OFF AND THE LINE WILL IMMEDIATELY BE SAMPLED AGAIN. IF IT IS STILL ACTIVE THE LAMP WILL BE TURNED ON FOR ANOTHER 75 MS, OTHERWISE IT WILL STAY OFF UNTIL THE LINE AGAIN BECOMES ACTIVE.

THE PROBE IS POWERED BY -4VDC AND GROUND, THROUGH A 42-INCH POWER CABLE. THE END OF THE CABLE HAS A 4-PIN SOCKET WHICH PLUGS ONTO THE POWER CROSS-OVER CONNECTORS ON THE MST BOARDS, OR AT OTHER SIMILAR LOCATIONS WHERE -4V AND GROUND HAVE BEEN PROVIDED IN THE PROPER PIN CONFIGURATION. ALWAYS KEEP THE SIDE OF THE POWER PLUG LABELED "UP" IN THE UP DIRECTION.

ADDITIONALLY, THE PROBE HAS TWO MST INPUT TERMINALS FOR 'GATING' PURPOSES. WHEN A JUMPER WIRE IS CONNECTED FROM ONE OF THESE GATES TO AN MST SIGNAL PIN, OPERATION OF THE INDICATOR LAMPS IS INHIBITED (BOTH LIGHTS OFF) UNTIL THE CORRECT POLARITY SIGNAL IS RECEIVED BY THE GATE. THE "+" GATE REQUIRES AN UP MST LEVEL TO START SAMPLING AND THE "-" GATE IS CONTINGENT UPON AN MST DOWN LEVEL. THESE GATES WORK FOR MST ONLY. HOWEVER, AN SLD SIGNAL AT THE SLD PROBE TIP MAY BE GATED WITH AN MST SIGNAL AT THE GATE. ALWAYS USE THE SHORTEST LEAD POSSIBLE WHEN JUMPERING A SIGNAL TO THE PROBE GATES.

- NOISE REJECTION -

THE PROBE INPUT SENSITIVITY IS COMPATIBLE WITH EITHER MST OR SLD CIRCUIT FAMILIES. THE PROBE CIRCUITRY CAN, HOWEVER, BE EFFECTED BY STRAY ELECTRICAL NOISE EMANATING FROM THE SWITCHING OF APPLIANCES SUCH AS DRILLS, FLUORESCENT LIGHTS OR FROM ELECTROSTATIC TYPE DISCHARGES. THE PROBE POWER CORD WHEN HANGING IN CLOSE PROXIMITY TO THE MEMORY AND ASSOCIATED MAGNETIC FIELD UNDER CERTAIN OPERATING CONDITIONS CAN GIVE ERRONEOUS INDICATIONS.

DETAILED FIELD TESTING OF CE PROBE - IF YOU SUSPECT THE PROBE IS NOT FUNCTIONING PROPERLY, PERFORM THE FOLLOWING TESTS TO VERIFY ITS ACCURACY (NC = NOT CONNECTED):

TEST NO.	CONNECT SLD TIP TO:	MST TIP	+ GATE	- GATE	INDICATOR RESPONSE
1.	+6V LAMINAR BUS	NC	NC	NC	UP LIGHT ON
2.	GROUND	NC	NC	NC	DOWN LIGHT ON
3.	NC	TIE-UP	NC	NC	UP LIGHT ON
4.	NC	TIE-DOWN	NC	NC	DOWN LIGHT ON
5.	NC	-4VDC	NC	NC	BOTH LIGHTS OFF
6.	NC	+6VDC LAMINAR BUS	NC	NC	BOTH LIGHTS OFF
7.	NC	CPU CLOCK	NC	NC	BOTH LIGHTS ON
8.	NC	CPU CLOCK	TIE-DOWN	NC	BOTH LIGHTS OFF
9.	NC	CPU CLOCK	NC	TIE-UP	BOTH LIGHTS OFF
10.	NC	(1)	NC	NC	PULSE ON LIGHT

NOTES: (1) CONNECT THE MST PROBE TO +PHASE 'B' CHANNEL LINE. SET THE CE MODE SWITCH TO CLOCK STEP. SEE IF THE PROBE WILL RESPOND (UP LIGHT FLASH ON) FOR EACH CLOCK. REPEAT TEST WITH PROBE CONNECTED TO A - PHASE 'B' SIGNAL AND SEE IF DOWN LIGHT WILL PULSE ON WITH EACH CLOCK ADVANCE.

THE FOLLOWING ARE TYPICAL SPECIFICATIONS PERTINENT TO THE PROBE. 'IN BETWEEN LEVELS' ARE NOT DEFINED AND WILL VARY FROM PROBE TO PROBE.

A. MST SPECIFICATIONS FOR MST PROBE TIP -

UP LEVEL: -0.55V TO -0.98V  
 DOWN LEVEL: -1.52V TO -2.18V  
 PROTECTION: +24VDC TO -30VDC  
 RESPONSE: 30 NANOSECOND PULSE WIDTH  
 INHIBIT RANGE: -0.5VDC TO +24VDC, -3.98VDC TO -30VDC, AND ON OPEN PINS.

B. SLD SPECIFICATIONS FOR SLD PROBE TIP -

UP LEVEL: +2.7VDC TO +60VDC  
 DOWN LEVEL: -.01VDC TO +0.45VDC  
 PROTECTION: -12VDC TO +60VDC  
 RESPONSE: 200 NS (WORSE CASE) PULSE WIDTH  
 INHIBIT RANGE: -3.0V TO -12.0V AND ON OPEN PINS.

C. SPECIFICATIONS FOR MST GATES -

1) "+" GATE:  
 ACTIVE RANGE: -1.01V TO -0.613V  
 INHIBIT RANGE: -1.55V TO -4.48V  
 2) "-" GATE:  
 ACTIVE RANGE: -1.55V TO -4.48V  
 INHIBIT RANGE: -0.613V TO -1.01V  
 3) PROTECTION: -4VDC TO +6VDC  
 4) RESPONSE: SAMF AS MST

D. POWER REQUIREMENTS: -4VDC +/- 12% AT 265 MA (MAX).

E. POWER DISSIPATION: 1.95 WATTS (WORSE CASE)

F. LAMPS: 2 EACH - PN 454612 (FIELD REPLACEABLE).

G. TIPS: 2 EACH - PN 453163 (FIELD REPLACEABLE).

3.3.2 THIS SECTION WAS INTENTIONALLY LEFT BLANK



3.3.3 CE SNS BITS - SPARE BITS IN EACH ATTACHMENT HAVE BEEN PROVIDED FOR CE USE. THESE BITS ALLOW THE CE TO INPUT SIGNALS WHICH ARE NOT NORMALLY AVAILABLE FOR SENSING INTO THE CPU. THESE SIGNALS ARE EXTREMELY USEFUL FOR DIAGNOSTIC MEASUREMENTS.

3.3.4 SINGLE PIN EXTENDERS -  
THE SINGLE PIN EXTENDERS (PN 2594238) SHIPPED WITH EACH SYSTEM ALLOW THE CE TO USE THE CE METER ON BOARD PINS WITHOUT SHORTING TO ADJACENT PINS. THIS EXTENDER SLIPS OVER THE PIN AND ALLOWS THE CE TO PLACE THE ALLIGATOR CLIPS OF HIS METER ON THE STUB END. THIS EXTENDER CAN ALSO BE USED TO MEASURE THE POWER TEST JACKS BY PLACING THE ALLIGATOR CLIP ON THE SLIP OVER END AND USING THE STUB END AS A METER PROBE.

3.3.5 MST CARD EXTENDERS - MST CARD EXTENDERS ARE AVAILABLE IN 1 WIDE (PN 2360067) AND 2 WIDE (PN 2360068) SIZES. THEY ALLOW YOU TO EXTEND MST CARDS ABOVE THE TOP OF ADJACENT CARDS IN THE GATES. THESE AIDS ARE USED FOR SCOPING MODULE PINS ON THE CARD AND FOR OTHER GENERAL SERVICE NEEDS. THEY ARE AVAILABLE AS BRANCH OFFICE TOOLS.

3.3.6 JUMPER WIRES - SIX JUMPER WIRES (2 EACH OF 6 INCH (PN 829117) 12 INCH (PN 2588263) AND 18 INCH (PN 2589117) ARE PROVIDED WITH EACH SYSTEM. THESE ARE USED IN CONJUNCTION WITH THE MAP CHARTS AND DIAGNOSTIC PROGRAMS. THEY ARE ALSO USED TO INPUT SIGNALS INTO THE CE DIAGNOSTIC PROBE GATES AND INTO THE CE SENSE BITS.

\*\*\*\*\*  
\* 1. ALWAYS USE THE SHORTEST JUMPER POSSIBLE WHEN JUMPERING \*  
\* SIGNAL PINS. \*  
\* 2. NEVER PLACE ONE END OF A JUMPER ON A PIN AND TOUCH THE \*  
\* OPPOSITE END TO OTHER PINS AS YOU COUNT THEM. \*  
\*\*\*\*\*

3.4.0 FE PUBLICATIONS:

THE FOLLOWING TYPES OF PUBLICATIONS WILL ALSO BE AVAILABLE FOR THE SYSTEM. EACH DEVICE HAS DETERMINED ITS OWN REQUIREMENTS FOR THE DOCUMENTS PRECEDED BY AN ASTERISK AND THESE MAY OR MAY NOT BE PROVIDED:

- A. FE THEORY OF OPERATIONS MANUAL (FETOM Y31-0207)
- \*B. FE MAINTENANCE MANUAL (FEMM Y31-0244)
- \*C. FE MAINTENANCE AND DIAGRAM MANUAL (FEMDM Y31-0202)
- D. FE AUTOMATED LOGIC DIAGRAMS (FEALD'S)
- E. INSTALLATION MANUAL (PN 2588280)
- F. ILLUSTRATED PARTS CATALOG (IPC Y31-0574)
- G. CE HANDBOOK FOR THE SYSTEM. (Y29-4046)
- H. PROGRAM LISTINGS.

4.0 STANDARD ABBREVIATIONS, SYMBOLS AND MEANINGS:

4.1 ABBREVIATIONS:

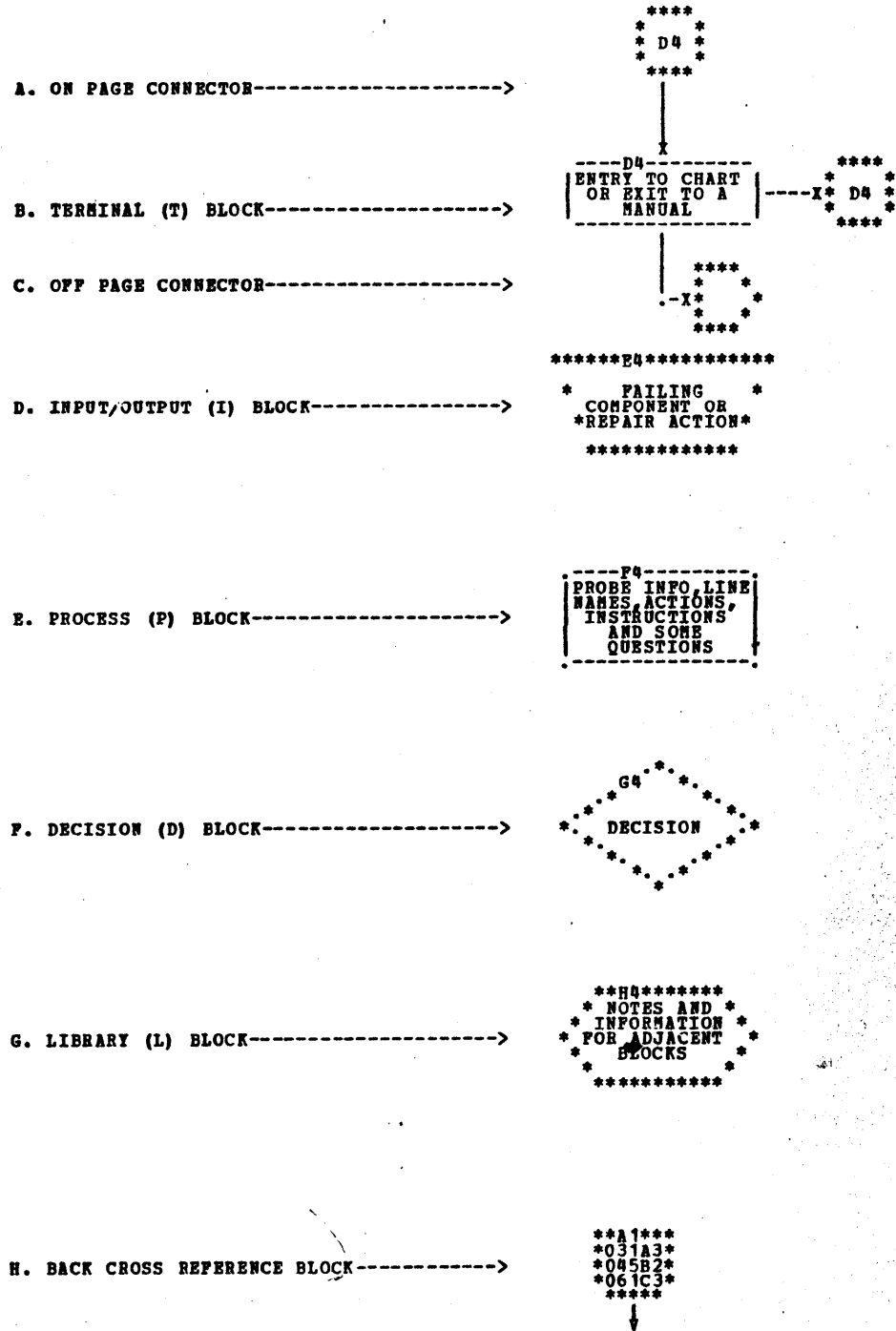
-----  
ACC ACCESS  
ALT ALTER  
ALU ARITHMETIC LOGIC UNIT  
AMP AMPLIFIER  
ARM ARMATURE  
ARR ADDRESS RECALL REGISTER  
ASMT ASSIGNMENT  
ATTN ATTENTION  
BIN BINARY  
CAR CARRY  
CARR CARRIAGE  
CHAN CHANNEL  
CHK CHECK  
CLK CLOCK  
CPU CENTRAL PROCESSING UNIT  
CR CONDITION REGISTER  
CS CYCLE STEAL  
CTRL CONTROL  
CYC CYCLE  
D. DEPRESS AND RELEASE  
DBI DATA BUSS IN  
DBO DATA BUSS OUT  
DEC DECIMAL  
DEV DEVICE  
DFC DUAL FEED CARRIAGE  
D.H. DEPRESS AND HOLD UNTIL NEXT NON-DECISION BLOCK  
DIAG DIAGNOSTIC  
DIG DIGIT  
DISP DISPLAY  
DPF DUAL PROGRAM FEATURE  
EM EMITTER  
EQ EQUAL  
FCU FILE CONTROL UNIT  
FD FEED  
FEMM FIELD ENGINEERING MAINTENANCE MANUAL  
FWD FORWARD  
GATE(+/-) PLACE '+' OR '-' GATE OF CE DIAGNOSTIC PROBE TO  
THE POINT INDICATED  
HOP HOPPER

IAR	INSTRUCTION ADDRESS REGISTER
INJ	INJECT
INV	INVALID
INCR	INCREMENTER
INST	INSTRUCTIONS
INT	INTERRUPT
INTF	INTERFACE
I/O	INPUT-OUTPUT
IPL	INITIAL PROGRAM LOAD / PROGRAM LOAD KEY
L.	LEFT
LVL	LEVEL
LPM	LINES PER MINUTE
LSR	LOCAL STORAGE REGISTER
M.	METER
MAG	MAGNET
MACH	MACHINE
MFCU	MULTI-FUNCTION CARD UNIT
MR	MANUAL ROUTINE
MS	MAIN STORAGE
OVFL	OVERFLOW REGISTER
P.	PROBE
PCB	PRINTER POWER CONTROL BOX
PCH	PUNCH
PEB	PRINTER ELECTRONICS BOARD
PROC	PROCESS
PR	PRESSURE ROLL
PS	POWER SUPPLY
PRT	PRINTER/PRINT
PTY	PARITY
PTX	PHOTO VARISTOR OR PHOTO TRANSISTOR
R./RGHT	RIGHT
RECOMP	RECOMPLEMENT
REG	REGISTER OR REGISTRATION
REV	REVERSE
RD	READ
RTN	ROUTINE
SAR	STORAGE ADDRESS REGISTER
SDR	STORAGE DATA REGISTER
SIOC	SERIAL INPUT/OUTPUT CHANNEL
SR	SYSTEM RESET
STOR	STORAGE
SW	SWITCH
SSW	SENSE SWITCH
TB	TERMINAL BLOCK
TEMP	TEMPORARY
TF	TEST FALSE
TRK	TRACK
UCS	UNIVERSAL CHARACTER SET
IR1	INDEX REGISTER 1
IR2	INDEX REGISTER 2

4.2 SYMBOLS:

THE FOLLOWING SYMBOLS HAVE BEEN ADOPTED AS MAP CHART STANDARDS FOR THE SYSTEM /3. INFORMATION AND REPAIR ACTION WHICH WILL NOT FIT IN ONE OF THE FOLLOWING STANDARD BLOCKS NORMALLY WILL BE PLACED IN A 'DRAW' BLOCK.

SYMBOL



4.3.0 STANDARD CALLOUTS

4.3.1 PROBE OPERATIONS - PROBE OPERATIONS ARE SPECIFIED IN THE FOLLOWING MANNER. ALL OPERATIONS REFER TO THE MST PROBE UNLESS SPECIFIED OTHERWISE:

P.A-B1K2S04	- MST CALLOUT
SLD PROBE ON PEB P.A-A1A3B02	- SLD CALLOUT
SLD P.A-B2D2U04	- SLD CALLOUT
P.A-B1K2S07	- MULTI-POINT
P.A-B1K2S09	PROBE OPERATION.
P.A-B1K2S11	
P.A-B1K2M08	- A MULTI-POINT
P.A-B1K2M06	PROBE OPERATION
P.A-B1K2D04	WITH ANOTHER ACTION
>D. CHECK RESET.	SPECIFIED. (PRESS
	CHECK RESET WHEN
	PROBING EACH POINT).

4.3.2 DIAGNOSTIC PROBE INDICATIONS:

LINE UP - RED LIGHT IS ON AND STAYS ON AFTER AN ACTION IS TAKEN. NO REFERENCE IS MADE AS TO WHAT THE LEVEL IS AT THE TIME THE PROBE IS PLACED ON THE PIN.

LINE DOWN - GREEN LIGHT IS ON AND STAYS ON EVEN AFTER AN ACTION IS TAKEN. NO REFERENCE IS MADE AS TO WHAT THE LEVEL IS AT THE TIME THE PROBE IS PLACED ON THE PIN.

LINE PULSING - BOTH THE RED AND THE GREEN LIGHTS WILL BE ON--OR ON ALTERNATELY.

PULSE ON LINE - RED AND GREEN LIGHTS WILL MAKE ONE OF THE FOLLOWING TRANSITIONS: A) RED TO GREEN TO RED B) GREEN TO RED TO GREEN OR EITHER THE RED OR GREEN LIGHT WILL BE ON AND THE OTHER WILL FLASH ON MOMENTARILY.

LEVEL CHANGE UP/DOWN - LIGHTS WILL CHANGE FROM GREEN TO RED (UP) OR RED TO GREEN (DOWN) WHEN THE REQUESTED ACTION IS TAKEN.

PULSE ON UP/DOWN LINE - BOTH LIGHTS ARE OFF INITIALLY AND EITHER THE RED (UP) OR GREEN (DOWN) LIGHT WILL PULSE ON. (NOTE: WHEN PULSE ON UP LINE IS CALLED OUT THE RED AND GREEN LIGHT MAY PULSE. THIS IS INHERENT IN THE PROBE DESIGN AND THE GREEN LIGHT SHOULD BE IGNORED).

4.3.3 CARD CALLOUTS (ALL CARDS ARE IN CPU MAIN FRAME UNLESS OTHERWISE SPECIFIED):

A-A3K2	(SINGLE CARD IN CPU)
PEB A-A1C3	(SINGLE CARD IN PEB GATE)
A-B2H2, A-B2K2	(MULTICARD CALLOUT)
PEB A-A1P5, CPU A-B1S4	(MULTICARD CALLOUT WITH CARDS ON DIFFERENT GATES)

4.3.4 CABLE CALLOUTS:

BAD CABLE MPCU TB3-1 TO CPU A-A3V4 (NORMAL INTERFACE CABLE CALLOUT):  
BAD CABLE PEB TB3-2 TO PCB TB4-1 (NORMAL BOX CABLE CALLOUT)  
CABLE PEB A-A1A5 TO CPU A-B1V4, CARD A-B1T4 (CABLE OR CARD MULTIPLE CALLOUT).

4.3.5 PSEUDO CALLOUTS:

WHEN A PARTICULAR FEATURE IS USED ON MORE THAN ONE MODEL OF THE SYSTEM, AND IF IT IS NOT ON THE SAME GATE OR BOARD ON EACH MODEL, THE MAP CHARTS USE PSEUDO CALLOUTS, Z-W5K2, OR Z-W5K2D09. WHENEVER PSEUDO LOCATIONS ARE SPECIFIED IN THE MAPS, THE TRUE LOCATION OF EACH BOARD (PER EACH SYSTEM & MODEL) WILL BE SPECIFIED IN BLOCK K5 OF ALL MAP CHART PAGES USING THE PSEUDO CALLOUT.

4.3.6 DIAGNOSTIC PROGRAMS (SEE USER'S GUIDE FOR DETAILED INFORMATION):

PROGRAM IDENTIFICATION - ALL SYSTEM 3 DIAGNOSTIC PROGRAMS ARE IDENTIFIED WITH A FOUR DIGIT ALPHA NUMERIC CODE. (E.G. P020, E020, ETC.) THE FIRST TWO DIGITS REPRESENT THE DEVICE ADDRESS THE THIRD DIGIT THE SECTION NUMBER AND THE LAST DIGIT THE VERSION LEVEL. SECTION CALLOUTS IN THE MAP ARE ONLY REFERRED TO BY THE FIRST THREE DIGITS (E.G. E02).

PROGRAM HALT ID'S - ALL HALTS WITHIN THE DIAGNOSTIC PROGRAMS HAVE A HALT ID. THE HALT ID CONSISTS OF FOUR ALPHA-NUMERIC CHARACTERS (E.G. E00C). THE FIRST TWO DIGITS ARE THE DEVICE ADDRESS ID AND THE LAST TWO ARE THE HALT ID. HALT ID'S FROM 01 TO 9F ARE ALWAYS ERROR HALTS. HALT ID'S FROM A0 TO FF ARE INFORMATION OF INTERVENTION HALTS.

PROGRAM CALLOUT:

RUN SECTION E02 - THIS MEANS TO GET SECTION E02 (LOAD IT IN THE PRIMARY HOPPER OF THE MPCU, IF NOT ON DISC). IPL THE PROGRAM INTO STORAGE, RESET THE NON-ERROR HALTS AND EXECUTE THE PROGRAM. ALL INSTRUCTIONS IN THE PRINTED OUTPUT MUST BE OBSERVED. IF ADDITIONAL ACTIONS ARE SPECIFIED IN THE MAP CHARTS, THEY TOO MUST BE PERFORMED PRIOR TO EXECUTING THE PROGRAM.

DIAGNOSTIC USER'S GUIDE  
CPU AND MEMORY TESTS

BLOCK 02, PAGE 001  
12 PAGES 02/24/72

PREV EC 816788 PRES EC 818693 PN 2589925

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1. GENERAL PROGRAM SUMMARY: SETTING UP THE CPU-MEMORY DIAGNOSTICS FOR THE EXISTING SYSTEM

1.1 GENERAL DESCRIPTION

THE CPU AND MEMORY DIAGNOSTIC DECK CONTAINS PROGRAMS NUMBERED HEXIDECIMALLY FROM 01 TO AF. THE PROGRAMS ARE CLASSIFIED AS FOLLOWS:

01 THRU 43	BASIC CPU TESTS
44 THRU 6F	NOT USED
70 THRU 7F	CPU I/O DEVICE TESTS
80 THRU 8F	DUAL PROGRAM TESTS
8P	CPU-MEMORY SEPARATOR
90 THRU 9F	MEMORY TESTS
AO THRU AF	SPECIAL TESTS, NOT NORMALLY USED
EJ	END-OF-PROGRAMS INDICATOR

FOR LISTINGS OF INDIVIDUAL PROGRAMS SEE SECTION 3.

1.2 PROGRAM IDENTIFICATION

THE PROGRAM NUMBER (ID) IS LOCATED (PUNCHED) IN COLUMNS 61 THRU 64 OF THE 96 COLUMN CARD. ALL DATA ON THE CARD, INCLUDING THE ID, IS IN THE IPL FORMAT. THE ID IS READ AS FOLLOWS:

COLUMN	CONTENTS	MEANING
61	0-F	SEQUENCING FOR MULTIPLE CARD PROGRAMS, NORMALLY ZERO
62	0-F	REVISION LEVEL
63	0-F	TENS DIGIT OF PROGRAM NUMBER
64	0-F	UNITS DIGIT OF PROGRAM NUMBER

NOTE: THE REVISION LEVEL IS THE SECOND CHARACTER OF THE FOUR CHARACTER PROGRAM ID. THIS DIFFERS FROM THE STANDARD ID IN WHICH THE REVISION LEVEL IS THE FOURTH CHARACTER.

EXAMPLE: 0394 PUNCHED IN COLUMNS 61-64 IS READ AS THE FIRST CARD OF THE PROGRAM (0 IN 61), REVISION LEVEL 3 (3 IN 62), AND PROGRAM NUMBER 94 (94 IN 63-64). 1394 IN COLUMNS 61-64 INDICATES THAT THIS IS THE SECOND CARD OF PROGRAM 94.

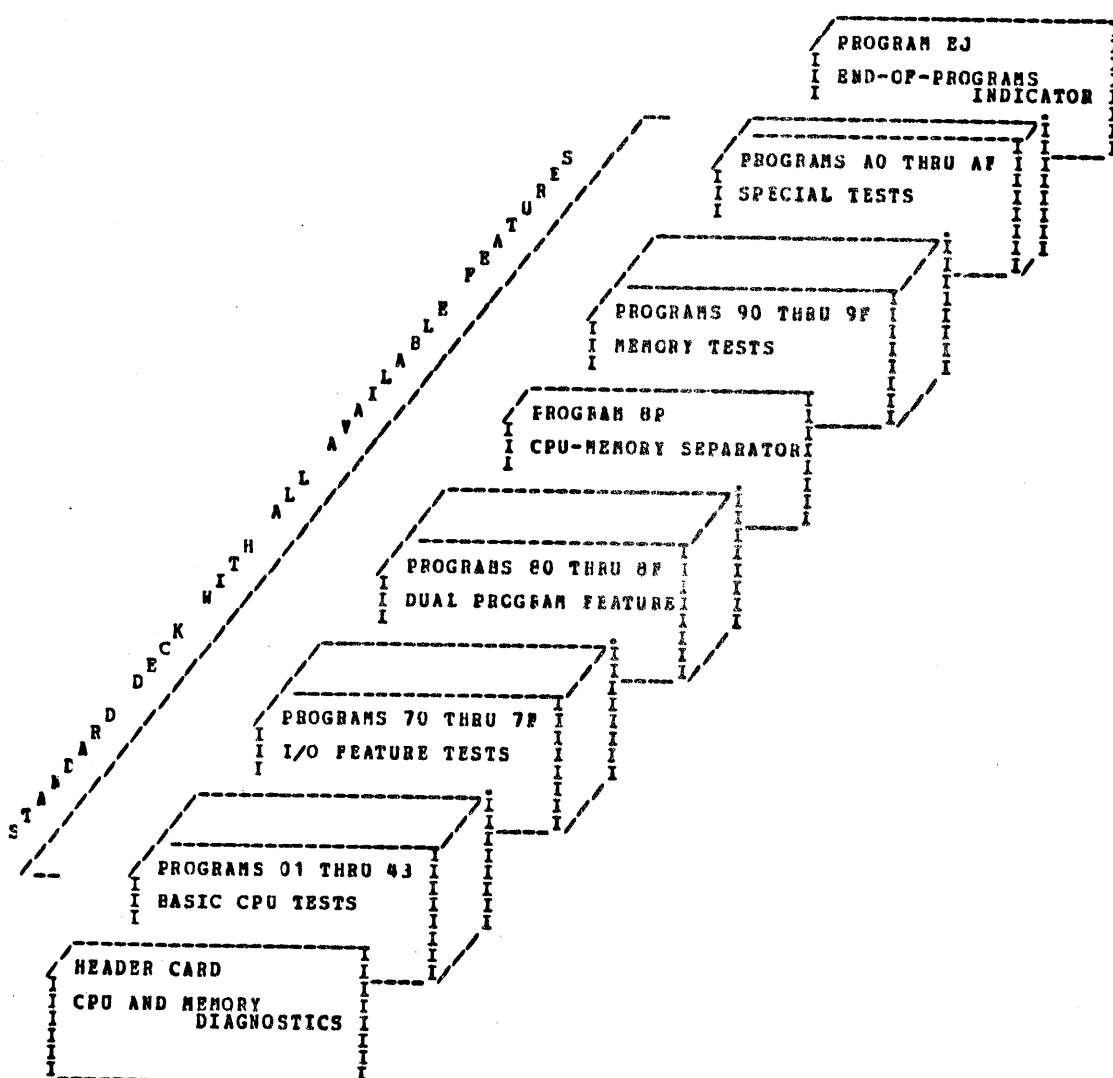
THE PRINTING ON THE CARD COULD BE EITHER THE STRAIGHT INTERPRET OF THE PUNCHED DATA OR THE FORMATTED HEADINGS OBTAINED WITH THE 'DUP' PROGRAM (P/N 2589943). ASSUME THE SAME EXAMPLE AS ABOVE. ONLY THE TOP THIRD OF THE 96 COLUMN CARD IS REPRESENTED.

<pre> -----DATA----- 11111111112222222222333 12345678901234567890123456789012 -----DATA-----1394 3333333444444444555555555566666 34567890123456789012345678901234 -----C-D BITS----- 6666677777777778888888888999999 56789012345678901234567890123456                 </pre>	<-- COLUMN --> <-- NUMBER -->  <-- COLUMN --> <-- NUMBER -->  <-- COLUMN --> <-- NUMBER -->	<pre> 394 LEVEL 3          IPL CARD 11111111112222222222333 12345678901234567890123456789012 CPU AND MEMORY DIAGNOSTICS 3333333444444444455555555566666 34567890123456789012345678901234 PN 2589927 EC XXXXX          0001 6666677777777778888888888999999 56789012345678901234567890123456                 </pre>
STRAIGHT INTERPRETED PRINT		FORMATTED PRINT

NOTE: THE PROGRAM ID FOR THE FORMATTED PRINTOUT IS OBTAINED FROM COLUMNS 62, 63, & 64. COLUMN 62 CONTAINS THE REVISION LEVEL FOR THE CPU AND MEMORY DIAGNOSTICS, THUS THE REVISION LEVEL APPEARS IN TWO PLACES ON THE FORMATTED CARD: THE PROGRAM ID AND THE LEVEL. PROGRAM NUMBER 094, 194, ..., 394, ..., 194 REFERS TO PROGRAM 94 AT THE REVISION LEVEL OF THE FIRST DIGIT.

1.3 DECK CONFIGURATION

THE CPU-MEMORY DIAGNOSTIC DECK IS A STANDARD DECK SENT WITH ALL SYSTEMS AND IS DESIGNED TO TEST ALL AVAILABLE FEATURES. THE CONFIGURATION OF THE WHOLE CPU-MEMORY DECK AS RELEASED TO THE FIELD IS AS FOLLOWS:





- \*\*\* 1.3.1 DETERMINE THE FEATURES PRESENT ON THE SYSTEM
- \*\*\* 1.3.2 REMOVE FEATURE TESTS FOR FEATURES THAT ARE NOT PRESENT ON THE SYSTEM. NOTE: IF NO DUAL PROGRAMMING FEATURE REMOVE CARDS 80 THRU 8F.
- | PROGRAM NUMBER | FUNCTION TESTED  |
|----------------|--|
| 70             | LOAD AND SENSE I/O LSR'S, MFCU                         |
| 71             | LOAD AND SENSE I/O LSR'S, PRINTER                      |
| 72             | LOAD AND SENSE I/O LSR'S, MFCU                         |
| 73             | LOAD AND SENSE I/O LSR'S, PRINTER                      |
| 74             | LOAD AND SENSE I/O LSR'S, KEYBOARD OR PRINTER KEYBOARD |
| 75             | LOAD AND SENSE I/O LSR'S, 5445 DISK                    |
| 76             | LOAD AND SENSE I/O LSR'S, 5445 DISK                    |
| 77             | LOAD AND SENSE I/O LSR'S, BSCA-2                       |
| 78             | LOAD AND SENSE I/O LSR'S, 5444 DISK                    |
| 79             | LOAD AND SENSE I/O LSR'S, 5444 DISK                    |
| 7A             | LOAD AND SENSE I/O LSR'S, BSCA-1                       |
| 7C             | LOAD AND SENSE I/O LSR'S, SIOC                         |
| 7E             | NOT USED   |
| 7F             | LOAD AND SENSE I/O LSR'S, 3411 TAPE                    |
- \*\*\* 1.3.3 REMOVE SPECIAL TESTS A0 THRU AF. STORE THESE CARDS WITH THE CONFIGURED DECK, BUT SEPARATED FROM IT. TESTS A0 THRU AF ARE TO BE USED ONLY IF ERROR CHECKING PROBLEMS ARE SUSPECTED OR ENCOUNTERED.

THESE  
STEPS  
MUST BE  
PERFORMED  
TO CONFIGURE  
THE DECK  
TO YOUR  
SYSTEM

NOTE: THE INSTRUCTIONS FOR RUNNING TESTS A0 AND A1 ARE IN THE CPU MAP CHARTS UNDER 'ERROR GENERATOR DIAGNOSTIC'.

## 2. GENERAL PROGRAM OPERATION

### 2.1 CPU DIAGNOSTICS (NOTE: ITEMS MARKED WITH \* ARE ONLY APPLICABLE TO SYSTEMS WITH DUAL PROGRAMMING FEATURE)

#### 2.1.1 SETUP

FILL CORE WITH 'FF'  
SET CONSOLE SWITCHES TO 00FE (FAILURE TO LEAVE SWITCHES AT -00FE- WILL CAUSE -3C- HALTS)  
\*SET DUAL PROGRAM FEATURE (DPP) SWITCH TO 'CANCEL PROG 1'  
\*SET DPP P1 AND P2 SWITCHES TO 'ON'  
PLACE CPU DECK IN MFCU PRIMARY HOPPER  
MAKE ALL DEVICES READY

#### 2.1.2 LOADING

DEPRESS PROGRAM LOAD KEY

#### 2.1.3 RUNNING

##### 2.1.3.1 OPERATOR INTERVENTION

THE CPU TESTS REQUIRE OPERATOR INTERVENTION IN THE FOLLOWING ORDER:

- 1) \*E1\* HALT ON CARD 1 - OPERATOR SHOULD RESET HALT
- 2) \*E4\* HALT ON CARD 1 - OPERATOR SHOULD RESET HALT
- 3) \*E9\* HALT ON CARD 1 - OPERATOR SHOULD RESET HALT
- \*4) \*88\* HALT IN P1 & P2 - OPERATOR SHOULD RESET P2 HALT
- \*5) \*INTERRUPT\* ON CARD 8A - OPERATOR SHOULD DEPRESS INTERRUPT KEY
- \*6) \*8C\* HALT IN P1 & P2 - OPERATOR SHOULD DEPRESS INTERRUPT KEY
- 7) CPU TEST COMPLETION
- \*02\* HALT WITH 8C CARDS IN MFCU PRIMARY HOPPER - END OF CPU TEST
- \*8P\* HALT WITH MEMORY DIAGNOSTICS IN MFCU PRIMARY HOPPER - END OF CPU TEST. TO RUN MEMORY DIAGNOSTICS SET CONSOLE DATA SWITCHES (SEE 2.2) AND RESET HALT.

##### 2.1.3.2 FAILURES

ADDITIONAL INTERVENTIONS, HALTS, CHECKS, OR LOOPS, SHOULD BE INTERPRETED AS CPU OR I/O MALFUNCTIONS.

CPU CARDS HALT WITH CARD NUMBER DISPLAYED IN HALT ID LIGHTS. REFER TO HALT INDEX, 4. IF A CHECK OR LOOP OCCURS OF A HALT ID THAT IS MEANINGLESS, DEPRESS SYSTEM RESET, START. TO EXECUTE THIS CARD DEPRESS HALT RESET OR START.

##### 2.1.3.3 LOOPING ON PROGRAM

IT IS POSSIBLE TO LOOP ON ANY CPU PROGRAM EXCEPT 012 AND 042. THE FOLLOWING PROCEDURE MUST BE USED:

- 1) IPL CPU CARDS 01 AND 02.
- 2) RESET HALTS E1, E4 AND E9. WHEN HALT 02 APPEARS ENTER 'CO 00 0003' STARTING IN LOCATION HEX '83'
- 3) IPL DESIRED CPU PROGRAM.
- 4) RESET HALT TO ALLOW PROGRAM EXECUTION.
- 5) THE NEXT PROGRAM CAN BE LOOPED ON BY REPEATING STEPS 03 AND 04 ABOVE.

## 2.2 MEMORY DIAGNOSTICS

PROGRAM NUMBER	CARDS	FUNCTION TESTED
90 **	1	SAR DECODE BITS 15, 14, 13, 12, 11, 10, 9
91 **	1	SAR DECODE BITS 8, 7, 6, 5, 4, 3, 2
92 **	1	SAR DECODE BITS 1, 0
93 **	12	SAR DECODE AND SAR BIT FAILURE TEST
94 *	7	HALF SELECT CORE TEST - LOWER CORE
95 *	7	RIPPLE BITS ON AND OFF TEST - LOWER CORE
96 *	7	WORST CASE CORE TEST - LOWER CORE
97 *	7	WORST CASE CORE TEST - UPPER CORE
98 *		NOT USED
99 *		NOT USED
9A *		NOT USED
9C *		NOT USED
9E *		NOT USED
9F *		NOT USED

\* PROGRAM CAN BE RUN INDIVIDUALLY.  
 \*\* PROGRAMS NEED TO BE RUN AS A GROUP.

NOTE: IN PROGRAMS 94 - 97 UPPER/LOWER CORE DESIGNATES WHERE THE PROGRAM RESIDES AND NOT THE PHYSICAL PORTION OF MEMORY TESTED.

## 2.2.1 SETUP

## 2.2.1.1 THERE ARE THREE WAYS TO RUN MEMORY DIAGNOSTICS

- 1) THE NORMAL METHOD, DIRECTLY AFTER THE CPU DIAGNOSTICS WITH CARD -8P- AS THE SEPARATOR.
- 2) THE MEMORY DIAGNOSTICS BY THEMSELVES WITH CARD 90 AS THE FIRST CARD.
- 3) PROGRAMS RUN INDIVIDUALLY. NOTE: PROGRAMS 90-91-92 SHOULD BE RUN AS A GROUP SINCE THEY ALL USE THE LOADER ON CARD 90. PROGRAMS 93, 94, 95, 96, 97 HAVE THEIR OWN LOADERS AND THUS CAN BE RUN INDIVIDUALLY.

## 2.2.1.2 SWITCH SETTINGS

## 2.2.1.2.1 SWITCH #1 (THIS SWITCH DESIGNATES THE AMOUNT OF CORE TO BE TESTED.)

- 1) WHEN THE MEMORY AND CPU DIAGNOSTICS ARE RUN CONSECUTIVELY, THE AMOUNT OF CORE TO BE TESTED SHOULD BE ENTERED ON THE LEFTMOST ADDRESS SWITCH BEFORE RESETTING THE -8P- HALT.
- 2) WHEN THE MEMORY DIAGNOSTICS ARE RUN AS A GROUP OR RUN INDIVIDUALLY, THE AMOUNT OF CORE TO BE TESTED SHOULD BE ENTERED ON THE LEFTMOST ADDRESS SWITCH BEFORE IPIING THE DIAGNOSTICS.
- 3) IF PROGRAMS 90 THRU 97 ARE BEING LOADED, INDIVIDUALLY OR AS A GROUP, ONLY THE AMOUNT OF CORE ENTERED ON THE LEFTMOST ADDRESS SWITCH WILL BE TESTED. SWITCHES 2, 3 AND 4 WILL BE IGNORED WITHOUT FURTHER CE INTERVENTION.

## 2.2.1.2.2 SWITCHES #2, 3 AND 4 (NORMALLY IGNORED.)

THESE SWITCHES ARE USED TO CONTROL PROGRAMS 94 THRU 97 AND ARE ONLY RECOGNIZED BY THE PROGRAMS WHERE THE FOLLOWING STEPS ARE PERFORMED.

- 1) ONLY ONE PROGRAM CAN BE CONTROLLED AT A TIME (IE - 94 OR 95 OR 96 OR 97).
- 2) SELECT THE PROGRAM TO BE RUN BY LOADING ONLY THOSE CARDS ASSOCIATED WITH THE PROGRAM IN THE MFCU.
- 3) UPON IPIING, THE PROGRAM ID WILL APPEAR IN THE HALT INDICATION LIGHTS. DEPRESSION OF HALT RESET (DPF) OR START KEY WILL LOAD THE REMAINDER OF THE PROGRAM.
- 4) AS SOON AS THE PROGRAM STARTS EXECUTING (MFCU RUNS OUT OF CARDS) DEPRESS CPU STOP.
- 5) DEPRESS SYSTEM RESET THEN DEPRESS START TO GET TO THE BEGINNING OF THE PROGRAM.
- 6) SET ADDRESS SWITCHES 2 - 4 TO DESIRED OPTIONS.
- 7) DEPRESS HALT RESET (DPF) OR START TO BEGIN EXECUTION OF SELECTED PROGRAM.

NOTE: IF IT IS DESIRED TO ENTER YOUR OWN TEST PATTERN IT IS NECESSARY TO CHANGE SWITCHES 3 AND 4 TO OTHER THAN '00' AT STEP #6. A -EP- HALT WILL APPEAR UPON DEPRESSION OF HALT RESET OR START IN STEP #7. YOU MUST THEN DEPRESS HALT RESET (DPF) OR START FOUR TIMES TO ENTER FOUR BYTES OF DESIRED BIT PATTERN. AN AUTOMATIC PROGRAM START WILL OCCUR AFTER THE FOURTH KEY DEPRESSION.

## 2.2.1.2.3 THE FUNCTIONS OF THE CONSOLE ADDRESS SWITCHES ARE:

SWITCH 1	SWITCH 2	SWITCH 3+4
0 TESTS CORE TO 4K	0 PROGRAM EXECUTED	00 NORMAL POSITION,
1 TESTS CORE TO 8K	1 ONCE ONLY	1C WC PATTERN FILL.
2 TESTS CORE TO 12K	1 BYPASS PROGRAM	1X ANY OTHER ENTRY
3 TESTS CORE TO 16K	2 LCOF PROGRAM	SETS -EP- HALT AND
4 TESTS CORE TO 20K	4 COMPLEMENT FILL	ALLOWS CE TO SE-
5 TESTS CORE TO 24K	4 PATTERN USED	LECT FILL PATTERN
6 TESTS CORE TO 28K	6 LCOF & COMPLEMENT	ON THESE TWO SWITCHES,
7 TESTS CORE TO 32K	6 FILL PATTERN USED	A BYTE AT A TIME,
8 TESTS CORE TO 36K	8 (PROGRAM 97 ONLY)	FOR A TOTAL OF FOUR
9 TESTS CORE TO 40K	LCOF ON HIGHEST	BYTES. 00 CAN BE
A TESTS CORE TO 44K	BSM (SEE 2 NOTE:)	USED AS A BYTE OF
B TESTS CORE TO 48K		PATTERN AFTER -EP-
C TESTS CORE TO 52K		HALT SET (SEE 1 NOTE:)
D TESTS CORE TO 56K		
E TESTS CORE TO 60K		
F TESTS CORE TO 64K		

1 NOTE: TURNING ADDRESS SWITCHES 3+4 (RIGHTMOST) TO A SETTING OTHER THAN 00 WILL SET AN -EP- (ENTER PATTERN) HALT WHICH WILL ALLOW THE CE TO ENTER HIS OWN 'WORST CASE' PATTERN. THE PATTERN IS ENTERED A BYTE AT A TIME ON SWITCHES 3+4. THE INITIAL SETTING OF SWITCHES TO A SETTING OTHER THAN 00 SELECTS THIS OPTION. THE INITIAL SWITCH SETTING IS NOT THE FIRST BYTE OF PATTERN. AFTER THE -EP- HALT THE SWITCHES CAN BE SET TO ANY DESIRED COMBINATION, EVEN TO 00. THE BYTE OF PATTERN THAT IS ENTERED IS THE SETTING ON SWITCHES 3+4 WHEN THE HALT IS RESET. THE -EP- HALT IS DISPLAYED FOUR TIMES, THUS ALLOWING THE CE TO CHOOSE THE FILL PATTERN. UNTIL IT IS CHANGED AGAIN EITHER BY THE CE THROUGH THE -EP- OPTION OR BY RE-IPIING THE PROGRAM, THE CE ENTERED FILL PATTERN WILL BE USED AS THE 1C FILL PATTERN.

2 NOTE: FOR SWITCH 1 SETTINGS 4 AND ABOVE, SWITCH 2 SETTING 8 WILL LOOP THE PROGRAM IN THE HIGHEST BSM (MEMORY BSM = 16K OF CORE) OR SELECTED PORTION THEREOF. WHEN SMOOING (SETTING VOLTAGE LEVELS), THE NEXT BSM IS CHOSEN BY INCREASING THE AMOUNT OF CORE TO BE TESTED BY 16K. THE PROGRAM WILL THEN LOOP ON THE HIGHEST BSM.

## EXAMPLES WITH SWITCH 2 SET TO 8:

SWITCH 1 SET TO 3,	PROGRAM LOOPS 0 TO 16K
SWITCH 1 SET TO 4,	PROGRAM LOOPS 16 TO 20K
SWITCH 1 SET TO 5,	PROGRAM LOOPS 16 TO 24K
SWITCH 1 SET TO 6,	PROGRAM LOOPS 16 TO 28K
SWITCH 1 SET TO 7,	PROGRAM LOOPS 16 TO 32K
SWITCH 1 SET TO 8,	PROGRAM LOOPS 32 TO 36K
SWITCH 1 SET TO A,	PROGRAM LOOPS 32 TO 44K
SWITCH 1 SET TO B,	PROGRAM LOOPS 32 TO 48K
SWITCH 1 SET TO C,	PROGRAM LOOPS 48 TO 52K
SWITCH 1 SET TO F,	PROGRAM LOOPS 48 TO 64K

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2.2.2 LOADING

DEPRESS PROGRAM LOAD KEY

2.2.3 RUNNING

2.2.3.1 OPERATOR INTERVENTION

2.2.3.1.1 NORMAL RUNNING AND DECK RUNNING

THE MEMORY DIAGNOSTICS IN NORMAL RUNNING OR WHEN RUN AS A GROUP DO NOT REQUIRE OPERATOR INTERVENTION OTHER THAN SETTING UP OF THE SWITCHES.

2.2.3.1.2 INDIVIDUAL IPLING

THE SWITCHES SHOULD BE SET PRIOR TO IPLING THE PROGRAMS. PROGRAMS 93 THRU 97 WHEN LOADED WILL TEST ONLY THE AMOUNT OF CORE ENTERED ON THE LEFTMOST ADDRESS SWITCH. TO GAIN CONTROL OF THE SWITCHES FOR PROGRAMS 94 THRU 97 A HALT, SYSTEM RESET, START HAS TO BE INITIATED.

2.2.3.1.3 MEMORY TEST COMPLETION

WHEN THE LAST MEMORY DIAGNOSTIC HAS BEEN COMPLETED ITS ID WILL APPEAR IN THE HALT INDICATOR LIGHTS (MAKE SURE THAT IT IS NOT AN ERROR HALT). NORMALLY, IF ALL DIAGNOSTICS ARE RUN, 'EJ' WILL APPEAR. IF FOR SOME REASON PROGRAMS A0 AND/OR A1 WERE NOT REMOVED FROM THE END OF THE DECK, THE DIAGNOSTICS WILL HALT WITH A PROCESSOR CHECK. UPON PERFORMING A 'SYSTEM RESET-START' THE PROGRAM ID WILL BE EVIDENT.

2.2.3.1.4 RUNNING TIMES OF MEMORY DIAGNOSTICS

THE FOLLOWING ARE THE RUN TIMES BY PROGRAM AND CORE SIZE:

CORE SIZE K	PROGRAM 93		PROGRAM 94		PROGRAM 95		PROGRAM 96		PROGRAM 97	
	MIN	SEC	MIN	SEC	MIN	SEC	MIN	SEC	MIN	SEC
4		0.5	2	4		21	1			0.1
8		1	4	4		44	1.5			0.3
16		2	7.5	6	1	6	2			0.5
32		3.5	9.5	28	1	50	2.5			0.6
64		5	11	2	2	2.5	3.5			0.7
128		6	12.5	35	2	5	4.5			0.9
256		7.5	15.5	57	2	5	5			1.0
512		8	16	3	3	19.5	6			1.1
1024		9.5	18	42	3	4	6.5			1.2
2048		11	19.5	4	4	4	7.5			1.4
4096		11.5	21.5	26	4	26	8			1.5
8192		12	23	48.5	4	48.5	8.5			1.6
16384		13	25	11	5	11	9			1.8
32768		13.5	26.5	33	5	33	10			1.9
65536		14.5	28.5	5	5	55.5	10.5			2.0
										2.2

2.2.3.2 FAILURES

CHECK TO SEE IF ALL THE CARDS HAVE BEEN READ IN. IF THE MPCU DROPPED READY THE PROGRAM WILL HALT WITH EITHER THE PROGRAM ID NUMBER OR -02- IN THE HALT LIGHTS. REMOVE THE CARD FROM THE PRIMARY FEED AND 'NPRO' THE MPCU. CAREFULLY INSERT THE CARD IN ITS PROPER PLACE IN THE PROGRAM AND RE-RUN THAT PROGRAM.

MEMORY PROGRAMS HALT WITH A PROCESSOR CHECK. TO DETERMINE WHAT PROGRAM FAILED, DO A SYSTEM RESET-START, OR, IF THAT FAILS TO DISPLAY THE PROGRAM NUMBER, IPL THE NEXT PROGRAM THEN REFERENCE THE FAILING PROGRAM TO THE MAP CHARTS.

3. HALT IDENTIFICATIONS

3.1 LIST OF PROGRAMS

PROGRAM NUMBER	DESCRIPTION
01	HPL, LIO MFCU, AND SIO MFCU
02	BOOTSTRAP
03	BRANCH AND JUMP ON CONDITION
04	LOAD REGISTER AND JUMP ON CONDITION
05	LOAD REGISTER AND JUMP ON CONDITION
06	COMPARE LOGICAL IMMEDIATE
07	COMPARE LOGICAL IMMEDIATE
08	NOT USED
09	MOVE LOGICAL IMMEDIATE
0A	SET BITS ON
0B	TEST BITS ON
0C	TEST BITS ON
0D	TEST BITS ON
0E	TEST BITS ON
0F	SET AND TEST BITS OFF
10	LOAD AND STORE REGISTER
11	LOAD AND STORE REGISTER
12	LOAD, STORE, AND ADD REGISTER
13	LOAD ADDRESS
14	MOVE NUMERIC TO NUMERIC
15	MOVE NUMERIC TO NUMERIC
16	MOVE ZONE TO ZONE
17	MOVE ZONE TO NUMERIC
18	MOVE NUMERIC TO ZONE
19	MOVE AND COMPARE LOGICAL CHARACTERS
1A	MOVE, ADD, SUBTRACT, AND COMPARE LOGICAL CHARACTERS
1B	NOT USED
1C	ZERO AND ADD DECIMAL
1D	ZERO AND ADD DECIMAL
1E	ZERO AND ADD DECIMAL
1F	ZERO AND ADD DECIMAL
20	NOT USED
21	ADD DECIMAL
22	ADD DECIMAL AND ZERO AND ADD DECIMAL
23	SUBTRACT DECIMAL
24	EDIT
25	EDIT
26	EDIT
27	EDIT
28	EDIT
29	EDIT
2A	EDIT
2B	INSERT AND TEST CHARACTERS
2C	INSERT AND TEST CHARACTERS
2D	INSERT AND TEST CHARACTERS
2E	INSERT AND TEST CHARACTERS
2F	INDEXING
30	INDEXING
31	INDEXING
32	INDEXING
33	INDEXING
34	INDEXING
35	INDEXING
36	INDEXING
37	INDEXING
38	INDEXING
39	LOAD AND STORE REGISTER
3A	CHECK IF 0 BIT STUCK DOWN
3B	SENSE CONSOLE DATA SWITCHES
3C	FIRST AND/OR SECOND INDEXED OP
3D	COMPARE LOGICAL IMMEDIATE
3E	COMPARE LOGICAL IMMEDIATE
3F	ADD DECIMAL
40	ADVANCE PROGRAM LEVEL
41	ADVANCE PROGRAM LEVEL
42	NOT USED
43	LOAD AND SENSE I/O LSR'S, MFCU
44	LOAD AND SENSE I/O LSR'S, MFCU
45	LOAD AND SENSE I/O LSR'S, MFCU
46	LOAD AND SENSE I/O LSR'S, MFCU
47	LOAD AND SENSE I/O LSR'S, MFCU
48	LOAD AND SENSE I/O LSR'S, MFCU
49	LOAD AND SENSE I/O LSR'S, MFCU
4A	LOAD AND SENSE I/O LSR'S, MFCU
4B	LOAD AND SENSE I/O LSR'S, MFCU
4C	LOAD AND SENSE I/O LSR'S, MFCU
4D	LOAD AND SENSE I/O LSR'S, MFCU
4E	LOAD AND SENSE I/O LSR'S, MFCU
4F	LOAD AND SENSE I/O LSR'S, MFCU
50	LOAD AND SENSE I/O LSR'S, MFCU
51	LOAD AND SENSE I/O LSR'S, MFCU
52	LOAD AND SENSE I/O LSR'S, MFCU
53	LOAD AND SENSE I/O LSR'S, MFCU
54	LOAD AND SENSE I/O LSR'S, MFCU
55	LOAD AND SENSE I/O LSR'S, MFCU
56	LOAD AND SENSE I/O LSR'S, MFCU
57	LOAD AND SENSE I/O LSR'S, MFCU
58	LOAD AND SENSE I/O LSR'S, MFCU
59	LOAD AND SENSE I/O LSR'S, MFCU
5A	LOAD AND SENSE I/O LSR'S, MFCU
5B	LOAD AND SENSE I/O LSR'S, MFCU
5C	LOAD AND SENSE I/O LSR'S, MFCU
5D	LOAD AND SENSE I/O LSR'S, MFCU
5E	LOAD AND SENSE I/O LSR'S, MFCU
5F	LOAD AND SENSE I/O LSR'S, MFCU
60	LOAD AND SENSE I/O LSR'S, MFCU
61	LOAD AND SENSE I/O LSR'S, MFCU
62	LOAD AND SENSE I/O LSR'S, MFCU
63	LOAD AND SENSE I/O LSR'S, MFCU
64	LOAD AND SENSE I/O LSR'S, MFCU
65	LOAD AND SENSE I/O LSR'S, MFCU
66	LOAD AND SENSE I/O LSR'S, MFCU
67	LOAD AND SENSE I/O LSR'S, MFCU
68	LOAD AND SENSE I/O LSR'S, MFCU
69	LOAD AND SENSE I/O LSR'S, MFCU
6A	LOAD AND SENSE I/O LSR'S, MFCU
6B	LOAD AND SENSE I/O LSR'S, MFCU
6C	LOAD AND SENSE I/O LSR'S, MFCU
6D	LOAD AND SENSE I/O LSR'S, MFCU
6E	LOAD AND SENSE I/O LSR'S, MFCU
6F	LOAD AND SENSE I/O LSR'S, MFCU
70	LOAD AND SENSE I/O LSR'S, MFCU
71	LOAD AND SENSE I/O LSR'S, MFCU
72	LOAD AND SENSE I/O LSR'S, MFCU
73	LOAD AND SENSE I/O LSR'S, MFCU
74	LOAD AND SENSE I/O LSR'S, MFCU
75	LOAD AND SENSE I/O LSR'S, MFCU
76	LOAD AND SENSE I/O LSR'S, MFCU
77	LOAD AND SENSE I/O LSR'S, MFCU
78	LOAD AND SENSE I/O LSR'S, MFCU
79	LOAD AND SENSE I/O LSR'S, MFCU
7A	LOAD AND SENSE I/O LSR'S, MFCU
7B	LOAD AND SENSE I/O LSR'S, MFCU
7C	LOAD AND SENSE I/O LSR'S, MFCU
7D	LOAD AND SENSE I/O LSR'S, MFCU
7E	LOAD AND SENSE I/O LSR'S, MFCU
7F	LOAD AND SENSE I/O LSR'S, MFCU
80	LOAD AND SENSE I/O LSR'S, MFCU
81	LOAD AND SENSE I/O LSR'S, MFCU
82	LOAD AND SENSE I/O LSR'S, MFCU
83	LOAD AND SENSE I/O LSR'S, MFCU
84	LOAD AND SENSE I/O LSR'S, MFCU
85	LOAD AND SENSE I/O LSR'S, MFCU
86	LOAD AND SENSE I/O LSR'S, MFCU
87	LOAD AND SENSE I/O LSR'S, MFCU
88	LOAD AND SENSE I/O LSR'S, MFCU
89	LOAD AND SENSE I/O LSR'S, MFCU
8A	LOAD AND SENSE I/O LSR'S, MFCU
8B	LOAD AND SENSE I/O LSR'S, MFCU
8C	LOAD AND SENSE I/O LSR'S, MFCU
8D	LOAD AND SENSE I/O LSR'S, MFCU
8E	LOAD AND SENSE I/O LSR'S, MFCU
8F	LOAD AND SENSE I/O LSR'S, MFCU
90	LOAD AND SENSE I/O LSR'S, MFCU
91	LOAD AND SENSE I/O LSR'S, MFCU
92	LOAD AND SENSE I/O LSR'S, MFCU
93	LOAD AND SENSE I/O LSR'S, MFCU
94	LOAD AND SENSE I/O LSR'S, MFCU
95	LOAD AND SENSE I/O LSR'S, MFCU
96	LOAD AND SENSE I/O LSR'S, MFCU
97	LOAD AND SENSE I/O LSR'S, MFCU
98	LOAD AND SENSE I/O LSR'S, MFCU
99	LOAD AND SENSE I/O LSR'S, MFCU
9A	LOAD AND SENSE I/O LSR'S, MFCU
9B	LOAD AND SENSE I/O LSR'S, MFCU
9C	LOAD AND SENSE I/O LSR'S, MFCU
9D	LOAD AND SENSE I/O LSR'S, MFCU
9E	LOAD AND SENSE I/O LSR'S, MFCU
9F	LOAD AND SENSE I/O LSR'S, MFCU
AA	LOAD AND SENSE I/O LSR'S, MFCU
AB	LOAD AND SENSE I/O LSR'S, MFCU
AC	LOAD AND SENSE I/O LSR'S, MFCU
AD	LOAD AND SENSE I/O LSR'S, MFCU
AE	LOAD AND SENSE I/O LSR'S, MFCU
AF	LOAD AND SENSE I/O LSR'S, MFCU
B0	LOAD AND SENSE I/O LSR'S, MFCU
B1	LOAD AND SENSE I/O LSR'S, MFCU
B2	LOAD AND SENSE I/O LSR'S, MFCU
B3	LOAD AND SENSE I/O LSR'S, MFCU
B4	LOAD AND SENSE I/O LSR'S, MFCU
B5	LOAD AND SENSE I/O LSR'S, MFCU
B6	LOAD AND SENSE I/O LSR'S, MFCU
B7	LOAD AND SENSE I/O LSR'S, MFCU
B8	LOAD AND SENSE I/O LSR'S, MFCU
B9	LOAD AND SENSE I/O LSR'S, MFCU
BA	LOAD AND SENSE I/O LSR'S, MFCU
BB	LOAD AND SENSE I/O LSR'S, MFCU
BC	LOAD AND SENSE I/O LSR'S, MFCU
BD	LOAD AND SENSE I/O LSR'S, MFCU
BE	LOAD AND SENSE I/O LSR'S, MFCU
BF	LOAD AND SENSE I/O LSR'S, MFCU
C0	LOAD AND SENSE I/O LSR'S, MFCU
C1	LOAD AND SENSE I/O LSR'S, MFCU
C2	LOAD AND SENSE I/O LSR'S, MFCU
C3	LOAD AND SENSE I/O LSR'S, MFCU
C4	LOAD AND SENSE I/O LSR'S, MFCU
C5	LOAD AND SENSE I/O LSR'S, MFCU
C6	LOAD AND SENSE I/O LSR'S, MFCU
C7	LOAD AND SENSE I/O LSR'S, MFCU
C8	LOAD AND SENSE I/O LSR'S, MFCU
C9	LOAD AND SENSE I/O LSR'S, MFCU
CA	LOAD AND SENSE I/O LSR'S, MFCU
CB	LOAD AND SENSE I/O LSR'S, MFCU
CC	LOAD AND SENSE I/O LSR'S, MFCU
CD	LOAD AND SENSE I/O LSR'S, MFCU
CE	LOAD AND SENSE I/O LSR'S, MFCU
CF	LOAD AND SENSE I/O LSR'S, MFCU
D0	LOAD AND SENSE I/O LSR'S, MFCU
D1	LOAD AND SENSE I/O LSR'S, MFCU
D2	LOAD AND SENSE I/O LSR'S, MFCU
D3	LOAD AND SENSE I/O LSR'S, MFCU
D4	LOAD AND SENSE I/O LSR'S, MFCU
D5	LOAD AND SENSE I/O LSR'S, MFCU
D6	LOAD AND SENSE I/O LSR'S, MFCU
D7	LOAD AND SENSE I/O LSR'S, MFCU
D8	LOAD AND SENSE I/O LSR'S, MFCU
D9	LOAD AND SENSE I/O LSR'S, MFCU
DA	LOAD AND SENSE I/O LSR'S, MFCU
DB	LOAD AND SENSE I/O LSR'S, MFCU
DC	LOAD AND SENSE I/O LSR'S, MFCU
DD	LOAD AND SENSE I/O LSR'S, MFCU
DE	LOAD AND SENSE I/O LSR'S, MFCU
DF	LOAD AND SENSE I/O LSR'S, MFCU
E0	LOAD AND SENSE I/O LSR'S, MFCU
E1	LOAD AND SENSE I/O LSR'S, MFCU
E2	LOAD AND SENSE I/O LSR'S, MFCU
E3	LOAD AND SENSE I/O LSR'S, MFCU

3.2 LIST OF HALTS  
3.2.1 HALTS FOR BASIC CPU TESTS

HALT ID	PROG #	SAR	ADDR	AT	REASON OR REFERENCE	HALT ID	PROG #	SAR	ADDR	AT	REASON OR REFERENCE	
		I-OP	I-Q	I-R	* IF HALT EXPECTED			I-OP	I-Q	I-R	* IF HALT EXPECTED	
		MACH CYCLES						MACH CYCLES				
00	00	-	REMOVE	HEACER	CARD	1C	1C	0	1	2	IPLHLT	PROG 1C
E1	1	0	1	2	* IPLHLT	1	1	34	35	36	HALT	PROG 1C
E2	1	0	D	E	HALT	2	2	37	38	39	HALT	PROG 1C
E4	1	2	2	3	* HALT	4	4	0	1	2	IPLHLT	PROG 1F
E7	1	2	F	3	HALT	7	7	10	11	12	HALT	PROG 1F
E5	1	5	5	3	HALT	5	5	29	2A	2B	HALT	PROG 1F
E6	1	5	5	8	HALT	6	6	30	31	32	HALT	PROG 1F
E9	1	5	5	B	* HALT	9	9	33	34	35	HALT	PROG 1F
02	2	8	8	2	IPLHLT	2	2	0	1	2	IPLHLT	PROG 20
03	2	8	8	5	HALT	2	2	20	20	20	HALT	PROG 20
03	3	0	1	2	IPLHLT	3	3	18	1C	1D	HALT	PROG 20
03	3	14	15	16	HALT	2	2	2C	2D	2E	HALT	PROG 20
03	3	17	18	19	HALT	3	3	2C	2D	2E	HALT	PROG 20
03	3	1A	1B	1C	HALT	4	4	36	37	38	HALT	PROG 20
03	3	20	21	22	HALT	5	5	39	3A	3B	HALT	PROG 20
03	3	23	24	25	HALT	6	6	0	1	2	IPLHLT	PROG 21
03	3	24	2A	2B	HALT	7	7	22	23	24	HALT	PROG 21
03	3	24	2A	2E	HALT	8	8	2C	2D	2E	HALT	PROG 21
03	3	24	2A	3B	HALT	9	9	36	37	38	HALT	PROG 21
03	3	24	2A	3B	HALT	10	10	39	3A	3B	HALT	PROG 21
04	4	0	1	2	IPLHLT	4	4	0	1	2	IPLHLT	PROG 22
04	4	0	E	F	HALT	2	2	14	15	16	HALT	PROG 22
04	4	10	11	12	HALT	3	3	1E	1F	20	HALT	PROG 22
04	4	16	17	18	HALT	4	4	31	32	33	HALT	PROG 22
04	4	16	17	21	HALT	5	5	0	1	2	IPLHLT	PROG 24
04	4	1F	20	21	HALT	6	6	31	32	33	HALT	PROG 24
04	4	28	29	2A	HALT	7	7	34	35	36	HALT	PROG 24
04	4	28	29	34	HALT	8	8	37	38	39	HALT	PROG 24
04	4	28	29	34	HALT	9	9	0	1	2	IPLHLT	PROG 25
05	5	0	1	2	IPLHLT	5	5	12	13	14	HALT	PROG 25
05	5	0	A	B	HALT	2	2	2F	30	31	HALT	PROG 25
05	5	10	11	12	HALT	3	3	0	1	2	IPLHLT	PROG 26
05	5	1A	1B	1C	HALT	4	4	2F	10	11	HALT	PROG 26
05	5	1A	1B	21	HALT	5	5	12	13	14	HALT	PROG 26
06	6	0	1	2	IPLHLT	6	6	35	36	37	HALT	PROG 26
06	6	0	12	13	HALT	2	2	27	27	27	HALT	PROG 27
06	6	11	12	13	HALT	3	3	29	2A	2B	HALT	PROG 27
06	6	14	15	16	HALT	4	4	2C	2D	2E	HALT	PROG 27
06	6	14	15	20	HALT	5	5	2F	30	31	HALT	PROG 27
06	6	28	29	34	HALT	6	6	0	1	2	IPLHLT	PROG 28
06	6	28	29	34	HALT	7	7	2D	2E	2F	HALT	PROG 28
07	7	0	1	2	IPLHLT	7	7	0	1	2	IPLHLT	PROG 29
07	7	11	12	13	HALT	2	2	34	35	36	HALT	PROG 29
07	7	11	12	34	HALT	3	3	37	38	39	HALT	PROG 29
07	7	11	12	34	HALT	4	4	0	1	2	IPLHLT	PROG 2A
09	9	0	1	2	IPLHLT	9	9	0	1	2	IPLHLT	PROG 2A
09	9	18	19	2A	HALT	2	2	10	11	12	HALT	PROG 2A
09	9	18	19	2A	HALT	3	3	13	14	15	HALT	PROG 2A
09	9	28	29	30	HALT	4	4	2C	2C	2C	HALT	PROG 2C
09	9	28	29	30	HALT	5	5	2C	2C	2C	HALT	PROG 2C
09	9	28	29	30	HALT	6	6	2E	2E	2E	HALT	PROG 2C
09	9	37	38	39	HALT	7	7	2E	2E	2E	HALT	PROG 2C
0A	A	0	1	2	IPLHLT	A	A	26	27	28	HALT	PROG 2E
0A	A	12	13	14	HALT	2	2	30	31	32	HALT	PROG 2E
0A	A	24	25	26	HALT	3	3	33	34	35	HALT	PROG 2E
0A	A	37	38	39	HALT	4	4	0	1	2	IPLHLT	PROG 2F
0C	C	0	1	2	IPLHLT	C	C	21	21	21	HALT	PROG 2F
0C	C	15	16	17	HALT	2	2	26	27	28	HALT	PROG 2F
0C	C	18	19	1A	HALT	3	3	31	32	33	HALT	PROG 2F
0C	C	22	23	24	HALT	4	4	0	1	2	IPLHLT	PROG 30
0C	C	31	32	33	HALT	5	5	1C	1D	1E	HALT	PROG 30
0E	E	0	1	2	IPLHLT	E	E	29	2A	2B	HALT	PROG 30
0E	E	33	34	35	HALT	2	2	0	1	2	IPLHLT	PROG 31
0E	E	33	34	35	HALT	3	3	27	28	29	HALT	PROG 31
10	10	0	1	2	IPLHLT	10	10	2A	2B	2C	HALT	PROG 31
10	10	19	1A	1B	HALT	2	2	140	111	112	HALT	PROG 31
10	10	1C	1D	1E	HALT	3	3	0	1	2	IPLHLT	PROG 32
10	10	26	27	28	HALT	4	4	23	24	25	HALT	PROG 32
10	10	39	3A	3B	HALT	5	5	2D	2E	2F	HALT	PROG 32
11	11	0	1	2	IPLHLT	11	11	30	31	32	HALT	PROG 32
12	12	0	1	2	IPLHLT	12	12	0	1	2	IPLHLT	PROG 33
12	12	11	12	13	HALT	2	2	26	29	2A	HALT	PROG 33
12	12	22	23	24	HALT	3	3	2B	2C	2D	HALT	PROG 33
12	12	33	34	35	HALT	4	4	2E	2F	30	HALT	PROG 33
12	12	36	37	38	HALT	5	5	0	1	2	IPLHLT	PROG 34
13	13	0	1	2	IPLHLT	13	13	2C	2D	2E	HALT	PROG 34
13	13	16	17	18	HALT	2	2	35	35	35	HALT	PROG 35
13	13	2C	2D	2E	HALT	3	3	31	32	33	HALT	PROG 35
14	14	0	1	2	IPLHLT	14	14	36	36	36	HALT	PROG 36
14	14	30	31	32	HALT	2	2	31	32	33	HALT	PROG 36
14	14	33	34	35	HALT	3	3	0	1	2	IPLHLT	PROG 37
14	14	36	37	38	HALT	4	4	31	32	33	HALT	PROG 37
15	15	0	1	2	IPLHLT	15	15	0	1	2	IPLHLT	PROG 38
15	15	14	15	16	HALT	2	2	18	19	1A	HALT	PROG 38
15	15	1E	1F	20	HALT	3	3	20	2E	2F	HALT	PROG 38
15	15	2E	30	31	HALT	4	4	0	1	2	IPLHLT	PROG 39
15	15	39	3A	3B	HALT	5	5	1A	1B	1C	HALT	PROG 39
16	16	0	1	2	IPLHLT	16	16	1D	1E	1F	HALT	PROG 39
16	16	18	19	1A	HALT	2	2	0	1	2	IPLHLT	PROG 3A
16	16	22	23	24	HALT	3	3	19	1A	1B	HALT	PROG 3A
16	16	25	2E	2F	HALT	4	4	0	1	2	IPLHLT	PROG 3C
17	17	0	1	2	IPLHLT	17	17	25	26	27	HALT	PROG 3C
17	17	14	15	16	HALT	2	2	28	29	2A	HALT	PROG 3C
17	17	25	26	27	HALT	3	3	2E	2C	2D	HALT	PROG 3C
17	17	30	30	31	HALT	4	4	0	1	2	IPLHLT	PROG 3E
17	17	39	3A	3B	HALT	5	5	0	1	2	IPLHLT	PROG 3E
18	18	0	1	2	IPLHLT	18	18	0B	0C	0D	HALT	PROG 40
18	18	14	15	16	HALT	2	2	0	1	2	IPLHLT	PROG 40
18	18	1E	1F	20	HALT	3	3	18	19	1A	HALT	PROG 40
18	18	28	29	2A	HALT	4	4	1B	1C	1D	HALT	PROG 40
18	18	39	3A	3B	HALT	5	5	0	1	2	IPLHLT	PROG 41
19	19	0	1	2	IPLHLT	19	19	15	16	17	HALT	PROG 41
19	19	14	15	16	HALT	2	2	0	1	2	IPLHLT	PROG 42
19	19	17	20	21	HALT	3	3	12	13	14	HALT	PROG 42
1A	1A	0	1	2	IPLHLT	1A	1A	15	16	17	HALT	PROG 42
1A	1A	18	19	1A	HALT	2	2	23	24	25	HALT	PROG 43
1A	1A	29	2A	2B	HALT	3	3	0	1	2	IPLHLT	PROG 43
1A	1A	36	37	38	HALT	4	4	21	22	23	HALT	

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PREV EC 816788 PRES EC 818693 PN 2589925

3.2.2 HALTS FOR FEATURE AND MEMORY TESTS

HALT ID	PROG #	SAR I-OF, I-Q I-R	ADDR 1-0 I-R	AT Q I-R	REASON OR REFERENCE
* IF HALT EXPECTED					
70	70	0	1	2	IPLHLT PROG 70
70	70	20	21	22	HALT 2 PROG 70
70	70	2A	2B	2C	HALT 3 PROG 70
70	70	33	34	35	HALT 4 PROG 70
71	71	0	1	2	IPLHLT PROG 71
71	71	23	24	25	HALT 2 PROG 71
71	71	30	31	32	HALT 3 PROG 71
71	71	33	34	35	HALT 4 PROG 71
72	72	0	1	2	IPLHLT PROG 72
73	73	0	1	2	IPLHLT PROG 73
74	74	0	1	2	IPLHLT PROG 74
74	74	1E	1C	1D	HALT 2 PROG 74
75	75	0	1	2	IPLHLT PROG 75
75	75	23	24	25	HALT 2 PROG 75
75	75	30	31	32	HALT 3 PROG 75
75	75	33	34	35	HALT 4 PROG 75
76	76	0	1	2	IPLHLT PROG 76
77	77	0	1	2	IPLHLT PROG 77
77	77	15	16	17	HALT 2 PROG 77
78	78	0	1	2	IPLHLT PROG 78
78	78	23	24	25	HALT 2 PROG 78
78	78	30	31	32	HALT 3 PROG 78
78	78	33	34	35	HALT 4 PROG 78
79	79	0	1	2	IPLHLT PROG 79
7A	7A	0	1	2	IPLHLT PROG 7A
7A	7A	15	16	17	HALT 2 PROG 7A
7C	7C	0	1	2	IPLHLT PROG 7C
7C	7C	1E	1C	1D	HALT 2 PROG 7C
7F	7F	0	1	2	IPLHLT PROG 7F
7F	7F	1E	1C	1D	HALT 2 PROG 7F
83	83	0	1	2	IPLHLT PROG 83
83	83	14	15	16	HALT 2 PROG 83
83	83	29	2A	2B	HALT 3 PROG 83
84	84	0	1	2	IPLHLT PROG 84
84	84	17	18	19	HALT 2 PROG 84
85	85	0	1	2	IPLHLT PROG 85
85	85	7	8	9	HALT 2 PROG 85
85	85	1E	1F	20	HALT 3 PROG 85
86	86	0	1	2	IPLHLT PROG 86
86	86	18	19	1A	HALT 2 PROG 86
87	87	0	1	2	IPLHLT PROG 87
87	87	25	26	27	HALT 2 PROG 87
88	88	0	1	2	IPLHLT PROG 88
88	88	0A	0B	0C	* HALT 2 PROG 88
88	88	10	11	12	HALT 3 PROG 88
88	88	25	26	27	HALT 4 PROG 88
89	89	0	1	2	IPLHLT PROG 89
89	89	23	24	25	HALT 2 PROG 89
8A	8A	0	1	2	IPLHLT PROG 8A
8A	8A	27	28	29	HALT 2 PROG 8A
8C	8C	0	1	2	IPLHLT PROG 8C
8C	8C	E	F	10	* HALT 2 PROG 8C
8P	8P	0	1	2	IPLHLT PROG 8P
8P	8P	C	D	E	* HALT 2 PROG 8P
90	90	60	61	62	HALT 1 PROG 90, SEE NOTE 1
91	91	C	1	2	IPLHLT PROG 91, SEE NOTE 1
92	92	0	1	2	IPLHLT PROG 92, SEE NOTE 1
93	93	0	1	2	IPLHLT PROG 92, SYS RESET
93	93	0	1	2	HALT, SEE NOTE 1
93	93	2CC	2C1	202	MPCU ERROR OR NOT READY
93	93	1E2	1E3	1E4	ADDR ERROR IN 0-16K BOM
93	93	1F0	1F1	1F2	ADDR ERROR IN 16-32K BOM
93	93	1F7	1F8	1F9	ADDR ERROR IN 32-48K BOM
93	93	1F7	1F8	1F9	ADDR ERROR IN 48-64K BOM
94	94	0	1	2	IPL HLT
94	94	2C0	2C1	202	MPCU ERROR OR NOT READY
94	94	4	5	6	SYS RESET HALT
95	95	2C	2E	2	* ENIER PATTERN HALT
95	95	0	1	2	IPL HLT
95	95	2CC	2C1	202	MPCU ERROR OR NOT READY
95	95	4	5	6	SYS RESET HALT
95	95	2E	2C	2D	* ENIER PATTERN HALT
96	96	0	1	2	IPL HLT
96	96	2CC	2C1	202	MPCU ERROR OR NOT READY
96	96	4	5	6	SYS RESET HALT
96	96	2E	2C	2D	* ENIER PATTERN HALT
97	97	0	1	2	IPL HLT
97	97	2CC	2C1	202	MPCU ERROR OR NOT READY
97	97	1A	1B	1C	SYS RESET HALT
97	97	44	45	46	* ENIER PATTERN HALT
A0	A0	0	1	2	IPL HLT
A0	A0	2E	2C	2D	* ENDING HALT
A1	A1	0	1	2	IPL HLT
A1	A1	17	18	19	* ENDING HALT
EJ	EJ	0	1	2	IPL HLT
EJ	EJ	3	4	5	* ENDING HALT

NOTE TO CE:

TO DETERMINE PROPER SAR HALT ADDRESS, TURN CE MCDE SWITCH TO INSTRUCTION STEP. RECORD SAR ADDRESS AND MACHINE CYCLE. THEN PUT MODE SWITCH BACK TO PROCESS AND CONTINUE.

TO REFERENCE HALTS TO HARDWARE FAILURES, SEE CPU MAP CHART INDEX TO DIAGNOSTIC HALTS ON PAGES 150 AND 151.

NOTE 1

DUE TO THE NATURE OF SAR DECODE FAILURES, ERROR HALTS ON SAR DECODE ERRORS WILL BE IDENTIFIED BY Q REGISTER DISPLAY.

Q REG	SAR BIT
-F0-	15
-F1-	14
-D0-	13
-C0-	12
-B0-	11
-A0-	10
-F3-	9
-H0-	8
-70-	7
-60-	6
-50-	5
-40-	4
-30-	3
-20-	2
-10-	1
-00-	0

## 9. DETAILED DESCRIPTION OF TESTS

### 9.1 FEATURE TESTS

- 70 LOAD AND SENSE I/O LSR'S, MPCU  
THE MPCU PRINT ADDRESS, READ ADDRESS, AND PUNCH ADDRESS LSR'S ARE TESTED FOR CORRECT ADDRESS SELECTION, CORRECT LOADING, AND FOR BITS STUCK OFF.
- 71 LOAD AND SENSE I/O LSR'S, PRINTER  
THE PRINTER IMAGE ADDRESS AND DATA ADDRESS LSR'S ARE TESTED FOR CORRECT ADDRESS SELECTION, CORRECT LOADING, AND FOR BITS STUCK OFF.
- 72 LOAD AND SENSE I/O LSR'S, MPCU  
THE MPCU PRINT ADDRESS, READ ADDRESS, AND PUNCH ADDRESS LSR'S ARE TESTED FOR BITS STUCK ON.
- 73 LOAD AND SENSE I/O LSR'S, PRINTER  
THE PRINTER IMAGE ADDRESS AND DATA ADDRESS LSR'S ARE TESTED FOR BITS STUCK ON.
- 74 LOAD AND SENSE I/O LSR'S, KEYBOARD  
THE KEYBOARD OR PRINTER KEYBOARD INTERRUPT LEVEL 1 IAR IS TESTED FOR CORRECT ADDRESS SELECTION, CORRECT LOADING, BITS STUCK OFF, AND BITS STUCK ON.
- 75 LOAD AND SENSE I/O LSR'S, 5445 DISK  
THE DISK DATA ADDRESS AND CONTROL ADDRESS LSR'S ARE TESTED FOR CORRECT ADDRESS SELECTION, CORRECT LOADING, INTERRUPT DATA SWITCH SELECTION, AND FOR BITS STUCK OFF.
- 76 LOAD AND SENSE I/O LSR'S, 5445 DISK  
THE DISK DATA ADDRESS AND CONTROL ADDRESS LSR'S ARE TESTED FOR BITS STUCK ON.
- 77 LOAD AND SENSE I/O LSR'S, BSCA-2  
THE BSCA LSR IS TESTED FOR CORRECT ADDRESS SELECTION, CORRECT LOADING, BITS STUCK OFF, AND BITS STUCK ON.
- 78 LOAD AND SENSE I/O LSR'S, 5444 DISK  
THE DISK DATA ADDRESS AND CONTROL ADDRESS LSR'S ARE TESTED FOR CORRECT ADDRESS SELECTION, CORRECT LOADING, INTERRUPT DATA SWITCH SELECTION, AND FOR BITS STUCK OFF.
- 79 LOAD AND SENSE I/O LSR'S, 5444 DISK  
THE DISK DATA ADDRESS AND CONTROL ADDRESS LSR'S ARE TESTED FOR BITS STUCK ON.
- 7A LOAD AND SENSE I/O LSR'S, BSCA-1  
THE BSCA LSR IS TESTED FOR CORRECT ADDRESS SELECTION, CORRECT LOADING, BITS STUCK OFF, AND BITS STUCK ON.
- 7C LOAD AND SENSE I/O LSR'S, SIOC  
THE SIOC LSR IS TESTED FOR CORRECT ADDRESS SELECTION, CORRECT LOADING, BITS STUCK OFF, AND BITS STUCK ON.
- 7F LOAD AND SENSE I/O LSR'S, J411 TAPE  
THE TAPE LSR IS TESTED FOR CORRECT ADDRESS SELECTION, CORRECT LOADING, BITS STUCK OFF, AND BITS STUCK ON.
- 83 DUAL PROGRAM FEATURE  
THE ABILITY TO LOAD AND STORE PROGRAM LEVEL 2 IAR IS TESTED.
- 84 DUAL PROGRAM FEATURE  
THE -APL- COMMAND IS TESTED IN BOTH PROGRAM LEVELS WITH DUAL PROGRAM MODE DISABLED AND THEN ENABLED USING -SIC- COMMAND FOR THE ENABLING AND DISABLING.
- 85 DUAL PROGRAM FEATURE  
THE DUAL PROGRAM CONTROL SWITCH IS TESTED.
- 86 DUAL PROGRAM FEATURE  
THE PROGRAM LEVEL 2 INDEX REGISTER 1 OR 2 SELECTION IS TESTED FOR STUCK UP OR DOWN CONDITION.
- 87 DUAL PROGRAM FEATURE  
THE ABILITY TO SELECT THE LSR'S ASSIGNED TO A SPECIFIC PROGRAM LEVEL IS TESTED.
- 88 DUAL PROGRAM FEATURE  
THE ABILITY TO BRANCH IN PROGRAM LEVEL 2 AND TO TURN ON ALL THE HALT ID LIGHTS IN BOTH PROGRAM LEVELS IS TESTED.
- 89 DUAL PROGRAM FEATURE  
THE DUAL PROGRAM INTERRUPT LEVEL 0 IAR IS TESTED FOR CORRECT SELECTION AND MULTIPLE STORING OF CONTENTS.
- 8A DUAL PROGRAM FEATURE  
THE DUAL PROGRAM INTERRUPT LEVEL 0 IAR IS TESTED FOR CORRECT IAR/ARR SELECT.
- 9C DUAL PROGRAM FEATURE  
THE PROGRAM LEVEL 1 AND PROGRAM LEVEL 2 IAR'S ARE TESTED.

**4.2 MEMORY TESTS**

- 90 SAR DECODE BITS 15,14,13,12,11,10,9  
TESTS FOR PROPER DECODING OF SAR BITS 15 THRU 9 AND THE ABILITY TO ADDRESS CORE LOC 0 THRU 127.
- 91 SAR DECODE BITS 8,7,6,5,4,3,2  
TESTS FOR PROPER DECODING OF SAR BITS 8 THRU 2 AND THE ABILITY TO ADDRESS CORE LOC 128 THRU 16,383.
- 92 SAR DECODE BITS 1,0  
TESTS FOR PROPER DECODING OF SAR BITS 1 AND 0 AND THE ABILITY TO ADDRESS CORE LOC 16,384 THRU 65,535
- 93 SAR DECODE AND SAR BIT FAILURE TEST  
THIS PROGRAM TESTS FOR PROPER DECODING OF SAR BITS IN BSM'S ABOVE 16K, TESTS THE ABILITY TO ADDRESS EACH CORE LOCATION WITHIN A 16K BSM, AND CHECKS FOR STORAGE ALTERATION IN CORE DUE TO SAR BIT FAILURE.
- 94 HALF SELECT CORE TEST - LOWER CORE  
THIS PROGRAM DETECTS THE DROPPING OR PICKING UP OF AN ODD NUMBER OF BITS WITHIN A BYTE CAUSED BY THAT BYTE BEING HALF-SELECTED 64 TIMES.
- 95 RIPPLE BITS ON AND OFF TEST - LOWER CORE  
THIS PROGRAM CHECKS THE ABILITY TO READ AND WRITE UNDER WORST CASE CONDITIONS.
- 96 WORST CASE CORE TEST - LOWER CORE  
THIS PROGRAM DETECTS THE ABILITY TO READ AND WRITE UNDER WORST CASE CONDITIONS.
- 97 WORST CASE CORE TEST - UPPER CORE  
THIS PROGRAM DETECTS THE ABILITY TO READ AND WRITE UNDER WORST CASE CONDITIONS. THIS PROGRAM RESIDES IN THE UPPER 256 BYTES OF THE SELECTED CORE SIZE.

**4.3 SPECIAL TESTS**

- A0 INVALID OP CODE TEST  
TESTS INVALID OP CODE CIRCUITRY WITH INVALID COMMANDS, INVALID BRANCHES, INVALID 1 ADDRESS INSTRUCTIONS, AND INVALID 2 ADDRESS INSTRUCTIONS.
- A1 PARITY CHECK CIRCUIT TEST  
TEST ALL PARITY CHECK CIRCUITRY BY FORCING DATA WITH BAD PARITY TO GO THROUGH THE NORMAL DATA FLOW.



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PREV EC 816700 PRES EC 818693 PM 2589925

5.1 CONVERSION TABLE: EBCDIC CODE TO CARE CODE

EBCDIC CODE	CARD CODE	EBCDIC CODE	CARD CODE	EBCDIC CODE	CARD CODE	EBCDIC CODE	CARD CODE
00	.....	40	.....	80	.....	C0	.....
01	.....	41	.....	81	.....	C1	.....
02	.....	42	.....	82	.....	C2	.....
03	.....	43	.....	83	.....	C3	.....
04	.....	44	.....	84	.....	C4	.....
05	.....	45	.....	85	.....	C5	.....
06	.....	46	.....	86	.....	C6	.....
07	.....	47	.....	87	.....	C7	.....
08	.....	48	.....	88	.....	C8	.....
09	.....	49	.....	89	.....	C9	.....
0A	.....	4A	.....	8A	.....	CA	.....
0B	.....	4B	.....	8B	.....	CB	.....
0C	.....	4C	.....	8C	.....	CC	.....
0D	.....	4D	.....	8D	.....	CD	.....
0E	.....	4E	.....	8E	.....	CE	.....
0F	.....	4F	.....	8F	.....	CF	.....
10	.....	50	.....	90	.....	D0	.....
11	.....	51	.....	91	.....	D1	.....
12	.....	52	.....	92	.....	D2	.....
13	.....	53	.....	93	.....	D3	.....
14	.....	54	.....	94	.....	D4	.....
15	.....	55	.....	95	.....	D5	.....
16	.....	56	.....	96	.....	D6	.....
17	.....	57	.....	97	.....	D7	.....
18	.....	58	.....	98	.....	D8	.....
19	.....	59	.....	99	.....	D9	.....
1A	.....	5A	.....	9A	.....	DA	.....
1B	.....	5B	.....	9B	.....	DB	.....
1C	.....	5C	.....	9C	.....	DC	.....
1D	.....	5D	.....	9D	.....	DD	.....
1E	.....	5E	.....	9E	.....	DE	.....
1F	.....	5F	.....	9F	.....	DF	.....
20	.....	60	.....	A0	.....	EO	.....
21	.....	61	.....	A1	.....	E1	.....
22	.....	62	.....	A2	.....	E2	.....
23	.....	63	.....	A3	.....	E3	.....
24	.....	64	.....	A4	.....	E4	.....
25	.....	65	.....	A5	.....	E5	.....
26	.....	66	.....	A6	.....	E6	.....
27	.....	67	.....	A7	.....	E7	.....
28	.....	68	.....	A8	.....	E8	.....
29	.....	69	.....	A9	.....	E9	.....
2A	.....	6A	.....	AA	.....	EA	.....
2B	.....	6B	.....	AB	.....	EB	.....
2C	.....	6C	.....	AC	.....	EC	.....
2D	.....	6D	.....	AD	.....	ED	.....
2E	.....	6E	.....	AE	.....	EE	.....
2F	.....	6F	.....	AF	.....	EF	.....
30	.....	70	.....	P0	.....	F0	.....
31	.....	71	.....	P1	.....	F1	.....
32	.....	72	.....	P2	.....	F2	.....
33	.....	73	.....	P3	.....	F3	.....
34	.....	74	.....	P4	.....	F4	.....
35	.....	75	.....	P5	.....	F5	.....
36	.....	76	.....	P6	.....	F6	.....
37	.....	77	.....	P7	.....	F7	.....
38	.....	78	.....	P8	.....	F8	.....
39	.....	79	.....	P9	.....	F9	.....
3A	.....	7A	.....	8A	.....	FA	.....
3B	.....	7B	.....	8B	.....	FB	.....
3C	.....	7C	.....	8C	.....	FC	.....
3D	.....	7D	.....	8D	.....	FD	.....
3E	.....	7E	.....	8E	.....	FE	.....
3F	.....	7F	.....	8F	.....	FF	.....
IE.C.E.A19.4.2.1I		ID.C.B.A19.4.2.1I		ID.C.E.A19.4.2.1I		ID.C.B.A19.4.2.1I	

5.2 CONVERSION TABLE: CARD CODE TO EBCDIC CODE

CARD CODE	EBCDIC CODE	CARD CODE	EBCDIC CODE	CARD CODE	EBCDIC CODE	CARD CODE	EBCDIC CODE
I.L.C.E.A18.4.2.11		I.L.C.B.A18.4.2.11		I.L.C.B.A18.4.2.11		I.D.C.B.A18.4.2.11	
.....	40	.....	00	IX.....	C0	IX.X.....	80
.....XI	F1	.....XI	B1	IX.....XI	71	IX.X.....XI	31
.....X.	F2	.....X.	B2	IX.....X.	72	IX.X.....X.	32
.....X.XI	F3	.....X.XI	B3	IX.....X.XI	73	IX.X.....X.XI	33
.....X.	F4	.....X.	B4	IX.....X.	74	IX.X.....X.	34
.....X.XI	F5	.....X.XI	E5	IX.....X.XI	75	IX.X.....X.XI	35
.....X.X.	F6	.....X.X.	B6	IX.....X.X.	76	IX.X.....X.X.	36
.....X.X.XI	F7	.....X.X.XI	B7	IX.....X.X.XI	77	IX.X.....X.X.XI	37
.....IX.	F8	.....IX.	B8	IX.....IX.	78	IX.X.....IX.	38
.....IX.XI	F9	.....IX.XI	B9	IX.....IX.XI	79	IX.X.....IX.XI	39
.....IX.X.	7A	.....IX.X.	3A	IX.....IX.X.	FA	IX.X.....IX.X.	BA
.....IX.X.XI	7B	.....IX.X.XI	3B	IX.....IX.X.XI	FB	IX.X.....IX.X.XI	BB
.....IX.X.X.	7C	.....IX.X.X.	3C	IX.....IX.X.X.	FC	IX.X.....IX.X.X.	BC
.....IX.X.X.XI	7D	.....IX.X.X.XI	3D	IX.....IX.X.X.XI	FD	IX.X.....IX.X.X.XI	BD
.....IX.X.X.X.	7E	.....IX.X.X.X.	3E	IX.....IX.X.X.X.	FE	IX.X.....IX.X.X.X.	BE
.....IX.X.X.X.XI	7F	.....IX.X.X.X.XI	3F	IX.....IX.X.X.X.XI	FF	IX.X.....IX.X.X.X.XI	BF
.....X.XI	F0	.....X.XI	B0	IX.....X.XI	70	IX.X.....X.XI	30
.....X.XI	61	.....X.XI	21	IX.....X.XI	E1	IX.X.....X.XI	A1
.....X.X.	E2	.....X.X.	A2	IX.....X.X.	62	IX.X.....X.X.	22
.....X.X.XI	E3	.....X.X.XI	A3	IX.....X.X.XI	63	IX.X.....X.X.XI	23
.....X.X.X.	E4	.....X.X.X.	A4	IX.....X.X.X.	64	IX.X.....X.X.X.	24
.....X.X.X.XI	E5	.....X.X.X.XI	A5	IX.....X.X.X.XI	65	IX.X.....X.X.X.XI	25
.....X.X.X.X.	E6	.....X.X.X.X.	A6	IX.....X.X.X.X.	66	IX.X.....X.X.X.X.	26
.....X.X.X.X.XI	E7	.....X.X.X.X.XI	A7	IX.....X.X.X.X.XI	67	IX.X.....X.X.X.X.XI	27
.....X.X.X.X.	E8	.....X.X.X.X.	A8	IX.....X.X.X.X.	68	IX.X.....X.X.X.X.	28
.....X.X.X.X.XI	E9	.....X.X.X.X.XI	A9	IX.....X.X.X.X.XI	69	IX.X.....X.X.X.X.XI	29
.....X.X.X.X.X.	50	.....X.X.X.X.X.	10	IX.....X.X.X.X.X.	EA	IX.X.....X.X.X.X.X.	AA
.....X.X.X.X.X.XI	6B	.....X.X.X.X.X.XI	2B	IX.....X.X.X.X.X.XI	EB	IX.X.....X.X.X.X.X.XI	AB
.....X.X.X.X.X.X.	6C	.....X.X.X.X.X.X.	2C	IX.....X.X.X.X.X.X.	EC	IX.X.....X.X.X.X.X.X.	AC
.....X.X.X.X.X.X.XI	6D	.....X.X.X.X.X.X.XI	2D	IX.....X.X.X.X.X.X.XI	ED	IX.X.....X.X.X.X.X.X.XI	AD
.....X.X.X.X.X.X.X.	6E	.....X.X.X.X.X.X.X.	2E	IX.....X.X.X.X.X.X.X.	EE	IX.X.....X.X.X.X.X.X.X.	AE
.....X.X.X.X.X.X.X.XI	6F	.....X.X.X.X.X.X.X.XI	2F	IX.....X.X.X.X.X.X.X.XI	EF	IX.X.....X.X.X.X.X.X.X.XI	AF
.....X.X.	60	.....X.X.	20	IX.....X.X.	E0	IX.X.....X.X.	A0
.....X.X.	D1	.....X.X.	91	IX.....X.X.	51	IX.X.....X.X.	11
.....X.X.	D2	.....X.X.	92	IX.....X.X.	52	IX.X.....X.X.	12
.....X.X.	D3	.....X.X.	93	IX.....X.X.	53	IX.X.....X.X.	13
.....X.X.	D4	.....X.X.	94	IX.....X.X.	54	IX.X.....X.X.	14
.....X.X.	D5	.....X.X.	95	IX.....X.X.	55	IX.X.....X.X.	15
.....X.X.	D6	.....X.X.	96	IX.....X.X.	56	IX.X.....X.X.	16
.....X.X.	D7	.....X.X.	97	IX.....X.X.	57	IX.X.....X.X.	17
.....X.X.	D8	.....X.X.	98	IX.....X.X.	58	IX.X.....X.X.	18
.....X.X.	D9	.....X.X.	99	IX.....X.X.	59	IX.X.....X.X.	19
.....X.X.	5A	.....X.X.	1A	IX.....X.X.	DA	IX.X.....X.X.	9A
.....X.X.	5B	.....X.X.	1B	IX.....X.X.	DB	IX.X.....X.X.	9B
.....X.X.	5C	.....X.X.	1C	IX.....X.X.	DC	IX.X.....X.X.	9C
.....X.X.	5D	.....X.X.	1D	IX.....X.X.	DD	IX.X.....X.X.	9D
.....X.X.	5E	.....X.X.	1E	IX.....X.X.	DE	IX.X.....X.X.	9E
.....X.X.	5F	.....X.X.	1F	IX.....X.X.	DF	IX.X.....X.X.	9F
.....X.X.XI	D0	.....X.X.XI	90	IX.....X.X.XI	6A	IX.X.....X.X.XI	2A
.....X.X.XI	C1	.....X.X.XI	81	IX.....X.X.XI	41	IX.X.....X.X.XI	01
.....X.X.XI	C2	.....X.X.XI	82	IX.....X.X.XI	42	IX.X.....X.X.XI	02
.....X.X.XI	C3	.....X.X.XI	83	IX.....X.X.XI	43	IX.X.....X.X.XI	03
.....X.X.XI	C4	.....X.X.XI	84	IX.....X.X.XI	44	IX.X.....X.X.XI	04
.....X.X.XI	C5	.....X.X.XI	85	IX.....X.X.XI	45	IX.X.....X.X.XI	05
.....X.X.XI	C6	.....X.X.XI	86	IX.....X.X.XI	46	IX.X.....X.X.XI	06
.....X.X.XI	C7	.....X.X.XI	87	IX.....X.X.XI	47	IX.X.....X.X.XI	07
.....X.X.XI	C8	.....X.X.XI	88	IX.....X.X.XI	48	IX.X.....X.X.XI	08
.....X.X.XI	C9	.....X.X.XI	89	IX.....X.X.XI	49	IX.X.....X.X.XI	09
.....X.X.XI	4A	.....X.X.XI	0A	IX.....X.X.XI	CA	IX.X.....X.X.XI	8A
.....X.X.XI	4B	.....X.X.XI	0B	IX.....X.X.XI	CB	IX.X.....X.X.XI	8B
.....X.X.XI	4C	.....X.X.XI	0C	IX.....X.X.XI	CC	IX.X.....X.X.XI	8C
.....X.X.XI	4D	.....X.X.XI	0D	IX.....X.X.XI	CD	IX.X.....X.X.XI	8D
.....X.X.XI	4E	.....X.X.XI	0E	IX.....X.X.XI	CE	IX.X.....X.X.XI	8E
.....X.X.XI	4F	.....X.X.XI	0F	IX.....X.X.XI	CF	IX.X.....X.X.XI	8F
I.D.C.E.A18.4.2.11		I.D.C.E.A18.4.2.11		I.D.C.E.A18.4.2.11		I.D.C.E.A18.4.2.11	

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**1. PURPOSE**

CARD ERAP (ERROR RECORDING ANALYSIS PROGRAM FOR MODEL C SOFTWARE) FORMATS AND PRINTS ERROR DATA FROM THE ERROR DATA CARDS PUNCHED BY THE SYSTEM INITIALIZER. WHENEVER THE SYSTEM INITIALIZER IS RUN, A CARD IS PUNCHED AND MERGED WITH THE DECK. RECORDED IN THIS CARD ARE THE LAST I/O ERRORS (UP TO 8) WHICH OCCURRED ON THE SYSTEM AND THE LAST PRINT POSITIONS (UP TO 6) GIVING HAMMER ECHO CHECKS ON THE 5203 LINE PRINTER. THE DATE IS ALSO PUNCHED.

ERAP NORMALLY READS THESE CARDS AND LISTS THEIR CONTENTS IN READABLE FORM. THEN IT LISTS ALL ERRORS IN A SUMMARIZED FASHION GROUPING ERRORS BY DEVICE, COUNTING THEIR OCCURRENCES, AND NAMING SPECIFICALLY THE TYPES OF ERRORS INDICATED. THEN ERAP SUMMARIZES THE HAMMER ECHO CHECKS AND THE NUMBER OF TIMES EACH WAS RECORDED.

**2. ERROR RECORDING**

ERRORS ARE RECORDED BY STORING THE Q BYTE AND R BYTE (CONTROL CODE) OF THE SIO INSTRUCTION WHICH CAUSED THE ERROR. THE 2 STATUS BYTES OF THE DEVICE ARE ALSO RECORDED. THUS AN ERROR IS REPRESENTED BY A FOUR BYTE ENTRY. AS THE SYSTEM RUNS, ERRORS ARE STORED IN CORE IN A SPECIAL PUSH-DOWN TABLE. WHEN THE SYSTEM INITIALIZER PROGRAM IS RUN, THE CONTENTS OF THE TABLE (8 MOST RECENT ERRORS) ARE PUNCHED INTO A CARD. THE ACTUAL PRINT POSITIONS CAUSING THE LAST 6 HAMMER ECHO CHECKS ARE ALSO PUNCHED. THUS, THE SIP (SYSTEM INITIALIZER) DECK GROWS BY ONE CARD EACH TIME IT IS RUN. INFORMATION IS PUNCHED IN HEXIDECIMAL FORMAT. EACH CARD MAY BE RECOGNIZED BY A 'W' IN COLUMN 1.

NOTE: ERROR DATA IS LOGGED BY THE RPG PROGRAM. MANUAL CONSOLE OPERATIONS OR USE OF ANY NON-RPG PROGRAMS, SUCH AS CP DIAGNOSTICS, MAY ALTER THIS AREA AND CAUSE THE INFORMATION TO BE INVALID. IF THE SIP FINDS AN INVALID DATE IN CORE, IT WON'T PUNCH A DATE INTO THE ERROR CARD. IF ERAP FINDS NO DATE ON THE CARD, IT IGNORES THAT CARD. THIS IS NOT A PERFECT CHECK, AND INVALID ERRORS CAN OCCUR. HOWEVER, IN A SYSTEM STRICTLY USING RPG PROGRAMS, THIS SHOULD NOT OCCUR.

**3. THE DECK**

**3.1 DECK ARRANGEMENT AND SYSTEM REQUIREMENTS**

ERAP IS A STAND ALONE PROGRAM (DOES NOT RUN UNDER DCP). IT REQUIRES A 5424 MFCU AND A 5203 LINE PRINTER. (IF THE PRINTER HAS THE DUAL CARRIAGE FEATURE, PAPER MUST BE LOADED IN THE LEFT CARRIAGE) THE ARRANGEMENT OF THE DECK, INCLUDING OPTIONAL CARDS, IS AS FOLLOWS FROM FRONT TO BACK.

1. A FIVE CARD IPL LOADER.
2. TEXT CARDS.
3. CHAIN IMAGE CARDS. THESE ARE NECESSARY ONLY IF THE THE UNIVERSAL CHARACTER SET IS INSTALLED ON THE 5203 PRINTER. THE FORMAT USED IS THE SAME AS THE DCP IMAGE CARDS. (IE. '/ CHAIN XXX' FOLLOWED BY EITHER 2 OR 5 CARDS. IF YOU DO NOT INCLUDE CHAIN IMAGE CARDS, ERAP AUTOMATICALLY ASSUMES THE STANDARD 48 CHARACTER SET.
4. COMMENT CARDS-- IDENTIFIED BY '\*' IN COLUMN 1. COMMENT CONTAINED ON THIS CARD IS PRINTED WHEN ERAP LOADS. (THESE MAY BE REMOVED FROM THE DECK FOR FASTER OPERATION).
5. REPLACE CARDS -- THESE ARE NEEDED IF BYTES IN CORE ARE TO BE ALTERED AT LOAD TIME. CARDS ARE OF THE SAME FORMAT AS DCP REPLACE CARDS.
6. END CARD-- 'E' IN FIRST COLUMN IS ALL THAT IS NECESSARY.
7. ERAP CONTROL CARDS. SEE NEXT SECTION 3.2 .
8. '/END' CARD INCLUDING CPU SERIAL NUMBER. SEE NEXT SECTION 3.2 .

**3.2 ERAP CONTROL CARDS**

THESE CARDS ARE SPECIAL CARDS USED BY ERAP TO PROVIDE BIT MEANINGS OF THE STATUS BYTES OF THE VARIOUS DEVICES. THERE ARE SEVEN CARDS PER DEVICE, EACH WITH A '/' IN THE FIRST COLUMN AND THE DEVICE ADDRESS IN THE SECOND. (THIS IS WITH THE EXCEPTION OF BSCA, WHICH HAS ONLY 8 BITS DESCRIBED AND THUS HAS ONLY 4 CONTROL CARDS.)

\*\* NONE OF THE ERAP CONTROL CARDS SHOULD BE REMOVED FROM THE DECK.

A DESCRIPTION OF A SEVEN CARD SET FOR ANY GIVEN DEVICE FOLLOWS:

-CARD 1-

COL	CONTENT
* 1	* SLASH '/'
* 2	* DEVICE ADDRESS IN HEXADECEMAL (EG. MFCU IS 'P')
* 3-9	* BLANK
* 10-85	* HEADING TO BE PRINTED FOR A DEVICE
* 86-88	* BLANK
* 89-96	* ID LEVEL SEQUENCE

-CARD 2 THRU 6-

COL	CONTENT
* 1	* SLASH '/'
* 2	* DEVICE ADDRESS IN HEX.
* 3-4	* BLANK
* 5-26	* BIT NUMBER, DASH, MEANING
* 27	* COMMA ','
* 28-49	* BIT NUMBER, DASH, MEANING
* 50	* COMMA ','
* 51-72	* BIT NUMBER, DASH, MEANING
* 73	* COMMA ','
* 74-88	* BLANK
* 89-96	* ID LEVEL AND SEQUENCE

CARD 2 HAS BITS 0,1 AND 2.  
 CARD 3 HAS BITS 3,4 AND 5. ETC.

-CARD 7-

SAME AS CARDS 2-6 EXCEPT WITH BIT MEANING OF BIT 15 IN COLUMNS 5-26 AND 27-88 ARE BLANK.

-END CARD-

THE SEVEN CARD GROUPS (ONE GROUP FOR EACH DEVICE) ARE ARRANGED SEQUENTIALLY IN ASCENDING ORDER BY DEVICE ADDRESS FOLLOWING THE END CARD OF THE OBJECT DECK. THE END OF THE CONTROL CARDS IS SIGNALLED BY A '/END' CONTROL CARD. THE FORMAT IS:

COL	CONTENT
* 1-4	* '/END'
* 10-14	* CPU SERIAL NUMBER
* 15-88	* BLANK
* 89-96	* SEQUENCING (OPTIONAL)



7. SAMPLE ERAP PRINTOUTS

7.1 FORMATTED LISTING-- SAMPLE PRINTOUT

	----- T A B L E 1 -----						----- T A B L E 2 -----					
	DEVICE	Q R	STATUS	BYTES 2 AND 1	PRINT POSITIONS		PRINT POSITIONS		DATE			
CARD # 1	MFCU	F1 05	0001	1100	0000 0100	*	015,022,128,022,022,022	*	03/09/70			
	MFCU	F1 05	0011	1000	1000 0000	*		*				
	LP	E4 02	0100	1000	0000 0101	*		*				
	MFCU	F1 05	0011	1000	1000 0000	*		*				
	LP	E4 03	0100	1000	0000 0101	*		*				
	MFCU	F1 05	0001	1100	0000 0100	*		*				
	MFCU	F1 05	0001	1100	0000 0100	*		*				
	LP	E2 02	0000	1101	0000 0101	*		*				
CARD # 2	LE	E2 02	0000	1101	0000 0101	*	015,015,022	*	03/09/70			
	MFCU	F2 05	0011	1000	0110 0000	*		*				
	LP	E4 03	0100	1000	0000 0101	*		*				
	LP	E2 02	0000	1101	0000 0101	*		*				
	MFCU	F2 07	0011	1000	0110 0000	*		*				
	LP	E2 02	0000	1100	0000 0101	*		*				

EXPLANATION OF FORMATTED LISTING:  
 ON 3/10 (MAR. 10) THE SYSTEM INITIALIZER PROGRAM WAS RUN AS USUAL RECORDING THE PREVIOUS DAY'S ERRORS.  
 PUNCHED IN A CARD WERE THE CONTENTS OF THE ERROR RECORDING TABLES AT THAT TIME. LATER  
 THE C.E. REMOVES ALL SUCH CARDS FROM THE SIP (SYSTEM INITIALIZER PROGRAM) AND RUNS ERAP.  
 ERAP READ THAT 1ST CARD AND PRINTED THE FIRST 8 ERRORS (IN TABLE 1) SHOWN ABOVE.  
 THE FIRST ERROR LISTED IS THE MOST RECENT. IT WAS AN MFCU ERROR WITH Q AND R BYTES OF F1  
 AND 05 RESPECTIVELY. STATUS BYTES WERE AS SHOWN.

ALSO ON THAT CARD WERE THE LAST 6 ACTUAL PRINT POSITIONS WHICH GAVE HAMMER ECHO CHECKS ON THE  
 5203 LINE PRINTER. THESE PRINT POSITIONS ARE PRINTED IN TABLE 2 OF THE ERAP PRINTOUT.  
 NOTE THAT THE PRINT POSITIONS LISTED IN TABLE 2 MAY OR MAY NOT BE RELATED TO THOSE ERRORS  
 LISTED IN TABLE 1.  
 LET'S SAY THE CUSTOMER IS RUNNING AND HE GETS 6 HAMMER ECHO CHECKS ON HIS 5203 LINE  
 PRINTER. THAT MEANS THAT THE ERROR TABLE (REPRESENTED BY TABLE 1) IS NEARLY FILLED WITH LP  
 ERRORS AND THE OTHER TABLE (REPRESENTED BY TABLE 2) IS FILLED. NOW SAY HE GETS SEVERAL MFCU  
 ERRORS. THESE WOULD PUSH LP ERRORS OUT OF TABLE 1 BUT WOULD NOT AFFECT TABLE 2.  
 THUS NOT ALL ERRORS INDICATED BY PRINT POSITIONS IN TABLE 2 MAY SHOW UP IN TABLE 1.

ERAP, HAVING LISTED THESE FIRST 8 ERRORS AND 6 PRINT POSITIONS, SPACES THE PRINTER, READS A  
 NEW CARD, AND PRINTS ITS ERRORS IF ANY. THIS CARD #2 CONTAINED ONLY 6 ERRORS AND ONLY 3  
 HAMMER ECHO CHECKS.  
 THIS CARD BY CARD LISTING CONTINUES UNTIL A BLANK CARD IS READ. AT THIS TIME THE PRESENT  
 CONTENTS OF THE ERROR TABLES IN CORE, IF VALID, ARE PUNCHED INTO THAT BLANK CARD SIMILAR  
 TO THE SIP. THIS FINAL CARD IS THEN PROCESSED. THE SUMMARY BY DEVICE THEN BEGINS.

7.2 SUMMARY BY DEVICE-- SAMPLE PRINTOUT

***** 5203 LINE PRINTER *****									
	Q R	SENSE 2	SENSE 1	COUNT					
	4-CE SNS BIT LATCHED	,5-	HAMMER ECHO CHECK	,13-	48 CHAR. CHAIN	,15-	CE SNS BIT	.	
	E2 02	0000	1100	0000	0101	1			
	4-CE SNS BIT LATCHED	,5-	HAMMER ECHO CHECK	,7-	SIO NO-OPED	,13-	48 CHAR. CHAIN	.	
	E2 02	0000	1101	0000	0101	3			
	1-CARRIAGE SPACE CHECK,4-CE SNS BIT LATCHED	,13-	48 CHAR. CHAIN	,15-	CE SNS BIT	.			
	E4 02	0100	1000	0000	0101	1			
	E4 03	0100	1000	0000	0101	2			
	----- DEVICE TOTAL 7 -----								
***** 5424 MFCU *****									
	3-CARD IN WAIT 2	,4-	RESERVED	,5-	HOPPER CYCLR N/COMPL,13-	HOPPER CHECK	.		
	F1 05	0001	1100	0000	0100	3			
	2-CARD IN WAIT 1	,3-	CARD IN WAIT 2	,4-	RESERVED	,9-	PUNCH CHECK	.	
	F2 05	0011	1000	0110	0000	1			
	F2 07	0011	1000	0110	0000	1			
	2-CARD IN WAIT 1	,3-	CARD IN WAIT 2	,4-	RESERVED	,8-	READ CHECK	.	
	F1 05	0011	1000	1000	0000	2			
	----- DEVICE TOTAL 7 -----								

EXPLANATION OF SUMMARY BY DEVICE:  
 THIS IS A SUMMARY OF THE TWO ERROR CARDS LISTED IN THE LAST EXAMPLE. ERAP GROUPS THE ERRORS  
 BY DEVICE. (DEVICE WITH LOWEST DEVICE ADDRESS IS FIRST ETC). ERRORS WITH THE SAME SENSE BYTES  
 (REGARDLESS OF Q & R BYTES) ARE GROUPED TOGETHER WITHIN EACH DEVICE. IF AN ERROR OCCURRED  
 SEVERAL TIMES EXACTLY THE SAME (Q & R BYTES INCLUDED) IT IS LISTED ONCE AND A 'COUNT' TELLS HOW  
 MANY TIMES IT OCCURRED.  
 IN THIS SUMMARY, AN ERROR IS FIRST DESCRIBED BY DECODING THE SENSE BYTES BIT BY BIT (BITS  
 NUMBERED 0-15). NOTE THE FIRST ERROR UNDER '5203 LINE PRINTER' HAD SENSE BITS 4,5,13, & 15 ON.  
 BIT MEANINGS ARE PRINTED WITH BIT NUMBER. BITS ARE NUMBERED 0-15.  
 THEN ALL LP ERRORS WITH THAT SENSE INFO ARE PRINTED GIVING THE Q,R, AND 2 SENSE BYTES WITH A  
 COUNT AS TO HOW MANY TIMES IT OCCURRED.  
 THIS CONTINUES FOR EACH DIFFERENT LP ERROR RECORDED. A 'DEVICE TOTAL' APPEARS AT THE END OF  
 EACH DEVICE SHOWING TOTAL ERRORS ON THAT DEVICE.  
 NOTE HOW THE 2ND MFCU ERROR HAD 5 SENSE BITS ON. BIT NUMBER 10 APPEARS ON THE NEXT LINE AFTER  
 BITS 2,3,4,9. A MAXIMUM OF 4 BITS ARE DESCRIBED PER LINE.  
 \*\*\*\* A GOOD METHOD OF DETERMINING IF ERAP IS POINTING OUT TROUBLE SPOTS IS TO LOOK AT DEVICE  
 TOTALS AND COUNTS IN THE SUMMARY SECTION.

FINALLY, ERAP SUMMARIZES ALL HAMMER ECHO CHECKS BY LISTING THE HAMMER NUMBERS  
 AND THE NUMBER OF TIMES THAT HAMMER CAUSED A HAMMER ECHO CHECK BASED ON PRINT  
 POSITIONS RECORDED. (SAMPLE OF THIS PRINTOUT NOT SHOWN).

7.3 SPECIAL OUTPUT FOR BSCA

ERROR RECORDING FOR BSCA IS NOT LIKE OTHER DEVICES. THE Q BYTE IS RECORDED NORMALLY, BUT IN PLACE OF THE R BYTE THE NUMBER OF RETRIES IS RECORDED. SENSE BYTE 2 IS RECORDED NORMALLY, BUT IN PLACE OF SENSE BYTE 1 THE COMPLETION CODE IS RECORDED. AS ERAP IS READING AND LISTING THE ERRORS ON EACH CARD, IF IT SEES A BSCA ERROR, IT WILL PRINT THE COMPLETION CODE IN HEX AND A NOTE TO REMIND THE FE OF THESE EXCEPTIONS.

PARTIAL SAMPLE OF FORMATTED LISTING:

DEVICE	Q	R	STATUS BYTES 2 AND 1		PRINT POSITIONS	DATE
					* 015,022,128,022,022,022	03/09/70
MFCU	F1	05	0001 1100 0000 0100			
MFCU	F1	05	0011 1000 1000 0000			
BSCA	81	07	0011 1000 41			
LP	E4	02	0100 1000 0000 0101			

NOTE FOR BSCA- R IS NO. OF RETRIES, SENSE 1 IS COMP. CODE.

FOR THE SUMMARY BY DEVICE THE BSCA SUMMARY SIMPLY PRINTS HEADINGS TO SHOW THE TRUE MEANING OF EACH BYTE IN AN ERROR.

PARTIAL SAMPLE OF SUMMARY BY DEVICE:

***** BSCA *****				
Q	RETRY	SENSE 2	COMP.CODE	COUNT
	2-ADAPTER CHK ON TRANS	3-ADAPTER CHK RECEIVE	4-INVALID ASCII CHAR	
81	07	0011 1000	41	1

7.4 BSCA COMPLETION CODES:

- |                                      |   |
|--------------------------------------|---|
| 40 - NORMAL COMPLETION CODE          | 4E - CUSTOMER PROGRAM LOST CONTROL              |
| 41 - END OF FILE (RECEIVED FILE)     | 4F - PERMANENT ERROR                            |
| 42 - END OF FILE (RECEIVED FILE)     | 80 - BUFFER PARTLY PROCESSED BY DATA MANAGEMENT |
| 46 - CONVERSATIONAL REPLY AVAILABLE  | 84 - BUFFER READY FOR DATA TRANSFER             |
| 4B - INVALID ASCII CHARACTER IN DATA | 88 - DATA TRANSFER IN PROGRESS                  |

8. HALT CODES AND MEANINGS

HALT CODE	MEANING	ACTION
E1	ILLEGAL DATA CARD	NPRO FROM SECONDARY HOPPER. CHECK FOR 'W' IN COLUMN ONE. RESET HALT AND NEXT CARD WILL BE READ.
E2	ILLEGAL ROTARY SWITCH ENTRY	CHANGE SWITCHES AND RESET HALT.
E3	TOO MANY DATA CARDS	TO CONTINUE LISTING, RESET HALT. REMAINING CARDS WILL BE LISTED BUT WILL NOT BE INCLUDED IN SUMMARY. TO BEGIN SUMMARY NOW, PUT 8 BLANK CARDS IN SECONDARY READY TO BE READ NEXT. MAKE MFCU READY AND RESET HALT.
E5	CONTROL CARD READ HAS NO '/' IN COLUMN 1.	NPRO THE BAW CARD. CORRECT IT AND REPLACE IT IN THE PRIMARY HOPPER READY TO BE READ NEXT. MAKE MFCU READY AND RESET HALT.
E6	CPU SERIAL # IS INVALID	PLACE CPU SERIAL # IN COLUMNS 10-14 OF '/END' CONTROL CARD. PLACE CARD IN PRIMARY HOPPER, MAKE MFCU READY AND RESET HALT.
EE	ERAP LOADED -- READY TO BEGIN	ENTER OPTIONS OR SET LEFTMOST ROTARY SWITCH TO '0' AND RESET HALT.
EJ	ERAP RUN COMPLETE	PROGRAM RESTART MAY BE ACCOMPLISHED (SEE SECTION 5.4).
FP	PROGRAM OPTION ACCEPTED	SET ROTARY SWITCHES TO OTHER OPTIONS OR SET LEFT SWITCH TO '0' AND RESET HALT.
H5	MFCU NOT READY OR ERROR.	IF NOT READY, MAKE IT READY AND RESET HALT. IF ERROR OCCURRED, PERFORM ACTION REQUIRED TO RETRY. ERAP WILL RETRY OPERATION WHEN HALT IS RESET.
H6	LINE PRINTER NOT READY	MAKE PRINTER READY AND RESET HALT.
HF	VALID ENTRY IN LEFTMOST ROTARY SWITCH.	RESET HALT TO CAUSE ERAP TO ACCEPT THE ENTRY

8.1 ERROR MESSAGES AND THEIR MEANINGS

ERROR MESSAGE	MEANING AND ACTION
CORE EXCEEDED, FOLLOWING NOT IN SUMMARY	ERRORS ARE SO NUMEROUS THAT THEY CAN'T BE HANDLED AND SUMMARIZED. SEE HALT -E3- FOR ACTION POSSIBLE.
NO CONTROL CARDS FOR THIS DEVICE	THIS MESSAGE HEADS A DEVICE ERROR SUMMARY WHEN NO ERAP CONTROL CARDS WERE FOUND FOR ITS BIT MEANINGS. IT IS POSSIBLE THAT THE CONTROL CARDS ARE OUT OF ORDER (MUST BE IN ASCENDING ORDER BY DEVICE ADDRESS) OR THAT THE ERROR IS SIMPLY INVALID, IN WHICH CASE IT SHOULD BE IGNORED.
-INVLD	THIS WILL BE PRINTED FOR THE 'DEVICE' IN THE FORMATTED LISTING WHENEVER A DEVICE ERROR IS FOUND FOR WHICH ERROR RECORDING IS NOT BEING DONE. THIS CONDITION IS ABNORMAL AND MAKES ALL INFORMATION ON THAT CARD QUESTIONABLE.

9. ERROR RECOVERY (PROC. CHECK OR PUNCH TROUBLE)

WHEN ERAP READS A BLANK CARD FROM THE SECONDARY HOPPER, IT TRIES TO ACCESS THE ERROR RECORDING AREA IN CORE AND PUNCH ON THAT CARD ANY ERRORS RECORDED. IF THERE IS BAD PARITY IN CORE A PROCESSOR CHECK OCCURS. IF PUNCHING IS BAD, 'H5' HALT IS REPEATED.

\*\*\*\* TO RECOVER (BYPASS PUNCHING AND ENTER SUMMARY) FROM ONE OF THESE CASES, DO A SYSTEM RESET/START. BETWEEN THE TIME THAT THE BLANK CARD IS READ AND THE SUMMARY BEGINS, THIS SPECIAL RECOVERY IS AVAILABLE. ANY OTHER TIME A COMPLETE ERAP RESTART IS ACCOMPLISHED FROM THIS ACTION.

10. SIP CARD FORMAT

COLUMN	CONTENT				
1	C'W'				
2-65	8 - 8 COLUMN FIELDS A FIELD OF ZEROS, IS AN EMPTY FIELD				
	FIELD POSITION      CONTENT				
	1-2                  Q				
	3-4                  R				
	5-6                  SENSE BYTE 2				
	7-8                  SENSE BYTE 1				
66-78	6 - 2 COLUMN FIELDS A HEXADECIMAL NUMBER OF THE PRINT POSITION WHERE A HAMMER ECHO CHECK OCCURRED. A ZERO ENTRY IS AN EMPTY ENTRY				
79-93	NOT USED				
94	MONTH				
95	DAY				
96	YEAR				
	PUNCH - MONTH      PUNCH - DAY      PUNCH - YEAR				
1	JAN	A	1	0	70
2	FEB	B	2	1	71
3	MAR	C	3	2	72
4	APR	D	4	3	73
5	MAY	E	5	4	74
6	JUNE	F	6	5	75
7	JULY	G	7	6	76
8	AUG	H	8	7	77
9	SEPT	I	9	8	78
EXCL. 0	MARK	EXCL. MARK	10	9	79
	NOV	J	11		
	DEC	K	12		
		L	13		
		M	14		
		N	15		
		O	16		
		P	17		
		Q	18		
		R	19		
		S	20		
		T	21		
		U	22		
		V	23		
		W	24		
		X	25		
		Y	26		
		Z	27		
		0	28		
		1	29		
			30		
			31		
		END			



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1. SUMMARY OF DISK ERAP

1.1 GENERAL DESCRIPTION

DISK ERAP (ERROR RECORDING ANALYSIS PROGRAM) RUNS UNDER DCP ON SYSTEM/3 .

DISK ERAP CONSISTS OF:

- A) SECTION PP7
- B) SECTION PP3 (ONLY WHEN 5445 IS PRESENT. THIS DECK IS ONLY DISTRIBUTED TO SYSTEM WITH 5445)
- C) DATA MODULE (PROG ID OCF)

X'AO' MUST BE DEFINED IN THE UDT FOR DISK ERAP TO RUN

1.2 ROUTINE DESCRIPTION

ROUTINE	DESCRIPTION	SENSE SWITCH
1	PRINTS AND CLEARS (UNDER SETTING OF SSW20) HISTORY TABLE AND THE MEANING OF THE ENTRIES IN THE HISTORY TABLE.	20
2	PRINTS AND CLEARS (UNDER SETTING OF SSW20) STATISTICAL DATA RECORDING (SDR) ENTRIES THAT ARE DEFINED IN THE UNIT DEFINITION TABLE (UDT).	20
3	PRINTS AND CLEARS (UNDER SETTING OF SSW20) A. MASTER SIO TABLE (5444) B. INDIVIDUAL VOLUME STATISTICS (UNDER SETTING OF SSW21-SSW24) FOR 5444.	20 20,21,22, 23,24
4	PRINTS AND CLEARS (UNDER SETTING OF SSW20) THE 5445 INDIVIDUAL VOLUME STATISTICS.	20 25,26

1.3 DECK ORGANIZATION

THE ORDER OF THE PROGRAM DECKS ARE AS FOLLOWS WHEN RUNNING FROM THE NPCU.

SYSTEM WITH NO 5445

- 1. PP7
- 2. OCF

SYSTEM WITH 5445

- 1. PP7
- 2. PP3
- 3. OCF

ERAP CAN BE RERUN WITHOUT RELOADING. IF RUNNING FROM CARDS A MESSAGE 'RELOAD DATA DECK' WILL OCCUR WITH AN -EA- HALT IF A ROUTINE IS LOOPED ON OR ERAP IS RERUN WITHOUT RELOADING. IF THIS OCCURS, FROM THE NPCU, PLACE THE DATA DECK IN PRIMARY HOPPER, MAKE NPCU READY, AND RESET HALT.

IT IS ESSENTIAL THAT THE CARD NUMBERS OF THE DATA DECK BE IN NUMERICAL ORDER, IF NOT A MESSAGE 'DATA CARDS NOT IN ORDER' WITH AN -EC- HALT WILL OCCUR.

**2. OPERATING PROCEDURES (DCP CONTROLLED SECTIONS)**

THIS SECTION DESCRIBES THE USER INTERFACE FOR ALL PROGRAMS OPERATING UNDER THE DIAGNOSTIC CONTROL PROGRAM (DCP). MORE DETAIL IS PROVIDED IN THE DCP USERS GUIDE (BLOCK 10).

**2.1 LOADING**

THE CE MODE SELECTOR SWITCH MUST BE IN THE 'PROCESS' POSITION. ALL CE CONTROL PANEL TOGGLE SWITCHES SHOULD BE IN THE NORMAL (DOWN) POSITION.

**2.1.1 LOADING ON A MODEL 10 FROM A NPCU.**

1. IF DCP IS LOADED, SKIP TO STEP 5.
2. IF A DISK SYSTEM, PLACE -PROGRAM LOAD SELECTOR- IN NPCU POSITION.
3. PLACE DCP FOLLOWED BY TEST SECTION/S INTO NPCU PRIMARY HOPPER. MAKE NPCU READY.
4. DEPRESS -PROGRAM LOAD- KEY. AFTER DCP IS LOADED, A -HA- HALT WILL OCCUR. COMMON SENSE SWITCHES MAY BE SET AT THIS TIME.
5. PLACE TEST SECTION/S INTO NPCU PRIMARY HOPPER AND MAKE NPCU READY (IF NOT ALREADY DONE).
6. IF A -HA- OR -HE- HALT OCCURS SKIP TO STEP 8.
7. DEPRESS -PROGRAM LOAD- KEY. DCP WILL PRINT SECTION TERMINATE MESSAGE AND HALT WITH A -HE-.
8. RESET THE HALT. DCP WILL LOAD THE SECTION AND DISPLAY A -AA- HALT.
9. MAKE DESIRED CONSOLE SWITCHES ENTRIES, IF ANY AND RESET THE HALT.

**2.1.2 LOADING ON A MODEL 10 FROM DISK WITH A 5424 (NPCU) ATTACHMENT.**

1. SKIP TO STEP 5 IF DCP IS ALREADY LOADED.
2. PLACE THE CE PACK ON R1 AND MAKE DRIVE 1 READY.
3. PLACE THE -PROGRAM LOAD SELECTOR- IN REMOVABLE POSITION.
4. DEPRESS -PROGRAM LOAD- KEY. AFTER DCP IS LOADED, A -HA- HALT WILL OCCUR. COMMON SENSE SWITCHES MAY BE SET AT THIS TIME.
5. USE CONSOLE SWITCHES ENTRY -DXXX- (XXX - PROG ID) TO SPECIFY THE PROGRAMS TO BE LOADED. (SEE SECTION 2.4)
6. SET LEFTMOST SWITCH TO -0- AND RESET HALT. DCP WILL LOAD THE SECTION AND DISPLAY A -HA- HALT.
7. MAKE ANY CONSOLE SWITCH ENTRY DESIRED AND/OR RESET HALT.

**2.1.3 LOADING ON A MODEL 10 FROM DISK WITH A 5422 ATTACHMENT.**

1. SKIP TO STEP 5 IF DCP IS ALREADY LOADED.
2. PLACE THE CE PACK ON R1 AND MAKE DRIVE 1 READY.
3. PLACE THE -PROGRAM LOAD SELECTOR- IN REMOVABLE POSITION.
4. PLACE -00FE- IN DATA SWITCHES AND DEPRESS -PROGRAM LOAD- KEY.

CPU AND MEMORY TEST ARE LOADED AND RUN BEFORE DCP IS LOADED. THE ORDER OF THE CPU AND MEMORY HALTS ARE LISTED BELOW. RESET THE HALTS IF THEY OCCUR IN THE FOLLOWING ORDER. IF THE HALTS AREN'T IN THE PROPER ORDER REFER TO BLOCK 5. WHEN THE -HE- HALT OCCURS GO TO STEP 5.

HALTS  
 A) -CC-  
 B) -LL-  
 C) -FF-  
 D) -HE-

5. USE CONSOLE SWITCHES ENTRY -DXXX- (XXX - PROG ID) TO SPECIFY THE PROGRAM/S TO BE LOADED. (SEE SECTION 2.4)
6. SET LEFTMOST SWITCH TO -0- AND RESET HALT. DCP WILL LOAD THE SECTION AND DISPLAY A -HA- HALT.
7. MAKE ANY CONSOLE SWITCH ENTRY DESIRED AND/OR RESET HALT.

**2.1.4 LOADING ON A MODEL 6 FROM DISK.**

1. SKIP TO STEP 8 IF DCP IS ALREADY LOADED.
2. LOAD THE CE PACK ON R1 AND MAKE DRIVE 1 READY.
3. PLACE THE -PROGRAM LOAD SELECTOR- IN REMOVABLE POSITION.
4. SET DATA SWITCHES TO -00FE- (-02FE- TO BYPASS STORAGE PROGRAMS OR -03FE- TO ALLOW SENSE SWITCH SETTING PRIOR TO PRINTING OR BYPASS THAT PORTION OF I/O LSRS INCLUDED IN THE CPU TESTS).
5. OPERATE PROGRAM LOAD.
6. THE FOLLOWING HALTS WILL OCCUR. AFTER EACH, OPERATE THE START KEY.

A) -EE-	{ABC 123}	
B) -FF-	{ABCD 12345}	
C) -805-	{A	5}
D) -805-	{A	5}

STORAGE SEPARATOR HALT.  
 STORAGE SEPARATOR HALT.

THE STORAGE SEPARATOR HALTS OCCUR ONLY IF THE DATA SWITCH ENTRIES ARE -00FE- OR -03FE-. OTHER HALTS OCCURRING AT THIS TIME SHOULD BE INVESTIGATED.

7. DCP WILL LOAD AND PERFORM A -PA5- (ABCD 1 3 5) HALT.
8. USE CONSOLE SWITCHES ENTRY -DXXX- (XXX -PROG ID) TO SPECIFY THE PROGRAM/S TO BE LOADED. (SEE SECTION 2.4)
9. SET LEFTMOST SWITCH TO -0- AND RESET HALT. DCP WILL LOAD THE SECTION AND DISPLAY A -PA5- (ABCD 1 3 5) HALT.
10. MAKE ANY CONSOLE DATA SWITCH ENTRY DESIRED AND/OR RESET HALT.

**2.2 PROGRAM RESTART**

DCP STORES INSTRUCTIONS STARTING AT LOCATION '0000' TO PROVIDE FOR A PROGRAM RESTART. THESE INSTRUCTIONS ALSO CHECK THE CONSOLE SWITCHES FOR A VALID ENTRY. TO PERFORM A PROGRAM RESTART, SIMPLY DEPRESS SYSTEM RESET FOLLOWED BY CPU START.

**2.3 TERMINATION**

NORMAL DCP-CONTROLLED CHAINING FROM ROUTINE TO ROUTINE PROVIDES AN AUTOMATIC TERMINATION OF A SECTION. IN ADDITION, THE CE MAY TERMINATE A SECTION AT ANY TIME BY (1) ENTERING 'RE00' IN THE CONSOLE SWITCHES, OR BY (2) LOADING THE NEXT SECTION. IN ALL CASES, DCP PRINTS A MESSAGE AND PERFORMS HALT 'HE'. THE SECTION CAN STILL BE RESTARTED AT THIS TIME BY USING THE PROGRAM RESTART PROCEDURE. IF NO RESTART IS DESIRED, RESET THE HALT TO LOAD THE NEXT SECTION.

2.4 CONSOLE ADDRESS/DATA SWITCH COMMUNICATIONS

THE ROTARY DATA SWITCHES ARE THE MEANS BY WHICH THE CE CAN COMMUNICATE WITH THE DIAGNOSTICS. ENTRIES ARE MADE AS FOLLOWS--

1. STOP CPU.
2. SET UP ROTARY SWITCHES FOR ONE OF THE FOLLOWING OPTIONS. X'S INDICATE POSITIONS WHICH VARY WITH THE NEED.

```

SWITCHES
 1 2 3 4
*** *** *** ***
F 0 X X - TURN OFF SENSE SWITCH 'XX'. (F008 WOULD TURN OFF SSW 08).
F 1 X X - TURN ON SENSE SWITCH 'XX'. (F108 WOULD TURN ON SSW 08).
F 2 X X - GO TO ROUTINE 'XX' AFTER CONSOLE ENTRY FINISHED. (F202 WOULD GO TO ROUTINE 2).
E E 0 0 - TERMINATE THE CURRENT SECTION.
D X X 0 - DISK--EXECUTE SECTIONS FOR DEVICE WITH UNIT CODE 'XX'. (DE00 - EXECUTE ALL 5203 PRINTER PROGRAMS)
D X X X - DISK--EXECUTE SECTION XXX. (DE01 - SECTION 801). (DE01 - EXECUTE SECTION 801)
    
```

NOTE - UP TO FOUR DISK INSTRUCTIONS MAY BE ENTERED DURING ONE ENTRY PHASE.

3. DEPRESS CPU START. (SYSTEM RESET FOLLOWED BY START WILL CALL IMMEDIATE ATTENTION TO THE SWITCHES--SEE NOTE BELOW).
4. WHEN DCP RECEIVES CONTROL, IT HALTS WITH 'HF' DISPLAYED. RESET THE HALT TO ENTER THE FIRST OPTION.
5. DCP WILL PERFORM HALT 'HU' OR 'HP'. LOAD THE NEXT OPTION AND RESET THE HALT.
6. REPEAT STEP 5 FOR AS MANY OPTIONS AS DESIRED. ALTERNATING CODES 'HU' AND 'HP' WILL SIGNAL DCP ACCEPTANCE.
7. WHEN DONE, SET LEFTMOST SWITCH TO '0' AND RESET THE HALT.

NOTE - WHEN USING F2XX IN THE SWITCHES TO GO TO A ROUTINE AFTER A SECTION HAS BEGUN, SYSTEM RESET/START SHOULD BE PERFORMED BEFORE MAKING THE ENTRY. (THIS PREVENTS ERRORS FOUND IN ONE ROUTINE FROM BEING DETECTED IN SOME OTHER ROUTINE. IT SHOULD NOT BE PERFORMED IF OTHERWISE SPECIFIED IN THE HAPS.)

2.5 COMMON SENSE SWITCHES

SENSE SWITCHES ARE EQUIVALENT TO 48 TOGGLE SWITCHES NUMBERED HEXADECIMALLY 00-2F. SENSE SWITCHES 00-0F ARE RESERVED FOR STANDARD OPTIONS PROVIDED BY DCP (LISTED BELOW). SENSE SWITCHES 10-2F ARE SIGNIFICANT TO THE PARTICULAR SECTION BEING RUN. INSTRUCTIONS FOR SETTING SENSE SWITCHES ARE CONTAINED IN SECTION 2.4.

SSW NUMBER	I	ON	I	OFF (NORMAL)
00	I	LOOP ON SECTION.	I	GO TO NEXT SECTION.
01	I	LOOP ON ROUTINE.	I	GO TO NEXT ROUTINE.
02	I	BYPASS MANUAL INTERVENTION ROUTINES.	I	EXECUTE ALL ROUTINES.
03	I	BYPASS ERROR PRINTING.	I	PRINT ERROR MESSAGES.
04	I	BYPASS NON-ERROR PRINTING.	I	PRINT NON-ERROR MESSAGES.
05	I	USE ALTERNATE PRINTER. PRINTER KEYBOARD, IF ATTACHED. OTHERWISE, NPCU.	I	NORMAL PRINTER.
06	I	BYPASS ERROR HALTS.	I	HALT AFTER ERROR.
07	I	LOAD AND GO. BYPASS COMMENTS AND PROMPTING HALTS.	I	PROMPTING MODE.
08	I	USE 5203 RIGHT CARRIAGE.	I	USE LEFT CARRIAGE.
09	I	DON'T CLEAR SECTION SENSE SWITCHES AFTER LOADING	I	CLEAR SECTION SENSE SWITCHES AFTER LOADING
0A-0F	I	RESERVED		

2.6 CONTROL PROGRAM HALTS.

ALL CONTROL PROGRAM (DCP) HALTS USE THE CHARACTER 'H' AS THE FIRST DIGIT OF THE HALT CODE. THE SECOND DIGIT IDENTIFIES THE CONDITION ACCORDING TO THE FOLLOWING TABLE.

HALT CODES MODEL	I	CONDITION	I	ACTION REQUIRED
F05	H0	INVALID RECORD FOUND WHILE LOADING.	I	CORRECT INVALID RECORD AND RELOAD.
F15	H1	A DEVICE CALLED FOR BY THE TEST SECTION WAS NOT DEFINED IN THE UDT CARDS.	I	CHECK UDT CARDS AND RELOAD OR RESET HALT TO BYPASS THE ERROR (ERRORS COULD RESULT).
F25	H2	DATA SWITCH ENTRY ERROR.	I	CORRECT DATA SWITCHES AND RESET HALT.
F35	H3	INVALID ROUTINE PREFIX FOUND DURING CHAINING FROM ONE ROUTINE TO NEXT.	I	ENTER ROUTINE SELECT OPTION 'F2XX' IN DATA SWITCHES AND RESET HALT. IF THIS DOES NOT WORK, RELOAD SECTION.
F55	H5	NPCU NOT READY OR ERROR. ERROR INDICATION SHOULD BE DISPLAYED IN THE NPCU LIGHTS.	I	DO A NON-PROCESS RUN-OUT, RELOAD DECK STARTING WITH RUNOUT CARD/S AND RESET THE HALT.
F65	H6	PRINTER NOT READY OR ERROR.	I	CLEAR CONDITION AND RESET THE HALT. IF FAILURE PERSISTS, RUN PRINTER FUNCTION TEST. SENSE SWITCHES 03 AND 04 MAY BE USED TO BYPASS PRINTING. SET SENSE SWITCH 05 TO USE ALTERNATE PRINTER.
F75	H7	DISK ERROR.	I	RESET HALT TO RETRY. IF ERROR PERSISTS, RELOAD.
FA5	HA	CONTROL PROGRAM IS PREPARED TO RECEIVE DATA SWITCH ENTRY. OCCURS AFTER DCP AND SECTION LOADING.	I	RESET THE HALT IF NO ENTRY DESIRED. TO LOAD OPTIONS, SET UP DATA SWITCHES AND RESET THE HALT. SSW 07 MAY BE USED TO BYPASS THIS HALT.
FC5	HC	DISK LOADER REQUIRES SPECIFICATION OF SECTIONS TO BE LOADED FROM DISK.	I	IF NO ENTRY HAS BEEN MADE PREVIOUSLY, LOAD PROGRAM SELECTION ENTRY 'DXXX' AND RESET THE HALT. UP TO EIGHT ENTRIES MAY BE MADE. IF ENTRIES HAVE EVER BEEN MADE THE PROGRAMS MAY BE REPEATED BY RESETTING THE HALT.
FD5	HD	SECTION RUNNING OR LOAD TABLE HAS SPECIFIED NEXT SECTION TO BE RUN. BUT CONTAINS -DXXX- WHERE XXX IS THE PROGRAM ID TO BE RUN.	I	DISK SYSTEM - DXXX IS NOT ON DISK PACK, RESET THE HALT AND THE NEXT PROGRAM IN THE LOAD TABLE WILL BE LOADED. CARD SYSTEM - PLACE DECK XXX IN THE NPCU HOPPER AND RESET THE HALT.
FE5	HE	CURRENT SECTION TERMINATED.	I	RESET HALT TO LOAD NEXT SECTION. SECTION MAY BE RESTARTED BY SYSTEM RESET/START.
FF5	HF	DCP HALTS WITH 'HF' DISPLAYED WHENEVER A VALID DATA SWITCH ENTRY IS RECOGNIZED. AS DCP ACCEPTS ENTRIES, ALTERNATING HALTS 'HU' AND 'HP' OCCUR.	I	LOAD A VALID DATA SWITCH ENTRY AND RESET THE HALT. REPEAT FOR ALTERNATING HALTS 'HU' AND 'HP'. TO TERMINATE ENTRY PROCEDURE, ROTATE LEFT-MOST SWITCH TO ZERO AND RESET HALT.
D1	D1	IPL LOADER CAN'T LOAD DCP BECAUSE OF A DISK ERROR.	I	RESET HALT TO RETRY. IF HALT PERSISTS, GET A NEW DISK PACK.

3. SENSE SWITCH DESCRIPTION

SENSE SWITCH	MEANING										
20	RE-INITIALIZE AREA IN ERROR RECORDING AREA ON DISK THAT IS BEING PRINTED OUT SSW20 = 0 CLEAR AREA SSW20 = 1 DONT CLEAR AREA										
2X X=1-4	PRINT AND CLEAR (UNDER SETTING OF SSW20) THE INDIVIDUAL VOLUME STATISTICS ON VOLUME X OF 5444. VOL 3 AND 4 WILL NOT BE PRINTED UNLESS 'X' IS DEFINED IN THE UDT.  SSW2X = 0 DONT PRINT VOLUME X ON 5444 SSW2X = 1 PRINT VOLUME X ON 5444.  <table style="margin-left: 40px;"> <thead> <tr> <th>VOLUME NUMBER</th> <th>DRIVE</th> </tr> </thead> <tbody> <tr><td>1</td><td>1 FIXED</td></tr> <tr><td>2</td><td>1 REMOV</td></tr> <tr><td>3</td><td>2 FIXED</td></tr> <tr><td>4</td><td>2 REMOV</td></tr> </tbody> </table>	VOLUME NUMBER	DRIVE	1	1 FIXED	2	1 REMOV	3	2 FIXED	4	2 REMOV
VOLUME NUMBER	DRIVE										
1	1 FIXED										
2	1 REMOV										
3	2 FIXED										
4	2 REMOV										
25	PRINT AND CLEAR (UNDER SETTING OF SSW20) THE INDIVIDUAL VOLUME STATISTICS OF DRIVE 1 OF 5445.										
26	PRINT AND CLEAR (UNDER SETTING OF SSW20) THE INDIVIDUAL VOLUME STATISTICS OF DRIVE 2 OF 5445.										

4. HALT DESCRIPTION

HALT	MEANING	CF ACTION										
EA	RELOAD DATA CARDS. THIS HALT WILL ONLY OCCUR UNDER CARD DCP AND IF A ROUTINE IS RUN MORE THAN ONCE PER LOAD.	RELOAD DATA CARDS (PROGRAM ID = OCP) INTO PRIMARY HOPPER RESET HALT.										
EC	DATA CARDS ARE NOT IN ORDER.	CARD DCP. RESORT DATA CARDS (PROGRAM ID = OCP) RERUN DISK ERAP DISK DCP. RE-INITIALIZE DCP DISK PACK, MAKE SURE DATA CARDS ARE IN ORDER. RERUN DISK ERAP										
EE	DATA DECK (PROG ID = OCP) IS NOT THE RIGHT LEVEL.	DISK ERAP WILL NOT RUN UNLESS THE LEVEL NUMBER OF OCP IS THE NUMBER PRINTED ON THE PRINTER. FIND THAT LEVEL AND RESET THE HALT.										
FO	SELECT VOLUME(S) ON 5444 TO PRINT INDIVIDUAL VOLUME STATISTICS.	SET SSW2X (X=1-4) AS DESIRED. RESET HALT.										
FX X=1-4	VOLUME X IS NOT READY ON 5444 OR A NON-RECOVERABLE ERROR HAS OCCURRED ON VOLUME X  <table style="margin-left: 40px;"> <thead> <tr> <th>VOLUME NUMBER</th> <th>DRIVE</th> </tr> </thead> <tbody> <tr><td>1</td><td>1 FIXED</td></tr> <tr><td>2</td><td>1 REMOV</td></tr> <tr><td>3</td><td>2 FIXED</td></tr> <tr><td>4</td><td>2 REMOV</td></tr> </tbody> </table>	VOLUME NUMBER	DRIVE	1	1 FIXED	2	1 REMOV	3	2 FIXED	4	2 REMOV	MAKE SURE VOLUME X IS READY AND EITHER 1. RESET HALT AND TRY AGAIN OR 2. RUN DISK FUNCTION TESTS
VOLUME NUMBER	DRIVE											
1	1 FIXED											
2	1 REMOV											
3	2 FIXED											
4	2 REMOV											
F5	5445 DISK ERROR. CHECK PRINTOUT ON PRINTER TO DETERMINE WHICH DRIVE.	MAKE SURE DRIVE IS READY. RESET THE HALT, IF HALT PERSIST RUN 5445 DIAGNOSTICS.										
FC	SELECT DRIVE(S) ON 5445 FOR INDIVIDUAL VOLUME STATISTICS.	SET SSW 25,26 AS DESIRED. RESET THE HALT										

5. DETAIL ROUTINE DESCRIPTION

5.1 ROUTINE 1

THIS ROUTINE PRINTS ALL RECORDED ENTRIES IN THE ERROR HISTORY TABLE IN CHRONOLOGICAL ORDER, OLDEST FIRST.  
 HERE IS A LIST OF DEVICES THAT CAN BE IN THE ERROR HISTORY TABLE.

1. 5444 -DISK
2. BSCA
3. 5471 -CONSOLE-PRINTER
4. 1442
5. 5424 -NPCU
6. 5203 -PRINTER
7. 2265
8. PRINTER MODEL 6 (5213 OR 2222)
9. LCD
10. CONSOLE MODEL 6
11. 5496 -DATA RECORDER
12. 1403 -PRINTER
13. 5445 -DISK

5.2 ROUTINE 2

THIS ROUTINE PRINTS ALL SDR (STATISTICAL DATA RECORDING) TABLES FOR DEVICES THAT ARE DEFINED IN THE UDT TABLE. HERE IS A LIST OF DEVICES THAT HAVE A SDR TABLE WITH THEIR UDT CODE.

```

    DEVICE UDT CODE
    *****
    * 5488 * I'AO' *
    * 5471 * I'10' *
    * 1442 * I'50' *
    * 5203 * I'E0' *
    * 1403 * I'E0' *
    * 5428 * I'F0' *
    * 5445 * I'CO' *
    *****
    * 5213 - 2222 * I'88' *
    * LCD * I'88' *
    * 5496 * I'88' *
    * 2265 * I'88' *
    * CONSOLE MODEL 6 * I'12' *
    *****
    
```

ALL VALUES IN THE SDR TABLE ARE PRINTED IN DECIMAL.

5.3 ROUTINE 3

THIS ROUTINE PRINTS THE MASTER SIO TABLE AND THE INDIVIDUAL VOLUME STATISTICS (IVS) AFTER THE MASTER SIO TABLE IS PRINTED A -FO- HALT WILL OCCUR TO LET THE CE TO SET SSW21-24 FOR SELECTION OF VOLUMES. AFTER ALL SELECTED INDIVIDUAL VOLUME STATISTICS HAVE BEEN PRINTED THE -FO- HALT WILL OCCUR AGAIN. AT THIS TIME THE CE CAN

1. REMOUNT NEW VOLUMES AND RESET SSW21-24 TO OBTAIN MORE INDIVIDUAL VOLUME STATISTICS. THIS LOOP WILL OCCUR UNTIL THERE ARE NO PRINTOUTS.
- OR
2. CLEAR SSW21-24 AND RESET HALT. THIS WILL TERMINATE ROUTINE 3.

'RO' MUST BE DEFINED IN THE UDT TABLE TO OBTAIN INDIVIDUAL VOLUME STATISTICS FROM VOLUME 3 AND 4. INDIVIDUAL VOLUME STATISTICS FOR VOLUMES WHICH HAVE A NON-STANDARD FORMAT FOR SYSTEM 3 DISK OPERATING SYSTEM WILL NOT BE PRINTED, A MESSAGE 'VOL X IS A NON-STANDARD PACK' WILL BE PRINTED, (X=1,4) IN THE IVS TABLE.

```

    VOL #      DRIVE
    *****
    * 1 * 1 FIXED *
    * 2 * 1 REMOV *
    * 3 * 2 FIXED *
    * 4 * 2 REMOV *
    *****
    
```

ALL VALUES IN THE MASTER SIO TABLE AND INDIVIDUAL VOLUME STATISTICS ARE PRINTED IN DECIMAL.

IF RUNNING FROM DISK THE CE CAN REMOVE THE DCP DISK PACK -- (ONLY AFTER THE -FO- HALT) -- TO MOUNT OTHER VOLUMES ON THAT DRIVE TO OBTAIN MORE INDIVIDUAL VOLUME STATISTICS. THE DCP DISK PACK WILL NEED TO BE REMOUNTED AFTER TERMINATION OF ERAP OR RESUM OF ERAP.

5.4 ROUTINE 4

THIS ROUTINE PRINTS THE 5445 INDIVIDUAL VOLUME STATISTICS. WHEN THE -FC- HALT OCCURS YOU CAN:

1. REMOUNT NEW VOLUMES AND RESET SSW25-26 TO OBTAIN MORE INDIVIDUAL VOLUME STATISTICS. THIS LOOP WILL OCCUR UNTIL THERE ARE NO PRINTOUTS.
- OR
2. CLEAR SSW25-26 AND RESET HALT. THIS WILL TERMINATE ROUTINE 4.

SINCE ROUTINE 4 IS AN OVERLAY TO THE DISK ERAP YOU CAN'T GO TO ROUTINE 4 JUST AFTER ERAP HAS BEEN LOADED. RSN 4 CAN BE GONE THRU THE DATA SWITCHES (F 2 0 4) ONLY AFTER ANY ONE OF THE FIRST THREE ROUTINES HAVE STARTED TO BE EXECUTED. -C8- MUST BE DEFINED IN THE UDT TO OBTAIN PRINTOUT FROM DEVICE TWO.

## 6. TABLE DESCRIPTION

### 6.1 ERROR HISTORY TABLE

THE HISTORY TABLE PROVIDES FOR 63 ENTRIES AND IS RECURSIVE WITH NO OVERFLOW OR STOP LOGIC PROVIDED ON RECORDING. THE 64TH TIME AN ENTRY IS MADE IT WILL OVERLAY THE FIRST ENTRY, THE 65TH ENTRY WILL OVERLAY THE SECOND, ETC. THEREFORE THE HISTORY CAN OBTAIN AT MOST 63 ENTRIES. 5444 (DISK) ENTRIES ARE DOUBLE ENTRIES.

THE HISTORY TABLE WILL CONTAIN PERMANENT AND TEMPORARY ERRORS. TEMPORARY ERRORS ON DISK WILL CONTAIN A RETRY COUNT WHICH TELLS THE NUMBER OF RETRIES. THE RETRY COUNT WILL BE ZERO FOR PERMANENT ERRORS ON DISK. TEMPORARY ERRORS FOR BSCA WILL NOT BE RECORDED. A PERMANENT ERROR IS DEFINED AS ONE THAT PERSIST THROUGHOUT THE NUMBER OF RETRIES OUTLINED IN THE ERROR RECOVERY PROCEDURES. A TEMPORARY ERROR IS DEFINED AS ONE WHERE RECOVERY OCCURS BEFORE THE MAXIMUM NUMBER OF RETRIES.

ERRORS ARE PRINTED IN CHRONOLOGICAL ORDER, OLDEST FIRST.

IN GENERAL, EACH ENTRIES IN THE ERROR HISTORY TABLE CONTAINS

1. Q AND R BYTES OF THE SIO INSTRUCTION (THE R BYTE IS NOT RECORDED FOR BSCA).
2. SENSE BYTE 0 AND 1 OF THE ERROR CONDITION.

FOR SOME DEVICES, MORE DATA IS RECORDED IN THE ERROR HISTORY TABLE THAN THE Q,R,SENSE BYTE 0-1. THIS ADDITIONAL DATA WILL BE PRINTED OUT AND EXPLAINED FOR EACH DEVICE.

### 6.2 MASTER DISK SIO TABLE FOR 5444.

THE MASTER SIO TABLE HAS COUNTERS FOR WRITES & VERIFIES AND READ & SCAN FOR EACH DRIVE.

ALL NUMBERS ARE PRINTED IN DECIMAL.

### 6.3 INDIVIDUAL VOLUME STATISTICS (IVS) DISK TABLE ON 5444.

THE IVS TABLE CONTAIN THE VOLUME ID, A COUNTER FOR TEMPORARY ERROR ON THE VOLUME, A COUNTER FOR THE NUMBER OF WRITES & VERIFIES ON THE VOLUME, A COUNTER FOR THE NUMBER OF READ & SCANS ON THE VOLUME, AND THE LOCATION OF UP TO THE LAST 12 PERMANENT DISK ERRORS.

THE TEMPORARY ERROR COUNTER CONTAINS THE COUNT OF MISSING ADDRESS MARKER, DATA CHECK ON READ, DATA CHECK ON WRITE, AND DATA CHECK IN IDENTIFIER.

A WRITE & VERIFY AND READ & SCAN WILL EACH BE RECORDED AS A SINGLE OPERATION.

THE NUMBER OF SEEK ARE NOT COUNTED.

ALL NUMBERS ARE PRINTED IN DECIMAL.

A MESSAGE 'VOL X IS A NON-STANDARD PACK' WILL BE PRINTED IN THE IVS TABLE IF THE PACK HAS A NON-STANDARD FORMAT FOR SYSTEM 3 DISK OPERATING SYSTEM.

```
VOL #   DRIVE
*****
* 1 * 1 FIXED *
* 2 * 1 REMOV *
* 3 * 2 FIXED *
* 4 * 2 REMOV *
*****
```

### 6.4 STATISTICAL DATA RECORDING (SDR) TABLES

EACH DEVICE SDR TABLE WILL CONSIST OF COUNTERS TO RECORD DISSTINGUISHABLE ERROR FOR THAT DEVICE. THE 5444 DEVICE HAS TEMPORARY AND PERMANENT COUNTERS. A PERMANENT ERROR IS DEFINED AS ONE PERSIST THROUGHOUT THE NUMBER OF RETRIES OUTLINED IN THE ERROR RECOVERY PROCEDURES. A TEMPORARY ERROR IS DEFINED AS ONE WHERE RECOVERY OCCURS BEFORE THE MAXIMUM NUMBER OF RETRIES.

ALL NUMBERS ARE PRINTED IN DECIMAL.

### 6.5 INDIVIDUAL VOLUME STATISTICS (IVS) DISK TABLE ON 5445.

THE IVS TABLE CONTAIN THE VOLUME ID, A COUNTER FOR TEMPORARY ERROR ON THE VOLUME, A COUNTER FOR THE NUMBER OF WRITES & VERIFIES ON THE VOLUME, A COUNTER FOR THE NUMBER OF READ & SCANS ON THE VOLUME, AND THE LOCATION OF UP TO THE LAST 122 PERMANENT DISK ERRORS.

THE TEMPORARY ERROR COUNTER CONTAINS THE COUNT OF MISSING ADDRESS MARKER, DATA CHECK ON READ, DATA CHECK ON WRITE, AND DATA CHECK IN IDENTIFIER.

A WRITE & VERIFY AND READ & SCAN WILL EACH BE RECORDED AS A SINGLE OPERATION.

THE NUMBER OF SEEK ARE NOT COUNTED.

ALL NUMBERS ARE PRINTED IN DECIMAL, EXCEPT THE PERMANENT ERRORS ARE PRINTED IN HEX AS -CCH- WHERE CC IS CYLINDER AND HH IS HEAD.

A MESSAGE 'VOL X IS A NON-STANDARD PACK' WILL BE PRINTED IN THE IVS TABLE IF THE PACK HAS A NON-STANDARD FORMAT FOR SYSTEM 3 DISK OPERATING SYSTEM.

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DIAGNOSTIC USER'S GUIDE  
USAGE METER DIAGNOSTIC DESCRIPTIONS  
PREV EC 818677      PRES EC 577054      P/N 2589740

BLOCK 08, PAGE 00  
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1. GENERAL PROGRAM SUMMARY OF -FF8-

1.1 INTENT

TO PROVIDE A DIAGNOSTIC PROGRAM WHICH WILL PROVIDE A SIX MINUTE RUN OF THE CPU USAGE METER AND THE USAGE METER OF EACH I/O DEVICE ATTACHED WHICH IS DEFINED IN THE UNIT DEFINITION TABLE (UDT) CARD.

2. OPERATING PROCEDURES (DCP CONTROLLED SECTIONS)

THIS SECTION DESCRIBES THE USER INTERFACE FOR ALL PROGRAMS OPERATING UNDER THE DIAGNOSTIC CONTROL PROGRAM (DCP). MORE DETAIL IS PROVIDED IN THE ICF USERS GUIDE (BLOCK 10).

2.1 LOADING

THE CE MODE SELECTOR SWITCH MUST BE IN THE 'PROCESS' POSITION. ALL CE CONTROL PANEL TOGGLE SWITCHES SHOULD BE IN THE NORMAL (DOWN) POSITION.

2.1.1 LOADING ON A MODEL 10 FROM A MFCU.

1. IF DCP IS LOADED, SKIP TO STEP 5.
2. IF A DISK SYSTEM, PLACE -PROGRAM LOAD SELECTOR- IN MFCU POSITION.
3. PLACE DCP FOLLOWED BY TEST SECTION/S INTO MFCU PRIMARY HOPPER. MAKE MFCU READY.
4. DEPRESS -PROGRAM LOAD- KEY. AFTER DCP IS LOADED, A -HA- HALT WILL OCCUR. COMMON SENSE SWITCHES MAY BE SET AT THIS TIME.
5. PLACE TEST SECTION/S INTO MFCU PRIMARY HOPPER AND MAKE MFCU READY (IF NOT ALREADY DONE).
6. IF A -HA- OR -HE- HALT OCCURS SKIP TO STEP 8.
7. DEPRESS -PROGRAM LOAD- KEY. DCP WILL PRINT SECTION TERMINATE MESSAGE AND HALT WITH A -BE-.
8. RESET THE HALT. DCP WILL LOAD THE SECTION AND DISPLAY A -HA- HALT.
9. MAKE DESIRED CONSOLE SWITCHES ENTRIES, IF ANY AND RESET THE HALT.

2.1.2 LOADING ON A MODEL 10 FROM DISK WITH A 5424 (MFCU) ATTACHMENT.

1. SKIP TO STEP 5 IF DCP IS ALREADY LOADED.
2. PLACE THE CE PACK ON R1 AND MAKE DRIVE 1 READY.
3. PLACE THE -PROGRAM LOAD SELECTOR- IN REMOVABLE POSITION.
4. DEPRESS -PROGRAM LOAD- KEY. AFTER DCP IS LOADED, A -HA- HALT WILL OCCUR. COMMON SENSE SWITCHES MAY BE SET AT THIS TIME.
5. USE CONSOLE SWITCHES ENTRY -DXXX- (XXX - PROG ID) TO SPECIFY THE PROGRAMS TO BE LOADED. (SEE SECTION 2.4)
6. SET LEFTMOST SWITCH TO -0- AND RESET HALT. DCP WILL LOAD THE SECTION AND DISPLAY A -HA- HALT.
7. MAKE ANY CONSOLE SWITCH ENTRY DESIRED AND/OR RESET HALT.

2.1.3 LOADING ON A MODEL 10 FROM DISK WITH A 5422 ATTACHMENT.

1. SKIP TO STEP 5 IF DCP IS ALREADY LOADED.
2. PLACE THE CE PACK ON R1 AND MAKE DRIVE 1 READY.
3. PLACE THE -PROGRAM LOAD SELECTOR- IN REMOVABLE POSITION.
4. PLACE -OOPE- IN DATA SWITCHES AND DEPRESS -PROGRAM LOAD- KEY.  
 CPU AND MEMORY TEST ARE LOADED AND RUN BEFORE DCP IS LOADED. THE ORDER OF THE CPU AND MEMORY HALT ARE LISTED BELOW. RESET THE HALTS IF THEY OCCUR IN THE FOLLOWING ORDER. IF THE HALTS AREN'T IN THE PROPER ORDER REFER TO BLOCK 5. WHEN THE -HE- HALT OCCURS GO TO STEP 5.

HALTS  
 A) -CC-  
 B) -LL-  
 C) -8P-  
 D) -HE-

5. USE CONSOLE SWITCHES ENTRY -DXXX- (XXX - PROG ID) TO SPECIFY THE PROGRAM/S TO BE LOADED. (SEE SECTION 2.4)
6. SET LEFTMOST SWITCH TO -0- AND RESET HALT. DCP WILL LOAD THE SECTION AND DISPLAY THE -HA- HALT.
7. MAKE ANY CONSOLE SWITCH ENTRY DESIRED AND/OR RESET HALT.

2.1.4 LOADING ON A MODEL 6 FROM DISK.

1. SKIP TO STEP 8 IF DCP IS ALREADY LOADED.
2. LOAD THE CE PACK ON R1 AND MAKE DRIVE 1 READY.
3. PLACE THE -PROGRAM LOAD SELECTOR- IN REMOVABLE POSITION.
4. SET DATA SWITCHES TO -OOPE- (-O2PE- TO BYPASS STORAGE PROGRAMS OR -O3PE- TO ALLOW SENSE SWITCH SETTING PRIOR TO PRINTING OR BYPASS THAT PORTION OF I/O LSES INCLUDED IN THE CPU TESTS).
5. OPERATE PROGRAM LOAD.
6. THE FOLLOWING HALTS WILL OCCUR. AFTER EACH, OPERATE THE START KEY.

A) -EE-	{ABC 123 }	
B) -PF5-	{ABCD 12345 }	
C) -805-	{A 5 }	STORAGE SEPARATOR HALT.
D) -805-	{A 5 }	STORAGE SEPARATOR HALT.

THE STORAGE SEPARATOR HALTS OCCUR ONLY IF THE DATA SWITCH ENTRIES ARE -OOPE- OR -O3PE-. OTHER HALTS OCCURRING AT THIS TIME SHOULD BE INVESTIGATED.

7. DCP WILL LOAD AND DISPLAY A -FA5- (ABCD 1 3 5) HALT.
8. USE CONSOLE SWITCHES ENTRY -DXXX- (XXX - PROG ID) TO SPECIFY THE PROGRAM/S TO BE LOADED. (SEE SECTION 2.4)
9. SET LEFTMOST SWITCH TO -0- AND RESET HALT. DCP WILL LOAD THE SECTION AND DISPLAY A -FA5- (ABCD 1 3 5) HALT.
10. MAKE ANY CONSOLE DATA SWITCH ENTRY DESIRED AND/OR RESET HALT.

2.2 PROGRAM RESTART

DCP STORES INSTRUCTIONS STARTING AT LOCATION '0000' TO PROVIDE FOR A PROGRAM RESTART. THESE INSTRUCTIONS ALSO CHECK THE CONSOLE SWITCHES FOR A VALID ENTRY. TO PERFORM A PROGRAM RESTART, SIMPLY DEPRESS SYSTEM RESET FOLLOWED BY CPU START.

2.3 TERMINATION

NORMAL DCP-CONTROLLED CHAINING FROM ROUTINE TO ROUTINE PROVIDES AN AUTOMATIC TERMINATION OF A SECTION. IN ADDITION, THE CE MAY TERMINATE A SECTION AT ANY TIME BY (1) ENTERING 'FE00' IN THE CONSOLE SWITCHES, OR BY (2) LOADING THE NEXT SECTION. IN ALL CASES, DCP PRINTS A MESSAGE AND PERFORMS HALT 'HE'. THE SECTION CAN STILL BE RESTARTED AT THIS TIME BY USING THE PROGRAM RESTART PROCEDURE. IF NO RESTART IS DESIRED, RESET THE HALT TO LOAD THE NEXT SECTION.

2.4 CONSOLE ADDRESS/DATA SWITCH COMMUNICATIONS

THE ROTARY DATA SWITCHES ARE THE MEANS BY WHICH THE CE CAN COMMUNICATE WITH THE DIAGNOSTICS. ENTRIES ARE MADE AS FOLLOWS--

1. STOP CPU.
2. SET UP ROTARY SWITCHES FOR ONE OF THE FOLLOWING OPTIONS. X'S INDICATE POSITIONS WHICH VARY WITH THE NEED.

SWITCHES				
1	2	3	4	
F	0	X	X	- TURN OFF SENSE SWITCH 'XX'. (F008 WOULD TURN OFF SSW 08).
F	1	X	X	- TURN ON SENSE SWITCH 'XX'. (F108 WOULD TURN ON SSW 08).
F	2	X	X	- GO TO ROUTINE 'XX' AFTER CONSOLE ENTRY FINISHED. (F202 WOULD GO TO ROUTINE 2).
E	E	0	0	- TERMINATE THE CURRENT SECTION.
D	X	X	0	- DISK--EXECUTE SECTIONS FOR DEVICE WITH UNIT CODE 'XX'. (DE00 - EXECUTE ALL 5203 PRINTER PROGRAMS)
D	X	X	X	- DISK--EXECUTE SECTION XXX. (DE01 - SECTION E01). (DE01 - EXECUTE SECTION E01)

NOTE - UP TO FOUR DISK INSTRUCTIONS MAY BE ENTERED DURING ONE ENTRY PHASE.

3. DEPRESS CPU START. (SYSTEM RESET FOLLOWED BY START WILL CALL IMMEDIATE ATTENTION TO THE SWITCHES--SEE NOTE BELOW).
4. WHEN DCP RECEIVES CONTROL, IT HALTS WITH 'HP' DISPLAYED. RESET THE HALT TO ENTER THE FIRST OPTION.
5. DCP WILL DISPLAY HALT 'HU' OR 'HP'. LOAD THE NEXT OPTION AND RESET THE HALT.
6. REPEAT STEP 5 FOR AS MANY OPTIONS AS DESIRED. ALTERNATING CODES 'HU' AND 'HP' WILL SIGNAL DCP ACCEPTANCE.
7. WHEN DONE, SET LEFTMOST SWITCH TO '0' AND RESET THE HALT.

NOTE - WHEN USING F2XX IN THE SWITCHES TO GO TO A ROUTINE AFTER A SECTION HAS BEGUN, SYSTEM RESET/START SHOULD BE PERFORMED BEFORE MAKING THE ENTRY. (THIS PREVENTS ERRORS FOUND IN ONE ROUTINE FROM BEING DETECTED IN SOME OTHER ROUTINE. IT SHOULD NOT BE PERFORMED IF OTHERWISE SPECIFIED IN THE MAPS.)

2.5 COMMON SENSE SWITCHES

SENSE SWITCHES ARE EQUIVALENT TO 48 TOGGLE SWITCHES NUMBERED HEXADECIMALLY 00-2F. SENSE SWITCHES 00-0F ARE RESERVED FOR STANDARD OPTIONS PROVIDED BY DCP (LISTED BELOW). SENSE SWITCHES 10-2F ARE SIGNIFICANT TO THE PARTICULAR SECTION BEING RUN. INSTRUCTIONS FOR SETTING SENSE SWITCHES ARE CONTAINED IN SECTION 2.4.

SSW NUMBER	ON	OFF	ACTION
00	I	I	LOOP ON SECTION. GO TO NEXT SECTION.
01	I	I	LOOP ON ROUTINE. GO TO NEXT ROUTINE.
02	I	I	BYPASS MANUAL INTERVENTION ROUTINES. EXECUTE ALL ROUTINES.
03	I	I	BYPASS ERROR PRINTING. PRINT ERROR MESSAGES.
04	I	I	BYPASS NON-ERROR PRINTING. PRINT NON-ERROR MESSAGES.
05	I	I	USE ALTERNATE PRINTER. PRINTER KEYBOARD, IF ATTACHED. OTHERWISE, MFCU. MFCU PRINTING.
06	I	I	BYPASS ERROR HALTS. HALT AFTER ERROR.
07	I	I	LOAD AND GO. BYPASS COMMENTS AND PRECEPTING HALTS. PRECEPTING MODE.
08	I	I	USE 5203 RIGHT CARRIAGE. USE LEFT CARRIAGE.
09	I	I	DON'T CLEAR SECTION SENSE SWITCHES AFTER LOADING. CLEAR SECTION SENSE SWITCHES AFTER LOADING.
0A-0F	I	I	RESERVED

2.6 CONTROL PROGRAM HALTS.

ALL CONTROL PROGRAM (DCP) HALTS USE THE CHARACTER 'H' AS THE FIRST DIGIT OF THE HALT CODE. THE SECOND DIGIT IDENTIFIES THE CONDITION ACCORDING TO THE FOLLOWING TABLE.

HALT CODES	MODEL	CONDITION	ACTION REQUIRED
F05	H0	INVALID RECORD FOUND WHILE LOADING.	CORRECT INVALID RECORD AND RELOAD.
F15	H1	A DEVICE CALLED FOR BY THE TEST SECTION WAS NOT DEFINED IN THE UDT CARDS.	CHECK UDT CARDS AND RELOAD OR RESET HALT TO BYPASS THE ERROR (ERRORS COULD RESULT).
F25	H2	DATA SWITCH ENTRY ERROR.	CORRECT DATA SWITCHES AND RESET HALT.
F35	H3	INVALID ROUTINE PREFIX FOUND DURING CHAINING FROM ONE ROUTINE TO NEXT.	ENTER ROUTINE SELECT OPTION 'F2XX' IN DATA SWITCHES AND RESET HALT. IF THIS DOES NOT WORK, RELOAD SECTION.
F55	H5	MFCU NOT READY OR ERROR. ERROR INDICATION SHOULD BE DISPLAYED IN THE MFCU LIGHTS.	DO A NON-PROCESS RUN-OUT, RELOAD DECK STARTING WITH RUNOUT CARD/S AND RESET THE HALT.
F65	H6	PRINTER NOT READY OR ERROR.	CLEAR CONDITION AND RESET THE HALT. IF FAILURE PERSISTS, RUN PRINTER FUNCTION TEST. SENSE SWITCHES 03 AND 04 MAY BE USED TO BYPASS PRINTING. SET SENSE SWITCH 05 TO USE ALTERNATE PRINTER.
F75	H7	DISK ERROR.	RESET HALT TO RETRY. IF ERROR PERSISTS, RELOAD.
FA5	HA	CONTROL PROGRAM IS PREPARED TO RECEIVE DATA SWITCH ENTRY. OCCURS AFTER DCP AND SECTION LOADING.	RESET THE HALT IF NO ENTRY DESIRED. TO LOAD OPTIONS, SET UP DATA SWITCHES AND RESET THE HALT. SSW 07 MAY BE USED TO BYPASS THIS HALT.
FC5	HC	DISK LOADER REQUIRES SPECIFICATION OF SECTIONS TO BE LOADED FROM DISK.	IF NO ENTRY HAS BEEN MADE PREVIOUSLY, LOAD PROGRAM SELECTION ENTRY 'DXXX' AND RESET THE HALT. UP TO EIGHT ENTRIES MAY BE MADE. IF ENTRIES HAVE EVER BEEN MADE, THE PROGRAMS MAY BE REPEATED BY RESSETTING THE HALT.
FD5	HD	SECTION RUNNING OR LOAD TABLE HAS SPECIFIED NEXT SECTION TO BE RUN. ARR CONTAINS 'DXXX' WHERE XXX IS THE PROGRAM ID TO BE RUN.	DISK SYSTEM - DXXX IS NOT ON DISK PACK, RESET THE HALT AND THE NEXT PROGRAM IN THE LOAD TABLE WILL BE LOADED. CARD SYSTEM - PLACE DECK XXX IN THE MFCU HOLES AND RESET THE HALT.
FE5	HE	CURRENT SECTION TERMINATED.	RESET HALT TO LOAD NEXT SECTION. SECTION MAY BE RESTARTED BY SYSTEM RESET/START.
FF5	HF	DCP HALTS WITH 'HP' DISPLAYED WHENEVER A VALID DATA SWITCH ENTRY IS RECOGNIZED. AS DCP ACCEPTS ENTRIES ALTERNATING HALTS 'HU' AND 'HP' OCCUR.	LOAD A VALID DATA SWITCH ENTRY AND RESET THE HALT. REPEAT FOR ALTERNATING HALTS 'HU' AND 'HP'. TO TERMINATE ENTRY PROCEDURE, ROTATE LEFT-MOST SWITCH TO ZERO AND RESET HALT.
D1	D1	IPL LOADER CAN'T LOAD DCP BECAUSE OF A DISK ERROR.	RESET HALT TO RETRY. IF HALT PERSISTS, GET A NEW DISK PACK.

2.7 OPERATING PROCEDURES FOR USAGE METER TEST -FF8-

THIS TEST RUNS UNDER THE DIAGNOSTIC CONTROL PROGRAM (DCP).

- 2.7.1 MAKE READY EACH DEVICE TO BE TESTED.
- 2.7.2 AFTER THE PROGRAM HAS BEEN LOADED, HALT 'FA' WILL OCCUR, IF TAPE IS DEFINED IN THE UDT, TO GIVE SPECIAL OPERATOR INSTRUCTIONS FOR THE TAPE UNITS. THEN THE PROGRAM WILL ISSUE START I/O'S TO EACH METERED DEVICE ATTACHED AND DEFINED IN THE UDT (EXCEPT SIOC).
- 2.7.3 AN -FO- HALT WILL OCCUR AFTER THE START I/O'S HAVE ALL BEEN ISSUED.
- 2.7.4 DO NOTHING TO THE I/O DEVICES WHICH ARE BEING TESTED. CERTAIN OPERATOR INTERVENTIONS WILL CAUSE THE USAGE METER TO STOP, SC UNLESS THE OPERATOR IS AWARE OF THE POSSIBILITIES FOR THE SPECIFIC DEVICE, IT IS RECOMMENDED THAT NO ACTION BE TAKEN.
- 2.7.5 CHECK TO BE CERTAIN THAT ALL METERS HAVE STOPPED (REFER TO CPU USAGE METER MAP IF THEY DID NOT) AND RECORD THE VALUES OF ALL THE USAGE METERS BEING TESTED. THIS MUST BE DONE AS ACCURATELY AS POSSIBLE IN ORDER FOR THE TEST RESULTS TO BE OF ANY VALUE.
- 2.7.6 RESET THE -FO- HALT. THE PROGRAM WILL RUN FOR SIX MINUTES AND THEN HALT.
- 2.7.7 WHEN THE -EE- HALT OCCURS, RECORD AND CONFIRM SIX MINUTES ON EACH DEVICE USAGE METER BEING TESTED.
- 2.7.8 REFER TO THE CPU MAP CHARTS IF THE CPU USAGE METER INCREMENTED INCORRECTLY. IF THE CPU METER IS CORRECT BUT A DEVICE METER IS INCORRECT, REFER TO THE MAP CHARTS FOR THAT DEVICE.
- 2.7.9 THE SIX MINUTE PROGRAM LOOP WILL BE RE-RUN IF THE -EE- HALT IS RESET. THE START I/O'S WILL NOT BE ISSUED AGAIN. ALL DEVICE USAGE METERS WILL RE-START AND RUN UNLESS THEY HAVE BEEN STOPPED BY THE UNIQUE DEVICE OPERATOR INTERVENTION WHICH WILL ALWAYS STOP A DEVICE METER. EXAMPLES OF THIS INTERVENTION ARE SPACING THE PRINTER AND EMPTYING WAIT 1 AND WAIT 2 OF THE MPCU BY THE WPRO KEY.
- 2.7.10 THE PROGRAM CAN BE RUN FROM THE VERY BEGINNING, INCLUDING THE MESSAGES AND THE START I/O'S, BY DOING A SYSTEM RESET, START.
- 2.7.11 HALTS

HALT TABLE

HALT NUMBER	CONDITION	ACTION REQUIRED
FA	SPECIAL OPERATOR INSTRUCTIONS REQUIRED BECAUSE TAPE 3410/3411 IS DEFINED IN THE UDT.	THE TAPE UNITS TO BE TESTED MUST BE ENABLED, AND READY WITH A SCRATCH TAPE AND A WRITE ENABLE RING INSTALLED.
FO	THE START I/O'S HAVE BEEN ISSUED TO THE ATTACHED DEVICES.	DO NOTHING TO THE I/O DEVICES. CHECK ALL USAGE METERS TO BE CERTAIN THAT THEY HAVE STOPPED. IF 'ALL' METERS CONTINUE TO RUN, REFER TO THE CPU USAGE METER MAP CHART. RECORD THE VALUE OF ALL USAGE METERS. RESET THE HALT.
EE	A RUN TIME OF 0.1 HOUR (6 MINUTES) HAS BEEN COMPLETED.	RECORD THE USE METERS AND MAKE CERTAIN THAT EACH ONE HAS ADVANCED 0.1 HOUR. IN THE EVENT OF AN INCORRECT READING, THE USAGE METER MAP CHART FOR THAT DEVICE SHOULD BE USED. THIS TEST WILL BE RERUN IF THE HALT IS RESET.

3. DETAILED DESCRIPTION OF TEST

INSTRUCTIONS ARE PRINTED BY THE PROGRAM WHICH WILL ENABLE THE OPERATOR TO SUCCESSFULLY RUN THE TEST WITHOUT ANY ADDITIONAL INFORMATION. THIS PROGRAM CAN BE USED TO CHECK THE METERS AGAINST REAL TIME BY MEASURING WITH A CLOCK, FROM THE TIME THE -FO- HALT IS RESET UNTIL THE -EE- HALT OCCURS. THE DURATION OF TIME SHOULD BE SIX MINUTES.

THE METERS ARE STARTED BY ISSUING A START I/O TO EACH DEVICE WHICH HAS BEEN DEFINED IN THE UDT CASE OF DCP. IF THE I/O DEVICES HAVE NOT BEEN MADE READY PRIOR TO THE LOADING OF THE PROGRAM, THE I/O ATTENTION LIGHT WILL COME ON IMMEDIATELY FOLLOWING THE MESSAGE TO MAKE ALL I/O DEVICES READY. WHEN ALL THE DEVICES HAVE BEEN MADE READY THE PROGRAM WILL ISSUE THE START I/O'S, PRINT THE INSTRUCTIONS, AND PERFORM AN -FO- HALT.

WHEN THE -FO- HALT IS RESET, THE PROGRAM WILL LOOP FOR SIX MINUTES. AT THE END OF THE SIX MINUTES THE PROGRAM WILL PERFORM AN -EE- HALT AND THE METERS SHOULD ALL STOP WITH AN ADDITIONAL SIX MINUTES INDICATED ON EACH ONE.

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5.16 DATA DECK END CARD . . . . .	5



2. INDEX TABLE FOR HALTS

HALT TABLE

HALT NUMBER	CONDITION	ACTION REQUIRED
80	THIS IS THE INITIAL PROGRAM HALT WHICH ALLOWS FOR THE SWITCHES TO BE SET TO SELECT PROGRAM OPTIONS. A SYSTEM RESET, START WILL ALSO RESULT IN THIS HALT.	THE ADDRESS SWITCHES MAY BE SET TO SELECT THE DESIRED PROGRAM OPTIONS. IF NO OPTIONS ARE SELECTED, ONE COPY WILL BE MADE WITH THIS PROGRAM'S SPECIAL PRINTING.
81	THE PRIMARY HOPPER IS NOT READY AT A TIME WHEN THE PROGRAM IS READY TO BEGIN READING DATA CARDS.	CARDS TO BE REPRODUCED MUST BE PUT IN THE PRIMARY IF IT IS DESIRED TO CONTINUE. OPTIONS MAY BE SELECTED OR MODIFIED AT THIS TIME.
82	THE SECONDARY HOPPER IS NOT READY.	THE SECONDARY HOPPER MUST BE MADE READY WITH BLANK CARDS IF THE CARDS WHICH HAVE BEEN READ ARE TO BE PROCESSED TO COMPLETION, AS PER THE OPTIONS SELECTED.
83	A READ CHECK WAS DETECTED WHILE READING THE DATA CARDS FROM THE PRIMARY.	THE CARD IN ERROR MUST BE NPRO'D FROM THE PRIMARY AND RE-READ.
84	A PUNCH CHECK WAS DETECTED IN THE LAST CARD STACKED.	THE LAST CARD PUNCHED MUST BE REMOVED AS THAT CARD WILL BE REPUNCHED AND SELECTED INTO THE SAME STACKER AGAIN.
85	THE ID OR THE LEVEL ON THE TEXT CARD BEING REPRODUCED IS NOT THE SAME AS THE HEADER CARD.	THE CARD IN ERROR MUST BE CORRECTED AND THAT ONE AND ALL CARDS BEYOND IT MUST BE RE-READ.
86	THE ID OR THE LEVEL ON THE END CARD IS NOT THE SAME AS THE HEADER CARD.	THE CARD IN ERROR MUST BE CORRECTED AND THAT ONE AND ALL CARDS BEYOND IT MUST BE RE-READ.
87	THE CARD TO BE PUNCHED IS NOT BLANK. NOTE: NON-BLANK CARDS ARE SELECTED TO STACKER 4 AND THERE IS NO HALT IF LESS THAN 3 COPIES ARE BEING MADE.	NPRO THE CARD FROM THE SECONDARY AND REMOVE IT FROM STACKER 1, OR JUST RESET THE HALT, IN WHICH CASE, THE CARD WITH PUNCHES IN IT WILL BE SELECTED INTO STACKER 1 AND THE PROGRAM WILL CONTINUE.
88	A READ CHECK WAS DETECTED WHILE READING PUNCHED CARDS FROM THE SECONDARY WHEN THE COMPARE OPTION IS BEING USED.	NPRO THE CARD FROM THE SECONDARY WAIT STATION AND RE-READ IT. THE PROGRAM WILL NOT CONTINUE UNTIL A SUCCESSFUL READ IS PERFORMED FROM THE SECONDARY.
89	THE CARD READ FROM THE SECONDARY DID NOT COMPARE WITH THE CARD FROM THE PRIMARY.	THE CARD IN THE PRIMARY SHOULD BE THE MASTER, SO THE SECONDARY SHOULD BE NPRO'D AND THAT CARD CORRECTED OR MARKED OR WHATEVER IS DESIRED. WHEN THIS HALT IS RESET THE NEXT CARD WILL BE READ FROM THE PRIMARY, THEN THE SECONDARY AND COMPARED.
8A	THE ID OR THE LEVEL ON THE COMMENT CARD BEING REPRODUCED IS NOT THE SAME AS THE HEADER CARD.	THE CARD IN ERROR MUST BE CORRECTED AND THAT ONE AND ALL CARDS BEYOND IT MUST BE RE-READ.

3. GENERAL PROGRAM INFORMATION

- 3.1 RESTART CAPABILITY IS PROVIDED WITH A SYSTEM-RESET, START SEQUENCE.
- 3.2 THE PROGRAM READS UP TO 50 CARDS FROM THE PRIMARY HOPPER AND THEN PUNCHES INTO BLANK CARDS FROM THE SECONDARY HOPPER.
- 3.3 CARDS FROM THE SECONDARY TO BE PUNCHED INTO ARE FIRST CHECKED TO BE CERTAIN THAT THEY ARE BLANK.
- 3.4 A FEED CHECK OR A HOPPER CHECK WHILE READING CARDS WILL RESULT IN AN I/O ATTENTION AND THE CARDS IN THE CARD PATH (IF THERE ARE ANY) MUST BE RE-READ.
- 3.5 THE 'M' AND 'ME' TAP CARDS CONTAIN ALL OF THE COMMENT INFORMATION SO THAT THE INSTRUCTIONS CAN BE READ DIRECTLY FROM THE CARD INSTEAD OF FROM THE PRINTER.

4. OPERATING PROCEDURES

- 4.1 D.U.P. IS A STAND-ALONE PROGRAM WHICH DOES NOT RUN UNDER A CONTROL PROGRAM (INCLUDING DCP).
- 4.2 D.U.P. IS IPL'ED FROM THE MFCU PRIMARY - AN '80' HALT INDICATES THE PROGRAM IS LOADED.
- 4.3 SSW'S ARE SET TO 'XX01, XX02, OR XX03' - X MEANING ANYTHING BUT 'F', AND 01 MEANING ONE COPY DESIRED.
- 4.4 ALL DIAGNOSTIC DECKS TO BE DUPED ARE PLACE IN MFCU PRIMARY AND EACH DECK IS SEPARATED BY A BLANK CARD.
- 4.5 PLACE BLANK CARDS IN THE MFCU SECONDARY AND RESET '80' HALT.
- 4.6 IF AN ERROR HALT OCCURS, REFERENCE SECTION 2. AND ATTEMPT TO CORRECT THE ERROR CONDITION.
- 4.7 AN '81' HALT INDICATES THE PROGRAM HAS FINISHED AND ANOTHER OPTION CAN BE PLACED IN THE SSW'S.

5. CARD FORMATS - ONLY THE PRINTED PORTION OF THE CARD (TOP ONE-THIRD) IS REPRESENTED.

NOTE: A STRAIGHT INTERPRET OF THE PUNCHED INFORMATION IS PERFORMED ON ANY CARD THAT DOES NOT FIT ONE OF THESE FORMATS.

5.1 FIRST CARD OF LOADER

```
-----  
PPP LEVEL R      LOADER CARD  
0000000001111111112222222222333  
12345678901234567890123456789012  
----- PROGRAM NAME -----  
333333344444444444555555555566666  
34567890123456789012345678901234  
PN XXXXXXX EC XXXXXXX      0001  
6666677777777778888888889999999  
56789012345678901234567890123456  
  
11111111111111111111111111111111  
99900000000001111111111222222222  
78901234567890123456789012345678
```

5.2 LOADER CARDS AFTER FIRST CARD

```
-----  
PPP LEVEL R      LOADER CARD  
0000000001111111112222222222333  
12345678901234567890123456789012  
----- PROGRAM NAME -----  
333333344444444444555555555566666  
34567890123456789012345678901234  
PN XXXXXXX EC XXXXXXX      000X  
6666677777777778888888889999999  
56789012345678901234567890123456  
  
11111111111111111111111111111111  
99900000000001111111111222222222  
78901234567890123456789012345678
```

5.3 SECTION OR DATA DECK HEADER CARDS

```
-----  
PPP LEVEL R      HEADER CARD  
0000000001111111112222222222333  
12345678901234567890123456789012  
----- PROGRAM NAME -----  
333333344444444444555555555566666  
34567890123456789012345678901234  
PN XXXXXXX EC XXXXXXX      0000  
6666677777777778888888889999999  
56789012345678901234567890123456  
  
11111111111111111111111111111111  
99900000000001111111111222222222  
78901234567890123456789012345678
```

5.4 RELOCATION CARD

```
-----  
PPP LEVEL R      RELOCATION CARD  
0000000001111111112222222222333  
12345678901234567890123456789012  
----- PROGRAM NAME -----  
333333344444444444555555555566666  
34567890123456789012345678901234  
PN XXXXXXX EC XXXXXXX      0001  
6666677777777778888888889999999  
56789012345678901234567890123456  
  
11111111111111111111111111111111  
99900000000001111111111222222222  
78901234567890123456789012345678
```

5.5 TEXT CARD

```
-----  
PPP LEVEL R      TEXT CARD  
0000000001111111112222222222333  
12345678901234567890123456789012  
----- PROGRAM NAME -----  
333333344444444444555555555566666  
34567890123456789012345678901234  
PN XXXXXXX EC XXXXXXX      XXXX  
6666677777777778888888889999999  
56789012345678901234567890123456  
  
11111111111111111111111111111111  
99900000000001111111111222222222  
78901234567890123456789012345678
```

5.6 COMMENT CARD

```
-----  
PPP LEVEL R      COMMENT CARD  
0000000001111111112222222222333  
12345678901234567890123456789012  
----- PROGRAM NAME -----  
333333344444444444555555555566666  
34567890123456789012345678901234  
PN XXXXXXX EC XXXXXXX      XXXX  
6666677777777778888888889999999  
56789012345678901234567890123456  
PRINTED FIRST LINE OF INPUT CARD  
11111111111111111111111111111111  
99900000000001111111111222222222  
78901234567890123456789012345678
```

5.7 REPLACE CARD

```
-----  
PPP LEVEL R      REPLACE CARD  
0000000001111111112222222222333  
12345678901234567890123456789012  
----- PROGRAM NAME -----  
333333344444444444555555555566666  
34567890123456789012345678901234  
PN XXXXXXX EC XXXXXXX      XXXX  
6666677777777778888888889999999  
56789012345678901234567890123456  
PRINTED FIRST LINE OF INPUT CARD  
11111111111111111111111111111111  
99900000000001111111111222222222  
78901234567890123456789012345678
```

5.8 END CARD

```
-----  
PPP LEVEL R      END CARD  
0000000001111111112222222222333  
12345678901234567890123456789012  
----- PROGRAM NAME -----  
333333344444444444555555555566666  
34567890123456789012345678901234  
PN XXXXXXX EC XXXXXXX      XXXX  
6666677777777778888888889999999  
56789012345678901234567890123456  
  
11111111111111111111111111111111  
99900000000001111111111222222222  
78901234567890123456789012345678
```



5.9 STAND-ALONE PROGRAM HEADER CARD

```
-----  
PPP LEVEL R      HEADER CARD  
00000000111111112222222222333  
12345678901234567890123456789012  
----- PROGRAM NAME -----  
3333333444444444555555555566666  
34567890123456789012345678901234  
PN XXXXXX EC XXXXXX      XXXX  
6666677777777788888888889999999  
56789012345678901234567890123456  
REMOVE THIS CARD BEFORE RUNNING  
11111111111111111111111111111111  
9990000000000111111111222222222  
78901234567890123456789012345678
```

5.10 ONE CARD IPL PROGRAM CARD

```
-----  
PPP LEVEL R 1 CARD PROGRAM--IPL  
00000000111111112222222222333  
12345678901234567890123456789012  
----- PROGRAM NAME -----  
3333333444444444555555555566666  
34567890123456789012345678901234  
PN XXXXXX EC XXXXXX      0001  
6666677777777788888888889999999  
56789012345678901234567890123456  
  
11111111111111111111111111111111  
9990000000000111111111222222222  
78901234567890123456789012345678
```

5.11 IPL CARD

```
-----  
PPP LEVEL R      IPL CARD  
00000000111111112222222222333  
12345678901234567890123456789012  
----- PROGRAM NAME -----  
3333333444444444555555555566666  
34567890123456789012345678901234  
PN XXXXXX EC XXXXXX      XXXX  
6666677777777788888888889999999  
56789012345678901234567890123456  
  
11111111111111111111111111111111  
9990000000000111111111222222222  
78901234567890123456789012345678
```

5.12 MO TAP CARD

```
-----  
PPP LEVEL R MO TAP DECK CARD  
00000000111111112222222222333  
12345678901234567890123456789012  
----- PROGRAM NAME -----  
3333333444444444555555555566666  
34567890123456789012345678901234  
PN XXXXXX EC XXXXXX      0000  
6666677777777788888888889999999  
56789012345678901234567890123456  
PRINT IF 65-88 NOT BLANK  
11111111111111111111111111111111  
9990000000000111111111222222222  
78901234567890123456789012345678
```

5.13 M1, M2, M3, M4, M5 TAP CARDS

```
-----  
PPP LEVEL R MX TAP DECK CARD  
00000000111111112222222222333  
12345678901234567890123456789012  
----- PROGRAM NAME -----  
3333333444444444555555555566666  
34567890123456789012345678901234  
PN XXXXXX EC XXXXXX      XXXX  
6666677777777788888888889999999  
56789012345678901234567890123456  
PRINT IF 65-88 NOT BLANK (IN MO)  
11111111111111111111111111111111  
9990000000000111111111222222222  
78901234567890123456789012345678
```

5.14 M & ME TAP CARDS

```
-----  
PPP-R ----- COMMENTS -----  
00000000111111112222222222333  
12345678901234567890123456789012  
----- COMMENTS -----  
3333333444444444555555555566666  
34567890123456789012345678901234  
----- COMMENTS ----- XXXX  
6666677777777788888888889999999  
56789012345678901234567890123456  
PN XXXXXX EC XXXXXX MX CARD  
11111111111111111111111111111111  
9990000000000111111111222222222  
78901234567890123456789012345678
```

5.15 DATA DECK CARD

```
-----  
----- STRAIGHT -----  
00000000111111112222222222333  
12345678901234567890123456789012  
----- INTERPRETED -----  
3333333444444444555555555566666  
34567890123456789012345678901234  
----- DATA ----- PPRXXXX  
6666677777777788888888889999999  
56789012345678901234567890123456  
  
11111111111111111111111111111111  
9990000000000111111111222222222  
78901234567890123456789012345678
```

5.16 DATA DECK END CARD

```
-----  
----- STRAIGHT -----  
00000000111111112222222222333  
12345678901234567890123456789012  
----- INTERPRETED -----  
3333333444444444555555555566666  
34567890123456789012345678901234  
----- DATA ----- PPRXXXX  
6666677777777788888888889999999  
56789012345678901234567890123456  
DATA DECK END CARD  
11111111111111111111111111111111  
9990000000000111111111222222222  
78901234567890123456789012345678
```

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1. DIAGNOSTIC CONTROL PROGRAM - SYSTEM DEFINITION

BEFORE THE DIAGNOSTIC CONTROL PROGRAM (DCP) CAN BE USED, SYSTEM DEFINITION CARDS MUST BE PUNCHED. THESE CARDS DESCRIBE THE PARTICULAR SYSTEM ON WHICH THE DCP IS TO BE USED AND ARE LOCATED IN THE DCP AS SHOWN IN FIGURE 1. SYSTEM DEFINITION CARDS (CPU, UDT AND CHAIN IMAGE) ARE PUNCHED ACCORDING TO THE FOLLOWING INSTRUCTIONS.

NOTE: THE FOLLOWING PROCEDURE MAY BE USED TO PUNCH CARDS ON THE S/3 WITHOUT A KEYBOARD OR DATA RECORDER.

1. FILL CORE WITH HEX '40'
2. DIAL IN THE FOLLOWING HEX DATA BEGINNING AT LOCATION 0000: F3F000 31F6000F 31F4000F F3F600 0100
3. BEGINNING AT '40100', DIAL IN THE DESIRED PUNCH/PRINT DATA. (EG. FOR 'CPU C,2000,0' DIAL 'C3D7E440C36BF2F0F0F06BFO')
4. PERFORM SYSTEM RESET, MAKE MPCU PRIMARY READY WITH BLANK CARDS, AND 'STEP' THROUGH THE 'INSTRUCTIONS.
5. TO PUNCH ANOTHER CARD, REPEAT STEPS 3 AND 4 ABOVE.

NOTE: WHEN PUNCHING ANY OF THE FOLLOWING CARDS FOR AN 80 COLUMN DECK, PUNCH COLUMNS 1-76 IN THE FIRST 80 COLUMN CARD AND COLUMNS 77-96 IN COLUMNS 1-19 OF THE 2ND 80 COLUMN CARD. YOU MUST ALWAYS USE 2 80 COLUMN CARDS FOR 1 96 COLUMN CARD EVEN IF THE SECOND CARD GOES IN THE DECK AS A BLANK.

I FOR CPU, UDT, CHAIN IMAGE, SENSE SWITCH, AND REPLACE CARDS --- USE NUMERIC 0, NOT LETTER O. I

1.1 CPU DEFINITION CARD (CPU M,CORE,F)

COLUMN I	CONTENTS
1-3	'CPU'
4	BLANK
5	SYSTEM MODEL 'C' - MODEL C (CARD SYSTEM) 'D' - MODEL D (DISK SYSTEM)
6	BLANK OR COMMA
7-10	CORE SIZE IN HEX '2000' - 8K '3000' - 12K '4000' - 16K '6000' - 24K '8000' - 32K 'C000' - 48K 'FFFF' - 64K
11	BLANK OR COMMA
12	'0' - NO DUAL PROGRAM FEATURE. '1' - DUAL PROGRAM FEATURE ATTACHED.

SAMPLE CPU CARD

CPU D,3000,1

THIS CARD DEFINES A MODEL D (DISK SYSTEM) CPU WHICH HAS 12 K CORE AND THE DUAL PROGRAM FEATURE.

MORE SAMPLES:

CPU D,8000,0  
CPU C,3000,0

1.2 UNIT DEFINITION CARDS (UDT UU-XYZ,UU,...,UU-WXY)

COLUMN I	CONTENTS
1-3	'UDI'
4	BLANK - UDT TABLE IS CLEARED PRIOR TO PROCESSING THIS CARD. ENTRIES FROM PREVIOUS UDT CARDS ARE WIPED OUT. NON-BLANK - UDT IS NOT CLEARED BEFORE PROCESSING THIS CARD. THIS CARD ACTS AS A CONTINUATION OF PREVIOUSLY LOADED UDT INFORMATION.
5-	'UU-XYZ,UU,...,UU-WXY' (NOTE BLANK POSITION) EACH UNIT IS SEPARATED BY COMMAS. UU - DEVICE IDENTIFICATION CODE. XYZ - OPTIONAL FEATURES IDENTIFICATION NUMBERS. IF THE DEVICE HAS NO FEATURES, ENTER ONLY THE DEVICE CODE. THE FIRST DEVICE DEFINED MUST BE THE LOADING DEVICE. (MPCU - F0 OR DISK - A0). THE SECOND DEVICE MUST BE THE PRINTER (5203 PRINTER - E0). DEVICE CODES AND FEATURES ARE SHOWN IN THE FOLLOWING CHART. NO MORE THAN 16 DIFFERENT DEVICES MAY BE DEFINED. WHEN A DEVICE CODE IS ENTERED MORE THAN ONCE (SAME OR CONTINUATION CARD), THE LAST ENTRY WILL BE USED. NOTE - THE LAST ENTRY ON A UDT CARD MUST ALWAYS BE FOLLOWED BY A BLANK. THE FOLLOWING PAGE CONTAINS A LIST OF EACH DEVICE AND THEIR OPTIONS FEATURES.

SAMPLE UDT CARD

UDT F0-1,E0-14,10,A0

THIS UDT CARD DEFINES A SYSTEM WITH  
A MPCU, SLOW SPEED FEATURE,  
A LINE PRINTER WITH 132 PRINT POSITIONS AND  
200 LPH SPEED,  
A PRINTER KEYBOARD WITH STANDARD FEATURES,  
A DISK DRIVE ON PRIMARY SPINDLE.

THE MPCU IS THE LOAD DEVICE.  
THE 5203 LINE PRINTER IS THE PRINTER.

MORE SAMPLES:

UDT F0,E0-0234  
UDT F0-1,E0,11  
UDT A0,E0-1,F0,10  
UDT F0-1,E0,11-3

NOTE- USE NUMBER 0, NOT LETTER O, IN THESE CARDS

DIAGNOSTIC USER'S GUIDE  
DIAGNOSTIC CONTROL PROGRAM

PREV EC 818390 PRES EC 818395 P/N 2589902

NOTE-THE DEVICE CODE -UU- IS IN HEX (THE NUMBER ZERO IS USED, NOT THE LETTER 'O').

DEVICE	CODE -UU-	STANDARD FEATURES	OPTIONAL FEATURES -XYZ...
5871 PRINTER KEYBOARD	10		
5875 KEYBOARD	11	DOMESTIC, UNITED KINGDOM, OR ITALY	0 - RESERVED 1 - NORWAY 2 - FINLAND-SWEDEN 3 - GERMANY 4 - DENMARK 5 - PORTUGAL 6 - FRANCE OR BELGIUM 7 - SPAIN
MLTA	20		0 - SEC. TERMINAL CONTROL TYPE (WORLD TRADE) 2 - AUTO POLL 3 - UNDER-THE-COVER LINE ADAPTER 8 - BMT CARD 2 PRESENT FOR CONTROL STORAGE 9 - BMT CARD 3 PRESENT FOR CONTROL STORAGE A - BMT CARD 4 PRESENT FOR CONTROL STORAGE
SIOC	30		
2501 (RPQ)	31		0 - 1000 CPM 1 - 600 CPM 2 - OPTICAL MARK READ 3 - 51/80 COLUMN CARDS
1017 (RPQ)	32		
1018 (RPQ)	33		0 - ERROR DETECTION 1 - ADVANCED FEED HOLE OR JAPANESE PUNCH
1231 (RPQ)	34		0 - MASTER MARK FEATURE
TRIN 1255	35	STACKERS 0, 2, 4, 6, 8	0 - RESERVED 1 - RESERVED 2 - ALTERNATE SORT FEAT. STACKERS 0, 1, 2, 3, 4 3 - DASH SYMBOL TRANS 4 - 12 STACKERS 5 - CMC7 MODELS 21, 22, 23
1270 (RPQ)	36		0 - 12 POCKET MODEL 1 - ALTERNATE SORT FEAT.
1419 (RPQ)	37		2 - BATCH NUMBER 3 - DASH TRANSMITTER 5 - CMC7 6 - PPL GROUP 2 7 - PPL GROUP 1
1017 N/1442 COMPAT- IBILITY (RPQ)	39		0 - ADVANCED FEED HOLE
1442 RPQ	50		0 - MODEL 7
1442 FEAT.	51	MODEL 6 300 CPM	0 - MODEL 7 400 CPM
PLOTTER (RPQ)	55		0 - 40 PPM CHDS/SEC 1 - 200 CARR/DRUM CHDS/SEC 2 - 450 " " " " " " 3 - 600 " " " " " " 4 - 900 " " " " " " NOTE - 1, 2, 3 & 4 MUTUALLY EXCLUSIVE.

DEVICE	CODE -UU-	STANDARD FEATURES	OPTIONAL FEATURES -XYZ...
2790 (RPQ)	58		
3411/3410 TAPR	70		
BSCA-1	80	ERCDCIC CODE AUTO ANSWER ITB (INTER- MEDIATE BLOCK CHECKING)	0 - MULTIPPOINT-TRIBUTARY 1 - INTERNAL CLOCK OR LOCAL MODELESS 2 - HIGH SPEED 3 - AUTO CALL 4 - TRANSPARENCY 5 - MULTIPPOINT - CONTROL STATION 6 - USASCII 7 - SWITCHED NETWORK
2972/2980	82		NOTE - ANY OPTIONS ARE SPECIFIED IN DATA CARDS
3735	83		
3270	87		0 - PRINTER 1 - USASCII 2 - 1920 CHAR BUFF 3 - RESERVED 4 -
BSCA-2	88	ERCDCIC CODE AUTO ANSWER ITB (INTER- MEDIATE BLOCK CHECKING)	0 - MULTIPPOINT-TRIBUTARY 1 - INTERNAL CLOCK OR LOCAL MODELESS 2 - HIGH SPEED 3 - AUTO CALL 4 - TRANSPARENCY 5 - MULTIPPOINT - CONTROL STATION 6 - USASCII 7 - SWITCHED NETWORK
5444 PRI SPIN DISK	80		0 - NOT USED 1 - 100 CYLINDER DISK 2 - HIGH SPEED ACTVATOR
5444 SEC SPIN DISK	80		0 - REMOVABLE DISK ONLY 2 - HIGH SPEED ACTVATOR
5445 DRIVE 1	C0		
5445 DRIVE 2	C8		
5445 DRIVE 3 (RPQ)	D0		
5445 DRIVE 4 (RPQ)	D8		
5203 PRINTER	E0	100 LPM 96 PRINT POSITIONS	0 - DUAL FEED CARRIAGE 1 - 132 PRINT POSITIONS 2 - 120 PRINT POSITIONS 3 - UNIVERSAL CHAR. SET 4 - 200 LINES PER MINUTE 5 - 300 LINES PER MINUTE
1403 PRINTER	E1	600 LPM	0 - 1100 LPM 1 - NOT USED 2 - NOT USED 3 - UCS
5424 HPCU	F0	500/120/120 CPM	0 - KATAKANA READ & PUNCH 1 - 250/60/60 CPM 2 - KATAKANA PRINT
AFLD MOD 10	F1		

1.3 CHAIN IMAGE CONTROL AND DATA CARDS

WHENEVER A LINE PRINTER IS ATTACHED TO THE SYSTEM, THE CE MUST DESCRIBE THE CHAIN. THIS IS DONE THROUGH THE USE OF CHAIN IMAGE CONTROL AND DATA CARDS IDENTICAL TO THOSE SUPPLIED TO THE COLD START PROGRAM BY THE CUSTOMER. IF NO CHAIN IMAGE CARDS ARE SUPPLIED, THE DEFAULT OPTION WILL BE TO A 48 CHARACTER SET.

1.3.1 CHAIN IMAGE CONTROL CARD (// CHAIN XXX)

```
*****
* COLUMN I CONTENTS
*-----*
* 1-8 I '// CHAIN'
*-----*
* 9 I BLANK
*-----*
* 10-12 I NUMBER OF PRINT CHARACTERS ON THE CHAIN.
* I '048' OR '120'
*****
```

1.3.2 CHAIN IMAGE DATA CARDS (MUST FOLLOW IMMEDIATELY AFTER CHAIN IMAGE CONTROL CARD)

```
*****
* COLUMN I CONTENTS
*-----*
* 1-48 I HEXADecimal CODES FOR THE CHARACTERS ON THE
* I PRINT CHAIN. TWO CHAIN IMAGE DATA CARD
* I CHARACTERS REPRESENT ONE PRINT CHARACTER.
* I EACH CHAIN IMAGE CARD DEFINES 24 PRINT CHAIN
* I CHARACTERS. IF A 48 CHARACTER PRINT CHAIN
* I IS BEING USED, TWO CHAIN IMAGE DATA CARDS ARE
* I REQUIRED. FOR A 120 CHARACTER CHAIN (UCS),
* I FIVE DATA CARDS ARE REQUIRED. THE CARDS MUST
* I BE IN THE CORRECT ORDER.
*****
```

1.3.3 80 COLUMN CHAIN IMAGE CARDS

THESE ARE NEEDED ONLY IF THE DIAGNOSTICS ARE ON DISK. THEY ARE NEEDED FOR THE DISK EDITOR THAT HAS A 1442 AS THE ONLY INPUT DEVICE. (SEE BLOCK 20) THE CUSTOMER MAY ALSO NEED THESE CARDS FOR THE 5422 FEATURE.

IF A TN TYPE CHAIN/TRAIN IS TO BE USED, AND THE 80 COLUMN CHAIN IMAGE CARDS FOR IT ARE AVAILABLE, CHECK THE FOLLOWING (3) CHARACTERS TO BE CORRECT FOR SYSTEM 3 OPERATION.

GRAPHIC CHARACTER	SYS/360/370 HEX CODE	SYSTEM/3 HEX CODE
LEFT BRACE	8B	C0
RIGHT BRACE	9B	D0
DEGREES SYMBOL	A1	CA

1.4 PUNCHING 80 COLUMN OBJECT (TEXT) CARDS ON THE 029 KEY PUNCH.

IF IT BECOMES NECESSARY TO PUNCH AN 80 COLUMN OBJECT (TEXT) CARD FROM THE CARD IMAGE AT THE END OF THE PROGRAM LISTING, YOU MAY DO SO BY USING THE SAME GRAPHIC SYMBOLS FOUND ON THE 129 KEY PUNCH. THERE ARE THREE SPECIAL CHARACTERS USED ON THE SYSTEM/3 PROGRAM LISTING, THE UPPER CASE 'D', UPPER CASE 'E', AND THE UPPER CASE 'H'.

THESE SPECIAL CHARACTERS MAY BE PUNCHED ON THE 129 AS FOLLOWS:  
UPPER CASE 'D', USE THE 'MULTIPUNCH' FEATURE AND PUNCH AN '11' PUNCH AND A '0' PUNCH IN THE SAME COLUMN.  
UPPER CASE 'E', USE THE KEY THAT IS THE 'EXPLANATION POINT', WHICH SHOULD PUNCH AN '11', '2', AND '8' PUNCH.  
UPPER CASE 'H', USE THE KEY THAT IS THE 'CENTS SIGN', WHICH SHOULD PUNCH AN '12', '2', AND '8' PUNCH.

CARD LAYOUT, CARD 1 COLUMNS 01-76 TEXT DATA.  
COLUMNS 77 CONTINUATION PUNCH 'X'  
COLUMNS 78-80 SEQUENCE NUMBERS

CARD LAYOUT, CARD 2 COLUMNS 01-12 TEXT DATA.  
COLUMNS 13-16 PROGRAM ID AND LEVEL  
COLUMNS 17-20 SEQUENCE NUMBER  
COLUMNS 21-77 BLANK  
COLUMNS 78-80 SEQUENCE NUMBER

2. OTHER CARD FORMATS

IPL-FORMAT LOADER, TEXT AND END CARDS ARE STANDARD OBJECT CARDS WHICH WILL NOT BE ALTERED OR PROVIDED BY THE CE. THERE ARE OTHER CARDS AVAILABLE TO THE CE TO PROVIDE FLEXIBILITY OF OPERATION. FIGURE 1 SHOWS RECOMMENDED PLACEMENT OF THESE CARDS.

2.1 SENSE SWITCH CARDS ('SSW XX,XX,...,XX')

SENSE SWITCH CARDS PROVIDE A MEANS OF SETTING SENSE SWITCHES AT LOAD TIME. (SENSE SWITCHES ARE DISCUSSED IN SECTION 6.) SENSE SWITCH CARDS IN DCP SHOULD SET ONLY COMMON SENSE SWITCHES 00-07, AND SSW CARDS IN TEST SECTIONS SHOULD SET ONLY SECTION SENSE SWITCHES 10-27. IF MORE THAN ONE SENSE SWITCH CARD IS PLACED IN A DECK, ONLY THOSE SENSE SWITCHES LISTED IN THE LAST CARD WILL BE ON. (DCP CLEARS ALL SECTION SENSE SWITCHES BEFORE LOADING EACH SECTION, UNLESS SSW09 IS ON)

```
*****
* COLUMN I CONTENTS
*-----*
* 1-3 I 'SSW'
*-----*
* 4 I BLANK
*-----*
* 5- I 'XX,...,XX'
*-----*
* I LIST OF SENSE SWITCHES TO BE TURNED ON
* I FOLLOWED BY AT LEAST ONE BLANK.
*****
```

EXAMPLE:

```
-----
/ SSW 05,07
I
```

THIS WILL TURN ON SENSE SWITCHES 5 & 7.

2.2 COMMENT CARDS ('\*...')

THESE CARDS PROVIDE FOR THE ABILITY TO PRINT OUT ANY COMMENT PERTAINING TO THE TEST. THE CE MAY WISH TO ADD TO THE COMMENT CARDS RELEASED. HE MAY ALSO DELETE THEM FOR FASTER OPERATION.

```
*****
* COLUMN I CONTENTS
*-----*
* 1 I '*'
*-----*
* 2-88 I COMMENT. THE CONTENTS OF THE CARD IS PRINTED.
*-----*
* 89-91 I ID AS IT APPEARS ON HEADER CARD.
*-----*
* 92 I LEVEL AS ON HEADER CARD.
*-----*
* 93-96 I PROPER SEQUENCE NUMBER OR, FOR ADDED COMMENT
* I CARDS, LEAVE BLANK.
*****
```

NOTE - WHEN ADDING COMMENT CARDS, FILL IN COLUMNS 89-92 AS SHOWN ABOVE AND LEAVE COLUMNS 93-96 BLANK.

2.3 REPLACE (PATCH) CARDS ('R XX...')

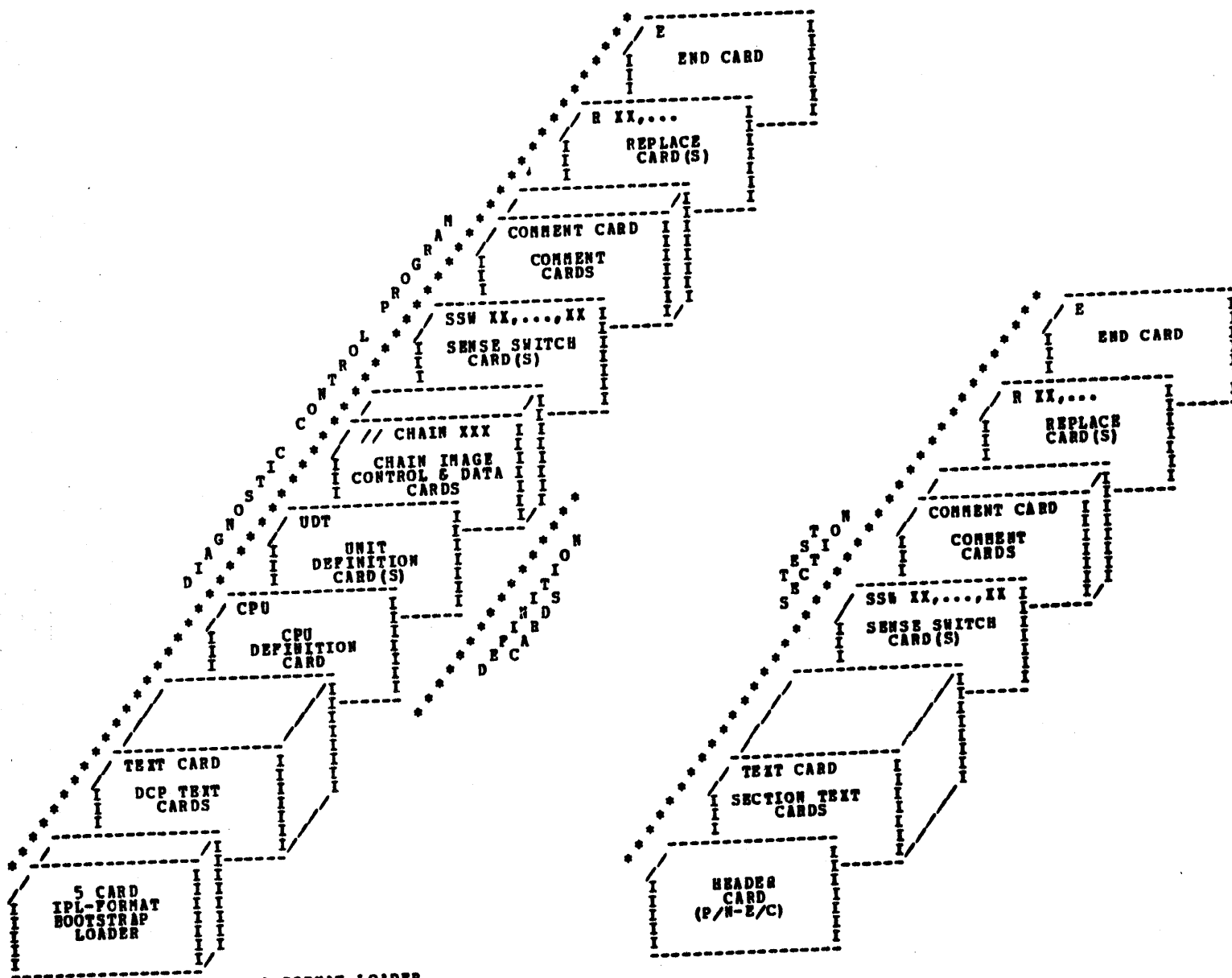
THESE HEXADECIMAL CARDS ARE USED TO ALTER CORE STORAGE FOR THE PURPOSE OF ELIMINATING BUGS OR MODIFYING PROGRAM FLOW. THE CE MAY USE THIS OPTION TO LOAD A HAND-PUNCHED PROGRAM BEGINNING AT X'400' OR ABOVE. THE DECK TO BE LOADED MAY BE HANDLED LIKE A TEST SECTION.

COLUMN	CONTENTS
1	'R'
2	BLANK - NORMAL PATCH. - LOADER WILL BRANCH TO HEX ADDRESS SPECIFIED IN COLUMNS 3-6.
3-6	4 HEX CHARACTERS SPECIFYING THE ADDRESS OF THE FIRST BYTE TO BE REPLACED OR EXECUTION ENTRY.
7	BLANK
8-	'XX, XXXX, XX, XXXXXXXX, ..., XXXX'

FREE FORM HEX DATA. TWO CHARACTERS FOR EACH BYTE TO BE PATCHED. COMMAS MAY BE USED BETWEEN ANY PAIR OF HEX DATA. A BLANK MUST FOLLOW THE LAST PAIR OF HEX DIGITS.

FIGURE 1.

DIAGNOSTICS CARD SYSTEM



NOTE: THIS 5 CARD IPL-FORMAT LOADER ONLY EXISTS IN THE 96 COLUMN CARD DECK. WHEN USING DCP IN 80 COLUMN CARDS, THE FUNCTIONS OF THIS LOADER ARE PERFORMED BY A 6 CARD LOADER CALLED FPR.

3. PROGRAM LOADING

3.1 PROGRAM LOADING FROM CARDS

3.1.1 LOADING FROM THE MFCU

- A. PLACE DCP FOLLOWED BY SECTION(S) INTO MFCU PRIMARY HOPPER.
- B. MAKE MFCU READY.
- C. DEPRESS PROGRAM LOAD KEY. (SEE NOTE 1 BELOW)
- D. DCP WILL LOAD AND PERFORM HALT 'HA' TO ALLOW INPUT OF SENSE SWITCHES. ENTER OPTIONS AND/OR RESET THE HALT.
- E. SECTION FOLLOWING DCP WILL BE LOADED. DCP WILL HALT, DISPLAYING 'HA'. ENTER OPTIONS AND/OR RESET HALT.

WHEN A SECTION COMPLETES EXECUTION, DCP PRINTS A MESSAGE AND PERFORMS HALT 'HE'. WHEN THE HALT IS RESET, DCP LOADS THE NEXT SECTION. A SECTION CAN BE TERMINATED PREMATURELY BY IPL'ING A NEW SECTION (HEADER CARD PROVIDES BOOTSTRAP) OR BY UTILIZING DATA SWITCH ENTRY 'EEXX'.

NOTE 1: DCP SWITCHES MAY BE SET AT LOAD TIME BY SETTING A VALID ENTRY ON THE ADDRESS SWITCHES JUST BEFORE DEPRESSING THE CPU LOAD KEY. THUS WHEN A SUFFICIENT AMOUNT OF DCP IS LOADED, IT WILL HALT 'HF' SIGNALING DCP'S READINESS TO ACCEPT ENTRIES AS USUAL. A SENSE SWITCH CARD (SECT. 2.2.1) WILL ALSO FORCE SENSE SWITCHES TO BE SET AT LOAD TIME.

NOTE 2: DCP LOADING DESTROY'S EXISTING DATA IN ALL OF CORE AS DEFINED IN THE CPU CARD.

3.1.2 LOADING FROM THE 1402

SEE BLOCK 7 OF THE USER'S GUIDE, (LOADING FROM THE APL DEVICE).

3.2 PROGRAM LOADING FROM DISK

THE CPU AND MEMORY TESTS ARE RUN BEFORE DCP IS LOADED ON A NO-MFCU SYSTEM. FOR A DETAIL DESCRIPTION OF THE CPU AND MEMORY TESTS REFER TO BLOCK 5 OF THE USER GUIDE.

TO CONFIGURE YOUR DIAGNOSTIC PACK USE PROGRAM PF6 ON THE DISK AND REFER BLOCK 20 OF THE USER GUIDE FOR THE DESCRIPTION OF PROGRAM PF6.

PLACE YOUR DIAGNOSTIC DISK PACK ON DRIVE 1 (SPINDLE A) AND REFER TO PARAGRAPH 3.2.1 OR 3.2.2 FOR DIRECTIONS ON LOADING.

-NOTE- THE SECOND UDT ENTRY MAY BE CHANGED IF THE DATA SWITCHES ARE SET TO 'E0' OR 'E1' AT IPL TIME.

3.2.1 LOADING ON A SYSTEM WITH A MFCU.

- A. TO LOAD FROM A DISK PACK CONFIGURED FOR A DIFFERENT PRINTER, PLACE THE PRINTER UDT ENTRY IN THE TWO RIGHT DATA SWITCHES.
  - B. SET PROGRAM LOAD SELECTOR TO REMOVABLE DISK.
  - C. PRESS IPL KEY. (IF A 'D1' HALT OCCURS, PFA HAS ENCOUNTERED A DISK ERROR WHILE LOADING PFB. RESET HALT TO RETRY. IF ERROR PERSISTS RUN DISK DIAGNOSTICS.)
  - D. DCP WILL LOAD AND PERFORM HALT 'HA' TO ALLOW INPUT OF OPTIONS. ENTER SENSE SWITCHES AND SECTIONS TO BE RUN (SEE 'DATA SWITCH ENTRY' BELOW).
  - E. WHEN LEFTMOST SWITCH IS SET TO '0' AND HALT IS RESET, SECTIONS WILL BE RUN IN THE ORDER THEY WERE ENTERED.
- SEE ALSO NOTES 1 AND 2 OF SECTION 3.1 ABOVE.

3.2.2 LOADING ON A SYSTEM WITH 5422 ATTACHMENT

3.2.2.1 LOADING FROM DISK

- A. SET PROGRAM LOAD SELECTOR TO REMOVABLE DISK.
  - B. PRESS IPL KEY. A SMALL -CC- HALT SHOULD OCCUR. IF NOT REFER TO BLOCK 5 OF THE USER'S GUIDE.
  - C. SET THE DATA SWITCHES TO 'X00PE' AND RESET THE SMALL -CC- HALT. A -LL- HALT SHOULD OCCUR. IF NOT REFER TO BLOCK 5 OF THE USER'S GUIDE.
  - D. RESET THE -LL- HALT. A -8P- SHOULD OCCUR. IF NOT REFER TO BLOCK 5 OF THE USER'S GUIDE.
  - E. RESET THE -8P- HALT. DCP WILL NOW BE LOADED, FOLLOWED BY THE RUNNING OF SECTION PFB (LSR CHECKOUT, THE DESCRIPTION IS IN BLOCK 5.) IF DCP IS LOADED SUCCESSFULLY AND THE RUNNING OF SECTION PFB IS SUCCESSFUL, THE NEXT HALT WILL BE A -HE-. IF A -D1- OCCURS, IT INDICATES THAT THE DISK LOADER CAN'T LOAD DCP. RESET THE -D1- TO RETRY THE LOAD. IF THE -D1- HALT RE-OCCURS REFER TO BLOCK 7.
  - F. IF ANY HALTS OCCUR OTHER THAN -HX- (DCP HALTS), REFER TO BLOCK 5.
  - G. AT THE -HE- HALT YOU MAY ENTER SENSE SWITCHES AND SECTIONS TO BE RUN. (SEE PARAGRAPH 5 'DATA SWITCH ENTRY' )
  - H. WHEN LEFTMOST SWITCH IS SET TO '0' AND HALT IS RESET, SECTIONS WILL BE RUN IN THE ORDER THEY WERE ENTERED.
- SEE ALSO NOTES 1 AND 2 OF SECTION 3.1 ABOVE.

3.2.2.2 LOADING FROM THE 1402

SEE BLOCK 7 OF THE USER'S GUIDE, (LOADING FROM THE APL DEVICE).

4. PROGRAM RESTART

AFTER SUCCESSFUL LOADING OF EACH SECTION, DCP STORES A PROGRAM RESTART ROUTINE STARTING AT LOCATION X'0000'. THIS ROUTINE CHECKS THE DATA SWITCHES AND BRANCHES TO THE FIRST ROUTINE OF THE SECTION. PROGRAM RESTART IS ACCOMPLISHED BY PUSHING SYSTEM RESET FOLLOWED BY START.

5. DATA SWITCH ENTRY

THE ROTARY ADDRESS SWITCHES ARE THE PRIMARY COMMUNICATIONS MEDIA BETWEEN THE DIAGNOSTICS AND THE CE. METHOD OF ENTRY--

A. STOP CPU.

B. SET UP ROTARY SWITCHES FOR ONE OF THE FOLLOWING OPTIONS.

		SWITCHES				
		1	2	3	4	
P	0	X	X			- TURN OFF SENSE SWITCH XX.
P	1	X	X			- TURN ON SENSE SWITCH XX.
P	2	X	X			- GO TO ROUTINE XX AFTER ENTRY PHASE COMPLETE.
E	E	X	X			- TERMINATE CURRENT SECTION.
D	X	X	0			- DISK--EXECUTE SECTIONS FOR DEVICE WITH UNIT CODE XX.
D	X	X	X			- DISK--EXECUTE SECTION XIX.

\*COMMON SENSE SWITCHES\*

- 00 - LOOP ON SECTION.
  - 01 - LOOP ON ROUTINE.
  - 02 - BYPASS MANUAL INTERVENTION ROUTINES.
  - 03 - BYPASS ERROR PRINTING.
  - 04 - BYPASS NON-ERROR PRINTING.
  - 05 - PRINT ON ALTERNATE PRINTER.
  - 06 - BYPASS ERROR PRINT.
  - 07 - LOAD AND GO.
  - 08 - USE 5203 RIGHT CARRIAGE.
  - 09 - LEAVE SECTION SWITCHES ON.
- \* UP TO FOUR DISK LOAD INSTRUCTIONS  
 \* MAY BE ENTERED DURING ONE ENTRY PHASE.

C. DEPRESS CPU START. (SYSTEM RESET FOLLOWED BY START WILL CALL IMMEDIATE ATTENTION TO THE SWITCHES--SEE NOTE BELOW.)

D. WHEN DCP RECEIVES CONTROL, IT HALTS WITH 'HF' DISPLAYED. RESET THE HALT TO ENTER THE FIRST OPTION.

E. DCP WILL PERFORM HALT 'HU' OR 'HP'. LOAD THE NEXT OPTION AND RESET THE HALT.

F. REPEAT STEP E FOR AS MANY OPTIONS AS DESIRED. ALTERNATING CODES 'HU' AND 'HP' WILL SIGNAL DCP ACCEPTANCE.

G. WHEN DONE, SET SWITCH 1 TO ZERO AND RESET HALT.

NOTE - WHEN USING P2XX IN THE SWITCHES TO GO TO A ROUTINE AFTER A SECTION HAS BEGUN, SYSTEM RESET/START SHOULD BE PERFORMED BEFORE MAKING THE ENTRY. (THIS PREVENTS ERRORS FOUND IN ONE ROUTINE FROM BEING DETECTED IN SOME OTHER ROUTINE. IT SHOULD NOT BE PERFORMED IF OTHERWISE SPECIFIED IN THE MAPS.)

**6. SENSE SWITCHES**

SENSE SWITCHES ARE EQUIVALENT TO 48 TOGGLE SWITCHES NUMBERED HEXADEcimALLY 00-2F. SENSE SWITCHES 00-0F ARE RESERVED FOR STANDARD OPTIONS PROVIDED BY DCP (LISTED BELOW). SENSE SWITCHES 10-2F ARE SIGNIFICANT TO THE PARTICULAR SECTION BEING RUN.

COMMON SENSE SWITCHES		
SSW NUMBER	ON	OFF (NORMAL)
00	LOOP ON SECTION.	GO TO NEXT SECTION.
01	LOOP ON ROUTINE.	GO TO NEXT ROUTINE.
02	BYPASS MANUAL INTERVENTION ROUTINES.	EXECUTE ALL ROUTINES.
03	BYPASS ERROR PRINTING.	PRINT ERROR MESSAGES.
04	BYPASS NON-ERROR PRINTING.	PRINT NON-ERROR MESSAGES.
05	USE ALTERNATE PRINTER. SEE NOTE.	NORMAL PRINTER.
06	BYPASS ERROR HALT.	HALT AFTER ERROR.
07	LOAD AND GO. BYPASS COMMENTS AND PROMPTING HALTS.	PROMPTING MODE.
08	USE 5203 RIGHT CARRIAGE.	USE LEFT CARRIAGE.
09	DON'T CLEAR SECTION SENSE SWITCHES AFTER LOADING.	CLEAR SECTION SENSE SWITCHES AFTER LOADING.
0A-0F	RESERVED	

WHEN A PRINTER KEYBOARD IS DEFINED IN THE UDT, IT WILL BE THE ALTERNATE PRINTER. OTHERWISE, THE NFCU WILL BE USED.

**7. CONTROL PROGRAM HALTS**

ALL CONTROL PROGRAM HALTS USE THE CHARACTER 'H' AS THE FIRST DIGIT OF THE HALT CODE. THE SECOND DIGIT IDENTIFIES THE CONDITION ACCORDING TO THE FOLLOWING TABLE.

HALT CODE	CONDITION	ACTION REQUIRED
H0	INVALID RECORD FOUND WHILE LOADING.	CORRECT INVALID RECORD AND RELOAD.
H1	A DEVICE CALLED FOR BY THE TEST SECTION WAS NOT DEFINED IN THE UDT CARDS.	CHECK UDT CARDS AND RELOAD OR RESET HALT TO BYPASS THE ERROR (ERRORS COULD RESULT).
H2	DATA SWITCH ENTRY ERROR.	CORRECT DATA SWITCHES AND RESET HALT. IF RUNNING FROM DISK, ONLY UP TO FOUR DISK-EXECUTE ENTRIES MAY BE ENTERED.
H3	INVALID ROUTINE PREFIX FOUND DURING CHAINING FROM ONE ROUTINE TO NEXT.	ENTER ROUTINE SELECT OPTION 'P2IX' IN DATA SWITCHES AND RESET HALT. IF THIS DOES NOT WORK, RELOAD SECTION.
H4	SEE USERS GUIDE BLOCK 07 (LOADING FROM APL DEVICE)	
H5	NFCU NOT READY OR ERROR. ERROR INDICATION SHOULD BE DISPLAYED IN THE NFCU LIGHTS.	DO A NON-PROCESS RUN-OUT, RELOAD DECK STARTING WITH RUNOUT CARD/S AND RESET THE HALT.
H6	PRINTER NOT READY OR ERROR.	CLEAR CONDITION AND RESET THE HALT. IF FAILURE PERSISTS, RUN PRINTER FUNCTION TEST. SENSE SWITCHES 03 AND 04 MAY BE USED TO BYPASS PRINTING. SET SENSE SWITCH 05 TO USE ALTERNATE PRINTER.
H7	DISK ERROR.	RESET HALT TO RETRY. IF ERROR PERSISTS, RELOAD.
HA	CONTROL PROGRAM IS PREPARED TO RECEIVE DATA SWITCH ENTRY. OCCURS AFTER DCP AND SECTION LOADING.	RESET THE HALT IF NO ENTRY DESIRED. TO LOAD OPTIONS, SET UP DATA SWITCHES AND RESET THE HALT. SSW 07 MAY BE USED TO BYPASS THIS HALT.
HC	DISK LOADER REQUIRES SPECIFICATION OF SECTIONS TO BE LOADED FROM DISK OR PROGRAM SELECTED NOT FOUND ON DISK.	IF NO ENTRY HAS BEEN MADE PREVIOUSLY, LOAD PROGRAM SELECTION ENTRY 'DIXX' AND RESET THE HALT. UP TO FOUR ENTRIES MAY BE MADE. IF ENTRIES HAVE EVER BEEN MADE, THE PROGRAMS MAY BE REPEATED BY RESETTING THE HALT.
HD	SECTION JUST TERMINATED HAS SPECIFIED NEXT SECTION TO BE RUN. ARR CONTAINS -DIXX- WHERE -XXX- IS THE PROGRAM IDENTIFICATION.	DISK SYSTEM - DIXX IS NOT ON DISK PACK, RESET THE HALT AND THE NEXT PROGRAM IN THE LOAD TABLE WILL BE LOADED. CARD SYSTEM - PLACE DIXX IN THE NFCU AND RESET THE HALT.
HE	CURRENT SECTION TERMINATED.	RESET HALT TO LOAD NEXT SECTION. SECTION MAY BE RESTARTED BY SYSTEM RESET/START.
HF	DCP HALTS WITH 'HP' DISPLAYED WHENEVER A VALID DATA SWITCH ENTRY IS RECOGNIZED. AS DCP ACCEPTS ENTRIES, ALTERNATING HALTS 'HU' AND 'HP' OCCUR.	LOAD A VALID DATA SWITCH ENTRY AND RESET THE HALT. REPEAT FOR ALTERNATING HALTS 'HU' AND 'HP'. TO TERMINATE ENTRY PROCEDURE, ROTATE LEFT-MOST SWITCH TO ZERO AND RESET HALT.

NOTE--THE 'HD' HALT WILL BE DISPLAYED AS A CAPITAL 'H' AND A LOWER CASE 'D'.



8. PRINTOUT HEADINGS

'\*ID UOXX. PROG PPRR-NN. SSWS YY,YY,....,YY'

THE ABOVE LINE IS PRINTED AS A HEADING FOR ALL MESSAGES. THE FIRST POSITION CONTAINS AN ASTERISK ONLY FOR ERROR MESSAGES. VARIABLE DATA PRINTED INCLUDES--

UOXX - DEVICE IDENTIFICATION (UU) AND INDEX NUMBER (XX). THE INDEX NUMBER POINTS TO THE CORRESPONDING DEVICE INDEX TABLE (SEE DEVICE MAP CHARTS) WHICH EXPLAINS THE CONDITION CAUSING THE PRINTOUT AND POSSIBLE SUBSEQUENT HALT. WITH THE FOLLOWING EXCEPTIONS, THE DEVICE CODE IS IDENTICAL TO THAT PUNCHED IN UDT CARDS (SEE SECTION 1.2).

PF - SYSTEM TEST LOADER AND SUPERVISOR.  
PE - CPU MODULE OF SYSTEM TEST.  
PF - DCP.

NOTE - 'XX' CODE '00' IS USED FOR PRINTOUTS WHICH HAVE NO SUBSEQUENT HALT. THE PRINTOUT IS USUALLY SELF-EXPLANATORY.

PPRR - TEST SECTION IDENTIFICATION (PPP) PLUS THE REVISION LEVEL (R). THIS INFORMATION IS ALSO PUNCHED IN COLUMNS 89-92 OF THE OBJECT DECK.

NN - ROUTINE CURRENTLY BEING EXECUTED.

YY,YY,....,YY - LISTING OF SENSE SWITCHES WHICH ARE CURRENTLY ON. IF NONE ARE ON, THIS AREA IS BLANK.

9. HALT CONVENTION

THE HALT SCHEME IS COMPATIBLE WITH PRINTOUTS AS INDICATED IN THE PREVIOUS SECTION. FOR ALL UNIT TESTS, HALTS WITH CODE 'XX' OCCUR TO INDICATE AN ERROR OR INTERVENTION REQUIRED CONDITION. THIS CODE REFERS TO THE SAME INDEX TABLE REFERENCED IN PRINTOUT HEADINGS. NOTE THAT SINCE ONLY ONE DEVICE IS BEING TESTED, THE UNIT CODE IS NOT PRESENTED. UNLIKE UNIT TESTS, THE SYSTEM TEST MUST PROVIDE THE UNIT CODE TO IDENTIFY THE FAILING DEVICE. THIS IS DONE BY PROVIDING TWO HALTS FOR EVERY ERROR OR INTERVENTION REQUIRED CONDITION. HALT 'UU' DEFINES THE DEVICE AND IS FOLLOWED BY HALT 'XX'. THE FOLLOWING CONVENTION IS USED IN ASSIGNING 'XX' CODES - 01-9F ERROR IDENTIFIERS, AO-PF OPERATOR INSTRUCTIONS.

\*\*\*\*\* END \*\*\*\*\*

DIAGNOSTIC USER'S GUIDE  
SYSTEM TEST

PREV EC 818390

PRES EC 818392

P/N 2589903

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SYSTEM TEST  
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1. PROGRAM OPERATION

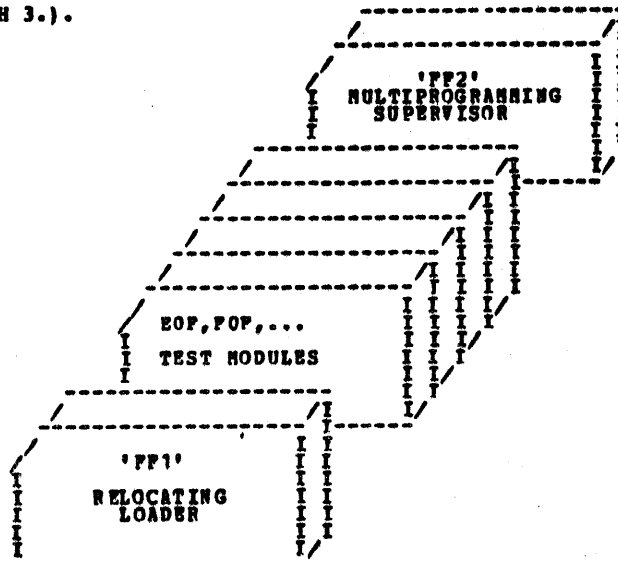
1.1 PREPARATION--

DCP MUST BE CONFIGURED PROPERLY BEFORE RUNNING THIS TEST. CHECK THE 'MODULE CONFIGURATION LIMITATION TABLE' (PARAGRAPH 3.1), AND ALSO THE 'CPU' AND 'UDT' CARDS IN THE 'DCP' DECK.

1.2 PROGRAM LOADING--

1.2.1 PROGRAM LOADING FROM CARDS

- A. IF DCP NOT ALREADY LOADED, PLACE DCP IN MPCU PRIMARY HOPPER.
- B. PLACE SYSTEM TEST OBJECT DECK (SHOWN AT RIGHT) IN MPCU PRIMARY HOPPER, MAKE MPCU READY.
- C. PREPARE DEVICES AS EXPLAINED IN 'TABLE OF SYSTEM TEST MODULES' (PARAGRAPH 3.).
- D. DEPRESS CPU LOAD. IF LOADING SECTION ONLY, 'HE' HALT WILL OCCUR. RESET.
- E. UNLESS SSW 07 IS ON, 'HA' HALTS WILL OCCUR AFTER LOADING OF:
  - 1) DCP.
  - 2) PF1 - RELOCATING LOADER.
 USE THESE PAUSES TO SET DESIRED OPTIONS.



F. RESET LAST HALT TO START SYSTEM TEST.

SENSE SWITCH OPTION--RELOCATING LOADER, SECTION PF1.

SENSE SWITCH 18 - HALT BEFORE LOADING EACH MODULE. LAST MODULE LISTED MAY BE DELETED BY SETTING TWO LEFTMOST DATA SWITCH TO 'A' BEFORE RESETTING HALT.

1.2.2 PROGRAM LOADING FROM DISK

- A. JPL DCP FROM DISK (LOADING OF DCP FROM DISK: SEE SECTION 2.1 PAGE 3)
- B. UPON LOADING, DCP WILL HALT WITH A 'HA' DISPLAYED TO ALLOW INPUT OF OPTIONS. ENTER COMMON SENSE SWITCHES AND SECTIONS TO BE RUN (SEE SECTION 2.4 'CONSOLE ADDRESS/DATA SWITCH COMMUNICATION'). TO LOAD ALL SYSTEM TEST MODULES - AS DEFINED IN THE UDT CARD - ENTER -DPF1- IN THE ADDRESS SWITCHES AND RESET HALT (THIS IS THE ONLY ENTRY NEEDED AS THE LOADER TAKES CARE OF LOADING THE REST OF THE MODULES AND THE SYSTEM TEST SUPERVISOR).
- C. WHEN THE SYSTEM TEST LOADER (PF1) IS LOADED, THE PROGRAM HALTS WITH A 'HA' HALT. THE SYSTEM TEST MODULES WERE NOT BE SEQUENTIALLY ON DISK. AFTER THE 'HA' HALT SENSE SWITCH 18 CAN BE SELECTED TO HALT BEFORE LOADING EACH MODULE, OTHERWISE RESET THE HALT.
- D. THE SYSTEM TEST RELOCATING LOADER (PF1) WILL LOAD ALL MODULES WHICH HAVE BEEN DEFINED IN DCP'S UDT TABLE. FINALLY, AFTER THE MODULES HAVE BEEN LOADED, THE SYSTEM TEST SUPERVISOR (PF2) WILL BE LOADED.

1.3 OPERATION AIDS--

TO ASSURE THOROUGH TESTING, ALLOW THE TEST TO RUN AT LEAST TWO MINUTES. NOTE THE FOLLOWING POINTS:

- A. A DEVICE MAY BE DISABLED AT ANY TIME BY MAKING IT NOT READY.
- B. A NOT READY DEVICE MAY BE BROUGHT BACK INTO THE TEST BY BEING MADE READY.
- C. THE SYSTEM RESET/START PROGRAM RESTART IS AVAILABLE.
- D. THE MULTIPROGRAMMING SUPERVISOR CONSISTS OF TWO ROUTINES. DATA SWITCH ENTRY 'P202' MAY BE USED TO LOG THE ERROR RECORDING TABLES.
  - ROUTINE 01 - SYSTEM TEST SUPERVISOR.
  - ROUTINE 02 - LOGOUT ROUTINE.
- E. ANY MODULE CAN BE REMOVED AND RUN DIRECTLY UNDER THE CONTROL OF DCP.
- F. THE SYSTEM TEST RELOCATING LOADER PRINTS A LIST OF MODULES AND STARTING ADDRESSES WITH AN EXAMPLE APPEARING BELOW:
 

NOTE - COMPARE THIS LIST TO THE 'MODULE CONFIGURATION LIMITATION TABLE' (PARAGRAPH 3.1).

-	ID PF00. PROG PF11-01. SSW	-
-	LIST OF MODULES & STARTING ADDRESSES	-
-	PF1 - CPU MODULE	0E00
-	EOP - 5203 PRINTER MODULE	1200
-	POP - 5424 MPCU MODULE	1600

THE STARTING ADDRESS PRINTED IN THE 'LIST OF STARTING ADDRESSES' IS NOT THE STARTING ADDRESS OF ANY SYSTEM TEST MODULE. IF SAR IS LOADED WITH THIS ADDRESS, THE RESULT WILL BE A PROCESSOR CHECK. THIS ADDRESS IS THE STARTING ADDRESS OF THE BLOCK OF CORE WHICH THE MODULE WAS ASSIGNED BY THE SYSTEM TEST RELOCATING LOADER. TO DETERMINE THE CONTENT OF THIS BLOCK OF CORE REFER TO THE LISTING OF THAT SYSTEM TEST MODULE.

NOTE: ALL SYSTEM TEST MODULES ARE RELOCATABLE. THE SYSTEM TEST RELOCATING LOADER ADDS A RELOCATION FACTOR TO ALL ADDRESSES IN THE MODULE. THUS, EVEN THOUGH ALL MODULES ARE ASSEMBLED BEGINNING AT LOCATION HEX -0A00-, THE FIRST ADDRESS OF THE RELOCATED MODULE CORRESPONDS TO THE STARTING ADDRESS OF THE ASSIGNED BLOCK OF CORE.

1.4 ENABLING AND DISABLING MODULES--

MODULES CAN BE ENABLED (ACTIVATED) OR DISABLED (DE-ACTIVATED) DURING EXECUTION BY ONE OF THE FOLLOWING METHODS:

- A. MAKE THE DEVICE BEING TESTED NOT READY.
- B. DATA SWITCHES. (STOP CPU, SET SWITCHES, START CPU).

AXXX - DISABLE MODULE XXX.  
BXXX - ENABLE MODULE XXX.

MODULE IDENTIFICATIONS ARE PRINTED BY THE RELOCATING LOADER AND ARE ALSO LISTED IN 'TABLE OF SYSTEM TEST MODULES' (PAGE 5).

NOTE: AS LONG AS SWITCHES ARE SET TO 'AXXX' OR 'BXXX' THE MODULE SELECTED WILL BE DISABLED OR ENABLED. TO COMPLETE THE ENABLING OF A MODULE, REMOVE THE 'B' FROM THE LEFTMOST ADDRESS SWITCH.



2.4 CONSOLE ADDRESS/DATA SWITCH COMMUNICATIONS

THE ROTARY DATA SWITCHES ARE THE MEANS BY WHICH THE CE CAN COMMUNICATE WITH THE DIAGNOSTICS. ENTRIES ARE MADE AS FOLLOWS--

1. STOP CPU.
2. SET UP ROTARY SWITCHES FOR ONE OF THE FOLLOWING OPTIONS. X'S INDICATE POSITIONS WHICH VARY WITH THE NEED.

SWITCHES				
1	2	3	4	
P	0	X	X	- TURN OFF SENSE SWITCH 'XX'. (P008 WOULD TURN OFF SSW 08).
P	1	X	X	- TURN ON SENSE SWITCH 'XX'. (P108 WOULD TURN ON SSW 08).
P	2	X	X	- GO TO ROUTINE 'XX' AFTER CONSOLE ENTRY FINISHED. (P202 WOULD GO TO ROUTINE 2).
E	0	0	0	- TERMINATE THE CURRENT SECTION.
D	X	X	0	- DISK--EXECUTE SECTIONS FOR DEVICE WITH UNIT CODE 'XX'. (DE00 - EXECUTE ALL 5203 PRINTER PROGRAMS)
D	X	X	X	- DISK--EXECUTE SECTION XXX. (DE01 - SECTION E01). (DRO1 - EXECUTE SECTION E01)

NOTE - UP TO FOUR DISK INSTRUCTIONS MAY BE ENTERED DURING ONE ENTRY PHASE.

3. DEPRESS CPU START. (SYSTEM RESET FOLLOWED BY START WILL CALL IMMEDIATE ATTENTION TO THE SWITCHES--SEE NOTE BELOW).
4. WHEN DCP RECEIVES CONTROL, IT HALTS WITH 'HP' DISPLAYED. RESET THE HALT TO ENTER THE FIRST OPTION.
5. DCP WILL PERFORM HALT 'HU' OR 'HP'. LOAD THE NEXT OPTION AND RESET THE HALT.
6. REPEAT STEP 5 FOR AS MANY OPTIONS AS DESIRED. ALTERNATING CODES 'HU' AND 'HP' WILL SIGNAL DCP ACCEPTANCE.
7. WHEN DONE, SET LEFTMOST SWITCH TO '0' AND RESET THE HALT.

NOTE - WHEN USING P2XX IN THE SWITCHES TO GO TO A ROUTINE AFTER A SECTION HAS BEGUN, SYSTEM RESET/START SHOULD BE PERFORMED BEFORE MAKING THE ENTRY. (THIS PREVENTS ERRORS FOUND IN ONE ROUTINE FROM BEING DETECTED IN SOME OTHER ROUTINE. IT SHOULD NOT BE PERFORMED IF OTHERWISE SPECIFIED IN THE MAPS.)

2.5 COMMON SENSE SWITCHES

SENSE SWITCHES ARE EQUIVALENT TO 48 TOGGLE SWITCHES NUMBERED HEXADECIMALLY 00-2F. SENSE SWITCHES 00-0F ARE RESERVED FOR STANDARD OPTIONS PROVIDED BY DCP (LISTED BELOW). SENSE SWITCHES 10-2F ARE SIGNIFICANT TO THE PARTICULAR SECTION BEING RUN. INSTRUCTIONS FOR SETTING SENSE SWITCHES ARE CONTAINED IN SECTION 2.4.

SSW NUMBER	ON	OFF (NORMAL)
00	LOOP ON SECTION.	GO TO NEXT SECTION.
01	LOOP ON ROUTINE.	GO TO NEXT ROUTINE.
02	BYPASS MANUAL INTERVENTION ROUTINES.	EXECUTE ALL ROUTINES.
03	BYPASS ERROR PRINTING.	PRINT ERROR MESSAGES.
04	BYPASS NON-ERROR PRINTING.	PRINT NON-ERROR MESSAGES.
05	USE ALTERNATE PRINTER. PRINTER KEYBOARD, IF ATTACHED. OTHERWISE, NPCU.	NORMAL PRINTER.
06	BYPASS ERROR HALTS.	HALT AFTER ERROR.
07	LOAD AND GO. BYPASS COMMENTS AND PROMPTING HALTS.	PROMPTING MODE.
08	USE 5203 RIGHT CARRIAGE.	USE LEFT CARRIAGE.
09	DON'T CLEAR SECTION SENSE SWITCHES AFTER LOADING	CLEAR SECTION SENSE SWITCHES AFTER LOADING
0A-0F	RESERVED	

2.6 CONTROL PROGRAM HALTS.

ALL CONTROL PROGRAM (DCP) HALTS USE THE CHARACTER 'H' AS THE FIRST DIGIT OF THE HALT CODE. THE SECOND DIGIT IDENTIFIES THE CONDITION ACCORDING TO THE FOLLOWING TABLE.

HALT CODES	MODEL	CONDITION	ACTION REQUIRED
P05	H0	INVALID RECORD FOUND WHILE LOADING.	CORRECT INVALID RECORD AND RELOAD.
P15	H1	A DEVICE CALLED FOR BY THE TEST SECTION WAS NOT DEFINED IN THE UDT CARDS.	CHECK UDT CARDS AND RELOAD OR RESET HALT TO BYPASS THE ERROR (ERRORS COULD RESULT).
P25	H2	DATA SWITCH ENTRY ERROR.	CORRECT DATA SWITCHES AND RESET HALT.
P35	H3	INVALID ROUTINE PREFIX FOUND DURING CHAINING FROM ONE ROUTINE TO NEXT.	ENTER ROUTINE SELECT OPTION 'P2XX' IN DATA SWITCHES AND RESET HALT. IF THIS DOES NOT WORK, RELOAD SECTION.
P55	H5	NPCU NOT READY OR ERROR. ERROR INDICATION SHOULD BE DISPLAYED IN THE NPCU LIGHTS.	DO A NON-PROCESS RUN-OUT, RELOAD DECK STARTING WITH RUNOUT CARD/S AND RESET THE HALT.
P65	H6	PRINTER NOT READY OR ERROR.	CLEAR CONDITION AND RESET THE HALT. IF FAILURE PERSISTS, RUN PRINTER FUNCTION TEST. SENSE SWITCHES 03 AND 04 MAY BE USED TO BYPASS PRINTING. SET SENSE SWITCH 05 TO USE ALTERNATE PRINTER.
P75	H7	DISK ERROR.	RESET HALT TO RETRY. IF ERROR PERSISTS, RELOAD.
PA5	HA	CONTROL PROGRAM IS PREPARED TO RECEIVE DATA SWITCH ENTRY. OCCURS AFTER DCP AND SECTION LOADING.	RESET THE HALT IF NO ENTRY DESIRED. TO LOAD OPTIONS, SET UP DATA SWITCHES AND RESET THE HALT. SSW 07 MAY BE USED TO BYPASS THIS HALT.
PC5	HC	DISK LOADER REQUIRES SPECIFICATION OF SECTIONS TO BE LOADED FROM DISK.	IF NO ENTRY HAS BEEN MADE PREVIOUSLY, LOAD PROGRAM SELECTION ENTRY 'DXXX' AND RESET THE HALT. UP TO EIGHT ENTRIES MAY BE MADE. IF ENTRIES HAVE EVER BEEN MADE, THE PROGRAMS MAY BE REPEATED BY RESETTING THE HALT.
PD5	HD	SECTION RUNNING OR LOAD TABLE HAS SPECIFIED NEXT SECTION TO BE RUN. ARP CONTAINS -DXXX- WHERE XXX IS THE PROGRAM ID TO BE RUN.	DISK SYSTEM - DXXX IS NOT ON DISK PACK, RESET THE HALT AND THE NEXT PROGRAM IN THE LOAD TABLE WILL BE LOADED. CARD SYSTEM - PLACE DECK XXX IN THE NPCU HOPPER AND RESET THE HALT.
PE5	HE	CURRENT SECTION TERMINATED.	RESET HALT TO LOAD NEXT SECTION. SECTION MAY BE RESTARTED BY SYSTEM RESET/START.
PF5	HF	DCP HALTS WITH 'HP' DISPLAYED WHENEVER A VALID DATA SWITCH ENTRY IS RECOGNIZED. AS DCP ACCEPTS ENTRIES, ALTERNATING HALTS 'HU' AND 'HP' OCCUR.	LOAD A VALID DATA SWITCH ENTRY AND RESET THE HALT. REPEAT FOR ALTERNATING HALTS 'HU' AND 'HP'. TO TERMINATE ENTRY PROCEDURE, ROTATE LEFT-MOST SWITCH TO ZERO AND RESET HALT.
D1	D1	IPL LOADER CAN'T LOAD DCP BECAUSE OF A DISK ERROR.	RESET HALT TO RETRY. IF HALT PERSISTS, GET A NEW DISK PACK.

3. TABLE OF SYSTEM TEST MODULES

MODULE ID	UNIT TESTED	PREPARATION	TEST OPERATION
10P	5471 PRINTER KEYBOARD	MAKE SURE PAPER IS LOADED.	KEYBOARD IS ENABLED AND PROCEED LIGHT TURNED ON. KEYED DATA KEYS ARE PRINTED. THE FUNCTION KEYS (REQ, END, AND CANCEL) ARE IGNORED.
11P	5475 KEYBOARD	NONE.	THE KEYBOARD IS INITIALLY ENABLED, UNLOCKED, RESTORED AND '00' IS LOADED INTO THE COLUMN INDICATOR STICK LIGHTS. ON SUCCEEDING INTERRUPTS FROM THE KEYS OR SWITCHES, THE DATA ENCODED BY THE KEYBOARD IS LOADED INTO THE COLUMN INDICATOR STICK LIGHTS AND DISPLAYED IN EBCDIC. THE MODULE WILL ALSO KEEP A RUNNING COUNT OF MULTIPLE INTERRUPTS FROM THE SKIP OR DUP KEYS IN THE COLUMN INDICATOR STICK LIGHTS. IF THE -0- OR -8- KEYS ARE DEPRESSED WHILE IN UPPER CASE (STANDARD KEYBOARD ONLY), THE COLUMN INDICATOR WILL BE BLANKED WITH THE ERROR LIGHT TURNED ON. FOR WORLD TRADE KEYBOARDS, THE COLUMN INDICATOR WILL BE BLANKED AND THE ERROR LIGHT TURNED ON WHEN THE 'INVALID CHARACTER' STATUS BIT IS DETECTED (ANYTIME THE UPPER CASE OF A KEY DOES NOT EXIST WHILE IN UPPER CASE OR ANYTIME THE LOWER CASE DOES NOT EXIST WHILE IN LOWER CASE). FOR ALL KEYBOARDS, UPPER SHIFT IS FORCED ANYTIME THE UPPER SHFT OR MULTI-PUNCH KEYS ARE DEPRESSED OR BY HAVING THE PROGRAM TOGGLE SWITCH IN THE 'ON' POSITION.
20P	HLTA	1. CONFIGURE THE HLTA SYSTEM TEST TO THE SYSTEM USING THE HLTA CONFIGURATOR PROGRAM -FE7- 2. CONFIGURATION OF SYSTEM TEST MODULES 2.1 RUNNING FROM CARDS. TAKE THE LAST CARD PUNCHED OUT BY -FE7- (N 0A0D KXXXX REP CARD FOR 20P) AND PLACE IT BEFORE THE END CARD OF THE HLTA SYSTEM TEST MODULE (20P). 2.1 RUNNING FROM DISK. THE SYSTEM TEST MODULE WILL BE CONFIGURED AUTOMATICALLY IF OUTPUT TO DISK IS SELECTED. 3. LOAD HLTA MICROCODE (ID = PFO) USING THE MICROCODE LOADER (ID=205)	DEFINITIONS: ADJACENT PAIRS - LINES 1-2, 3-4, 5-6, AND 7-8 LOOP TEST - SAMPLING THE DATA TRANSMITTED ON ONE LINE OF THE ADJACENT PAIR WRAP TEST - TRANSMITTING ON ONE LINE OF AN ADJACENT PAIR AND RECEIVING ON THE OTHER TEST OPERATION: THE LOOP AND WRAP TESTS WILL BE PERFORMED FOR THE SPEED(S) DEFINED FOR THE SYSTEM. IF JUMPED (WORLD TRADE) AS WELL AS NON-JUMPED SPEEDS ARE PRESENT, THE TESTS WILL BE PERFORMED FOR THE NON-JUMPED SPEEDS ONLY. IF ONLY ONE LINE OF AN ADJACENT PAIR IS PRESENT, ONLY THE LOOP TEST WILL BE PERFORMED. IF BOTH LINES OF AN ADJACENT PAIR ARE PRESENT, TESTING WILL ALTERNATE BETWEEN LOOP TEST ON EACH LINE AND THE WRAP TEST. WRAPPING WILL BE DONE IN BOTH DIRECTIONS.
35P	1255 MAGNETIC READER	THE READER/SORTER MUST BE PLACED IN THE 'ON-LINE' MODE AND THE START KEY DEPRESSED IN PREPARATION OF DOCUMENT FEEDING. LOAD HOPPER WITH DOCUMENTS. ALL DATA FIELDS SHOULD BE ENABLED (SWITCHES DEPRESSED): AMOUNT, PROCESS CONTROL, ACCOUNT NUMBER, TRANSIT ROUTING, AND SERIAL NUMBER.	THE SIOC WILL BE CHECKED UPON INITIAL ENTRY INTO THIS MODULE. ONCE THE SIOC HARDWARE IS CHECKED, THE 1255 WILL BE EXERCISED. ONE DOCUMENT AT A TIME WILL BE READ FROM THE HOPPER AND STACKED. THE DOCUMENTS WILL BE RIPPLE STACKED. STACKING WILL BE AS FOLLOWS: DOT ENTRY 35 6 STACKERS, STANDARD SORT: 0-2-4-6-8-R 35-2 6 STACKERS, ALTERNATE SORT: 0-1-2-3-4-R 35-4 12 STACKERS, SORT: 0-1-2-3-4-R-5-6-7-8-9-A NOTE: IF THE CPU 'STOP' KEY IS DEPRESSED, THE 1255 MAY HALT WITH A 'STACKER COMMAND' CHECK. RESET THE STACKER COMMAND CHECK PRIOR TO DEPRESSING CPU 'START'.
36P	1270 OPTICAL READER	THE READER/SORTER MUST BE PLACED IN THE 'ON-LINE' MODE AND THE START KEY DEPRESSED IN PREPARATION OF DOCUMENT FEEDING. LOAD HOPPER WITH DOCUMENTS. ENABLE ALL 7 DATA FIELDS (SWITCHES DEPRESSED).	THE SIOC WILL BE CHECKED UPON INITIAL ENTRY INTO THIS MODULE. ONCE THE SIOC HARDWARE IS CHECKED, THE 1270 WILL BE EXERCISED. ONE DOCUMENT AT A TIME WILL BE READ FROM THE HOPPER AND STACKED. THE DOCUMENTS WILL BE RIPPLE STACKED. STACKING WILL BE AS FOLLOWS: DOT ENTRY 36 6 STACKERS, STANDARD SORT: 0-2-4-6-8-R 36-1 6 STACKERS, ALTERNATE SORT: 0-1-2-3-4-R 36-0 12 STACKERS, SORT: 0-1-2-3-4-R-5-6-7-8-9-A NOTE: IF THE CPU 'STOP' KEY IS DEPRESSED, THE 1270 MAY HALT WITH A 'SORT' CHECK. RESET THE 'SORT' CHECK PRIOR TO DEPRESSING CPU 'START'.
50P	1442 RPO READER PUNCH	LOAD THE HOPPER WITH BLANK CARDS.	FEED, READ AND PUNCH COMMANDS ARE EXERCISED IN RANDOM ORDER. BOTH STACKERS ARE USED. PUNCHED CARDS MUST BE LOADED BACK INTO THE HOPPER FOR PROGRAM VERIFICATION. AT LEAST ONCE WHEN THE 1442 BECOMES NOT READY DUE TO AN EMPTY HOPPER, THE OPERATOR SHOULD DEPRESS THE 1442 START KEY -- WITHOUT RELOADING THE HOPPER. THE MESSAGE '1442 LAST CARD' SHOULD BE PRINTED AFTER THE NEXT FEED CYCLE TO INDICATE THAT THE 'LAST CARD' BIT WAS SET. IF THIS MESSAGE APPEARS AT ANY OTHER TIME, AN ERROR CONDITION EXISTS.
51P	1442 ATTACH. READER PUNCH		
70P	3410/3411 TAPE	MAKE THE TAPE UNIT(S) READY WITH THE WRITE-ENABLE RING INSTALLED. (SEE PARAGRAPH 3.1 FOR LIMITATIONS) (ON THIS DEVICE.)	A STORED TABLE OF TAPE COMMANDS IS EXECUTED REPEATEDLY ON ALL TAPE UNITS, ATTACHED AND READY, UNTIL EOT MARK IS DETECTED. NOTE-A WRITE RETRY IS PERFORMED (15) TIMES BEFORE AN ERROR IS INDICATED.
80P AND 81P	BSCA 1 AND BSCA 2	THE EXTERNAL CABLE SWITCH MAY OPTIONALLY BE PUT ON. (ONLY IF NOT HIGH SPEED FEATURE) IF THE SWITCH IS ON, THE DATA GOES OUT TO THE END OF THE DATA SET CABLE AND BACK INTO THE ADAPTER. A BSCA ERROR WILL OCCUR IF THIS SWITCH IS THROWN DURING BSCA OPERATION. * NOTICE * A BSCA WITH SWITCHED NETWORK WILL GET A UNIT CHECK (DISCONNECT TIMEOUT) IF THE LOGOUT TAKES OVER 20 SECONDS. THIS ERROR SHOULD BE DISREGARDED.	THE BSCA DIAGNOSTIC INSTRUCTION 'TEST LOOP' IS USED IN THIS ROUTINE. A BYTE OF DATA 7F IS CYCLE STEALED OUT OF CORE INTO THE BSCA. (THE BSCA IS FIRST ENABLED). THE BYTE IS THEN SENT INTO THE SHIFT REGISTER, SHIFTED OUT THE TRANSMIT TRIGGER AND INTO THE RECEIVE TRIGGER WHERE IT GOES BACK TO THE SHIFT REGISTER. THIS BYTE (SHIFTED LEFT 7 BIT POSITIONS) IS THEN PUT BACK IN CORE AT N+1 ADDRESS WHERE N WAS STARTING ADDRESS. THIS BYTE IS CONTINUALLY SHIFTED AND STORED IN CORE AT THE INCREMENTED ADDRESS UNTIL FINALLY WHEN THE INCREMENTED ADDRESS EQUALS THE STOP LSR ADDRESS AN INTERRUPT OCCURS. IN THE INTERRUPT ROUTINE THE DATA IN CORE AND THE STATUS CONDITIONS ARE CHECKED FOR PROPER VALUES.
A0P	5400 DISK	MAKE SURE SPINDLE DRIVE(S) ARE READY. (SEE PARAGRAPH 3.1 FOR LIMITATIONS) (ON THIS DEVICE.)	A STORED TABLE OF DISK COMMANDS IS EXECUTED REPEATEDLY. THE PROGRAM ALTERS THESE COMMANDS TO EXERCISE BOTH FIXED AND REMOVABLE DISKS. BOTH SPINDLE DRIVES ARE EXERCISED WHEN THE DUAL SPINDLE FEATURE IS INSTALLED.
C0P	5405 DISK	MAKE SURE DRIVE(S) ARE READY. (SEE PARAGRAPH 3.1 FOR LIMITATIONS) (ON THIS DEVICE.)	A STORED TABLE OF DISK COMMANDS IS EXECUTED REPEATEDLY. THE PROGRAM ALTERS THESE COMMANDS TO EXERCISE BOTH DRIVES IF THIS TEST IS BEING RUN ON A TWO DRIVE SYSTEM.

MODULE ID	UNIT TESTED	PREPARATION	TEST OPERATION
EOP	5203 PRINTER	LOAD FORMS IN LEFT CARRIAGE. (SENSE SWITCH 08 MAY BE USED TO OPERATE ON THE RIGHT CARRIAGE). (SEE PARAGRAPH 3.1 FOR LIMITATIONS) (ON THIS DEVICE).	COMMANDS ARE ISSUED IN RANDOM ORDER. A RIPPLE PATTERN IS PRINTED.
E1P	1403 PRINTER	LOAD PAPER, MAKE READY.	COMMANDS ARE ISSUED IN RANDOM ORDER. A RIPPLE PATTERN IS PRINTED.
POP	5824 NPCU	PLACE BLANK CARDS IN BOTH HOPPERS AND MAKE NPCU READY.	PRIMARY CARDS ARE READ INTO STACKER 1. CARDS FROM THE SECONDARY UNDERGO ONE OF THE FOLLOWING OPERATIONS. 1. PUNCH ONLY TO STACKER 2. 2. PRINT ONLY TO STACKER 3. 3. PUNCH/PRINT TO STACKER 4. COMMANDS ARE ISSUED IN RANDOM ORDER. PUNCHED CARDS FROM STACKERS 2 AND 4 SHOULD BE RELOADED INTO THE PRIMARY HOPPER FOR PROGRAM VERIFICATION. NOTE: THE PUNCHED CARDS MUST BE CHECKED WITH A CARD GAUGE. OFF PUNCHING CAN BE FAIRLY SEVERE AND YET NOT CAUSE READ ERRORS WHEN THE CARDS ARE RELOADED FOR PROGRAM VERIFICATION.
PE1	5410 CPU	IF DUAL PROGRAM, P1 AND P2 SWITCHES MUST BE ON.	CPU INSTRUCTIONS ARE EXECUTED AND TESTED IN SEGMENTS. ALSO, ALL AVAILABLE CORE IS SCANNED. ON SYSTEMS WITH DUAL PROGRAMMING FEATURE DO NOT PRESS 'INTERUPT' KEY WHEN KEY IS NOT LIT.

3.1 SYSTEM TEST MODULE CONFIGURATION LIMITATIONS TABLE

ATTACHMENT OF ANY OR ALL OTHER I/O DEVICES, NOT MENTIONED IN THE TABLE ARE IRRELEVANT.

MODULE ID	UNIT TESTED	RECOMMENDED MODULE COMBINATIONS TO AVOID	OVERRUN CONDITIONS IN THE SYSTEM TEST (READ DOWN)
AOP	5000 DISK	X	X
COP	5845 DISK	X	X
EOP	5203 PRINTER	X	X
7OP	3410/3411 TAPE	X	X

NOTE - 'X' IN THE TABLE MEANS THE DEVICE IS ATTACHED AND ENABLED.

- 1. NOT DEFINING THE DEVICE IN THE 'ODT'.
- 2. NOT LOADING THE MODULE WITH THE OTHERS.
- 3. FOLLOWING THE INSTRUCTIONS IN PARAGRAPH 1.4.

4. LOGOUT OF ERROR RECORDING TABLES--

EACH TEST MODULE HAS A TABLE IN WHICH INFORMATION CONCERNING ERRORS AND CURRENT OPERATION IS STORED. IT WAS MENTIONED PREVIOUSLY THAT THE LOGOUT CAPABILITY IS CONTAINED IN ROUTINE 2 OF THE SYSTEM TEST SUPERVISOR. THEREFORE, A DATA SWITCH CALL FOR ROUTINE '02' CAN BE USED TO OBTAIN A LOGOUT. AN ALTERNATE METHOD IS DESCRIBED BELOW:

- 1) STOP THE CPU
- 2) SET LEFT TWO ADDRESS SWITCHES TO 'BB'
- 3) START CPU
- 4) AFTER LOGOUT OCCURS, CHANGE DATA SWITCHES BEFORE RESTARTING

MODULE ID	UNIT TESTED	SAMPLE LOGOUT	COMMENTS AND EXPLANATIONS
10P	5471 PRINTER KEYBOARD	5471 PRINTER KEYBOARD LAST 3 SIOS XXXX XXXX XXXX SENSE DATA AFTER LAST 3 INTRPTS (IN Q CODE ORDER 11,13,19,1B) XXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXX SENSE DATA AFTER LAST 3 ERRORS (SAME Q CODE ORDER) XXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXX	SEE 5471 ATTACHMENT DESC. FOR BIT SIGNIFICANCE. DATA ARRANGED AS FOLLOWS: QCODE QCODE QCODE QCODE* 11 13 19 1B* LO HI LO HI LO HI LO HI* XX XX XX XX XX XX XX XX*
11P	5475 KEYBOARD	KYBD SNS ORDER 11, 12, 13 XXXX XXXX XXXX	DATA ARRANGED AS FOLLOWS: LO HI ADDR ADDR BYTE BYTE XX XX
20P	NLPA	NO ERROR LOGOUT	NO ERROR LOGOUT
35P	1255 MAGNETIC CHARACTER READER	LAST 3 1255 ERRORS 0000 0000 0000	DATA ARRANGED AS FOLLOWS: ENTRIES ARE ERROR HALTS. LEAST RECENT PREVIOUS MOST RECENT
36P	1270 OPTICAL CHARACTER READER	LAST 3 1270 ERRORS 0000 0000 0000	DATA ARRANGED AS FOLLOWS: ENTRIES ARE ERROR HALTS. LEAST RECENT PREVIOUS MOST RECENT
50P	RPO 1442	1442 - LAST 3 CMDS AND STATUS XXXXXX XXXXXX XXXXXX XXXXXX	DATA ARRANGED AS FOLLOWS: LEAST REC CMD & CONT BYTE* PREVIOUS CMD & CONT BYTE* MOST REC CMD & CONT BYTE* STATUS BYTES SEE 1442 DESC FOR BIT SIG.*
51P	ATTACH.		





9. SYSTEM TEST HALTS AND PRINTOUTS

A FOUR DIGIT IDENTIFICATION CODE IS ASSOCIATED WITH EVERY PRINTOUT AND HALT. 'OUXX' UU - UNIT IDENTIFICATION CODE.  
 IN A PRINTOUT, THIS INFORMATION APPEARS IN THE HEADING LINE AS 'ID OUXX...'. FOR HALTS, THE SAME INFORMATION IS PRESENTED IN  
 TWO HALTS, HALT 'OU' FOLLOWED BY HALT 'XX'.

UNIT OR PROGRAM	INDEX NUMBER	MEANING	
'10' 5471 PRINTER KEYBOARD	01	KEYBOARD CHECK.	
	02	KEYBOARD TRANSLATOR CHECK.	
	03	PRINTER MALFUNCTION.	
	04	PRINTER TRANSLATOR CHECK.	
	05	FEEDBACK SWITCH ERROR.	
	06	LONG FUNCTION SWITCH ERROR.	
	08	NON-PRINTABLE CHARACTER.	
	11	KEYBOARD - NO STATUS INDICATION OF INTERRUPT.	
	12	IAR/ARR SELECTION ERROR WHEN ATTEMPTING TO RESET AN INTERRUPT.	
	'11' 5475 KEYBOARD	01	KEYBOARD FAILURE - INTERRUPT LEVEL 1. DO LOGOUT TO SEE WHAT STATUS IS STORED.
	'20' NLTA	01	ADAPTER CHECK.
		02	INTERRUPT TAKEN WITHOUT OP-END INTERRUPT PENDING.
03		OP-END INTERRUPT TAKEN BUT NO LINES WITH OP-END INTERRUPT PENDING.	
04		LINE LOOP/WRAP ERROR.	
PP		SYSTEM TEST MODULE NOT CONFIGURED FOR SYSTEM.	
'35' 1255 MAGNETIC CHARACTER READER	01	SIOC IS BUSY.	
	02	NO SIOC DEVICE ATTACHED, CHECK CONNECTORS.	
	03	DATA TRANSFER REGISTER AND DIAGNOSTIC BYTE ERROR.	
	04	FUNCTION REGISTER BITS STUCK ON OR OFF.	
	05	LENGTH COUNT REGISTER BITS STUCK ON OR OFF.	
	06	DATA ADDRESS REGISTER BITS STUCK ON OR OFF.	
	07	DATA TRANSFER REGISTER BITS STUCK ON OR OFF.	
	08	INTERRUPT TAKEN IN LEVEL 4 WITHOUT INTERRUPT REQUEST.	
	09	REMOVE DIAGNOSTIC CONNECTOR AND ATTACH DEVICE.	
	10	SIOC INTERRUPT ENABLE LATCH COULD NOT BE TURNED OFF.	
	11	INTERRUPT IN LEVEL 4 WAS NOT TAKEN.	
	12	INTERRUPT LEVEL 4 COULD NOT BE DISABLED.	
	13	INTERRUPT LEVEL 4 IAR BITS STUCK ON OR OFF.	
	14	DATA TRANSFER PARITY CHECK.	
	21	1255 DEVICE ID BITS NOT EQUAL TO -0011-.	
	22	SIOC BUSY TOO LONG.	
	23	ISSUED ENGAGE BUT NO DOCUMENTS WERE FED.	
	24	INTERRUPT DID NOT OCCUR AFTER READ WAS COMPLETED.	
	25	INTERRUPT LEVEL 4 NOT RESET.	
	26	1255 STATUS BYTE ERROR-LCR OVERFLOW.	
	27	DATA NOT TRANSFERRED (DAR NOT DECREMENTED). CHECK DOCUMENTS FOR PROPER ORIENTATION.	
	28	DATA NOT READ INTO CORE.	
	29	DATA TRANSFER REG PARITY CHECK OR NO-OP BIT ON.	
	30	(MESSAGE ONLY) '1255 READY DROPPED BEFORE INTERRUPT REQUESTED'	
	31	ISSUED DISERGEAGE BUT DOCUMENTS CONTINUED TO FEED.	
	32	'I/O DISCONNECT' ON AFTER SIO INSTRUCTION EXECUTED.	
	33	'SORTER IS STOPPED' DID NOT BECOME ACTIVE (1.6 SEC).	
	34	(MESSAGE ONLY) '1255 AUTO REJECT'. CAUSES OF AUTO REJECT: DOCUMENT SPACING, DOCUMENT LENGTH, LATE READ, LATE STACKER SELECT.	

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P/N 2589903

UNIT OR PROGRAM	-XX- INDEX NUMBER	MEANING	
1270 OPTICAL CHARACTER READER	01	SIOC IS BUSY.	
	02	NO SIOC DEVICE ATTACHED, CHECK CONNECTORS.	
	03	DATA TRANSFER REGISTER AND DIAGNOSTIC BYTE ERROR.	
		04	FUNCTION REGISTER BITS STUCK ON OR OFF.
		05	LENGTH COUNT REGISTER BITS STUCK ON OR OFF.
		06	DATA ADDRESS REGISTER BITS STUCK ON OR OFF.
		07	DATA TRANSFER REGISTER BITS STUCK ON OR OFF.
		08	INTERRUPT TAKEN IN LEVEL 4 WITHOUT INTERRUPT REQUEST.
		09	REMOVE DIAGNOSTIC CONNECTOR AND ATTACH DEVICE.
		10	SIOC INTERRUPT ENABLE LATCH COULD NOT BE TURNED OFF.
		11	INTERRUPT IN LEVEL 4 WAS NOT TAKEN.
		12	INTERRUPT LEVEL 4 COULD NOT BE DISABLED.
		13	INTERRUPT LEVEL 4 IAR BITS STUCK ON OR OFF.
		14	DATA TRANSFER PARITY CHECK.
		21	1270 DEVICE ID BITS NOT EQUAL TO -0011-.
		22	SIOC BUSY TOO LONG.
		23	ISSUED ENGAGE BUT NO DOCUMENTS WERE FED.
		24	INTERRUPT DID NOT OCCUR AFTER READ WAS COMPLETED.
		25	INTERRUPT LEVEL 4 NOT RESET.
		26	1270 STATUS BYTE ERROR-LSR OVERFLOW.
		27	DATA NOT TRANSFERRED (DAR NOT DECREMENTED). CHECK DOCUMENTS FOR PROPER ORIENTATION.
		28	DATA NOT READ INTO CORE.
		29	DATA TRANSFER REG PARITY CHECK OR NO-OP BIT ON.
		30	ISSUED DISENGAGE BUT DOCUMENTS CONTINUED TO FEED.
		31	'I/O DISCONNECT' ON AFTER SIO INSTRUCTION EXECUTED.
		32	'SORTER IS STOPPED' DID NOT BECOME ACTIVE (1.6 SEC).
		33	(MESSAGE ONLY) '1270 AUTO REJECT'. CAUSES OF AUTO REJECT: DOCUMENT SPACING, DOCUMENT LENGTH, LATE READ, LATE STACKER SELECT.
	1442 RPO READER PUNCH	08	STATUS ERROR.
		11	A NON-BLANK CARD WAS READ AND DID NOT CONTAIN THE PATTERN BEING PUNCHED BY THE 1442 MODULE. NPRO TO OBTAIN THE CARD IN ERROR.
		98	A FEED COMMAND CAUSED DATA TRANSFER.
	1442 ATTACH	99	WARNING: THE 'LAST CARD' BIT WAS SET. THE LAST CARD SHOULD BE AT THE 1442 PRE-PUNCH STATION.
	170 3410/3411 TAPE	01	TAPE UNIT FAILURE. SEE TAPE LOGOUT DESCRIPTION TO DETERMINE TYPE OF FAILURE. (LOGOUT IS THE SAME FORMAT AS THE ERROR PRINTOUT.)
		01	BSCA FAILURE. SEE DESCRIPTION OF BSCA LOGOUT TO DETERMINE NATURE OF FAILURE. (LOGOUT WILL BE THE SAME AS ERROR PRINTOUT IN FORMAT)
180 6 5444 DISK	01	SEEK BUSY BIT IS INITIALLY ACTIVE.	
	02	DISK IS INITIALLY BUSY.	
	03	LOAD/SENSE OF THE DISK REGISTERS REVEALS A BAD REGISTER.	
	04	SEEK TRAVEL CHECK. THE HEADS ARE NOT LOCATED AT THE EXPECTED TRACK.	
	05	STATUS CHECK. STATUS BYTE(S) ARE IN ERROR AFTER THE LAST COMMAND.	
	06	DISK IS NOT READY. NOTE THIS HALT WILL ONLY OCCUR ONCE.	
	07	SEEK BUSY DID NOT TIME OUT.	
	08	DISK READ/WRITE BUSY DID NOT TIME OUT.	
	09	DISK DATA ADDRESS REGISTER DID NOT INCREMENT PROPERLY.	
	0A	DATA WAS NOT TRANSFERRED DURING A READ OPERATION.	
	0C	DATA WAS NOT TRANSFERRED DURING A WRITE OPERATION.	
180 6 5445 DISK	01	SEEK BUSY BIT IS INITIALLY ACTIVE.	
	02	DISK IS INITIALLY BUSY.	
	03	LOAD/SENSE OF THE DISK REGISTERS REVEALS A BAD REGISTER.	
	04	SEEK TRAVEL CHECK. THE HEADS ARE NOT LOCATED AT THE EXPECTED TRACK.	
	05	STATUS CHECK. STATUS BYTE(S) ARE IN ERROR AFTER THE LAST COMMAND.	
	06	DISK IS NOT READY. NOTE THIS HALT WILL ONLY OCCUR ONCE.	
	07	SEEK BUSY DID NOT TIME OUT.	
	08	DISK READ/WRITE BUSY DID NOT TIME OUT.	
	09	DISK DATA ADDRESS REGISTER DID NOT INCREMENT PROPERLY.	
	0A	DATA WAS NOT TRANSFERRED DURING A READ OPERATION.	
	0C	DATA WAS NOT TRANSFERRED DURING A WRITE OPERATION.	
	0E	THE DISK DRIVE DROPPED READY AFTER ISSUING A SEEK COMMAND.	
	10	NO SCAN HIT AFTER DOING A SCAN EQUAL OPERATION.	
	11	SCAN EQUAL SENSE BIT NOT ON AFTER DOING A SCAN EQUAL OPERATION.	

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UNIT OR PROGRAM	-XK- INDEX NUMBER	MEANING
'50' 5203 PRINTER	01	CARRIAGE SYNC CHECK.
	02	CARRIAGE SPACE CHECK.
	03	FORMS JAM CHECK.
	04	CHAIN SYNC CHECK.
	05	INCREMENTER SYNC OR SLIP CHECK.
	06	INCREMENTER FAILURE CHECK.
	07	THERMAL CHECK.
	08	NO-OP STATUS BIT SET WITH NO OTHER STATUS BITS.
	09	HAMMER ECHO CHECK. THE PRINT POSITION LISTED IN THE LOGOUT IS THE POSITION THE LPDAR WAS ADDRESSING WHEN THE ERROR OCCURRED. (IGNORE IT IF IT IS NOT BETWEEN 1 - 132.) IF PRINT POSITION (P) IS 1-4 OR 13-16, THE FAILING HAMMER IS = (P+119)/4. IF P IS 5-12 OR 17-24, THE FAILING HAMMER IS = (P+107)/4. AND IF P IS 25-132, THE FAILING HAMMER IS = (P-21)/4. (IGNORE ANY REMAINDERS)
	0A	ANY HAMMER ON CHECK.
'51' 1433 PRINTER	0C	UNPRINTABLE CHARACTER SKIPPED.
	14	PRINTER BUSY TOO LONG.
	33	NO ERROR CHECK STATUS BIT, BUT CARRIAGE LINE COUNTER WAS IN ERROR.
	01	CARRIAGE SYNC CHECK.
'50' 5424 NPCU	03	FORMS JAM CHECK./CARRIAGE STOP KEY.
	04	CHAIN SYNC CHECK.
	05	PRINT DATA CHECK.
	08	NO-OP STATUS BIT SET WITH NO OTHER STATUS BITS.
	09	HAMMER ECHO CHECK (OF SET ADDRESS OR RESET ADDRESS). THE HAMMER NUMBER FAILING (SAME AS PRINT POSITION) IS AVAILABLE IN LOGOUT. (UNLIKE 5203, THE VALUE IN LOGOUT IS, ITSELF, THE HAMMER NUMBER).
	0A	ANY HAMMER ON CHECK.
	0C	UNPRINTABLE CHARACTER SKIPPED.
14	PRINTER BUSY TOO LONG.	
33	NO ERROR CHECK STATUS BIT, BUT CARRIAGE LINE COUNTER WAS IN ERROR. (AN ERROR PRINT OCCURS).	
12	FEED CHECK. NPCU INDICATORS SPECIFY WHICH TYPE.	
13	HOPPER CHECK.	
14	PRINT CLUTCH CHECK.	
15	PRINT DATA CHECK.	
16	PUNCH INVALID.	
17	PUNCH CHECK.	
18	READ CHECK.	
19	NO-OP STATUS BIT SET WHEN NO ERROR WAS PRESENT.	
35	COMPARE ERROR. NON-BLANK CARD WAS READ FROM PRIMARY HOPPER AND DID NOT CONTAIN THE PATTERN BEING PUNCHED BY THE SYSTEM TEST. CARD IN ERROR IS IN PRIMARY WAIT STATION.	

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UNIT OR PROGRAM	-XX- INDEX NUMBER	MEANING
5410 CPU	01	JUMP FALSE DID NOT JUMP ON A FALSE CONDITION.
	02	JUMP TRUE DID NOT JUMP ON A TRUE CONDITION.
	03	BRANCH FALSE DID NOT BRANCH ON A FALSE CONDITION.
	04	JUMP TRUE DID NOT JUMP ON A TRUE CONDITION.
	05	BRANCH TRUE DID NOT BRANCH ON A TRUE CONDITION. (TEST BITS ON)
	06	BRANCH TRUE DID NOT BRANCH ON A TRUE CONDITION. (TEST BITS OFF)
	07	JUMP EQUAL DID NOT JUMP ON AN EQUAL CONDITION. (COMPARE LOGICAL IMMEDIATE - ZEROS)
	08	JUMP EQUAL DID NOT JUMP ON AN EQUAL CONDITION. (COMPARE LOGICAL IMMEDIATE - P'S)
	09	ZERO AND ADD ZONED DECIMAL FAILED.
	0A	ADD ZONED DECIMAL FAILED.
	0B	LOAD AND STORE XR1 FAILED.
	0C	LOAD AND STORE XR2 FAILED.
	0D	MOVE IMMEDIATE INDEXED BY XR1 FAILED.
	0E	MOVE IMMEDIATE INDEXED BY XR2 FAILED.
	0F	LOAD ADDRESS USING XR1 FAILED.
	10	MOVE ZONE TO ZONE FAILED.
	11	MOVE NUMERIC TO ZONE FAILED.
	12	MOVE NUMERIC TO NUMERIC FAILED.
	13	MOVE ZONE TO NUMERIC FAILED.
	14	LOAD ADDRESS OF XR2 USING XR1 AS DISPLACEMENT FAILED.
	15	LOAD ADDRESS OF XR1 USING XR2 AS DISPLACEMENT FAILED.
	16	JUMP ON DECIMAL OVERFLOW FAILED.
	17	BRANCH ON DECIMAL OVERFLOW FAILED.
	18	BRANCH ON NO DECIMAL OVERFLOW FAILED.
	19	JUMP ON NO DECIMAL OVERFLOW FAILED.
	1A	EDIT INSTRUCTION FAILED.
	1C	INSERT AND TEST CHARACTER FAILED TO SET FIELD CORRECTLY.
	1E	ARR NOT SET CORRECTLY AFTER INSERT AND TEST CHARACTER INSTRUCTION.
	31	ADVANCE PROGRAM LEVEL INSTRUCTION DID NOT CAUSE PROGRAM LEVEL TO ADVANCE. MAKE SURE P1 & P2 SWITCHES ARE BOTH ON.
	32	APL CAUSED PROGRAM ADVANCE WHEN NOT ENABLED.
	89	INTERRUPT LEVEL 0 FAILURE.
SYSTEM TEST LOADER AND SUPERVISOR	01	AVAILABLE CORE HAS BEEN USED. THE REMAINING MODULES WILL BE BYPASSED.
	02	DEVICE CALLED FOR IN MODULE UDT NOT DEFINED. RESET HALT TO OVERLAY THIS MODULE.
	E0	HALT BEFORE LOADING A MODULE TO ALLOW DELETION. SET LEFTMOST SWITCH TO 'A' TO DELETE LAST MODULE LISTED.
	F1	ROUTINE 2 LOGOUT COMPLETE. REMOVE 'BB' FROM CONSOLE SWITCHES AND RESET HALT TO RESTART.
	F2	DISK ERROR WHILE SEARCHING DISK FOR SYSTEM TEST. RESET HALT TO RETRY.

NOTE- HALT CODE CHARACTERS 'B' AND 'D' ARE DISPLAYED AS LOWER CASE LETTERS ON MODEL 10 CPU'S.

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1. GENERAL PROGRAM SUMMARY

1.1 TEST AND OPTIONS

1.1.1 TEST

SECTION	ROUTINE	INTENT	APPLICABLE SENSE SWITCHES
FF4 - MASTER TIMING ANALYSIS PROGRAM -MTAP-	01	RECORD AND INDICATE, BY PRINTOUT, THE CONDITION OF A MAXIMUM OF EIGHT SENSE LINES.	28,29,2B

1.1.2 SENSE SWITCH OPTIONS

SENSE SWITCH NUMBER	OPTION PROVIDED WHEN SENSE SWITCH IS ON	SECTIONS WHERE USED
28	PRINT DATA ONLY WHEN THERE IS A STATUS ERROR OR THE DEVICE BECOMES NOT READY.	FF4
29	PRINT THE DATA IN A TABULAR FORM.	FF4
2B	BYPASS THE INITIAL EXECUTION OF SAMPLE COMMAND WITHOUT SAMPLING.	FF4

**2. OPERATING PROCEDURES (DCP CONTROLLED SECTIONS)**

THIS SECTION DESCRIBES THE USER INTERFACE FOR ALL PROGRAMS OPERATING UNDER THE DIAGNOSTIC CONTROL PROGRAM (DCP). MORE DETAIL IS PROVIDED IN THE DCP USERS GUIDE.

**2.1 LOADING**

THE CE MODE SELECTOR SWITCH MUST BE IN THE 'PROCESS' POSITION. ALL CE CONTROL PANEL TOGGLE SWITCHES SHOULD BE IN THE NORMAL (DOWN) POSITION.

LOADING FROM CARDS	LOADING FROM DISK
1. IF DCP LOADED, SKIP TO STEP 5. 2. IF DISK SYSTEM - PLACE IPL SELECTOR IN 'MFCU' POSITION. 3. PLACE DCP FOLLOWED BY TEST SECTION/S INTO MFCU PRIMARY HOPPER. MAKE MFCU READY. 4. DEPRESS PROGRAM LOAD KEY. AFTER DCP IS LOADED, HALT 'HA' WILL OCCUR. COMMON SENSE SWITCHES MAY BE SET AT THIS TIME. 5. PLACE TEST SECTION/S INTO MFCU PRIMARY HOPPER AND MAKE MFCU READY (IF NOT ALREADY DONE). 6. IF CPU IS HALTED WITH 'HA' OR 'HE' DISPLAYED, SKIP TO STEP 8. 7. DEPRESS PROGRAM LOAD KEY. DCP WILL PRINT SECTION TERMINATE MESSAGE AND HALT, DISPLAYING 'HE'. 8. RESET THE HALT. DCP WILL LOAD THE SECTION AND PERFORM HALT 'HA'. 9. MAKE DESIRED CONSOLE SWITCH ENTRIES, IF ANY, AND RESET THE HALT.	1. SKIP TO STEP 5 IF DCP ALREADY LOADED. 2. LOAD THE CE PACK AND MAKE FILE READY. 3. PLACE THE IPL SELECTOR IN THE PROPER POSITION. (NORMALLY - REMOVABLE DISK). 4. DEPRESS PROGRAM LOAD. AFTER DCP IS LOADED, HALT 'HA' OCCURS. COMMON SENSE SWITCHES MAY NOW BE SET. 5. USE CONSOLE SWITCH ENTRY 'DXXX' TO SPECIFY THE PROGRAM/S TO BE LOADED. (SEE SECTION 2.4) 6. SET LEFTMOST SWITCH TO '0' AND RESET THE HALT. DCP WILL LOAD THE FIRST SECTION SPECIFIED AND PERFORM HALT 'HA'. 7. MAKE ANY CONSOLE SWITCH ENTRIES DESIRED AND/OR RESET THE HALT.

**2.2 PROGRAM RESTART**

DCP STORES INSTRUCTIONS STARTING AT LOCATION '0000' TO PROVIDE FOR A PROGRAM RESTART. THESE INSTRUCTIONS ALSO CHECK THE CONSOLE SWITCHES FOR A VALID ENTRY. TO PERFORM A PROGRAM RESTART, SIMPLY DEPRESS SYSTEM RESET FOLLOWED BY CPU START.

**2.3 TERMINATION**

NORMAL DCP-CONTROLLED CHAINING FROM ROUTINE TO ROUTINE PROVIDES AN AUTOMATIC TERMINATION OF A SECTION. IN ADDITION, THE CE MAY TERMINATE A SECTION AT ANY TIME BY (1) ENTERING 'EEO0' IN THE CONSOLE SWITCHES, OR BY (2) LOADING THE NEXT SECTION. IN ALL CASES, DCP PRINTS A MESSAGE AND PERFORMS HALT 'HE'. THE SECTION CAN STILL BE RESTARTED AT THIS TIME. IF NO RESTART IS DESIRED, RESET THE HALT TO LOAD THE NEXT SECTION.

**2.4 CONSOLE ADDRESS/DATA SWITCH COMMUNICATIONS**

THE ROTARY DATA SWITCHES ARE THE MEANS BY WHICH THE CE CAN COMMUNICATE WITH THE DIAGNOSTICS. ENTRIES ARE MADE AS FOLLOWS--

1. STOP CPU.
2. SET UP ROTARY SWITCHES FOR ONE OF THE FOLLOWING OPTIONS. X'S INDICATE POSITIONS WHICH VARY WITH THE NEED.
 

SWITCHES	
1    2    3    4	
*** **	*** **
F 0 X X	- TURN OFF SENSE SWITCH 'XX'. (F008 WOULD TURN OFF SSW 08).
F 1 X X	- TURN ON SENSE SWITCH 'XX'. (F108 WOULD TURN ON SSW 08).
F 2 X X	- GO TO ROUTINE 'XX' AFTER CONSOLE ENTRY FINISHED. (F202 WOULD GO TO ROUTINE 2).
E E 0 0	- TERMINATE THE CURRENT SECTION.
D X X 0	- DISK--EXECUTE SECTIONS FOR DEVICE WITH UNIT CODE 'XX'. (DE00 - EXECUTE ALL 5203 PRINTER PROGRAMS)
D X X X	- DISK--EXECUTE SECTION XXX. (DE01 - SECTION E01). (DE01 - EXECUTE SECTION E01)
- NOTE - UP TO EIGHT DISK INSTRUCTIONS MAY BE ENTERED DURING ONE ENTRY PHASE.
3. DEPRESS CPU START. (SYSTEM RESET FOLLOWED BY START WILL CALL IMMEDIATE ATTENTION TO THE SWITCHES).
4. WHEN DCP RECEIVES CONTROL, IT HALTS WITH 'HF' DISPLAYED. RESET THE HALT TO ENTER THE FIRST OPTION.
5. DCP WILL PERFORM HALT 'HU' OR 'HP'. LOAD THE NEXT OPTION AND RESET THE HALT.
6. REPEAT STEP 5 FOR AS MANY OPTIONS AS DESIRED. ALTERNATING CODES 'HU' AND 'HP' WILL SIGNAL DCP ACCEPTANCE.
7. WHEN DONE, SET LEFTMOST SWITCH TO '0' AND RESET THE HALT.

**2.5 COMMON SENSE SWITCHES**

SENSE SWITCHES ARE EQUIVALENT TO 48 TOGGLE SWITCHES NUMBERED HEXADEcimALLY 00-2F. SENSE SWITCHES 00-0F ARE RESERVED FOR STANDARD OPTIONS PROVIDED BY DCP (LISTED BELOW). SENSE SWITCHES 10-2F ARE SIGNIFICANT TO THE PARTICULAR SECTION BEING RUN. INSTRUCTIONS FOR SETTING SENSE SWITCHES ARE CONTAINED IN SECTION 2.4.

COMMON SENSE SWITCHES	
SSW NUMBER	ON (NORMAL)
00	LOOP ON SECTION.    GO TO NEXT SECTION.
01	LOOP ON ROUTINE.    GO TO NEXT ROUTINE.
02	BYPASS MANUAL INTERVENTION ROUTINES.    EXECUTE ALL ROUTINES.
03	BYPASS ERROR PRINTING.    PRINT ERROR MESSAGES.
04	BYPASS NON-ERROR PRINTING.    PRINT NON-ERROR MESSAGES.
05	USE ALTERNATE PRINTER. PRINTER KEYBOARD, IF ATTACHED, OTHERWISE, MFCU.    NORMAL PRINTER.
06	BYPASS ERROR HALTS.    HALT AFTER ERROR.
07	LOAD AND GO. BYPASS COMMENTS AND PROMPTING HALTS.    PROMPTING MODE.
08	USE 5203 RIGHT CARRIAGE.    USE LEFT CARRIAGE.
09-0F	RESERVED

2.6 CONTROL PROGRAM HALTS.

ALL CONTROL PROGRAM (DCP) HALTS USE THE CHARACTER 'H' AS THE FIRST DIGIT OF THE HALT CODE. THE SECOND DIGIT IDENTIFIES THE CONDITION ACCORDING TO THE FOLLOWING TABLE.

* HALT * CODE	CONDITION	ACTION REQUIRED
H0	INVALID RECORD FOUND WHILE LOADING.	CORRECT INVALID RECORD AND RELOAD.
H1	A DEVICE CALLED FOR BY THE TEST SECTION WAS NOT DEFINED IN THE UDT CARDS.	CHECK UDT CARDS AND RELOAD OR RESET HALT TO BYPASS THE ERROR (ERRORS COULD RESULT).
H2	DATA SWITCH ENTRY ERROR.	CORRECT DATA SWITCHES AND RESET HALT.
H3	INVALID ROUTINE PREFIX FOUND DURING CHAINING FROM ONE ROUTINE TO NEXT.	ENTER ROUTINE SELECT OPTION 'F2XX' IN DATA SWITCHES AND RESET HALT. IF THIS DOES NOT WORK, RELOAD SECTION.
H5	MFCU NOT READY OR ERROR. ERROR INDICATION SHOULD BE DISPLAYED IN THE MFCU LIGHTS.	DO A NON-PROCESS RUN-OUT, RELOAD DECK STARTING WITH RUNOUT CARD/S AND RESET THE HALT.
H6	PRINTER NOT READY OR ERROR.	CLEAR CONDITION AND RESET THE HALT. IF FAILURE PERSISTS, RUN PRINTER FUNCTION TEST. SENSE SWITCHES 03 AND 04 MAY BE USED TO BYPASS PRINTING. SET SENSE SWITCH 05 TO USE MFCU AS PRINTER.
H7	DISK ERROR.	RESET HALT TO RETRY. IF ERROR PERSISTS, RELOAD.
HA	CONTROL PROGRAM IS PREPARED TO RECEIVE DATA SWITCH ENTRY. OCCURS AFTER DCP AND SECTION LOADING.	RESET THE HALT IF NO ENTRY DESIRED. TO LOAD OPTIONS, SET UP DATA SWITCHES AND RESET THE HALT. SSW 07 MAY BE USED TO BYPASS THIS HALT.
HC	DISK LOADER REQUIRES SPECIFICATION OF SECTIONS TO BE LOADED FROM DISK.	IF NO ENTRY HAS BEEN MADE PREVIOUSLY, LOAD PROGRAM SELECTION ENTRY 'DXXX' AND RESET THE HALT. UP TO EIGHT ENTRIES MAY BE MADE. IF ENTRIES HAVE EVER BEEN MADE, THE PROGRAMS MAY BE REPEATED BY RESETTING THE HALT.
HD	SECTION JUST TERMINATED HAS SPECIFIED NEXT SECTION TO BE RUN. ARR CONTAINS -DXXX- WHERE -XXX- IS THE PROGRAM IDENTIFICATION.	LOAD SPECIFIED SECTION IN MFCU PRIMARY HOPPER AND RESET THE HALT.
HE	CURRENT SECTION TERMINATED.	RESET HALT TO LOAD NEXT SECTION. SECTION MAY BE RESTARTED BY SYSTEM RESET/START.
HF	DCP HALTS WITH 'HF' DISPLAYED WHENEVER A VALID DATA SWITCH ENTRY IS RECOGNIZED. AS DCP ACCEPTS ENTRIES, ALTERNATING HALTS 'HU' AND 'HP' OCCUR.	LOAD A VALID DATA SWITCH ENTRY AND RESET THE HALT. REPEAT FOR ALTERNATING HALTS 'HU' AND 'HP'. TO TERMINATE ENTRY PROCEDURE, ROTATE LEFT-MOST SWITCH TO ZERO AND RESET HALT.



**2.7 OPERATING PROCEDURES FOR MASTER TIMING ANALYSIS PROGRAM (MTAP)**  
 THIS SECTION DESCRIBES THE USER INFORMATION PECULIAR TO THE OPERATION OF MTAP AND ITS ASSOCIATED TIMING ANALYSIS PROGRAMS (TAP'S)

**2.7.1 LOADING**

MTAP MAY BE LOADED FROM CARDS OR DISK AS DESCRIBED ABOVE. ONCE MTAP HAS BEEN LOADED, A TAP WILL BE LOADED EACH TIME THE -FF- HALT IS RESET. THE ACTION REQUIRED TO SET UP TAPS FOR LOADING FROM CARDS OR DISK IS DESCRIBED UNDER THE -FF- HALT CODE IN SECTION 2.7.6. IF THE TWO LEFT CONSOLE SWITCHES ARE SET AT -AA- THE PREVIOUS TAP WILL BE RE-EXECUTED.

NOTE--EACH TIME A NEW DEVICE IS TO BE TESTED, MTAP MUST BE RELOADED.

**2.7.2 PROGRAM IDENTIFICATION**

THE PROGRAM ID IS IN COLUMNS 89-91. THE ID OF MTAP IS -FF4-. TAP ID'S BEGIN AT -001- AND GO THRU -OFF-.

**2.7.3 DECK CONFIGURATION**

THE DECKS NECESSARY TO RUN A TAP ARE DCP, MTAP AND THE REQUIRED TAP. THE DECK SEQUENCE IS AS SHOWN AT 4.1.1.6.

**2.7.4 TERMINATION**

ANY TAP MAY BE TERMINATED AT ANY POINT IN ITS OPERATION BY PRESSING STOP AND THEN SYSTEM RESET.

**2.7.5 SENSE SWITCHES**

THE SENSE SWITCHES UNIQUE TO MTAP AND THE FUNCTIONS OF EACH ARE AS FOLLOWS.

SENSE SWITCH NUMBER	ON	OFF
28	REPEAT EXECUTION OF COMMANDS AND THE REQUIRED SAMPLING. THERE WILL BE NO DATA PRINTED UNTIL A STATUS ERROR OR A DEVICE NOT-READY CONDITION OCCURS. THE DATA WHICH WILL THEN BE PRINTED WILL BE ONLY THE ONE SET OF SAMPLES WHICH WERE TAKEN IMMEDIATELY PRECEDING OR DURING THE OCCURRENCE OF THE STATUS ERROR OR NOT-READY CONDITION.	THE DATA WILL NORMALLY BE PRINTED AT THE COMPLETION OF SAMPLING OF THE SPECIFIED NUMBER OF COMMANDS. A STATUS ERROR OR DEVICE NOT-READY CONDITION WILL CAUSE A PRINTOUT OF DATA, BUT THE DATA WILL BE THE COMBINED RESULT OF ALL SAMPLES TAKEN.
29	THE DATA WILL BE PRINTED IN A TABULAR FORM. THIS OPTION SHOULD BE SELECTED IF THE OUTPUT DEVICE IS OTHER THAN THE LINE PRINTER. NOTE--A SCOPE TYPE PRINTOUT OF THE SAME IDENTICAL INFORMATION MAY BE RECEIVED FOLLOWING THE TABULAR PRINTOUT IF THE DATA SWITCHES ARE AT -FF- WHEN THE TABULAR PRINTOUT IS COMPLETED.	THE DATA WILL BE PRESENTED IN A SCOPE TYPE GRAPHIC PRINTOUT.
2B	THIS OPTION IS APPLICABLE ONLY WHEN RUNNING TAP'S ON THE MFCU BECAUSE THE FUNCTION IS AUTOMATIC FOR TAP'S ON ALL OTHER DEVICES. THIS OPTION WILL BYPASS THE NORMAL INITIALIZING PRIOR TO FIRST SAMPLING. IT MAY BE NECESSARY TO USE THIS OPTION WHEN THE PROBLEM PREVENTS PROPER DEVICE OPERATION THRU THE NORMAL SAMPLE TIME. ITS NEED MAY BE INDICATED BY DATA WHICH INDICATES NO LEVEL CHANGE.	WHEN RUNNING TAP'S ON THE MFCU, ALL OF THE COMMANDS FROM THE COMMAND TABLE WILL BE EXECUTED ONCE WITH NO SAMPLING DONE FOLLOWING THE NORMAL SAMPLE COMMAND. THIS IS DONE TO INSURE PROPER INITIALIZATION PRIOR TO EXECUTION OF THE FIRST SAMPLE COMMAND SO THAT THE DATA WILL BE AS EXPECTED.

**2.7.6 HALTS**

THE HALTS UNIQUE TO MTAP ARE LISTED AND EXPLAINED BELOW.

HALT CODE	CONDITION	ACTION REQUIRED
F9	THIS HALT OCCURS IF THE REQUIRED COMMANDS WERE ISSUED, BUT SAMPLING WAS NOT PERFORMED. IT MAY OCCUR BECAUSE OF NOT ENOUGH CARDS, THE DEVICE BEING SAMPLED NOT BEING READY, ETC.	THE TEST MUST BE REPEATED. THIS MAY BE DONE BY MAKING THE DEVICE READY IN THE PRESCRIBED MANNER, SETTING THE TWO LEFT ADDRESS SWITCHES TO -AA- AND RESETTING THE HALT.
FE	THIS HALT IS SPECIFIED BY THE M2 CARD IN THE TAP DECK TO ALLOW FOR OPERATOR INTERVENTION.	THE TASK NORMALLY SPECIFIED IN A CONTROL CARD MESSAGE SHOULD BE DONE AT THIS TIME. THE HALT SHOULD THEN BE RESET TO CONTINUE.
FF	THE PROGRAM IS READY TO LOAD A TAP DECK. THIS HALT OCCURS AT THE VERY BEGINNING OF PROGRAM EXECUTION BEFORE THE FIRST TAP IS LOADED. THE SAME HALT ALSO OCCURS AT THE COMPLETION OF THE DATA PRINTOUT, WHICH IS AGAIN AN INDICATION THAT A TAP MAY BE LOADED OR THAT THE TWO LEFT ADDRESS SWITCHES MAY BE SET TO -AA- FOR RE-EXECUTION OF THE PREVIOUSLY LOADED TAP. A SYSTEM RESET, START FROM ANYWHERE IN THE PROGRAM WILL ALSO RESULT IN THE SAME HALT AND THE SAME CONDITION.	LOADING FROM CARDS: THE DESIRED TAP DECK MUST BE LOADED INTO THE PRIMARY FEED, THE MFCU MADE READY AND THE HALT RESET TO LOAD THE PROGRAM. WHEN RUNNING ON THE MFCU THE SECONDARY MUST BE MADE READY WITH 12 CARDS AND THERE MUST BE 12 CARDS BEHIND THE TAP DECK BEFORE THE HALT IS RESET. IF A TAP DECK HAS ALREADY BEEN LOADED AND IT IS DESIRED TO REPEAT THE TEST, THE TWO LEFT ADDRESS SWITCHES MUST BE SET TO -AA- BEFORE THE HALT IS RESET. BOTH FEEDS MUST AGAIN BE READY WITH THE SAME NUMBER OF CARDS.  LOADING FROM DISK: SELECT THE TAP TO BE RUN BY SETTING THE CONSOLE SWITCHES TO OXXX WHERE XXX IS THE ID OF THE TAP DESIRED. WHEN THE SWITCHES ARE SET TO THE DESIRED TAP ID, RESET THE HALT.

**2.7.7 RUNNING**

THE DEVICE BEING SAMPLED MUST BE READY AT THE TIME THE -FF- OR -F9- HALT IS RESET. THIS IS NECESSARY EVEN THOUGH THE COMMAND BEING ISSUED DOES NOT REQUIRE A READY DEVICE.

3. INDEX TABLE FOR HALTS

INDEX NUMBER "XX"	MEANING OF HALT
F9	INDICATES SAMPLING WAS NOT PERFORMED AS EXPECTED.
FE	ALLOWS FOR OPERATOR INTERVENTION.
FF	THE PROGRAM IS NOW READY TO LOAD A TAP.

4. DETAILED DESCRIPTION OF TEST

4.1 SECTION FF4

4.1.1 ROUTINE 1 - MASTER TIMING ANALYSIS PROGRAM (MTAP)

THIS PROGRAM IS WRITTEN TO UTILIZE A SET OF CONTROL CARDS CALLED A TIMING ANALYSIS PROGRAM (TAP) WHICH WILL CAUSE IT TO RECORD AND PRINTOUT SPECIFIC TIMINGS.  
 THE PROGRAM HAS 5 INTERRELATED FUNCTIONS.

4.1.1.1 INITIALIZING

THIS SECTION CONTROLS THE LOADING OF THE TAP'S WHETHER FROM CARDS OR DISK. IT PRINTS THE CONTENTS OF EACH CARD AS IT IS READ AND MODIFIES THE PROGRAM TO PERFORM AS SPECIFIED IN THE FOLLOWING AREAS.

4.1.1.1.1 COMMANDS AND/OR DELAYS

THERE MAY BE UP TO 7 COMMANDS AND/OR DELAYS.  
 FOR FURTHER DETAILS REFER TO M1 CARD INFORMATION.

4.1.1.1.2 LINES TO BE SAMPLED AND RECORDED

BITS FROM 2 DIFFERENT SENSE COMMANDS MAY BE SAMPLED AND RECORDED. ONLY BITS FROM 2 OF THE POSSIBLE 4 BYTES INVOLVED MAY BE SAMPLED. A TOTAL OF 8 OF THE POSSIBLE 16 BITS IN THOSE 2 BYTES MAY BE SAMPLED.  
 FOR FURTHER DETAILS REFER TO M2 CARD INFORMATION (COLUMNS 05-20).

4.1.1.1.3 SAMPLE TIME

THIS IS A DECIMAL NUMBER BETWEEN 1 AND 999 WHICH SPECIFIED THE TIME BETWEEN SAMPLES IN INCREMENTS OF 50 MICRO-SECONDS.

4.1.1.1.4 NUMBER OF SAMPLES

THIS IS A DECIMAL NUMBER BETWEEN 1 AND 250 WHICH SPECIFIED HOW MANY SAMPLES WILL BE TAKEN.

4.1.1.1.5 NUMBER OF COMMANDS TO BE SAMPLED

THIS IS A DECIMAL NUMBER BETWEEN 1 AND 9999 WHICH SPECIFIES HOW MANY TIMES THE COMMAND WHICH IS BEING ISSUED FOR SAMPLING PURPOSES WILL BE EXECUTED AND SAMPLED. AN ERROR OR NOT READY CONDITION WILL TERMINATE SAMPLING AND CAUSE A DATA PRINTOUT REGARDLESS OF THE NUMBER.

4.1.1.1.6 HALT REQUEST

THIS ALLOWS FOR AN -FE- HALT FOLLOWING THE LOADING OF THE TAP FOR MANUAL INTERVENTION, IF REQUIRED.

4.1.1.1.7 LOAD I/O'S

THIS PROVIDES FOR THE SETTING UP OF THE LOAD I/O'S, WHICH ARE UNIQUE FOR EACH DEVICE.  
 FOR FURTHER DETAILS REFER TO M2 CARD INFORMATION (COLUMNS 37-42).

4.1.1.1.8 SYNC INFORMATION

THERE MAY BE UP TO 3 SEQUENTIAL SYNC'S. EACH SYNC SPECIFICATION MAY ALSO CALL FOR A DELAY OF FROM 50 MICRO-SECONDS TO .5 SECONDS FOLLOWING THE OCCURRENCE OF THE SYNC. ONE DELAY ONLY, WITH NO SYNC REQUIRED, MAY BE SPECIFIED BY LEAVING THE FINAL SYNC SENSE AREA BLANK.

IT IS ALSO POSSIBLE TO SPECIFY THE SYNC AS THE GOING OFF OF A TEST I/O CONDITION. THIS REQUIRES A -T- IN COLUMN 51 AND THE TIO 'Q' CODE IN COLUMNS 53 & 54. ALL OTHER SYNC INFORMATION AREA MUST BE BLANK WHEN USING A TIO SYNC.

FOR FURTHER DETAILS REFER TO M2 CARD INFORMATION (COLUMNS 51-86).

4.1.1.2 COMMAND EXECUTION

THIS SECTION HANDLES ALL LOAD I/O'S INCLUDING THOSE WHICH REQUIRE SPECIAL SETUPS BECAUSE OF SPECIFIC DEVICE REQUIREMENTS. IT ALSO HANDLES EXECUTION OF ALL COMMANDS, SAMPLED AND NON-SAMPLED.

4.1.1.3 SYNC

THIS SECTION WILL REMAIN IN CONTROL UNTIL SUCH TIME AS ALL SYNC CONDITIONS SPECIFIED HAVE BEEN FULFILLED

4.1.1.4 SAMPLING

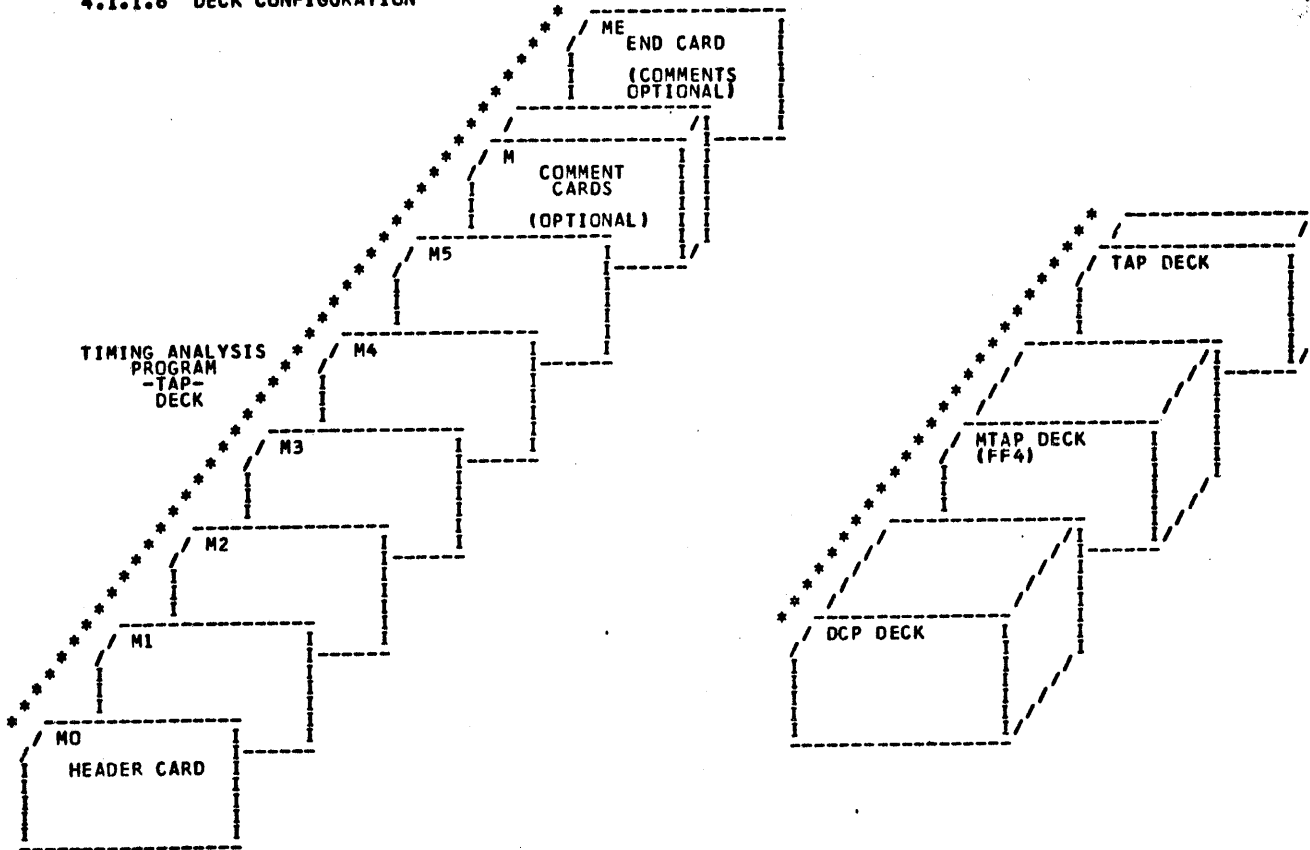
THIS SECTION WILL SENSE AND STORE THE UP AND DOWN LEVELS OF THE LINES CONTAINED IN THE SPECIFIED SENSE BYTES. THE INFORMATION WILL BE STORED IN SUCH A WAY THAT THE EARLIEST AND THE LATEST EXCURSION OF EACH LINE CHANGE WILL BE RECORDED. DATA COLLECTION WILL CONTINUE UNTIL THE SPECIFIED NUMBER OF SAMPLES HAVE BEEN TAKEN.

4.1.1.5 OUTPUT

THIS SECTION WILL SELECT THE INFORMATION FOR THE LINES SPECIFIED AND PRINT IT IN THE FORMAT SPECIFIED. THE NORMAL FORMAT WILL BE A GRAPHIC SCOPE TYPE PRINTOUT. IT WILL SHOW THE UP AND DOWN CONDITIONS OF THE SPECIFIED LINES AND THE EARLIEST AND LATEST TIME OF ANY LEVEL CHANGE. EACH LINE WILL BE IDENTIFIED FROM THE NAME INFORMATION WHICH IS ENTERED BY MEANS OF AN M3 AND AN M4 CARD. A TABULAR TYPE OUTPUT, WHICH CONTAINS THE SAME INFORMATION, MAY BE SPECIFIED BY TURNING ON SENSE SWITCH -29- AFTER MTAP HAS BEEN LOADED. A SCOPE TYPE PRINTOUT OF THE SAME IDENTICAL INFORMATION MAY BE RECEIVED FOLLOWING THE TABULAR PRINT OUT IF THE DATA SWITCHES ARE AT -FF- WHEN THE TABULAR PRINTOUT IS COMPLETED.

NOTE: THERE IS A TIME DELAY OF A MINIMUM OF 115 MICRO-SECONDS BETWEEN THE EXECUTION OF THE START I/O TO BE SAMPLED AND THE FIRST DATA THAT CAN BE SAMPLED. THEREFORE, IF THERE IS NO SYNC SPECIFIED, OR THE SYNC LINE CHANGES AT THE TIME OF THE SIO, THE PRINTOUT WILL VARY FROM WHAT WILL BE SEEN WITH A SCOPE. THE AMOUNT OF VARIANCE WILL DEPEND UPON THE SAMPLE TIME.

4.1.1.6 DECK CONFIGURATION



4.1.1.7 CONTROL CARD CONFIGURATION

```

*****
*
*                               MO CARD
*
*****
*
*   HEADER CARD.
*
* COLUMN
* 01  -M-
* 02  -O-
* 03-11 -BLANK-
* 12  -P-
* 13  -N-
* 14  -BLANK-
* 15-21 PART NUMBER
* 22  -BLANK-
* 23  -E-
* 24  -C-
* 25  -BLANK-
* 26-32 EC NUMBER (RIGHT JUSTIFIED)
* 33-87 TAP PROGRAM NAME
* 88  -BLANK-
* 89  * PROGRAM
* 90  * IDENTIFICATION
* 91  * NUMBER
* 92  * ENGINEERING CHANGE LEVEL
* 93  * CARD
* 94  * DECK
* 95  * SEQUENCE
* 96  * NUMBER
*****
    
```

```

*****
*
*                               M1 CARD
*
*****
*
*   THIS CARD CONTAINS COMMAND AND DELAY INFORMATION.
*
* COLUMN
* 01  -M-
* 02  -I-
* 03  -BLANK-
* 04  -BLANK-
* 05  * EACH AREA MAY
* 06  * CONTAIN A
* 07  * DELAY OR
* 08  * A COMMAND
* 09  *
* 10  *
* 11  *
* 12  *
* 13-16
* 17-20
* 21-24
* 25-28
* 29-32
* 33-36
* 37-40
* 41-44
* 45-48
* 49-52
* 53-56
* 57-60
* 61-64
* 65-68
* 69-72
* 73-76
* 77-80
* 81-84
* 85-88
* 89  * PROGRAM
* 90  * IDENTIFICATION
* 91  * NUMBER
* 92  * ENGINEERING CHANGE LEVEL
* 93  * CARD
* 94  * DECK
* 95  * SEQUENCE
* 96  * NUMBER
*****
*
*   THIS AREA MAY CONTAIN UP TO 7 COMMANDS AND/OR DELAYS.
*
*   COMMANDS:
*
*   EACH COMMAND IS FOUR CHARACTERS LONG AND CONTAINS THE Q AND R BYTE OF THE DESIRED COMMAND.
*   SAMPLING WILL BE DONE FOLLOWING EXECUTION OF THE LAST COMMAND ONLY.
*   THE LAST COMMAND IS THE ONE IMMEDIATELY PRECEEDING A -0000-.
*
*   DELAYS:
*
*   EACH DELAY SPECIFICATION AREA IS 4 DIGITS LONG AND MUST BEGIN WITH A -0-.
*   THE LAST 3 DIGITS ARE A DECIMAL NUMBER OF 100 MSEC INCREMENTS OF DELAY BETWEEN COMMANDS.
*
*   THIS AREA MAY CONTAIN THE FUNCTION OF THE COMMAND BEING SAMPLED IN PLAIN ENGLISH.
*   THIS AREA MAY BE USED FOR COMMENTS.
*****
    
```

M2 CARD

THIS CARD CONTAINS INFORMATION REGARDING BITS TO BE RECORDED, SAMPLE TIME, NUMBER OF SAMPLES, LOAD I/O'S REQUIRED, SYNC'S ETC.

COLUMN

01 -M-  
02 -2-  
03 -BLANK-  
04 -BLANK-

05 \* FIRST SENSE COMMAND. Q BYTE ONLY.  
06 \*  
07 \* SENSE BYTE CONTAINING DESIRED INFORMATION. LOW CORE BYTE -00-. HIGH CORE BYTE -01-.  
08 \*  
09 \* BITS -IN HEX- OF BYTE SPECIFIED TO BE INCLUDED IN PRINTED OUTPUT. MAXIMUM OF 8 BITS MAY BE SPECIFIED ON CARD.  
10 \*  
11 \* CONTAINS -OR- IF BYTE SPECIFIED ABOVE IS TO BE CONTINUOUSLY SAMPLED EVERY 50 MICROSECONDS.  
12 \*

13 \* SECOND SENSE COMMAND, IF REQUIRED. IT MAY BE THE SAME AS THE FIRST WITH THE OTHER BYTE SPECIFIED.  
14 \*  
15 \* SPECIFIES SIGNIFICANT BYTE OF THIS SENSE AS COLUMNS 7,8 DO FOR THE FIRST SENSE.  
16 \*  
17 \* BITS -IN HEX- OF BYTE DEFINED ABOVE. 8 BIT MAXIMUM INCLUDES CONTENTS OF COLUMNS 9,10,17 AND 18.  
18 \*  
19 \* SAME AS COLUMNS 11,12. ONLY ONE -OR- MAY BE SPECIFIED. THE FIRST ONE WILL ASSUME PRIORITY.  
20 \*

21 -0-  
22 \* SAMPLE TIME IN 50 MICROSECOND INCREMENTS. IT MUST BE FROM 001 TO 999.  
23 \*  
24 \*  
25 -BLANK-  
26 \* NUMBER OF SAMPLES TO BE TAKEN. MUST NOT EXCEED 250.  
27 \*  
28 \*  
29 -BLANK-  
30 \* NUMBER OF COMMANDS TO BE SAMPLED. MUST BE FROM 0001 TO 9999.  
31 \*  
32 \*  
33 \*  
34 -BLANK-  
35 \* HALT REQUEST. MUST CONTAIN AN -H- IF -FE- HALT IS DESIRED FOLLOWING THE LOADING OF THE COMPLETE -TAP-.  
36 -BLANK-  
37 \* REQUIRED LOAD-I/O Q CODE FOR DEVICE BEING TESTED.  
38 \*  
39 \* ADDITIONAL LOAD-I/O Q CODE IF REQUIRED. IF NOT REQUIRED, RE-INTER SAME ONE ENTERED IN COLUMNS 37,38.  
40 \*  
41 \* ADDITIONAL LOAD-I/O Q CODE IF REQUIRED. IF NOT REQUIRED, RE-INTER SAME ONE ENTERED IN COLUMNS 37,38.  
42 \*

43 \* THIS AREA MUST  
44 \* CONTAIN THE  
45 \* FOUR BYTE  
46 \* DISK CONTROL FIELD  
47 \* FOR DISK TAP'S.  
48 \* IT SHOULD BE  
49 \* BLANK IF NOT  
50 \* A DISK TAP.

51 \* SENSE COMMAND Q BYTE OF FINAL SYNC. THIS IS THE  
52 \* SYNC TO SPECIFY IF ONLY ONE SYNC IS REQUIRED.  
53 \*  
54 -7- IF THE LINE LOGIC LEVEL BEGIN SYNCED ON IS TO BE DOWN. -9- IF IT IS TO BE UP.  
55 \* BIT OR BITS -IN HEX- WHICH WILL BE TESTED FOR THE LEVEL SPECIFIED ABOVE.  
56 \*  
57 \* SENSE BYTE CONTAINING THE BITS SPECIFIED ABOVE. HIGH -01-. LOW -00-.  
58 \*  
59 \* DELAY FOLLOWING THE SYNC BEFORE SAMPLING IS BEGUN. THIS IS A DECIMAL NUMBER OF 50 MICROSECOND INCREMENTS.  
60 \*  
61 \* NOTE: AREA MUST BE ALL ZEROS IF NO DELAY IS REQUIRED.  
62 \*

63 \* SENSE COMMAND Q BYTE OF FIRST SYNC IF THERE TWO, OR SECOND SYNC IF THERE ARE THREE.  
64 \*  
65 \* SAME  
66 \* TYPE  
67 \* INFORMATION  
68 \* AS SPECIFIED  
69 \* IN COLUMNS  
70 \* 53-62  
71 \* IF THIS  
72 \* SYNC  
73 \* IS  
74 \* REQUIRED

75 \* SENSE COMMAND Q BYTE OF FIRST SYNC  
76 \* IF THREE ARE REQUIRED.  
77 \* SAME  
78 \* TYPE  
79 \* INFORMATION  
80 \* AS SPECIFIED  
81 \* IN COLUMNS  
82 \* 53-62  
83 \* IF THIS  
84 \* SYNC  
85 \* IS  
86 \* REQUIRED

87 \* NO OF TIMES TO REPEATEDLY SYNC AND SAMPLE AFTER 1 COMMAND.  
88 \* MUST BE BLANK IF THIS OPERATION IS NOT DESIRED.  
89 \* PROGRAM  
90 \* IDENTIFICATION  
91 \* NUMBER  
92 \* ENGINEERING CHANGE LEVEL  
93 \* CARD  
94 \* DECK  
95 \* SEQUENCE  
96 \* NUMBER

NOTE: THE GOING OFF OF A TIO CONDITION MAY BE THE SYNC BY PLACING A -T- IN COLUMN 51 AND THE TIO -Q- CODE IN COLUMNS 53 & 54. COLUMNS 55 TO 86 MUST THEN BE BLANK.

\* NOTE: IF THIS IS A DISK TAP, THIS BYTE MAY CONTAIN ANOTHER 3RD BYTE OF THE 4 BYTE DISK CONTROL FIELD. THIS PROVIDES FOR FORWARD-REVERSE BIT MODIFICATION SO THAT A SAMPLE COMMAND CAN BE EXECUTED REPEATEDLY WITHOUT RUNNING OUT OF DISK. THIS BYTE WILL NOT BE USED UNLESS THERE ARE AT LEAST TWO COMMANDS, IN WHICH CASE THIS BYTE WILL BE USED FOR THE NON-SAMPLE COMMAND AND THE BYTE LOCATED IN COLUMNS 47 AND 48 WILL BE USED FOR THE SAMPLE COMMAND.

M3 CARD

THIS CARD CONTAINS THE FIRST HALF (9 CHARACTERS) OF THE NAME OF THE BIT BEING RECORDED. THE LAST NAME IS LIMITED TO 7 CHAR.  
THE NAME IN COLUMNS 05-13 IS FOR THE LEFT MOST BIT SPECIFIED IN COLUMNS 9-10 OF THE M2 CARD, 16-24 FOR NEXT BIT RIGHT, ETC.

COLUMN  
01 -M-  
02 -3-  
03 -BLANK-  
04 -BLANK-  
05-13 FIRST HALF OF BIT NAME, 9 CHARACTERS.  
14 -BLANK-  
15 -BLANK-  
16-24 FIRST HALF OF BIT NAME.  
25 -BLANK-  
26 -BLANK-  
27-35 FIRST HALF OF BIT NAME.  
36 -BLANK-  
37 -BLANK-  
38-46 FIRST HALF OF BIT NAME.  
47 -BLANK-  
48 -BLANK-  
49-57 FIRST HALF OF BIT NAME.  
58 -BLANK-  
59 -BLANK-  
60-68 FIRST HALF OF BIT NAME.  
69 -BLANK-  
70 -BLANK-  
71-79 FIRST HALF OF BIT NAME.  
80 -BLANK-  
81 -BLANK-  
82-88 FIRST HALF IF BIT NAME, 7 CHARACTERS ONLY.  
89 \* PROGRAM  
90 \* IDENTIFICATION  
91 \* NUMBER  
92 ENGINEERING CHANGE LEVEL  
93 \* CARD  
94 \* DECK  
95 \* SEQUENCE  
96 \* NUMBER

M4 CARD

THIS CARD CONTAINS THE SECOND HALF (9 CHARACTERS) OF THE NAME OF THE BIT BEING RECORDED. THE LAST NAME IS LIMITED TO 7 CHAR.

THIS CARD IS THE SAME AS THE M3 CARD EXCEPT THAT IT CONTAINS THE LAST HALF OF THE BIT NAMES.

M5 CARD

THIS CARD CONTAINS THE TOLERANCE LIMITS FOR UP TO 17 LEVEL CHANGES.

COLUMN  
01 -M-  
02 -5-  
03 -BLANK-  
04 -BLANK-  
05-88 \* CONTAINS UP TO 17 PAIRS OF DOUBLE HEXIDECIMAL NUMBERS WHICH INDICATE THE BEGINNING AND ENDING PRINTER LINES WHERE  
\* TRANSITION LIMITS ARE TO BE SHOWN. AN 'FF' MUST SEPARATE LIMITS OF ONE SENSE BIT FROM ANOTHER. IF NO LIMITS ARE  
\* WANTED FOR A PARTICULAR SENSE BIT, THE 'FF' MUST BE PRESENT. THE DATA ON THE CARD MUST BE TERMINATED BY AN 'FE'.

EXAMPLE: M5 0209FFFF041F232FFFFF0102FF0A0BFF1018FE

LEFT LINE OF DATA WOULD HAVE ASTERICKS IN PRINT LINES 2-9  
NEXT LINE OF DATA WOULD HAVE NO LIMITS.  
NEXT LINE OF DATA WOULD HAVE ASTERICKS IN PRINT LINES 4-31 & 30-47.  
NEXT LINE OF DATA WOULD HAVE NO LIMITS.  
NEXT LINE OF DATA WOULD HAVE NO LIMITS.  
NEXT LINE OF DATA WOULD HAVE NO LIMITS.  
NEXT LINE OF DATA WOULD HAVE ASTERICKS IN PRINT LINES 1-2.  
NEXT LINE OF DATA WOULD HAVE ASTERICKS IN PRINT LINES 10-11.  
NEXT LINE OF DATA WOULD HAVE ASTERICKS IN PRINT LINES 16-27.

IF NO LIMITS ARE WANTED, THERE MUST BE AN M5 CARD LIKE THE FOLLOWING. M5 FE

89 \* PROGRAM  
90 \* IDENTIFICATION  
91 \* NUMBER  
92 ENGINEERING CHANGE LEVEL  
93 \* CARD  
94 \* DECK  
95 \* SEQUENCE  
96 \* NUMBER

M AND ME CARDS

THE M CARD IS AN OPTIONAL COMMENT CARD, WITH ANY NUMBER OF CARDS PERMISSIBLE.  
THE ME CARD IS AN END CARD WHICH STARTS EXECUTION OF THE TAP.

COLUMN  
01 -M-  
02 -X- (MUST CONTAIN AN 'E' ON THE ME CARD, AND BE BLANK ON THE M CARD.)  
03-88 COMMENTS (OPTIONAL ON THE ME CARD)

89 \* PROGRAM  
90 \* IDENTIFICATION  
91 \* NUMBER  
92 ENGINEERING CHANGE LEVEL  
93 \* CARD  
94 \* DECK  
95 \* SEQUENCE  
96 \* NUMBER

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1. GENERAL PROGRAM SUMMARY

NOTE: DISK DRIVE 1 ALSO REFERS TO SPINDLE 0.

NOTE: DISK DRIVE 2 ALSO REFERS TO SPINDLE 1.

NOTE: IF LOADING FROM TAPE CASSETTE REFER TO BLOCK 20 (PROCEDURE FOR UPDATING A CE DIAGNOSTIC DISK PACK 5406).

1.1 DEVICE TESTS AND OPTIONS

1.1.1 DEVICE TESTS

SECTION	ROUTINE	INTENT	* APPLICABLE * * SENSE * SWITCHES *
A01 - FCU LOGIC DIAGNOSE TEST	01	THIS ROUTINE USES A HARDWARE STEP FACILITY TO SET UP THE FCU LOGIC FOR ALL KNOWN CONDITIONS AND THEN TESTS THE OUTPUT FOR SPECIFIED RESULTS. ERROR MESSAGES WILL BE PROVIDED THAT WILL EITHER DIRECTLY OR INDIRECTLY INDICATE BY THE USE OF THE FAULT TABLE THE UNITS THAT SHOULD BE REPLACED.	
	02	THIS ROUTINE USES A HARDWARE STEP FACILITY TO TEST THE HIGH PERFORMANCE ACCESS FEATURE. IF THE FEATURE IS NOT DEFINED, THIS ROUTINE IS AUTOMATICALLY BYPASSED. (5410 ONLY)	
A03 - SEEK FUNCTION TEST	01	THE CYLINDER 0 SENSE BIT IS CHECKED FOR A '1' AFTER THE ACCESS MECHANISM IS POSITIONED AT CYLINDER 0 THE CYLINDER 0 SENSE BIT IS CHECKED FOR A '0' AFTER THE ACCESS MECHANISM IS POSITIONED AT CYLINDER 1	15 1E 1F
	02	AFTER THE ACCESS IS POSITIONED AT CYLINDER 0, A 'READ ID' COMMAND IS PERFORMED USING HEAD 0 HEAD 1, HEAD 2, HEAD 3	15-16 1E-1F
	03	THE SEEK CHECK AND THE NO-OP SENSE BITS ARE TESTED FOR A '1' AFTER GIVING TWO FORWARD SEEKS WHICH SHOULD POSITION THE ACCESS MECHANISM BEYOND THE INNER LIMIT SWITCH AND ONE READ ID COMMAND WHICH SHOULD BE ACCEPTED BUT NOT EXECUTED BY THE CONTROL UNIT. THESE BITS ARE ALSO TESTED FOR A '0' AFTER A RECALIBRATE AND SENSE HAVE BEEN ISSUED.	1E 1F
	04	A SERIES OF SEEKS FORWARD AND REVERSE, FOLLOWED BY A READ ID COMMAND ARE PERFORMED	
	05	THE HEAD SETTling TIME IS MEASURED AFTER A ONE TRACK SEEK. THIS ROUTINE IS BYPASSED IF THE HIGH PERFORMANCE ACCESS FEATURE IS DEFINED. HEAD SETTling IS MEASURED IN A01 ROUTINE 02 FOR HIGH PERFORMANCE. (5410 ONLY)	
	06	THE SEEK CHECK TIMEOUT COUNTER IS CHECKED	
	07	THIS IS A CONTROL ROUTINE THAT FACILITATES STEPPING TO DISK 2 IF THAT DISK IS PRESENT	
A05--WRITE DATA FUNCTION TEST	01	THE 'NO RECORD FOUND' SENSE BIT IS TESTED FOR A '1' AFTER A 'WRITE DATA' COMMAND IS PERFORMED USING A CONTROL FIELD WHERE THE CYLINDER ADDRESS IN CORE DOES NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	15 16 1E 1F 27
	02	A SERIES OF 24 ONE SECTOR 'WRITE DATA' COMMANDS IS PERFORMED USING HEADS 0 AND 2.	15-16 1E-1F
	03	A SERIES OF 24 ONE SECTOR 'WRITE DATA' COMMANDS IS PERFORMED USING HEADS 1 AND 3.	15-16 1E-1F
	04	A 2 SECTOR 'WRITE DATA' COMMAND IS PERFORMED USING SECTORS 0 AND 1, HEADS 0 AND 2.	15-16 1E-1F
	05	HEAD SWITCHING IS CHECKED BY PERFORMING A 2 SECTOR 'WRITE DATA' COMMAND BEGINNING WITH HEAD 0 OR 2 SECTOR 23 AND ENDING WITH HEAD 1 OR 3 SECTOR 0	15-16 1E-1F
	06	THE 'END OF CYLINDER' SENSE BIT IS TESTED FOR A '1' AFTER A 2 SECTOR 'WRITE DATA' COMMAND IS PERFORMED WHICH BEGINS WITH HEAD 1 SECTOR 23 OR HEAD 3 SECTOR 23	15-16 1E-1F

SECTION	ROUTINE	INTENT	APPLICABLE SENSE SWITCHES
A06--VERIFY DATA FUNCTION TEST	01	THE 'NO RECORD FOUND' SENSE BIT IS TESTED FOR A '1' AFTER A 'VERIFY DATA' COMMAND IS PERFORMED USING A CONTROL FIELD WHERE THE CYLINDER ADDRESS IN CORE DOES NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	15-16 1E-1F
	02	A SERIES OF 24 ONE SECTOR 'WRITE DATA' AND 'VERIFY DATA' COMMANDS IS PERFORMED USING HEADS 0 AND 2	15-16 1E-1F
	03	A SERIES OF 24 ONE SECTOR 'WRITE DATA' AND 'VERIFY DATA' COMMANDS IS PERFORMED USING HEADS 1 AND 3	15-16 1E-1F
	04	A 2 SECTOR 'WRITE DATA' AND 'VERIFY DATA' COMMAND IS PERFORMED USING SECTORS 0 AND 1, HEADS 0 AND 2	15-16 1E-1F
	05	HEAD SWITCHING IS CHECKED BY PERFORMING A 2 SECTOR 'VERIFY DATA' COMMAND BEGINNING WITH HEAD 0 OR 2 SECTOR 23 AND ENDING WITH HEAD 1 OR 3 SECTOR 0	15-16 1E-1F
	06	THE 'END OF CYLINDER' SENSE BIT IS TESTED FOR A '1' AFTER A 2 SECTOR 'VERIFY DATA' COMMAND IS PERFORMED WHICH BEGINS WITH HEAD 1 SECTOR 23 OR HEAD 3 SECTOR 23	15-16 1E-1F
A07--READ DATA DIAGNOSTIC FUNCTION TEST	01	THE 'NO RECORD FOUND' SENSE BIT IS TESTED FOR A '1' AFTER A 'READ DATA DIAGNOSTIC' COMMAND IS PERFORMED USING A CONTROL FIELD WHERE THE CYLINDER ADDRESS IN CORE DOES NOT EQUAL THE CYLINDER NO. OF THE CE TRACK	15-16 1E-1F
	02	A ONE SECTOR 'WRITE DATA' AND 'READ DATA DIAGNOSTIC' COMMAND IS GIVEN USING HEADS 0 AND 2.	15-16 1E-1F
	03	A ONE SECTOR 'WRITE DATA' AND 'READ DATA DIAGNOSTIC' COMMAND IS GIVEN USING HEADS 1 AND 3.	15-16 1E-1F
	04	A 2 SECTOR 'WRITE DATA' AND 'READ DATA DIAGNOSTIC' COMMAND IS GIVEN USING SECTORS 0 AND 1, HEADS 0 AND 2	15-16 1E-1F
	05	THE 'END OF CYLINDER' SENSE BIT IS TESTED FOR A '1' AFTER A 24 SECTOR 'READ DATA DIAGNOSTIC' IS PERFORMED WHICH BEGINS AT SECTOR 0, HEAD 1 OR 3	15-16 1E-1F
A09--READ DATA FUNCTION TEST	01	THE 'NO RECORD FOUND' SENSE BIT IS TESTED FOR A '1' AFTER A 'READ DATA' COMMAND IS PERFORMED USING A CONTROL FIELD WHERE THE CYLINDER ADDRESS IN CORE DOES NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	15-16 1E-1F
	02	A SERIES OF 24 ONE SECTOR 'WRITE DATA' AND 'READ DATA' COMMANDS IS PERFORMED USING HEADS 0 AND 2	15-16 1E-1F
	03	A SERIES OF 24 ONE SECTOR 'WRITE DATA' AND 'READ DATA' COMMANDS IS PERFORMED USING HEADS 1 AND 3	15-16 1E-1F
	04	A 2 SECTOR 'WRITE DATA' AND 'READ DATA' COMMAND IS PERFORMED USING SECTORS 0 AND 1, HEADS 0 AND 2	15-16 1E-1F
	05	HEAD SWITCHING IS CHECKED BY PERFORMING A 2 SECTOR 'READ DATA' COMMAND BEGINNING WITH HEAD 0 OR 2 SECTOR 23 AND ENDING WITH HEAD 1 OR 3 SECTOR 0	15-16 1E-1F
	06	THE 'END OF CYLINDER' SENSE BIT IS TESTED FOR A '1' AFTER A 2 SECTOR 'READ DATA' COMMAND IS PERFORMED WHICH BEGINS WITH HEAD 1 SECTOR 23 OR HEAD 3 SECTOR 23	15-16 1E-1F



SECTION	ROUTINE	INTENT	APPLICABLE SENSE SWITCHES
A09--WRITE ID AND SELECT DISK	01	THE 'WRITE ID FUNCTION IS TESTED USING HEAD 0. AFTER THE WRITE IS COMPLETED, 24 VERIFY DATA COMMANDS ARE ISSUED TO CHECK THE WRITES.	15 1E-1F
	02	THE 'WRITE ID FUNCTION IS TESTED USING HEAD 1. AFTER THE WRITE IS COMPLETED, 24 VERIFY DATA COMMANDS ARE ISSUED TO CHECK THE WRITES.	15 1E-1F
	03	THE 'WRITE ID FUNCTION IS TESTED USING HEAD 2. AFTER THE WRITE IS COMPLETED, 24 VERIFY DATA COMMANDS ARE ISSUED TO CHECK THE WRITES.	16 1E-1F
	04	THE 'WRITE ID FUNCTION IS TESTED USING HEAD 3. AFTER THE WRITE IS COMPLETED, 24 VERIFY DATA COMMANDS ARE ISSUED TO CHECK THE WRITES.	16 1E-1F
	05	THE ABILITY TO SELECT BOTH THE FIXED AND REMOVABLE DISK IS TESTED BY WRITING 2 DIFFERENT PATTERNS ON EACH OF THE 2 DISKS.	1E-1F
	06	THE LOGICAL END OF CYLINDER IS TESTED BY FIRST WRITING TRACK 1 ID'S ON TRACK 0 OF THE CE CYLINDER, AND THEN DOING A 24 SECTOR VERIFY DATA COMMAND ON TRACK 0 AND TESTING FOR END OF CYLINDER.	1E-1F
	07	THIS IS A CONTROL ROUTINE THAT FACILITATES STEPPING TO DISK 2 IF THAT DISK IS PRESENT	1E-1F
	08	THE ABILITY TO INHIBIT WRITING IS TESTED BY FIRST WRITING ONE SECTOR OF FF WITH THE FILE WRITE SWITCH ON AND THEN WRITING ONE SECTOR OF 00 WITH THE FILE WRITE SWITCH OFF.	1E-1F
A0A--SCAN EQUAL FUNCTION TEST	01	THE 'NO RECORD FOUND' SENSE BIT IS TESTED FOR A '1' AFTER A 'SCAN EQUAL' COMMAND IS PERFORMED USING A CONTROL FIELD WHERE THE CYLINDER ADDRESS IN CORE DOES NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	15-16 1E-1F
	02	A SCAN FOUND CONDITION IS GENERATED AND THEN TESTED FOR BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN EQUAL' COMMAND WHERE THE DATA ON THE DISK IS EQUAL TO THE DATA FIELD IN CORE	15-16 1E-1F
	03	THE SCAN EQUAL SENSE BIT IS TESTED FOR A '1' AFTER GENERATING A SCAN EQUAL CONDITION BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN EQUAL' COMMAND WHERE THE DATA ON THE DISK IS EQUAL TO THE DATA FIELD IN CORE	15-16 1E-1F
	04	THE SCAN EQUAL SENSE BIT IS TESTED FOR A '0' AFTER GENERATING A SCAN NOT EQUAL CONDITION BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN EQUAL' COMMAND WHERE THE DATA ON THE DISK IS NOT EQUAL TO THE DATA FIELD IN CORE	15-16 1E-1F
	05	A SCAN FOUND CONDITION AND A '1' FOR THE SCAN EQUAL SENSE BIT ARE TESTED FOR AFTER EACH PASS THROUGH A SERIES OF 24 SECTOR 'SCAN EQUAL' COMMANDS WHERE ONE SECTOR ON THE DISK IS EQUAL TO THE DATA IN CORE AND 23 SECTORS ON THE DISK ARE NOT EQUAL TO THE DATA IN CORE. 24 PASSES ARE MADE AND THE EQUAL SECTOR IS MOVED DOWN THE TRACK ONE SECTOR FOR EACH OF THE 24 PASSES.	15-16 1E-1F
	06	THE 'END OF CYLINDER' SENSE BIT IS TESTED FOR A '1' AFTER A 2 SECTOR 'SCAN EQUAL' COMMAND IS PERFORMED BEGINNING AT SECTOR 23 OF HEAD 1 OR HEAD 3 WHERE THE DATA ON THE DISK IS NOT EQUAL TO THE DATA IN CORE.	15-16 1E-1F
	07	A SCAN FOUND CONDITION IS GENERATED AND THEN TESTED FOR BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN EQUAL' WHERE BOTH THE DATA ON THE DISK AND THE DATA IN CORE COMPRISES 256 BYTES OF '55'	15-16 1E-1F
	08	A SCAN FOUND CONDITION IS GENERATED AND THEN TESTED FOR BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN EQUAL' WHERE ONE BYTE OF DATA ON THE DISK IS EQUAL TO ONE BYTE OF DATA IN CORE AND THE COMPARE FUNCTION OF THE REMAINING 255 BYTES OF DATA IS MASKED OFF WITH 255 BYTES OF 'FF'	15-16 1E-1F

SECTION	ROUTINE	APPLICABLE SENSE SWITCHES	
AOB--SCAN LOW OR EQUAL FUNCTION TEST	01	THE 'NO RECORD FOUND' SENSE BIT IS TESTED FOR A '1' AFTER A 'SCAN LOW OR EQUAL' COMMAND IS PERFORMED USING A CONTROL FIELD WHERE THE CYLINDER ADDRESS IN CORE DOES NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	15-16 1E-1F
	02	A SCAN FOUND CONDITION IS GENERATED AND THEN TESTED FOR BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN LOW OR EQUAL' COMMAND WHERE THE DATA ON THE DISK IS EQUAL TO THE DATA FIELD IN CORE	15-16 1E-1F
	03	THE SCAN EQUAL SENSE BIT IS TESTED FOR A '1' AFTER GENERATING A SCAN EQUAL CONDITION BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN LOW OR EQUAL' COMMAND WHERE THE DATA ON THE DISK IS EQUAL TO THE DATA FIELD IN CORE	15-16 1E-1F
	04	THE SCAN EQUAL SENSE BIT IS TESTED FOR A '0' AFTER GENERATING A SCAN NOT EQUAL BUT LOW CONDITION BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN LOW OR EQUAL' COMMAND WHERE THE DATA ON THE DISK IS NOT EQUAL BUT IS LOWER THAN THE DATA FIELD IN CORE	15-16 1E-1F
	05	A SCAN FOUND CONDITION IS TESTED FOR AFTER EACH PASS THROUGH A SERIES OF 24 SECTOR 'SCAN LOW OR EQUAL' COMMANDS WHERE ONE SECTOR ON THE DISK IS WRITTEN WITH DATA THAT IS EQUAL TO THE DATA IN CORE, AND 23 SECTORS HAVE BEEN WRITTEN WITH DATA THAT IS HIGHER THAN THE DATA IN CORE. 24 PASSES ARE MADE AND THE EQUAL SECTOR IS MOVED DOWN THE TRACK ONE SECTOR FOR EACH OF THE 24 PASSES.	15-16 1E-1F
	06	THE 'END OF CYLINDER' SENSE BIT IS TESTED FOR A '1' AFTER A 2 SECTOR 'SCAN LOW OR EQUAL' COMMAND IS PERFORMED BEGINNING AT SECTOR 23 OF HEAD 1 OR HEAD 3 WHERE THE ON THE DISK IS NOT LOW OR EQUAL TO THE DATA IN CORE	15-16 1E-1F
	07	A SCAN FOUND CONDITION IS GENERATED AND THEN TESTED FOR BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN LOW OR EQUAL' WHERE BOTH THE DATA ON THE DISK AND THE DATA IN CORE COMPRISES 256 BYTES OF '55'	15-16 1E-1F
	08	A SCAN FOUND CONDITION IS GENERATED AND THEN TESTED FOR BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN LOW OR EQUAL' WHERE ONE BYTE OF DATA ON THE DISK IS EQUAL TO ONE BYTE OF DATA IN CORE AND THE COMPARE FUNCTION OF THE REMAINING 255 BYTES OF DATA IS MASKED OFF WITH 255 BYTES OF 'FF'	15-16 1E-1F
AOC--SCAN HIGH OR EQUAL FUNCTION TEST	01	THE 'NO RECORD FOUND' SENSE BIT IS TESTED FOR A '1' AFTER A 'SCAN HIGH OR EQUAL' COMMAND IS PERFORMED USING A CONTROL FIELD WHERE THE CYLINDER ADDRESS IN CORE DOES NOT EQUAL THE CYLINDER NUMBER OF THE CE TR.	15-16 1E-1F
	02	A SCAN FOUND CONDITION IS GENERATED AND THEN TESTED FOR BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN HIGH OR EQUAL' COMMAND WHERE THE DATA ON THE DISK IS EQUAL TO THE DATA FIELD IN CORE	15-16 1E-1F
	03	THE SCAN EQUAL SENSE BIT IS TESTED FOR A '1' AFTER GENERATING A SCAN EQUAL CONDITION BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN HIGH OR EQUAL' COMMAND WHERE THE DATA ON THE DISK IS EQUAL TO THE DATA FIELD IN CORE	15-16 1E-1F
	04	THE SCAN EQUAL SENSE BIT IS TESTED FOR A '0' AFTER GENERATING A SCAN NOT EQUAL BUT HIGH CONDITION BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN HIGH OR EQUAL' COMMAND WHERE THE DATA FIELD IN CORE IS HIGH	15-16 1E-1F
	05	A SCAN FOUND CONDITION IS TESTED FOR AFTER EACH PASS THROUGH A SERIES OF 24 SECTOR 'SCAN HIGH OR EQUAL' COMMANDS WHERE ONE SECTOR ON THE DISK IS WRITTEN WITH DATA THAT IS EQUAL AND 23 SECTORS HAVE BEEN WRITTEN WITH DATA THAT IS LOWER THAN THE DATA THAT IS IN CORE. 24 PASSES ARE MADE, WITH THE EQUAL SECTOR BEING MOVED DOWN THE TRACK 1 SECTOR FOR EACH OF THE 24 PASSES	15-16 1E-1F
	06	THE 'END OF CYLINDER' SENSE BIT IS TESTED FOR A '1' AFTER A 2 SECTOR 'SCAN HIGH OR EQUAL' COMMAND IS PERFORMED BEGINNING AT SECTOR 23 OF HEAD 1 OR HEAD 3 WHERE THE DATA ON THE DISK IS NOT HIGH OR EQUAL TO THE DATA IN CORE	15-16 1E-1F
	07	A SCAN FOUND CONDITION IS GENERATED AND THEN TESTED FOR BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN HIGH OR EQUAL' WHERE BOTH THE DATA ON THE DISK AND THE DATA IN CORE COMPRISES 256 BYTES OF '55'	15-16 1E-1F
	08	A SCAN FOUND CONDITION IS GENERATED AND THEN TESTED FOR BY DOING A ONE SECTOR 'WRITE DATA' FOLLOWED BY A ONE SECTOR 'SCAN HIGH OR EQUAL' WHERE ONE BYTE OF DATA ON THE DISK IS EQUAL TO ONE BYTE OF DATA IN CORE AND THE COMPARE FUNCTION OF THE REMAINING 255 BYTES OF DATA IS MASKED OFF WITH 255 BYTES OF 'FF'	15-16 1E-1F

* A0D- DISK REVOLUTION TEST	01	PROGRAM TESTS THE ROTATIONAL SPEED OF DISK DRIVE 1 FOR THE NUMBER OF REVOLUTIONS SELECTED FROM 100 TO 1500 IN INCREMENTS OF 100.	1E-1F
	02	PROGRAM TESTS THE ROTATIONAL SPEED OF DISK DRIVE 2 FOR THE NUMBER OF REVOLUTIONS SELECTED FROM 100 TO 1500 IN INCREMENTS OF 100.	1E-1F
* A0E - SEEK FUNCTION TEST	01	A 'READ ID' IS PERFORMED AFTER A 'SEEK' TO EACH CYLINDER BEGINNING WITH ZERO AND STOPPING AT MAXIMUM	1E-1F
	02	A 'READ ID' IS PERFORMED AFTER A 'SEEK' TO EACH CYLINDER BEGINNING WITH MAXIMUM AND STOPPING AT ZERO	1E-1F
	03	A 'READ ID' IS PERFORMED AFTER A 'SEEK' TO EVERY 2ND CYLINDER BEGINNING WITH ZERO AND STOPPING AT MAXIMUM	1E-1F
	04	A 'READ ID' IS PERFORMED AFTER A 'SEEK' TO EVERY 2ND CYLINDER BEGINNING WITH MAXIMUM AND STOPPING AT ZERO	1E-1F
	05	A 'READ ID' IS PERFORMED AFTER A 'SEEK' TO EVERY 9TH CYLINDER BEGINNING WITH ZERO AND STOPPING AT MAXIMUM	1E-1F
	06	A 'READ ID' IS PERFORMED AFTER A 'SEEK' TO EVERY 9TH CYLINDER BEGINNING WITH MAXIMUM AND STOPPING AT ZERO	1E-1F
	07	A 'READ ID' IS PERFORMED AFTER EACH 'SEEK', WHERE THE SEEKS CONSIST OF A SERIES OF MIXED LONG AND SHORT MOVEMENT SEEKS.	
	08	THIS ROUTINE WILL TIME A 100 TRACK SEEK IF THE HIGH PERFORMANCE ACCESS FEATURE IS DEFINED. (5410 ONLY)	1E-1F
* R01- PCU LOGIC DIAGNOSE	01	THIS ROUTINE CONTAINS ADDITIONAL TESTS OF THE TYPE CONTAINED IN SECTION A01. SENSE LINES MUST BE PLUGGED FOR THIS ROUTINE.	
	02	THIS ROUTINE WILL BE USED TO DIAGNOSE UNSAFE CONDITIONS. SENSE LINES MUST BE PLUGGED FOR THIS ROUTINE. THE CE PROBE MUST BE USED.	
* R03- DISK IPL FORMAT CHECK	01	PROGRAM READS SECTOR 00 OF TRACK 000 (IPL DATA) OF BOTH THE FIXED AND RENOVABLE DISKS. THE PROGRAM THEN INSTRUCTS THE OPERATOR TO IPL THE DISKS. THE IPL DATA IS THEN COMPARED AGAINST THE READ DATA.	1B
* R04- DISK FRIEND TEST	01	PROGRAM BUILDS A COMMANDS TABLE BY READING VARIOUS CONSOLE SWITCH SETTINGS, AS SET BY THE OPERATOR.	
	02	PROGRAM INTERPRETS AND ISSUES EACH SWITCH SETTING SEQUENTIALLY. NOTE - PROGRAM LOOPS ON THIS ROUTINE AND THE COMMANDS TABLE.	17, 18 19, 1A 1C,
	03	PROGRAM PRINTS A LOG-OUT OF THE CURRENT COMMANDS TABLE. NOTE - THIS ROUTINE MUST BE DIALED IN VIA DCP'S SSWS -P203-	

SECTION	ROUTINE		APPLICABLE * SENSE * SWITCHES *
BOA- CYLINDER 0 RESTORE PROGRAM	01	PROGRAM WILL SAVE CYLINDER 0 BY WRITING IT ON CYLINDER 3. WRITE A ONE SECTOR RESTORE PROGRAM ON CYLINDER 3 SECTOR DC. PRINTOUT THE 22 BYTE MANUAL ROUTINE.	
BOB- 5444 ADJUSTMENT ROUTINES	01	PROGRAM MEASURES HOW LONG IT TAKES FOR THE FLEXIBLE DISK TO COVER THE TRACK CROSSING CELL AFTER THE SEEK SIO, TO CHECK FOR ADJUSTMENT OF THE CLUTCHES.	10, 11, 12, 13, 27
	02 THRU 06	SAME AS ROUTINE 01 EXCEPT THAT THE ROUTINE NUMBER BECOMES THE NUMBER OF TRACKS PER SEEK.	10, 11 12, 13 27
	07	PRINTOUT STATUS, AND THE ID FIELD FOR THE CURRENT POSITION OF THE CARRAGE.	10, 11 12, 13
	08	QUICK SEEK CHECK ROUTINE.	10, 11 12, 13
	09	MINI - FRIEND	10, 11 12, 13
	0A	SCAN DISK FOR ERRORS AND FLAGGED TRACKS.	10, 11 12, 13
	0B	DATA SEPARATOR ADJUSTMENT.	10, 11 12, 13
	0C	ENCODE PLATE ADJUSTMENT. (SYMMETRY)	10, 11 12, 13
	0D	FEED BACK DELAY ADJUSTMENT (SPEED).	10, 11 12, 13
	0E	DISK READ SCOPING LOP.	10, 11 12, 13

1.1.2 OPTIONS

SENSE SWITCH OPTIONS		
SENSE SWITCH NUMBER	OPTION PROVIDED WHEN SENSE SWITCH IS ON	SECTIONS WHERE USED
10	PROGRAM WILL USE REMOVABLE DISK WHEN RUNNING.	BOB
11	PROGRAM WILL USE FIXED DISK WHEN RUNNING.	BOB
12	PROGRAM WILL USE DRIVE 1 WHEN RUNNING.	BOB
13	PROGRAM WILL USE DRIVE 2 WHEN RUNNING.	BOB
15	DO NOT TEST THE UPPER DISK (HEADS 0 & 1)	AO3, AO5, THRU AOC
16	DO NOT TEST THE LOWER DISK (HEADS 2 & 3)	AO3, AO5, THRU AOC
17	A CORE DUMP OF THE START I/O COMMAND AND ITS CONTROL FIELD IS PRINTED PRIOR TO ITS EXECUTION.	BO4
18	PROGRAM DELAYS AFTER EXECUTING A COMMAND. THE PROGRAM SENSES THE CONSOLE SWITCHES FOR THE 'TIME' OF THE DELAY. NOTE - MAXIMUM SETTING WOULD BE AN -CFFF- TO PREVENT DCP FROM STOPPING THE PROGRAM.	BO4
19	PRINT THE DATA THAT WAS READ FROM THE DISK. THE DATA IS PRINTED IN HEX FORMAT.	BO4
1A	PROGRAM HALTS AFTER EVERY COMMAND IN THE TABLE HAS BEEN EXECUTED.	BO4
1B	THE IPL AND READ FORMAT ARE PRINTED FOR VISUAL COMPARISON. NOTE - THE TWO FORMATS ARE EQUAL.	BO3
1C	THE PROGRAM WILL NOT 'PRESET' THE READ/WRITE AREA. THAT IS, THE PROGRAM WILL LEAVE WHATEVER DATA THAT IS IN THIS AREA ALONE.	BO4
1E	NEVER RUN DISK DRIVE 1	AO3 THRU AOE
1F	NEVER RUN DISK DRIVE 2	AO3 THRU AOE
20	CAUSES "PER CYCLE" OPTION TO PRINT. WITH 1 TRACK SEEKS, THIS OPTION WILL PRINT OVER 400 LINES. THIS OPTION SHOULD BE USED ONLY WHEN DATA IS NEEDED FOR ANALYSIS. THIS OPTION CAN BE RESET BY - STOP - SYSTEM RESET - TURN OFF SSW 20 - RESTART DESIRED ROUTINE. (SSW 28 OVERRIDES SSW 20)	BOB
23	CHECK FORWARD CLUTCH ONLY - ELIMINATES REVERSE MEASUREMENTS AND PRINTOUT.	BOB
24	CHECK REVERSE CLUTCH ONLY - ELIMINATES FORWARD MEASUREMENTS AND PRINTOUT.	BOB
27	USE LOWER HEAD WHEN RUNNING PROGRAM. (RTN 1 THRU 7 ONLY).	BOB
28	SNAPSHOT MODE - RUN 3 MEASUREMENTS AND RETURN TO START HALT (OVERRIDES SSW 20)	BOB
2E	RUN ROUTINE 01 THRU 06 IF SSW 2F IS ON.	BOB
2F	RUN MULT. ROUTINES - ROUTINE 01 THRU 03 IF SSW 2E IS OFF. ROUTINE 01 THRU 06 IF SSW 2E IS ON.	BOB

1.2 TIMING ANALYSIS PROGRAMS -TAPS- AND OPTIONS

USE OF TAP'S FOR THE 5444 FILE IS DESCRIBED IN THE 5444 NAPS APPENDIX B.

1.3 STAND ALONE TESTS

THERE WILL BE NO STAND ALONE TESTS

NOTE: 5444 MASTER TAPS ARE USED ONLY ON FRICTION FILES.

2. OPERATING PROCEDURES (DCP CONTROLLED SECTIONS)

THIS SECTION DESCRIBES THE USER INTERFACE FOR ALL PROGRAMS OPERATING UNDER THE DIAGNOSTIC CONTROL PROGRAM (DCP). MORE DETAIL IS PROVIDED IN THE DCP USERS GUIDE.

2.1 LOADING

THE CE MODE SELECTOR SWITCH MUST BE IN THE 'PROCESS' POSITION. ALL CE CONTROL PANEL TOGGLE SWITCHES SHOULD BE IN THE NORMAL (DOWN) POSITION.

LOADING FROM CARDS	LOADING FROM DISK
1. IF DCP LOADED, SKIP TO STEP 5. 2. IF DISK SYSTEM, PLACE IPL SELECTOR IN 'MFCU' POSITION. 3. PLACE DCP FOLLOWED BY TEST SECTION/S INTO MFCU PRIMARY HOPPER. MAKE MFCU READY. 4. DEPRESS PROGRAM LOAD KEY. AFTER DCP IS LOADED, HALT 'HA' WILL OCCUR. COMMON SENSE SWITCHES MAY BE SET AT THIS TIME. 5. PLACE TEST SECTION/S INTO MFCU PRIMARY HOPPER AND MAKE MFCU READY (IF NOT ALREADY DONE). 6. IF CPU IS HALTED WITH 'HA' OR 'HE' DISPLAYED, SKIP TO STEP 8. 7. DEPRESS PROGRAM LOAD KEY. DCP WILL PRINT SECTION TERMINATE MESSAGE AND HALT, DISPLAYING 'HE'. 8. RESET THE HALT. DCP WILL LOAD THE SECTION AND PERFORM HALT 'HA'. 9. MAKE DESIRED CONSOLE SWITCH ENTRIES, IF ANY, AND RESET THE HALT.	1. SKIP TO STEP 5 IF DCP ALREADY LOADED. 2. LOAD THE CE PACK AND MAKE FILE READY. 3. PLACE THE IPL SELECTOR IN THE PROPER POSITION. (NORMALLY - REMOVABLE DISK). 4. DEPRESS PROGRAM LOAD. (IF MODEL 5406 SEE 5406 IMP USERS GUIDE PN 5129400 FOR UNIQUE INSTRUCTIONS) AFTER DCP IS LOADED, HALT 'HA' ('FA5' ON MODEL 5406) OCCURS. COMMON SENSE SWITCHES MAY NOW BE SET. 5. USE CONSOLE SWITCH ENTRY 'DIXX' TO SPECIFY THE PROGRAM/S TO BE LOADED. (SEE SECTION 2.4) 6. SET LEFTMOST SWITCH TO '0' AND RESET THE HALT. DCP WILL LOAD THE FIRST SECTION SPECIFIED AND PERFORM HALT 'HA' ('FA5' ON MODEL 5406). 7. MAKE ANY CONSOLE SWITCH ENTRIES DESIRED AND/OR RESET THE HALT.

2.2 PROGRAM RESTART

DCP STORES INSTRUCTIONS STARTING AT LOCATION '0000' TO PROVIDE FOR A PROGRAM RESTART. THESE INSTRUCTIONS ALSO CHECK THE CONSOLE SWITCHES FOR A VALID ENTRY. TO PERFORM A PROGRAM RESTART, SIMPLY DEPRESS SYSTEM RESET FOLLOWED BY CPU START.

2.3 TERMINATION

NORMAL DCP-CONTROLLED CHAINING FROM ROUTINE TO ROUTINE PROVIDES AN AUTOMATIC TERMINATION OF A SECTION. IN ADDITION, THE CE MAY TERMINATE A SECTION AT ANY TIME BY (1) SYSTEM RESET AND ENTERING 'PE00' IN THE CONSOLE SWITCHES OR BY (2) LOADING THE NEXT SECTION. IN ALL CASES, DCP PRINTS A MESSAGE AND PERFORMS HALT 'HE' ('FE5' ON MODEL 5406). THE SECTION CAN STILL BE RESTARTED AT THIS TIME. IF NO RESTART IS DESIRED, RESET THE HALT TO LOAD THE NEXT SECTION.

2.4 CONSOLE ADDRESS/DATA SWITCH COMMUNICATIONS

THE ROTARY DATA SWITCHES ARE THE MEANS BY WHICH THE CP CAN COMMUNICATE WITH THE DIAGNOSTICS. ENTRIES ARE MADE AS FOLLOWS--

1. STOP CPU.
2. SET UP ROTARY SWITCHES FOR ONE OF THE FOLLOWING OPTIONS. X'S INDICATE POSITIONS WHICH VARY WITH THE NEED.

SWITCHES	1	2	3	4	
P	0	X	X	X	- TURN OFF SENSE SWITCH 'XX'. (P008 WOULD TURN OFF SSW 08).
P	1	X	X	X	- TURN ON SENSE SWITCH 'XX'. (P108 WOULD TURN ON SSW 08).
P	2	X	X	X	- GO TO ROUTINE 'XX' AFTER CONSOLE ENTRY FINISHED. (P202 WOULD GO TO ROUTINE 2).
E	P	0	0	0	- TERMINATE THE CURRENT SECTION.
D	X	X	0	0	- DISK--EXECUTE SECTIONS FOR DEVICE WITH UNIT CODE 'XX'. (DA00 - EXECUTE ALL DISK PROGRAMS)
D	X	X	X	X	- DISK--EXECUTE SECTION XXX. (DA01 - SECTION A01). (DA01 - EXECUTE SECTION A01)

NOTE - UP TO FOUR DISK INSTRUCTIONS MAY BE ENTERED DURING ONE ENTRY PHASE.

3. DEPRESS CPU START. (SYSTEM RESET FOLLOWED BY START WILL CALL IMMEDIATE ATTENTION TO THE SWITCHES. SEE NOTE BELOW).
4. WHEN DCP RECEIVES CONTROL, IT HALTS WITH 'HP' ('PF5' ON MODEL 5406) DISPLAYED. RESET THE HALT TO ENTER THE FIRST OPTION.
5. DCP WILL PERFORM HALT 'HU' OR 'HP' ('P05' OR 'PF5' ON MODEL 5406). LOAD THE NEXT OPTION AND RESET THE HALT.
6. REPEAT STEP 5 FOR AS MANY OPTIONS AS DESIRED. ALTERNATING CODES 'HU' AND 'HP' ('P05' OR 'PF5' ON MODEL 5406) WILL SIGNAL DCP ACCEPTANCE.
7. WHEN DONE, SET LEFTMOST SWITCH TO '0' AND RESET THE HALT.  
 NOTE: - WHEN USING P2XX IN THE SWITCHES TO GO TO A ROUTINE AFTER A SECTION HAS BEGUN, SYSTEM RESET/START SHOULD BE PERFORMED BEFORE MAKING THE ENTRY. (THIS PREVENTS ERRORS FOUND IN ONE ROUTINE FROM BEING DETECTED IN SCMP OTHER ROUTINE. IT SHOULD NOT BE PERFORMED IF OTHERWISE SPECIFIED IN THE MAPS.)

2.5 COMMON SENSE SWITCHES

SENSE SWITCHES ARE EQUIVALENT TO 48 TOGGLE SWITCHES NUMBERED HEXADECIMALLY 00-2F. SENSE SWITCHES 00-0F ARE RESERVED FOR STANDARD OPTIONS PROVIDED BY DCP (LISTED BELOW). SENSE SWITCHES 10-2F ARE SIGNIFICANT TO THE PARTICULAR SECTION BEING RUN. INSTRUCTIONS FOR SETTING SENSE SWITCHES ARE CONTAINED IN SECTION 2.4.

COMMON SENSE SWITCHES			
SSW NUMBER	I	ON	OFF (NORMAL)
00	I	LCOP ON SECTION.	GO TO NEXT SECTION.
01	I	LOOP ON ROUTINE.	GO TO NEXT ROUTINE.
02	I	BYPASS MANUAL INTERVENTION ROUTINES.	EXECUTE ALL ROUTINES.
03	I	BYPASS ERROR PRINTING.	PRINT ERROR MESSAGES.
04	I	BYPASS NON-ERROR PRINTING.	PRINT NON-ERROR MESSAGES.
05	I	USE ALTERNATE PRINTER. PRINTER KEYBOARD, IF ATTACHED. OTHERWISE, MFCU.	NORMAL PRINTER.
06	I	BYPASS ERROR HALTS.	HALT AFTER ERROR.
07	I	LOAD AND GO. BYPASS COMMENTS AND PROMPTING HALTS.	PROMPTING MODE.
08	I	USE 5203 RIGHT CARRIAGE.	USE LEFT CARRIAGE.
09	I	DON'T CLEAR SECTION SENSE SWITCHES AFTER LOADING	CLEAR SECTION SENSE SWITCHES AFTER LOADING
0A-0F	I	RESERVED	

2.6 CONTROL PROGRAM HALTS.

ALL CONTROL PROGRAM (DCP) HALTS USE THE CHARACTER 'H' AS THE FIRST DIGIT OF THE HALT CODE. THE SECOND DIGIT IDENTIFIES THE CONDITION ACCORDING TO THE FOLLOWING TABLE.

HALT CODES	MODEL	CONDITION	ACTION REQUIRED
5406	5410		
P05	H0	INVALID RECORD FOUND WHILE LOADING.	CORRECT INVALID RECORD AND RELOAD.
P15	H1	A DEVICE CALLED FOR BY THE TEST SECTION WAS NOT DEFINED IN THE UDT CARDS.	CHECK UDT CARDS AND RELOAD OR RESET HALT TO BYPASS THE ERROR (ERRORS COULD RESULT).
P25	H2	DATA SWITCH ENTRY ERROR.	CORRECT DATA SWITCHES AND RESET HALT.
P35	H3	INVALID ROUTINE PREFIX FOUND DURING CHAINING FROM ONE ROUTINE TO NEXT.	ENTER ROUTINE SELECT OPTION 'FIX' IN DATA SWITCHES AND RESET HALT. IF THIS DOES NOT WORK, RELOAD SECTION.
P55	H5	MFCU NOT READY OR ERROR. ERROR INDICATION SHOULD BE DISPLAYED IN THE MFCU LIGHTS.	DO A NON-PROCESS RUN-OUT, RELOAD DECK STARTING WITH RUNOUT CARD/S AND RESET THE HALT.
P65	H6	PRINTER NOT READY OR ERROR.	CLEAR CONDITION AND RESET THE HALT. IF FAILURE PERSISTS, RUN PRINTER FUNCTION TEST. SENSE SWITCHES 03 AND 04 MAY BE USED TO BYPASS PRINTING. SET SENSE SWITCH 05 TO USE MFCU AS PRINTER.
P75	H7	DISK ERROR.	RESET HALT TO RETRY. IF ERROR PERSISTS, RELOAD.
PA5	HA	CONTROL PROGRAM IS PREPARED TO RECEIVE DATA SWITCH ENTRY. OCCURS AFTER DCP AND SECTION LOADING.	RESET THE HALT IF NO ENTRY DESIRED. TO LOAD OPTIONS, SET UP DATA SWITCHES AND RESET THE HALT. SW 07 MAY BE USED TO BYPASS THIS HALT.
PC5	HC	DISK LOADER REQUIRES SPECIFICATION OF SECTIONS TO BE LOADED FROM DISK, OR SELECTED SECTION NOT ON DISK.	IF NO ENTRY HAS BEEN MADE PREVIOUSLY, LOAD PROGRAM SELECTION ENTRY 'DEIX' AND RESET THE HALT. UP TO EIGHT ENTRIES MAY BE MADE. IF ENTRIES HAVE EVER BEEN MADE, THE PROGRAMS MAY BE REPEATED BY RESETTING THE HALT.
PD5	HD	SECTION JUST TERMINATED HAS SPECIFIED THE NEXT SECTION TO BE RUN. THE ARR CONTAINS -DXXX- WHERE -XXX- IS THE PROGRAM IDENTIFICATION.	LOAD SPECIFIED SECTION IN MFCU PRIMARY HOPPER AND RESET THE HALT.
PE5	HP	CURRENT SECTION TERMINATED.	RESET HALT TO LOAD NEXT SECTION. SECTION MAY BE RESTARTED BY SYSTEM RESET/START.
PF5	HF	DCP HALTS WITH 'HF' DISPLAYED WHENEVER A VALID DATA SWITCH ENTRY IS RECOGNIZED. AS DCP ACCEPTS ENTRIES, ALTERNATING HALTS 'HD' AND 'HP' OCCUR.	LOAD A VALID DATA SWITCH ENTRY AND RESET THE HALT. REPEAT FOR ALTERNATING HALTS 'HD' AND 'HP'. TO TERMINATE ENTRY PROCEDURE, ROTATE LEFT-MOST SWITCH TO ZERO AND RESET HALT.

NOTE: THE 'HD' HALT WILL BE DISPLAYED AS A CAPITAL 'H' AND A LOWER CASE 'D'.

3 INDEX TABLE FOR HALTS AND PRINTOUTS

3.1 ERROR HALTS

INDEX NUMBER	MEANING OF HALT	MAP CHART REFERENCE
01 SECTION A01	AN ERROR WAS RECOGNIZED BY SECTION A01. SEE THE DETAILED ROUTINE DESCRIPTION OF A01 OR THE PCU MAPS FOR ADDITIONAL INFORMATION REGARDING THE PRINTOUT.	
01 SECTION A03	AT LEAST ONE ERROR OCCURRED WHILE SELECTING AND DOING A READ ID USING EACH HEAD	
02	AT LEAST ONE ERROR OCCURRED WHILE DOING A SERIES OF FORWARD AND REVERSE SEEKS	
03	THE NO-OP SENSE BIT WAS NOT SET AFTER GIVING A SEEK BEYOND TRACK CAPACITY FOLLOWED BY A READ ID	
04	THE HEAD SETTTLING TIME IS INCORRECT	
05	AFTER A RECALIBRATE, THE CYLINDER 0 SENSE BIT, (BYTE 1 BIT 1) WAS NOT ON.	
06	AFTER A SEEK TO CYLINDER 1, THE CYLINDER 0 SENSE BIT, (BYTE 1 BIT 1), WAS NOT OFF.	
07	AFTER A SEEK TO 47 CYLINDERS BEYOND TRACK CAPACITY, THE SEEK CHECK SENSE BIT, (BYTE 0 BIT 7), WAS NOT ON.	
08	THE NO-OP & SEEK CHECK SENSE BITS WERE NOT RESET AFTER A SENSE AND A SIO	
09	AN ERROR OCCURRED WHILE SEEKING	
0A	AFTER A SEEK AND READ ID, THE CYLINDER NUMBER READ DOES NOT EQUAL THE ONE EXPECTED.	
0B	ACCESS OVER RUN SWITCH SWITCHED TOO SOON.	
0C	AFTER ISSUING A SEEK FORWARD COMMAND OF 1 TRACK, THE SEEK BUSY SENSE BIT NEVER CAME ON.	
0E	AN ERROR OCCURRED WHILE DOING A RECALIBRATE (SEE SECTION B0B, BTN 08 & 09)	
0F	ERROR OCCURRED WHILE DOING A READ ID.	
10	WRITE DATA COMMAND DID NOT GIVE ANY ERROR WHEN ISSUED WHERE THE CONTROL FIELD CYLINDER NUMBER DOES NOT MATCH THE CYLINDER NUMBER OF THE CE TRACK	
11	THE NO RECORD FOUND SENSE BIT NOT SET AFTER ISSUING A WRITE DATA COMMAND WHERE THE CONTROL FIELD ID DOES NOT MATCH THE CYLINDER ID OF THE CE TRACK	
12	AN ERROR OR ERRORS OCCURRED WHILE DOING A WRITE DATA COMMAND USING HEADS 0 OR 2.	
13	THE SECTOR COUNTER IN THE DISK CONTROL FIELD WAS NOT STEPPED AFTER THE COMPLETION OF A ONE SECTOR WRITE DATA COMMAND	
14	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS CHANGED AFTER A ONE SECTOR WRITE DATA COMMAND	
15	THE WRITE DATA FIELD IN CORE WAS CHANGED AFTER COMPLETION OF A WRITE DATA COMMAND	
16	THE SECTOR COUNTER IN THE DISK CONTROL FIELD WAS NOT STEPPED TO PF AFTER COMPLETION OF A WRITE ID COMMAND.	
17	AN ERROR OR ERRORS OCCURRED WHILE DOING A WRITE DATA COMMAND USING HEADS 1 OR 3	
18	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS NOT STEPPED CORRECTLY AFTER THE COMPLETION OF A 2 SECTOR WRITE DATA COMMAND	
19	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS NOT STEPPED CORRECTLY AFTER THE COMPLETION OF A 2 SECTOR WRITE DATA COMMAND WHERE THERE WAS HEAD SWITCHING	
1A	AN ERROR OR ERRORS OCCURRED WHILE DOING A 2 SECTOR WRITE DATA COMMAND WITH HEAD SWITCHING	



INDEX NUMBER XXI	MEANING OF HALT	MAP CHART REFERENCE
1C	A TIO ON AN ERROR DID NOT BRANCH AFTER ATTEMPTING TO WRITE PAST THE END OF CYLINDER USING A 2 SECTOR WRITE DATA COMMAND	
1E	THE END OF CYLINDER SENSE BIT IS NOT ON AFTER ATTEMPTING A 2 SECTOR WRITE DATA COMMAND WHICH BEGINS AT SECTOR 23 OF HEAD 1 OR HEAD 3	
1F	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS CHANGED AFTER ATTEMPTING A 2 SECTOR WRITE DATA COMMAND WHICH BEGINS AT SECTOR 23 OF HEAD 1 OR HEAD 3	
20	THE VERIFY DATA COMMAND DID NOT GIVE ANY ERROR WHEN THE CYLINDER NUMBER IN THE DISK CONTROL FIELD DID NOT EQUAL THE CYLINDER NUMBER OF THE CE TRK.	
21	THE NO RECORD FOUND SENSE BIT WAS NOT SET AFTER ISSUING A VERIFY DATA COMMAND WHERE THE CYLINDER NUMBER IN THE DISK CONTROL FIELD DID NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	
22	AN ERROR OR ERRORS OCCURRED WHILE DOING A VERIFY DATA COMMAND USING HEADS 0 OR 2	
23	THE SECTOR COUNTER IN THE DISK CONTROL FIELD WAS NOT STEPPED AFTER DOING A ONE SECTOR VERIFY DATA COMMAND	
24	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS CHANGED AFTER DOING A ONE SECTOR VERIFY DATA COMMAND	
25	THE DATA FIELD IN CORE WAS CHANGED AFTER GIVING A ONE SECTOR VERIFY DATA COMMAND	
26	THE SECTOR NUMBER IN THE DISK CONTROL FIELD WAS NOT STEPPED TO 5C AT THE COMPLETION OF A WRITE ID COMMAND.	
27	AN ERROR OR ERRORS OCCURRED WHILE DOING A VERIFY DATA COMMAND USING HEADS 1 OR 3	
28	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS NOT STEPPED CORRECTLY AFTER THE COMPLETION OF A 2 SECTOR VERIFY DATA COMMAND	
29	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS NOT STEPPED CORRECTLY AFTER THE COMPLETION OF A 2 SECTOR VERIFY DATA COMMAND WHERE THERE WAS HEAD SWITCHING FROM 0 TO 1 OR 2 TO 3	
2A	A TIO ON AN ERROR DID NOT BRANCH AFTER ATTEMPTING TO VERIFY DATA PAST THE END OF CYLINDER. IF SECTION A09, THIS IS LOGICAL END OF CYLINDER.	
2C	AN ERROR OR ERRORS OCCURRED WHILE DOING A 2 SECTOR VERIFY DATA COMMAND WITH HEAD SWITCHING FROM 0 TO 1 OR 2 TO 3	
2E	THE END OF CYLINDER SENSE BIT IS NOT ON AFTER ATTEMPTING A TO VERIFY DATA TO THE END OF CYLINDER. NOTE: IF SECTION A09, THIS IS LOGICAL E.O.C.	
2F	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS CHANGED AFTER ATTEMPTING A 2 SECTOR VERIFY DATA COMMAND WHICH BEGINS AT SECTOR 23 OF HEAD 1 OR HEAD 3.	
30	THE READ DATA DIAGNOSTIC COMMAND DID NOT GIVE ANY ERROR WHEN THE CYLINDER NUMBER IN THE DISK CONTROL FIELD DID NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK.	
31	THE NO RECORD FOUND SENSE BIT WAS NOT SET AFTER ISSUING A READ DATA DIAGNOSTIC COMMAND WHERE THE CYLINDER NUMBER IN THE DISK CONTROL FIELD DID NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	
32	AN ERROR OR ERRORS OCCURRED WHILE DOING A ONE SECTOR READ DATA DIAGNOSTIC COMMAND USING HEADS 0 OR 2.	
33	THE SECTOR COUNTER IN THE DISK CONTROL FIELD WAS NOT STEPPED AFTER DOING A ONE SECTOR READ DATA DIAGNOSTIC COMMAND	
34	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS CHANGED AFTER DOING A ONE SECTOR READ DATA DIAGNOSTIC COMMAND	
35	THE WRITE DATA FIELD IN CORE WAS CHANGED AFTER GIVING A ONE SECTOR READ DATA DIAGNOSTIC COMMAND	
36	THE READ FIELD DOES NOT CONTAIN THE EXPECTED DATA AFTER A ONE SECTOR WRITE DATA AND READ DATA DIAGNOSTIC	
37	AN ERROR OR ERRORS OCCURRED WHILE DOING A ONE SECTOR READ DATA DIAGNOSTIC COMMAND USING HEADS 1 OR 3.	

INDEX NUMBER 'XX'	MEANING OF HALT	MAP CHART REFERENCE
38	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS NOT STEPPED CORRECTLY AFTER THE COMPLETION OF A 2 SECTOR READ DATA DIAGNOSTIC COMND.	
39	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS NOT STEPPED CORRECTLY AFTER A READ DATA DIAGNOSTIC COMMAND OF 24 SECTORS	
3A	AN ERROR OR ERRORS OCCURRED WHILE DOING A READ DATA DIAGNOSTIC COMMAND OF 24 SECTORS	
3C	A SEEK CHECK OCCURRED WHILE SEEKING THE CE CYLINDER	
3E	THE DISK DATA ADDRESS IS NOT AT THE CORRECT ADDRESS AT THE COMPLETION OF A WRITE OR READ OPERATION	
3F	THE DISK DATA ADDRESS WAS NOT STEPPED AFTER A WRITE COMMAND	
40	THE READ DATA COMMAND DID NOT GIVE ANY ERROR WHEN ISSUED WHERE THE DISK CONTROL FIELD CYLINDER NUMBER DOES NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	
41	THE NO RECORD FOUND SENSE BIT WAS NOT SET AFTER ISSUING A READ DATA COMMAND WHERE THE CYLINDER NUMBER IN THE DISK CONTROL FIELD DID NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	
42	AN ERROR OR ERRORS OCCURRED WHILE DOING A READ DATA COMMAND USING HEADS 0 OR 2	
43	THE SECTOR COUNTER IN THE DISK CONTROL FIELD WAS NOT STEPPED AFTER THE COMPLETION OF A READ DATA COMMAND	
44	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS CHANGED AFTER COMPLETION OF A ONE SECTOR READ DATA COMMAND	
45	THE WRITE DATA FIELD IN CORE WAS ALTERED AFTER COMPLETION OF A READ DATA COMMAND	
45	FILE SEEKED TO THE WRONG CYLINDER (AOE ONLY).	
46	THE READ FIELD DOES NOT CONTAIN THE EXPECTED DATA AFTER THE COMPLETION OF A WRITE DATA AND READ DATA COMMAND	
47	AN ERROR OR ERRORS OCCURRED WHILE DOING A READ DATA COMMAND USING HEADS 1 OR 3	
48	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS NOT STEPPED CORRECTLY AFTER THE COMPLETION OF A 2 SECTOR READ DATA COMMAND	
49	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS NOT STEPPED CORRECTLY AFTER COMPLETING A 2 SECTOR READ DATA COMMAND USING HEAD SWITCHING FROM HEAD 0 OF 2 SECTOR 23 TO HEAD 1 OR 3 SECTOR 0	
4A	AN ERROR OR ERRORS OCCURRED WHILE DOING A READ DATA COMMAND USING HEAD SWITCHING FROM HEAD 0 OR 2 TO HEAD 1 OR 3.	
4C	A TIO FOR ERROR DID NOT BRANCH AFTER ATTEMPTING TO READ DATA PAST THE END OF CYLINDER USING A 2 SECTOR READ DATA COMMAND	
4E	THE END OF CYLINDER SENSE BIT IS NOT ON AFTER ATTEMPTING A 2 SECTOR READ DATA COMMAND WHICH BEGINS AT SECTOR 23 OF HEAD 1 OR HEAD 3	
4F	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS CHANGED AFTER ATTEMPTING A 2 SECTOR READ DATA COMMAND WHICH BEGINS AT SECTOR 23 OF HEAD 1 OR HEAD 3	
50	THE SCAN EQUAL COMMAND DID NOT GIVE ANY ERROR WHEN ISSUED WHERE THE DISK CONTROL FIELD CYLINDER NUMBER DOES NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	
51	THE NO RECORD FOUND SENSE BIT WAS NOT SET AFTER ISSUING A SCAN EQUAL COMMAND WHERE THE CYLINDER NUMBER IN THE DISK CONTROL FIELD DID NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	
52	AN ERROR OR ERRORS OCCURRED WHILE DOING A SCAN EQUAL COMMAND WHERE THE DATA FIELD IN CORE IS EQUAL TO THE DATA FIELD ON THE DISK	
53	THE SECTOR COUNTER IN THE DISK CONTROL FIELD WAS NOT STEPPED AFTER COMPLETION OF A ONE SECTOR SCAN EQUAL COMMAND	
54	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS CHANGED AFTER COMPLETION OF A ONE SECTOR SCAN EQUAL COMMAND	

INDEX NUMBER	MEANING OF HALT	HAP CHART REFERENCE
55	THE DATA FIELD IN MEMORY WAS ALTERED AFTER COMPLETION OF A ONE SECTOR SCAN EQUAL COMMAND	
55	FILE IS ACCESSING TOO SLOWLY (ACE ONLY).	
56	A SCAN FOUND CONDITION WAS NOT PRESENT OR DETECTED BY A TIO AFTER A SCAN FOUND CONDITION WAS GENERATED WITH A ONE SECTOR SCAN EQUAL COMMAND	
57	THE SCAN EQUAL SENSE BIT WAS NOT ON AFTER DOING A ONE SECTOR SCAN EQUAL COMMAND USING EQUAL DATA FIELDS	
58	AN ERROR OR ERRORS OCCURRED WHEN DOING A ONE SECTOR SCAN EQUAL COMMAND USING DATA FIELDS THAT ARE NOT EQUAL	
59	A SCAN FOUND CONDITION WAS DETECTED BY A TIO AFTER DOING A ONE SECTOR SCAN EQUAL COMMAND USING DATA FIELDS THAT ARE NOT EQUAL	
5A	THE SCAN EQUAL SENSE BIT WAS ON AFTER DOING A SCAN EQUAL COMMAND WHERE THE DATA FIELD IN CORE WAS NOT EQUAL TO THE DATA FIELD ON THE DISK	
5C	A SCAN EQUAL OCCURRED AT THE WRONG SECTOR WHEN DOING A 24 SECTOR SCAN EQ.	
5D	A TIO FOR ERROR DID NOT BRANCH AFTER ATTEMPTING TO SCAN EQUAL PAST THE END OF CYLINDER	
5E	THE END OF CYLINDER SENSE BIT IS NOT ON AFTER ATTEMPTING TO SCAN EQUAL PAST THE END OF CYLINDER USING A 2 SECTOR SCAN	
5F	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS CHANGED AFTER COMPLETION OF A 2 SECTOR SCAN EQUAL WHICH BEGAN AT SECTOR 23 HEAD 1 OR SECTOR 23 HEAD 3	
60	THE SCAN LOW OR EQUAL COMMAND DID NOT GIVE ANY ERROR WHEN ISSUED WHERE THE DISK CONTROL FIELD CYLINDER NUMBER DOES NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	
61	THE NO RECORD FOUND SENSE BIT WAS NOT SET AFTER ISSUING A SCAN LOW OR EQUAL COMMAND WHERE THE CYLINDER NUMBER IN THE DISK CONTROL FIELD DOES NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	
62	AN ERROR OR ERRORS OCCURRED WHILE DOING A SCAN LOW OR EQUAL COMMAND WHERE THE DATA FIELD ON THE DISK IS EQUAL TO THE DATA FIELD IN CORE	
63	THE SECTOR COUNTER IN THE DISK CONTROL FIELD WAS NOT STEPPED AFTER COMPLETION OF A ONE SECTOR SCAN LOW OR EQUAL COMMAND	
64	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS CHANGED AFTER THE COMPLETION OF A ONE SECTOR SCAN LOW OR EQUAL COMMAND	
65	THE DATA FIELD IN MEMORY WAS ALTERED AFTER COMPLETION OF A ONE SECTOR SCAN LOW OR EQUAL COMMAND	
66	A SCAN FOUND CONDITION WAS NOT PRESENT OR DETECTED BY A TIO AFTER A SCAN FOUND CONDITION WAS GENERATED WITH A ONE SECTOR SCAN LOW OR EQUAL	
66	AN ERROR WAS DETECTED IN THE HIGH PERFORMANCE ACCESS FEATURE CIRCUITRY. (5410 ONLY)	
67	THE SCAN EQUAL SENSE BIT WAS NOT ON AFTER DOING A ONE SECTOR SCAN LOW OR EQUAL COMMAND USING EQUAL DATA FIELDS	
68	AN ERROR OR ERRORS OCCURRED WHEN DOING A ONE SECTOR SCAN LOW OR EQUAL COMMAND WHERE THE DATA ON THE DISK IS LOWER THAN THE DATA FIELD IN CORE	
69	A SCAN FOUND CONDITION WAS DETECTED BY A TIO AFTER DOING A ONE SECTOR SCAN LOW OR EQUAL COMMAND USING DATA ON THE DISK THAT IS NOT LOW OR EQUAL TO THE DATA IN CORE	
6A	THE SCAN EQUAL SENSE BIT WAS ON AFTER DOING A SCAN LOW OR EQUAL COMMAND WHERE THE DATA FIELD IN CORE WAS NOT EQUAL TO THE DATA FIELD ON THE DISK	
6C	A SCAN FOUND OCCURRED AT THE WRONG SECTOR WHILE DOING A 24 SECTOR SCAN LOW OR EQUAL	
6D	A TIO FOR ERROR DID NOT BRANCH AFTER ATTEMPTING TO SCAN LOW OR EQUAL PAST END OF CYLINDER	
6E	THE END OF CYLINDER SENSE BIT IS NOT ON AFTER ATTEMPTING TO SCAN LOW OR EQUAL PAST THE END OF CYLINDER USING A 2 SECTOR SCAN	

INDEX NUMBER	MEANING OF HALT	MAP CHART REFERENCE
6P	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS CHANGED AFTER COMPLETION OF A 2 SECTOR SCAN LOW OR EQUAL COMMAND WHICH BEGINS AT SECTOR 23 HEAD 1 OR SECTOR 23 HEAD 3	
70	THE SCAN HIGH OR EQUAL COMMAND DID NOT GIVE ANY ERROR WHEN ISSUED WHERE THE DISK CONTROL FIELD CYLINDER NUMBER DOES NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	
71	THE NO RECORD FOUND SENSE BIT WAS NOT SET AFTER ISSUING A SCAN HIGH OR EQUAL COMMAND WHERE THE CYLINDER NUMBER IN THE DISK CONTROL FIELD DOES NOT EQUAL THE CYLINDER NUMBER OF THE CE TRACK	
72	AN ERROR OR ERRORS OCCURRED WHILE DOING A SCAN HIGH OR EQUAL COMMAND WHERE THE DATA FIELD ON THE DISK IS EQUAL TO THE DATA FIELD IN CORE	
73	THE SECTOR COUNTER IN THE DISK CONTROL FIELD WAS NOT STEPPED AFTER COMPLETION OF A ONE SECTOR SCAN HIGH OR EQUAL COMMAND	
74	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS CHANGED AFTER THE COMPLETION OF A ONE SECTOR SCAN HIGH OR EQUAL COMMAND	
75	THE DATA FIELD IN MEMORY WAS ALTERED AFTER COMPLETION OF A ONE SECTOR SCAN HIGH OR EQUAL COMMAND	
76	A SCAN FOUND CONDITION WAS NOT PRESENT OR DETECTED BY A TIO AFTER A SCAN FOUND CONDITION WAS GENERATED WITH A ONE SECTOR SCAN HIGH OR EQUAL	
77	THE SCAN EQUAL SENSE BIT WAS NOT ON AFTER DOING A ONE SECTOR SCAN HIGH OR EQUAL COMMAND USING EQUAL DATA FIELDS	
78	AN ERROR OR ERRORS OCCURRED WHEN DOING A ONE SECTOR SCAN HIGH OR EQUAL COMMAND WHERE THE DATA ON THE DISK IS HIGHER THAN THE DATA FIELD IN CORE	
79	A SCAN FOUND CONDITION WAS DETECTED BY A TIO AFTER DOING A ONE SECTOR SCAN HIGH OR EQUAL COMMAND USING DATA ON THE DISK THAT IS NOT HIGHER OR EQUAL TO THE DATA IN CORE	
7A	THE SCAN EQUAL SENSE BIT WAS ON AFTER DOING A SCAN HIGH OR EQUAL COMMAND WHERE THE DATA FIELD IN CORE WAS NOT EQUAL TO THE DATA FIELD ON THE DISK	
7C	A SCAN FOUND OCCURRED AT THE WRONG SECTOR WHILE DOING A 24 SECTOR SCAN HIGH OR EQUAL	
7D	A TIO FOR ERROR DID NOT BRANCH AFTER ATTEMPTING TO SCAN HIGH OR EQUAL PAST END OF CYLINDER	
7E	THE END OF CYLINDER SENSE BIT IS NOT ON AFTER ATTEMPTING TO SCAN HIGH OR EQUAL PAST THE END OF CYLINDER USING A 2 SECTOR SCAN	
7P	THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD WAS CHANGED AFTER COMPLETION OF A 2 SECTOR SCAN HIGH OR EQUAL COMMAND WHICH BEGINS AT SECTOR 23 HEAD 1 OR SECTOR 23 HEAD 3	
80	THE GO LINE DOES NOT COME UP FOR A SEEK WITH MOVEMENT	
81	THE GO LINE IS UP FOR A NO MOTION SEEK	
82	THE GO LINE HAS DROPPED BEFORE RECEIVING THE CORRECT NUMBER OF TRACK CROSSING PULSES	
83	THE GO LINE DID NOT DROP AFTER RECEIVING THE CORRECT NUMBER OF TRACK CROSSING PULSES	
84	THE GO LINE HAS DROPPED BEFORE RECEIVING ANY TRACK CROSSING PULSES	
85	THE GO LINE IS UP AND NO TRACK CROSSING PULSES WERE RECEIVED	
86	THERE IS A SOLID ERROR WITH ONE HEAD	
87	THERE IS A SOLID ERROR WITH ALL FOUR HEADS	
88	THE DISK IS NOT READY OR THERE IS A SOLID ERROR ON BEFORE STARTING THE TEST	

INDEX NUMBER	MEANING OF HALT	MAP CHART REFERENCE
89	THE INDEX SENSE BIT NEVER COMES ON	
8A	THE SEEK BUSY SENSE BIT IS HUNG UP	
8C	THE ACCESS MECHANISM IS POSITIONED BETWEEN TRACKS	
8E	AN UNEXPECTED TIMEOUT OCCURRED WHILE THE CURRENT ROUTINE WAS RUNNING	
8F	DRIVE X BUSY TOO LONG (B04 ONLY).	
8F	THE TRACK CROSSING SENSE BIT IS ON ALL THE TIME	
90	THE HEAD SETTLING SENSE BIT IS ON ALL THE TIME	
91	THE HEAD SETTLING SENSE BIT NEVER COMES ON	
92	SEEK CHECK TIMEOUT COUNTER FAILURE OR DISK DRIVE 2 IS NOT SPECIFIED IN DCP'S UDT CARD WHEN IT IS PRESENT ON THE SYSTEM.	
93	THE CONTROL UNIT IS STILL IN CE MODE WHEN IT SHOULD NOT BE.	
94	WHEN TESTING THE ABILITY TO SELECT EITHER DISK, THE SAME DISK IS ALWAYS SELECTED.	
95	MINIMUM DISK SPEED LESS THAN ALLOWABLE SPECIFICATION	
96	MAXIMUM DISK SPEED GREATER THAN ALLOWABLE SPECIFICATION	
97	SPINDLE STATUS CHECK - SEE PRINTOUT FOR BITS IN ERROR	
98	SPINDLE IS INITIALLY BUSY.	
99	SPINDLE DID NOT GO BUSY.	
9A	WHEN THE FILE WRITE SWITCH WAS TURNED OFF, WRITING WAS STILL ALLOWED.	
9C	AN ERROR OCCURRED WHILE DOING A WRITE ID COMMAND.	
9E	THE IPL'D DATA DOES NOT CORRESPOND TO THE DATA READ FROM THE IPL SECTOR. SEE THE PRINTOUT FOR WHICH DISK IS IN ERROR.	
9F	NO DATA WAS LOADED FROM THE DISK DURING THE IPL OPERATION. SEE PRINTOUT FOR THE DISK IN ERROR.	
FE	INTERVENTION REQUIRED	

3.2 NON-ERROR HALTS AND PRINTOUTS

3.2.1 SECTIONS A01 - A0E  
 B03 - B04

INDEX NUMBER 'XX'	MEANING OF HALT	MAP CHART REFERENCE
11-2E	SEE DETAILED DESCRIPTION OF B0B. 10'S POSITION = DRIVE, 01'S POSITION = ROUTINE.	
E0	THIS HALT INSTRUCTS THE OPERATOR TO SET THE CONSOLE SWITCHES FOR AN OPTION TO BE STORED IN THE COMMANDS TABLE FOR SECTION -B04-.	
E1 E2	THESE HALTS ALTERNATE AS EACH CONSOLE SWITCH OPTION IS ACCEPTED AND STORED IN THE COMMANDS TABLE OF SECTION -B04-.	
E3	CONSOLE SWITCH OPTION -0000- (END OF TABLE) WAS ACCEPTED AND PROGRAM IS READY TO START EXECUTING THE STORED COMMANDS TABLE IN SECTION -B04-.	
E4	PROGRAM -B04- HAS JUST COMPLETED EXECUTING THE STORED COMMANDS TABLE. RESET OF THIS HALT WILL CAUSE THE PROGRAM TO START ANOTHER TABLE PASS.	
E5	LOG-OUT OF CURRENT EXECUTION OF COMMANDS TABLE IN SECTION -B04- IS COMPLETED.	
E6	CAN NOT ISSUE A COMMAND TO DISK DRIVE 2 BECAUSE THIS DISK DRIVE IS NOT DEFINED IN DCP'S -UDT- TABLE	
E7	CAN NOT SELECT TRACKS 4, 5, 6, 71, 72, 73, 74, 75 OF A REMOVABLE DISK. THIS IS A SAFEGUARD TO PROTECT DIAGNOSTIC PATTERNS STORED ON A CE REMOVABLE DISK.	
E8	CONSOLE SWITCH 1 OR 2 SETTING IS IN ERROR. CORRECT THE SETTING AND RESET THIS HALT.	
E9	CONSOLE SWITCHES 3 AND 4 SPECIFY TOO LARGE A VALUE FOR A SECTOR OR A TRACK. CORRECT THE SETTING AND RESET THIS HALT.	
EA	DISK SYSTEM CONFIGURATION IS NOT DEFINED TO DCP. CORRECT DCP'S UDT TABLE TO CORRESPOND TO THE SYSTEM CONFIGURATION AND RELOAD THE PROGRAM.	
EC	THIS HALT INSTRUCTS THE OPERATOR TO IPL THE SPECIFIED DISK (SEE PRINTOUT) WITH ADDRESS STOP SET FOR 0000 ADDRESS. AFTER DOING THIS THE OPERATOR MUST ALTER SAR TO -0C00- TO START THE PROGRAM RUNNING AGAIN.	
EE	DUMP OF THE IPL AND READ DATA IN SECTION -B03- IS COMPLETE. NOTE - THE DATA IS NOT IN ERROR.	
EF	OPERATOR MUST SPECIFY THE NUMBER OF SECTORS TO READ OR WRITE FOR PROGRAM B04.	
F1	THE DISK SYSTEM IS DEFINED AS A MODEL 3, VIA THE UDT CARD. THEREFORE YOU CAN NOT SELECT THE FIXED DISK ON DRIVE 2.	
F0	RESET THE HALT AND COUNT THE PULSES ON THE CE PROBE.	
F8	OPERATOR MUST OPERATE THE DISK WRITE INHIBIT SWITCH PER PRINTED INSTR- UCTIONS AND RESET THE HALT. SECTION A09, ROUTINE 08.	
F9	SET DATA SWITCHES TO DEFINE THE NUMBER OF REVOLUTIONS TO TIME NOTE: IF SSW 7 IS ON, THE DEFAULT CONDITION IS 100 REVOLUTIONS.	
FA	SENSE SWITCHES 15 AND 16 ARE BOTH ON. THIS IS AN INVALID COMBINATION OF SWITCH SETTINGS. TURN ONE OR BOTH OF THEM OFF TO CONTINUE.	
PC	HALT TO CONNECT JUMPERS FOR ROUTINE 08 IN SECTION A03. WHEN ALL CONNECTIONS HAVE BEEN MADE, RESET THE HALT NOTE: BE SURE TO POSITION THE ACCESS MECHANISM AT CYLINDER 0 BEFORE RESETTING THE HALT.	
PE	INTERVENTION REQUIRED	

#### 4. DETAILED DESCRIPTION OF TESTS

##### 4.1 SECTION A01 - R01

BOTH OF THESE SECTIONS REQUIRE THAT DISK DRIVE 1 IS READY. DRIVE 2 (IF PRESENT AND HIGH PERFORMANCE, MUST BE READY) OTHERWISE NOT USED.

THESE TESTS USE THE CPU TO SIMULATE SIGNALS FROM THE DISK FILE. COMMANDS ARE ISSUED TO THE CONTROL UNIT BY THESE PROGRAMS AND THE RESULTS MONITORED BY THE USE OF INDICATORS AVAILABLE TO THE PROGRAM. IF THE INDICATORS ARE NOT AS EXPECTED, AN ERROR PRINTOUT WILL OCCUR. THIS PRINTOUT WILL CONSIST OF THE FOLLOWING:

1. A MESSAGE NUMBER WHICH INDICATES HOW FAR THE TEST HAS ADVANCED.
  2. THE CONDITION OF THE BUSY AND ERROR INDICATORS,
  3. THE STATUS IN HEX,
  4. THE CONTROL FIELD,
  5. THE LSR CONTENTS,
  6. AND THE FIRST BYTE OF DATA TRANSFERRED.
- SEE THE PCU MAPS FOR AN EXPLANATION OF THE MESSAGE NUMBERS AND THE ASSOCIATED CARDS THAT THEY CALL OUT.

THE FOLLOWING IS AN EXPLANATION OF THE OTHER DATA PUT OUT:

1. -B- THIS REPRESENTS THE STATE OF BUSY. A 'Y' MEANS YES IT IS BUSY AND A 'N' MEANS NO IT IS NOT BUSY.
2. -R- THIS REPRESENTS THE STATE OF THE NOT READY/ERROR CONDITION. A 'Y' INDICATES THAT THE TIO ON NOT READY/ERROR DID BRANCH AND A 'N' INDICATES THAT IT DID NOT.
3. -STATUS- THIS INFORMATION IS THE 4 BYTES OF SENSE DATA RECEIVED FROM THE PCU AT THE TIME OF THE FAILURE.
4. -CTRL FLD- THIS INFORMATION IS THE CONTENTS OF THE DISK CONTROL FIELD AT THE TIME OF THE FAILURE.
5. -DFCR- THIS INFORMATION IS THE CONTENTS OF THE DISK CONTROL REGISTER ADDRESS AT THE TIME OF THE FAILURE.
6. -DFDR- THIS INFORMATION IS THE CONTENTS OF THE DISK DATA REGISTER AT THE TIME OF THE FAILURE.
7. -DATA- THIS INFORMATION IS THE CONTENTS OF THE DISK DATA FIELD AT THE TIME OF THE FAILURE.

##### SECTION A01

PROGRAM A01 CHECKS SEVERAL DISK OPERATIONS WITH THE ATTACHMENT CIRCUITRY OPERATING IN 'CE' MODE. CE MODE IS TURNED ON BY A 'LIO' INSTRUCTION WHICH ELECTRONICALLY DISCONNECTS THE FILE FROM THE CONTROL UNIT. WHILE IN CE MODE, THE CPU PROVIDES THOSE SIGNALS THAT NORMALLY COME FROM THE FILE. THESE INCLUDE INDEX, SEPERATED CLOCK AND SEPERATED DATA. ALSO CONTROLLED BY THE CE MODE OF OPERATION ARE THE WRITE OSCILLATOR AND THE INHIBIT DATA CYCLE REQUEST.

THE FOLLOWING IS A DESCRIPTION OF THE TESTS CONTAINED WITHIN A01.

1. READ ID  
THIS TEST TESTS THAT THE OP IS ACCEPTED, THAT A DATA CHECK PREVENTS END OP, THAT A-M RESTART IS ACTIVATED IF ALL CONDITIONS OF THE ADDRESS MARK ARE NOT MET, THAT PRE-ID RESETS ERROR CONDITIONS AND THAT THE OPERATION ENDS AT POST ID COUNTER SET IF DATA CHECK IS OFF.
2. READ DATA  
THIS TEST TESTS THAT THE OP IS ACCEPTED, THAT TRACK CONDITION CHECK CAN BE SENSED, THAT PRE-ID DOES NOT RESET ERRORS, THAT MISSING ADDRESS MARK CHECK CIRCUITS ARE INHIBITED BY DATA CHECK, THAT OVERRUN AND PARALLEL PARITY CHECK CAN BE SENSED, THAT PARALLEL PARITY CHECK FORCES EQUIPMENT CHECK AND THAT EQUIPMENT CHECK ENDS THE OPERATION.
3. READ DATA  
THIS TEST TESTS LR STATUS RESET, START ORIENTATION RESET, START ORIENTATION, CCR ADVANCE GATE, BCA COUNTER, BLOCK SDR TO B REG, PROPER ADVANCE OF DFDR, THAT A SYNC CHARACTER IS NOT RECOGNIZED IN THE DATA FIELD, THAT ONLY OE IS RECOGNIZED AS A SYNC CHARACTER, THAT AN CHARACTER IS NOT RECOGNIZED EXCEPT AT AM TIME, AND THAT A COUNTER SET OF 16 OCCURS FOR INDEX TIME.
4. WRITE DATA  
THIS TEST TESTS THAT THE OP IS ACCEPTED BY THE CONTROL UNIT, THAT TWO CONSECUTIVE ODD ID'S WILL FORCE MISSING ADDRESS MARK, THAT MISSING ADDRESS MARK CAN BE SENSED, AND THAT THE P. C. U. ERROR ENDS THE OPERATION AT POST ID.
5. READ DATA DIAGNOSTIC  
THIS TEST TESTS THAT SET TO H IS NOT ACTIVATED, THAT AN CHARACTERS WHICH HAVE EXTRA AN BITS AND EXTRA OR MISSING DATA BITS ARE ACCEPTED, THAT STATUS RESETS AT PRE-ID, THAT NO RECORD FOUND CAN BE FORCED BY UNEQUAL COMPARE AFTER ID ORIENTATION, THAT NO RECORD FOUND CAN BE SENSED, THAT ERRORS DO NOT END THE OPERATION, THAT END OF CYLINDER CAN BE SENSED AND THAT END OF CYLINDER ENDS THE OPERATION
6. WRITE ID  
THIS TEST TESTS THE WRITE ID OP FOR PROPER OPERATION AND THAT N CARRY PREVENTS ADVANCE FROM POST DATA TO AM TIME. IF AN ERROR HAS BEEN RECOGNIZED BY THIS TIME, A HALT OCCURS AND THE REMAINDER OF THE TESTS ARE NOT RUN. IF NO ERROR IS DETECTED THE PROGRAM WILL CONTINUE WITH THE REMAINDER OF THE TESTS.
7. READ DATA DIAGNOSTIC  
THIS READ DATA DIAGNOSTIC TESTS THAT IF A SIO IS ISSUED DURING INDEX TIME THE OPERATION DOES NOT START UNTIL INDEX HAS GONE OFF AND COME BACK ON AND THAT AN ODD ADDRESS AFTER INDEX FORCES A MISSING ADDRESS MARK
8. WRITE DATA  
THIS WRITE DATA COMMAND TESTS THAT EVEN ADDRESS BEFORE INDEX FORCES MISSING ADDRESS MARK.
9. SCAN OPERATIONS  
SCAN OPS ARE CHECKED FOR SCAN FOUND, THAT SCAN FOUND END OP, THAT SCAN MARK CHARACTER WORKS AND THAT EQUAL HIT WORKS.
10. READ VEPIPY  
THIS TEST TESTS THAT NO DATA CYCLE REQUESTS OCCUR DURING DATA TIME AND THAT EXECUTE IS NOT ON AFTER BUSY DECES.
11. SPEK  
THIS TESTS THE PCU FOR PROPER OPERATION OF THE HIGH PERFORMANCE ACCESS FEATURE, IF DEFINED BY OPTION BIT 2 IN THE HDT TABLE.

##### SECTION R01

PROGRAM R01 USES CE MODE AND CE SENSE BYTE THROUGH EXTERNAL WIRING TO PINPOINT PROBLEMS WHICH NEED MORE THOROUGH ANALYSIS THAN IS POSSIBLE WITH A01. PROPER OPERATION, WITH FREQUENT SAMPLING OF CE SENSE LINES, OF READ ID, READ DATA, WRITE ID AND WRITE DATA IS TESTED IN THIS PROGRAM. ROUTINE 01 IS USED TO FURTHER ANALYZE PROBLEMS DETECTED IN A01. ROUTINE 02 IS USED, WHEN CALLED FOR IN THE MAP CHARTS, TO ANALYZE PROBLEMS IN THE UNSAFE AREA OR IN THE INCORRECT WRITING AREA.  
R01 WILL NEVER HAVE MORE THAN ONE ERROR MESSAGE NUMBER.

HALTS UNIQUE TO A01 AND R01	
01- OCCURS AFTER AN ERROR PRINTOUT	-- REFER TO PCU MAP CHARTS PAGE 509.
02- OCCURS AFTER REF 10 PRINTOUT	-- REFER TO PCU MAP CHARTS PAGE 509.
03- OCCURS AFTER AN ERROR PRINTOUT	-- REFER TO PCU MAP CHARTS PAGE 509.
E0 STOP FOR INTERVENTION IN UNSAFE ROUTINE	-- FOLLOW PRINTED INSTRUCTIONS
E1 STOP FOR INTERVENTION IN UNSAFE ROUTINE	-- FOLLOW PRINTED INSTRUCTIONS
E4 STOP FOR JUMPER PLACEMENT	-- FOLLOW PRINTED INSTRUCTIONS
E5 STOP FOR JUMPER PLACEMENT	-- FOLLOW PRINTED INSTRUCTIONS

## 4.2 SECTION A07, SEEK AND READ ID TESTS.

- ROUTINE 01, CYLINDER ZERO AND SEEK BUSY SENSE BIT TEST  
 BEFORE ANY ACCESS MOVEMENT IS ATTEMPTED, THE SEEK BUSY SENSE BIT IS TESTED TO DETERMINE IF IT IS ON. IF IT IS NOT THEN A RECALIBRATE FOLLOWED BY A SEEK TO CYLINDER 1 IS ISSUED. THE SEEK BUSY LINE IS AGAIN TESTED TO DETERMINE IF IT COMES UP FOR A SEEK. IF IT DOES THEN A SECOND LOOP IS ENTERED WHILE THE SEEK BUSY LINE REMAINS UP. WHEN IT DROPS, THE CYLINDER 0 BIT IS TESTED FOR OFF. NEXT A RECALIBRATE IS ISSUED AND AFTER THE SEEK BUSY LINE DROPS, THE CYLINDER 0 SENSE BIT IS TESTED FOR ON.
- ROUTINE 02, TEST OF READ FROM ALL HEADS  
 AFTER A RECALIBRATE AND A SEEK TO CYLINDER 0, A SERIES OF 4 READ ID COMMANDS ARE ISSUED USING EACH OF THE 4 HEADS. THE RESULTS OF EACH READ ARE SAVED AND ANALYZED AFTER ALL READS ARE COMPLETED. IF ANY ERRORS ARE NOTED, THEN THE RESULTS, (GOOD OR IN ERROR), ARE PRINTED OUT:  
 ITEMS CHECKED ARE:  
 1. THE READ ID FUNCTION  
 2. THE TRANSFER OF A CYLINDER ADDRESS OF 0,  
 3. THE SELECTION OF THE CORRECT READ.
- ROUTINE 03, TEST OF THE SEEK CHECK AND NOOP SENSE BITS.  
 THE SEEK CHECK AND NOOP SENSE BITS ARE CHECKED BY FIRST SEEKING TO THE CE TRACK AND THEN ISSUING A SEEK TO 47 CYLINDERS BEYOND THE CE TRACK FOLLOWED BY A READ ID COMMAND WHICH SHOULD BE PROVISIONALLY ACCEPTED. THE SECOND SEEK SHOULD SET THE SEEK CHECK SENSE BIT, AND IF THAT BIT IS ON, THEN THE READ ID COMMAND SHOULD HAVE SET THE NOOP SENSE BIT. AFTER THESE TWO SENSE BITS HAVE BEEN TESTED FOR ON, ANOTHER SENSE IS ISSUED TO TEST THE NOOP SENSE BIT FOR OFF. A RECALIBRATE COMMAND IS GIVEN TO RESET THE SEEK CHECK SENSE BIT, AND A SENSE COMMAND IS GIVEN TO TEST THE SEEK CHECK BIT FOR OFF.
- ROUTINE 04, BASIC SEEK FORWARD AND REVERSE TEST.  
 AFTER A RECALIBRATE, A SERIES OF EIGHT SEEKS, (FOUR FORWARD AND FOUR REVERSE), ARE ISSUED TO TEST THE ABILITY OF THE PILE TO MOVE IN BOTH THE FORWARD AND REVERSE DIRECTION. THE RESULTS OF EACH SEEK ARE SAVED, AND AFTER ALL SEEKS HAVE BEEN ISSUED, THE RESULTS ARE ANALYZED. IF ANY ERRORS ARE FOUND, THEN THE RESULTS OF ALL SEEKS, (GOOD OR IN ERROR), ARE PRINTED OUT.  
 ITEMS CHECKED ARE:  
 1. THE DIRECTION AND THE NUMBER OF TRACKS OF MOVEMENT THAT RESULTED FROM EACH SEEK COMMAND.  
 2. THE DEVICE STATUS FOR EACH SEEK COMMAND.
- ROUTINE 05, MEASURE OF HEAD SETTling TIME  
 BEFORE ANY MOTION IS INITIATED, THE HEAD SETTling SENSE BIT IS TESTED FOR OFF. IF IT IS, THEN A SEEK TO CYLINDER 0 FOLLOWED BY A SEEK TO CYLINDER 1 IS ISSUED. IF THERE ARE NO SEEK ERRORS, A SENSE LOOP IS ENTERED TO WAIT FOR THE HEAD SETTling SENSE BIT TO COME ON. IF THIS BIT NEVER COMES ON, AN ERROR MESSAGE IS PRINTED OUT. IF THIS BIT DOES COME ON, THEN A SECOND SENSE LOOP IS ENTERED TO TIME THE DURATION OF THE HEAD SETTling LINE. THE COMPUTED TIME IS COMPARED WITH THE ALLOWABLE MINIMUM AND MAXIMUM VALUES, AND IF THIS TIME IS OUT OF TOLLERENCE THE ACTUAL HEAD SETTling TIME IS PRINTED OUT. (IF 5410 BYPASSED FOR HI-PERFORMANCE)
- ROUTINE 06, TEST OF THE SEEK CHECK TIMEOUT COUNTER.  
 THIS ROUTINE WILL BE RUN ONLY WHILE TESTING DISK DRIVE 1 AND WILL BE BYPASSED IF DISK DRIVE 2 IS TURNED ON. AFTER A SEEK FORWARD COMMAND IS ISSUED, INDEX PULSES ARE GENERATED IN CE MODE TO CAUSE THE SEEK CHECK TIMEOUT COUNTER TO TIME OUT AND A SEEK CHECK TO BE GENERATED. ONCE THIS IS DONE, A READ ID COMMAND IS USED TO TAKE THE CONTROL UNIT OUT OF CE MODE.
- ROUTINE 07, UTILITY ROUTINE  
 THIS ROUTINE PERFORMS NO TESTS, BUT DOES INITIALIZE CERTAIN PROGRAM CONTROLS SO THAT THIS SECTION MAY BE RERUN ON ANOTHER DISK DRIVE WITHOUT RELOADING THE PROGRAM.
- ROUTINE 08, A SEEK TEST WHICH CHECKS THE TRACK CROSSING AND GO FORWARD-GO REVERSE LINES  
 THIS IS A MANUAL ROUTINE WHICH MUST BE SELECTED BY THE USE OF THE CONSOLE SWITCHES. IT REQUIRES THE PLACEMENT OF THREE JUMPERS PRIOR TO BEGINNING OPERATION. A SERIES OF FORWARD AND REVERSE SEEKS ARE ISSUED WITH THE GO FORWARD, GO REVERSE AND TRACK CROSSING LINES MONITORED FOR CORRECT OPERATION. THIS ROUTINE WILL LOOP TILL AN ERROR OCCURS OR TILL THE OPERATOR STOPS THE PROGRAM.



## 4.3 SECTION A05, WRITE DATA TEST.

IF THIS PROGRAM IS RUNNING ON BOTH THE FIXED AND THE REMOVABLE DISK, (SSW'S 15 AND 16 BOTH OFF), EACH ROUTINE WILL BE RUN TWICE IN SUCCESSION, FIRST ON THE REMOVABLE DISK AND THEN ON THE FIXED DISK. IN THE EVENT THAT THIS ALL ROUTINES IN THIS SECTION DO A SEEK TO THE CE TRACK AS THE FIRST OPERATION OF EACH ROUTINE. THE PRINTOUT THAT A SEEK FAILS TO POSITION THE ACCESS MECHANISM AT THE CE TRACK OR GIVES ANY ERRORS WHILE DOING SO, THE PRINTOUT THAT FOLLOWS WILL GIVE THE STATUS ERRORS THAT OCCURRED WHILE THE SEEK WAS BEING PERFORMED AND MAY TELL THE CE TO RUN ONE OF THE SEEK FUNCTION TESTS BEFORE CONTINUING WITH THIS TEST. WITH THE EXCEPTION OF SEEK ERRORS, THE FUNCTIONS OF THIS SECTION NOT DEPENDENT ON THE FUNCTIONS PERFORMED IN ANY OTHER SECTIONS. THE TESTS ARE, HOWEVER, ORDERED IN A BUILDING BLOCK APPROACH AND ANY DEVIATION FROM THE NATURAL ORDER OF RUNNING MAY PRODUCE MISLEADING RESULTS.

- ROUTINE 01,** CHECK OF THE NO RECORD FOUND SENSE BIT USING THE WRITE DATA COMMAND. AFTER AN ERROR FREE SEEK TO THE CE TRACK, A ONE SECTOR WRITE COMMAND IS INITIATED WHERE THE CYLINDER BYTE OF THE DISK CONTROL FIELD IS SET TO FF. THIS SHOULD CAUSE AN ERROR CONDITION TO BE GENERATED AFTER 2 REVOLUTIONS OF THE DISK. WHEN THIS IS DETECTED BY A TEST I/O COMMAND, A SENSE IS ISSUED. DEVICE STATUS BIT 0 BIT 5 IS TESTED FOR ON. THIS IS THE NO RECORD FOUND SENSE BIT. IF EITHER THE TEST I/O COMMAND FAILS TO DETECT AN ERROR OR THE NO RECORD FOUND SENSE BIT IS NOT ON, ERROR MESSAGES WILL RESULT.
- ROUTINE 02,** A CHECK OF THE WRITE FUNCTION USING HEADS 0 AND 2. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A SERIES OF 24 ONE SECTOR WRITES ARE ISSUED BEGINNING WITH SECTOR 0 AND ENDING WITH SECTOR 23. THE DATA PATTERN USED FOR THIS WRITE IS 256 BYTES OF F7. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, THE STATUS BITS FROM THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS A HEX REPRESENTATION. AFTER EACH WRITE HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:  
 1. THE WRITE DATA ADDRESS IS TESTED FOR AN INCREASE OF 256 BYTES.  
 2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED FROM 00 TO FF.  
 3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD (BYTE 2), IS TESTED FOR NO CHANGE.  
 4. THE DATA WRITE FIELD IS TESTED FOR NO CHANGE.
- ROUTINE 03,** CHECK OF THE WRITE FUNCTION USING HEADS 1 AND 3. THIS ROUTINE FUNCTIONS EXACTLY LIKE ROUTINE 02 WITH THE EXCEPTION THAT IT USES HEADS 1 AND 3 INSTEAD OF HEADS 0 AND 2. SEE THE DESCRIPTION OF ROUTINE 2 FOR DETAILS.
- ROUTINE 04,** A CHECK OF THE WRITE DATA FUNCTION WITH A 2 SECTOR WRITE USING HEADS 0 OR 2. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH SELECTS HEADS 0 OR 2, A 2 SECTOR WRITE DATA COMMAND IS ISSUED WHICH BEGINS WITH SECTOR 0. THE DATA PATTERN USED FOR THIS WRITE IS 512 BYTES OF 10. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, THE STATUS BITS ASSOCIATED WITH THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS A HEX REPRESENTATION. AFTER THE 2 SECTOR WRITE HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:  
 1. THE WRITE DATA ADDRESS IS TESTED FOR AN INCREASE OF 512.  
 2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 01 TO FF.  
 3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD (BYTE 2), IS TESTED FOR HAVING STEPPED UP FROM 00 TO 04.  
 4. THE DATA WRITE FIELD IS TESTED FOR NO CHANGE.
- ROUTINE 05,** A CHECK OF THE WRITE DATA FUNCTION USING HEAD SWITCHING. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEADS 0 OR 2, A 2 SECTOR WRITE DATA COMMAND IS ISSUED WHICH BEGINS WITH SECTOR 23 OF HEAD 0 OR 2 AND ENDS WITH SECTOR 0 OF HEAD 1 OR 3. THE DATA PATTERN USED FOR THIS WRITE IS 512 BYTES OF F7. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, THE STATUS BITS ASSOCIATED WITH THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS A HEX REPRESENTATION. AFTER THE 2 SECTOR WRITE HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:  
 1. THE WRITE DATA ADDRESS IS TESTED FOR AN INCREASE OF 512.  
 2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 01 TO FF.  
 3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD (BYTE 2), IS TESTED FOR HAVING STEPPED UP FROM 5C TO 80.  
 4. THE DATA WRITE FIELD IS TESTED FOR NO CHANGE.
- ROUTINE 06,** A CHECK OF THE END OF CYLINDER SENSE BIT USING THE WRITE DATA COMMAND. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH SELECTS HEAD 1 OR HEAD 3, A 2 SECTOR WRITE DATA COMMAND IS ATTEMPTED WHICH BEGINS WITH SECTOR 23 OF HEAD 1 OR SECTOR 23 OF HEAD 3. THIS OPERATION SHOULD PRODUCE AN ERROR SINCE THE END OF CYLINDER WILL HAVE BEEN REACHED AFTER WRITING JUST ONE OF THE 2 SECTORS SPECIFIED. IF NO ERROR IS DETECTED BY A TEST I/O FOR ERROR, IT WILL BE SO NOTED. A SENSE IS ISSUED AND STATUS BYTE 1 BIT 2 IS TESTED FOR ON, (END OF CYLINDER). IF THIS BIT IS NOT ON, IT WILL BE SO NOTED. ALSO TESTED ARE THE FOLLOWING:  
 1. THE WRITE DATA ADDRESS IS TESTED FOR AN INCREASE OF 256.  
 2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 01 TO 00.  
 3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD IS TESTED FOR ITS ORIGINAL VALUE OF 0C.

## 4.4 SECTION A06, VERIFY DATA TEST.

IF THIS PROGRAM IS RUNNING ON BOTH THE FIXED AND THE REMOVABLE DISK, (SSW'S 15 AND 16 BOTH OFF), EACH ROUTINE WILL BE RUN TWICE IN SUCCESSION, FIRST ON THE REMOVABLE DISK AND THEN ON THE FIXED DISK. ALL ROUTINES IN THIS SECTION DO A SEEK TO THE CE TRACK AS THE FIRST OPERATION OF EACH ROUTINE. HERE THE CYLINDER ID IS READ AND COMPARED WITH THE KNOWN ID OF THE CE TRACK. IN THE EVENT THAT THIS SEEK FAILS TO POSITION THE ACCESS MECHANISM AT THE CE TRACK OR GIVES ANY ERRORS WHILE DOING SO, THE PRINTOUT THAT FOLLOWS WILL GIVE THE STATUS ERRORS THAT OCCURRED WHILE THE SEEK WAS BEING PERFORMED AND MAY TELL THE CE TO RUN ONE OF THE SEEK FUNCTION TESTS BEFORE CONTINUING WITH THIS TEST. WITH THE EXCEPTION OF SEEK ERRORS, THE FUNCTIONS OF THIS SECTION ARE NOT DEPENDENT ON THE FUNCTIONS PERFORMED IN ANY OTHER SECTIONS. THE TESTS ARE HOWEVER, ORDERED IN A BUILDING BLOCK APPROACH AND ANY DEVIATION FROM THE NATURAL ORDER OF RUNNING MAY PRODUCE MISLEADING RESULTS.

- ROUTINE 01, CHECK OF THE NO RECORD FOUND SENSE BIT USING THE VERIFY DATA COMMAND. AFTER AN ERROR FREE SEEK TO THE CE TRACK, A ONE SECTOR VERIFY DATA COMMAND IS INITIATED WHERE THE CYLINDER BYTE OF THE DISK CONTROL FIELD IS SET TO FF. THIS SHOULD CAUSE AN ERROR CONDITION TO BE GENERATED AFTER 2 REVOLUTIONS OF THE DISK. WHEN THIS IS DETECTED BY A TEST I/O COMMAND, A SENSE IS ISSUED. DEVICE STATUS BYTE 0 BIT 5 IS TESTED FOR ON. THIS IS THE NO RECORD FOUND SENSE BIT. IF EITHER THE TEST I/O COMMAND FAILS TO DETECT AN ERROR OR THE NO RECORD FOUND SENSE BIT IS NOT ON, ERROR MESSAGES WILL RESULT.
- ROUTINE 02, A CHECK OF THE VERIFY FUNCTION USING HEADS 0 AND 2. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A SERIES OF 24 ONE SECTOR WRITE DATA AND VERIFY DATA COMMANDS ARE ISSUED BEGINNING WITH SECTOR 0 AND ENDING WITH SECTOR 23. THE DATA PATTERN USED FOR THE WRITE IS 256 BYTES OF E7. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE VERIFY OPERATION, THE STATUS BITS FROM THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. AFTER EACH VERIFY HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:
1. THE WRITE DATA ADDRESS IS TESTED FOR AN INCREASE OF 256 BYTES.
  2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 00 TO FF.
  3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD (BYTE 2), IS TESTED FOR NO CHANGE.
  4. THE DATA WRITE FIELD IS TESTED FOR NO CHANGE.
- ROUTINE 03, CHECK OF THE VERIFY DATA FUNCTION USING HEADS 1 AND 3. THIS ROUTINE FUNCTIONS EXACTLY LIKE ROUTINE 02 WITH THE EXCEPTION THAT IT USES HEADS 1 AND 3 INSTEAD OF HEADS 0 AND 2. SEE THE DESCRIPTION OF ROUTINE 2 FOR DETAILS.
- ROUTINE 04, A CHECK OF THE VERIFY DATA FUNCTION WITH A 2 SECTOR VERIFY DATA COMMAND USING HEADS 0 OR 2. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH SELECTS HEADS 0 OR 2, A 2 SECTOR WRITE DATA COMMAND FOLLOWED BY A 2 SECTOR VERIFY DATA COMMAND WHICH BEGINS WITH SECTOR 0 IS ISSUED. THE DATA PATTERN USED FOR THE WRITE IS 512 BYTES OF 10. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT, AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE VERIFY OPERATION, THE STATUS BITS ASSOCIATED WITH THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS A HEX REPRESENTATION. AFTER THE 2 SECTOR VERIFY HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:
1. THE WRITE DATA ADDRESS IS TESTED FOR AN INCREASE OF 512.
  2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 01 TO FF.
  3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD (BYTE 2), IS TESTED FOR HAVING STEPPED UP FROM 00 TO 04.
  4. THE DATA WRITE FIELD IS TESTED FOR NO CHANGE.
- ROUTINE 05, A CHECK OF THE VERIFY DATA FUNCTION USING HEAD SWITCHING. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEADS 0 OR 2, A 2 SECTOR WRITE DATA COMMAND AND A 2 SECTOR VERIFY DATA COMMAND IS ISSUED WHICH BEGINS WITH SECTOR 23 OF HEAD 0 OR 2 AND ENDS WITH SECTOR 0 OF HEAD 1 OR 3. THE DATA PATTERN USED FOR THE WRITE IS 512 BYTES OF E7. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE VERIFY OPERATION, THE STATUS BITS ASSOCIATED WITH THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS A HEX REPRESENTATION. AFTER THE 2 SECTOR VERIFY HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:
1. THE WRITE DATA ADDRESS IS TESTED FOR AN INCREASE OF 512.
  2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 01 TO FF.
  3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD (BYTE 2), IS TESTED FOR HAVING STEPPED UP FROM 5C TO 80.
  4. THE DATA WRITE FIELD IS TESTED FOR NO CHANGE.
- ROUTINE 06, A CHECK OF THE END OF CYLINDER SENSE BIT USING THE VERIFY DATA COMMAND. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH SELECTS HEAD 1 OR HEAD 3, A 2 SECTOR VERIFY DATA COMMAND IS ATTEMPTED WHICH BEGINS WITH SECTOR 23 OF HEAD 1 OR SECTOR 23 OF HEAD 3. THIS OPERATION SHOULD PRODUCE AN ERROR SINCE THE END OF CYLINDER WILL HAVE BEEN REACHED AFTER VERIFYING JUST ONE OF THE 2 SECTORS SPECIFIED. IF NO ERROR IS DETECTED BY A TEST I/O FOR ERROR, IT WILL BE SO NOTED. A SENSE IS ISSUED AND STATUS BYTE 1 BIT 2 IS TESTED FOR ON. (END OF CYLINDER). IF THIS BIT IS NOT ON, IT WILL BE SO NOTED. ALSO TESTED ARE THE FOLLOWING:
1. THE VERIFY DATA ADDRESS IS TESTED FOR AN INCREASE OF 256.
  2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 01 TO 00.
  3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD IS TESTED FOR ITS ORIGINAL VALUE OF DC.

4.5 SECTION A07, READ DATA DIAGNOSTIC TEST.

IF THIS PROGRAM IS RUNNING ON BOTH THE FIXED AND THE REMOVABLE DISK, (SSW'S 15 AND 16 BOTH OFF), EACH ROUTINE WILL BE RUN TWICE IN SUCCESSION, FIRST ON THE REMOVABLE DISK AND THEN ON THE FIXED DISK. EACH ROUTINE, HERE THE CYLINDER ID IS READ AND COMPARED WITH THE KNOWN ID OF THE CE TRACK. IN THE EVENT THAT THIS SEEK FAILS TO POSITION THE ACCESS MECHANISM AT THE CE TRACK OR GIVES ANY ERRORS WHILE DOING SO, THE PRINTOUT THAT FOLLOWS WILL GIVE THE STATUS ERRORS THAT OCCURRED WHILE THE SEEK WAS BEING PERFORMED AND MAY TELL THE CE TO RUN ONE OF THE SEEK FUNCTION TESTS BEFORE CONTINUING WITH THIS TEST. WITH THE EXCEPTION OF SEEK ERRORS, THE FUNCTIONS OF THIS SECTION ARE NOT DEPENDENT ON THE FUNCTIONS PERFORMED IN ANY OTHER SECTIONS. THE TESTS ARE HOWEVER, ORDERED IN A BUILDING BLOCK APPROACH AND ANY DEVIATION FROM THE NATURAL ORDER OF RUNNING MAY PRODUCE MISLEADING RESULTS.

ROUTINE 01, CHECK OF THE NO RECORD FOUND SENSE BIT USING THE READ DATA DIAGNOSTIC COMMAND. AFTER AN ERROR FREE SEEK TO THE CE TRACK, A ONE SECTOR READ DATA DIAGNOSTIC COMMAND IS INITIATED WHERE THE CYLINDER BYTE OF THE DISK CONTROL FIELD IS SET TO FF. THIS SHOULD CAUSE AN ERROR CONDITION TO BE GENERATED AFTER 2 REVOLUTIONS OF THE DISK. WHEN THIS IS DETECTED BY A TEST I/O COMMAND, A SENSE IS ISSUED. DEVICE STATUS BYTE 0 BIT 5 IS TESTED FOR ON. THIS IS THE NO RECORD FOUND SENSE BIT. IF EITHER THE TEST I/O COMMAND FAILS TO DETECT AN ERROR OR THE NO RECORD FOUND SENSE BIT IS NOT ON, ERROR MESSAGES WILL RESULT.

ROUTINE 02, A CHECK OF THE READ DATA DIAGNOSTIC COMMAND USING HEADS 0 OR 2. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA FOLLOWED BY A ONE SECTOR READ DATA DIAGNOSTIC COMMAND IS ISSUED. THE DATA PATTERN USED FOR THE WRITE IS 256 BYTES OF F7. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE READ DATA DIAGNOSTIC COMMAND, THE STATUS BITS FROM THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS A HEX REPRESENTATION. AFTER THE READ DATA DIAGNOSTIC COMMAND HAS FINISHED, THE FOLLOWING FUNCTIONS ARE TESTED:  
1. THE READ DATA ADDRESS IS TESTED FOR NO CHANGE.  
2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 00 TO FF.  
3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD (BYTE 2), IS TESTED FOR NO CHANGE.

ROUTINE 03, CHECK OF THE READ DATA DIAGNOSTIC COMMAND USING HEADS 1 AND 3. THIS ROUTINE FUNCTIONS EXACTLY LIKE ROUTINE 02 WITH THE EXCEPTION THAT IT USES HEADS 1 AND 3 INSTEAD OF HEADS 0 AND 2. SEE THE DESCRIPTION OF ROUTINE 2 FOR DETAILS.

ROUTINE 04, A CHECK OF THE READ DATA DIAGNOSTIC COMMAND USING A 2 SECTOR READ DATA DIAGNOSTIC COMMAND USING HEADS 0 OR 2. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH SELECTS HEADS 0 OR 2, A 2 SECTOR WRITE DATA COMMAND FOLLOWED BY A 2 SECTOR READ DATA DIAGNOSTIC COMMAND WHICH BEGINS WITH SECTOR 0 IS ISSUED. THE DATA PATTERN USED FOR THE WRITE IS 512 BYTES OF 10. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE READ DATA DIAGNOSTIC COMMAND, THE STATUS BITS ASSOCIATED WITH THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS A HEX REPRESENTATION. AFTER THE 2 SECTOR READ DATA DIAGNOSTIC COMMAND HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:  
1. THE READ DATA ADDRESS IS TESTED FOR NO CHANGE.  
2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 01 TO FF.  
3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD (BYTE 2), IS TESTED FOR HAVING STEPPED UP FROM 00 TO 04.  
4. THE READ FIELD IS TESTED FOR THE CORRECT DATA.

ROUTINE 05, A CHECK OF THE READ DATA DIAGNOSTIC COMMAND WHEN READING TO THE END OF CYLINDER. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEADS 1 OR 3, A SERIES OF 24 ONE SECTOR WRITE DATA COMMANDS IS INITIATED WHERE 23 SECTORS ARE WRITTEN WITH ZEROS AND THE 24TH IS WRITTEN WITH FF. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED A 24 SECTOR READ DATA DIAGNOSTIC COMMAND IS INITIATED. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE READ DATA DIAGNOSTIC OPERATION, THE STATUS BITS ASSOCIATED WITH THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS A HEX REPRESENTATION. AFTER THE READ DATA DIAGNOSTIC COMMAND HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:  
1. THE READ DATA ADDRESS IS TESTED FOR NO CHANGE.  
2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 17 TO FF.  
3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD IS TESTED FOR HAVING STEPPED UP FROM 80 TO DC.  
4. THE READ FIELD IS TESTED FOR CONTAINING 256 BYTES OF FF.

## 4.6 SECTION A08, READ DATA TEST.

IF THIS PROGRAM IS RUNNING ON BOTH THE FIXED AND THE REMOVABLE DISK, (SSW'S 15 AND 16 BOTH OFF), EACH ROUTINE WILL BE RUN TWICE IN SUCCESSION, FIRST ON THE REMOVABLE DISK AND THEN ON THE FIXED DISK. ALL ROUTINES IN THIS SECTION DO A SEEK TO THE CE TRACK AS THE FIRST OPERATION OF EACH ROUTINE. HERE THE CYLINDER ID IS READ AND COMPARED WITH THE KNOWN ID OF THE CE TRACK. IN THE EVENT THAT THIS SEEK FAILS TO POSITION THE ACCESS MECHANISM AT THE CE TRACK OR GIVES ANY ERRORS WHILE DOING SO, THE PRINTOUT THAT FOLLOWS WILL GIVE THE STATUS ERRORS THAT OCCURRED WHILE THE SEEK WAS BEING PERFORMED AND MAY TELL THE CE TO RUN ONE OF THE SEEK FUNCTION TESTS BEFORE CONTINUING WITH THIS TEST. WITH THE EXCEPTION OF SEEK ERRORS, THE FUNCTIONS OF THIS SECTION ARE NOT DEPENDENT ON THE FUNCTIONS PERFORMED IN ANY OTHER SECTIONS. THE TESTS ARE HOWEVER, ORDERED IN A BUILDING BLOCK APPROACH AND ANY DEVIATION FROM THE NATURAL ORDER OF RUNNING MAY PRODUCE MISLEADING RESULTS.

**ROUTINE 01,** CHECK OF THE NO RECORD FOUND SENSE BIT USING THE READ DATA COMMAND. AFTER AN ERROR FREE SEEK TO THE CE TRACK, A ONE SECTOR READ DATA COMMAND IS INITIATED WHERE THE CYLINDER BYTE OF THE DISK CONTROL FIELD IS SET TO FF. THIS SHOULD CAUSE AN ERROR CONDITION TO BE GENERATED AFTER 2 REVOLUTIONS OF THE DISK. WHEN THIS IS DETECTED BY A TEST I/O COMMAND, A SENSE IS ISSUED. DEVICE STATUS BYTE 0 BIT 5 IS TESTED FOR ON. THIS IS THE NO RECORD FOUND SENSE BIT. IF EITHER THE TEST I/O COMMAND FAILS TO DETECT AN ERROR OR THE NO RECORD FOUND SENSE BIT IS NOT ON, ERROR MESSAGES WILL RESULT.

**ROUTINE 02,** A CHECK OF THE READ DATA FUNCTION USING HEADS 0 AND 2. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A SERIES OF 24 ONE SECTOR WRITE DATA AND READ DATA COMMANDS ARE ISSUED BEGINNING WITH SECTOR 0 AND ENDING WITH SECTOR 23. THE DATA PATTERN USED FOR THE WRITE IS 256 BYTES OF E7. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE READ OPERATION, THE STATUS BITS FROM THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. AFTER EACH READ HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:

1. THE READ DATA ADDRESS IS TESTED FOR AN INCREASE OF 256 BYTES.
2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 00 TO FF.
3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD (BYTE 2), IS TESTED FOR NO CHANGE.
4. THE DATA READ FIELD IS TESTED FOR THE CORRECT DATA.

**ROUTINE 03,** CHECK OF THE READ DATA FUNCTION USING HEADS 1 AND 3. THIS ROUTINE FUNCTIONS EXACTLY LIKE ROUTINE 02 WITH THE EXCEPTION THAT IT USES HEADS 1 AND 3 INSTEAD OF HEADS 0 AND 2. SEE THE DESCRIPTION OF ROUTINE 2 FOR DETAILS.

**ROUTINE 04,** A CHECK OF THE READ DATA FUNCTION WITH A 2 SECTOR READ DATA COMMAND USING HEADS 0 OR 2. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH SELECTS HEADS 0 OR 2, A 2 SECTOR WRITE DATA COMMAND FOLLOWED BY A 2 SECTOR READ DATA COMMAND WHICH BEGINS WITH SECTOR 0 IS ISSUED. THE DATA PATTERN USED FOR THE WRITE IS 512 BYTES OF 10. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE READ OPERATION, THE STATUS BITS ASSOCIATED WITH THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS A HEX REPRESENTATION. AFTER THE 2 SECTOR READ HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:

1. THE READ DATA ADDRESS IS TESTED FOR AN INCREASE OF 512.
2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 01 TO FF.
3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD (BYTE 2), IS TESTED FOR HAVING STEPPED UP FROM 00 TO 04.
4. THE DATA READ FIELD IS TESTED FOR THE CORRECT DATA.

**ROUTINE 05,** A CHECK OF THE READ DATA FUNCTION USING HEAD SWITCHING. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEADS 0 OR 2, A 2 SECTOR WRITE DATA COMMAND AND A 2 SECTOR READ DATA COMMAND IS ISSUED WHICH BEGINS WITH SECTOR 23 OF HEAD 0 OR 2 AND ENDS WITH SECTOR 0 OF HEAD 1 OR 3. THE DATA PATTERN USED FOR THE WRITE IS 512 BYTES OF E7. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE READ OPERATION, THE STATUS BITS ASSOCIATED WITH THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS A HEX REPRESENTATION. AFTER THE 2 SECTOR READ HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:

1. THE READ DATA ADDRESS IS TESTED FOR AN INCREASE OF 512.
2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 01 TO FF.
3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD (BYTE 2), IS TESTED FOR HAVING STEPPED UP FROM 5C TO 80.
4. THE DATA READ FIELD IS TESTED FOR THE CORRECT DATA.

**ROUTINE 06,** A CHECK OF THE END OF CYLINDER SENSE BIT USING THE READ DATA COMMAND. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH SELECTS HEAD 1 OR HEAD 3, A 2 SECTOR READ DATA COMMAND IS ATTEMPTED WHICH BEGINS WITH SECTOR 23 OF HEAD 1 OR SECTOR 23 OF HEAD 3. THIS OPERATION SHOULD PRODUCE AN ERROR SINCE THE END OF CYLINDER WILL HAVE BEEN REACHED AFTER READING JUST ONE OF THE 2 SECTORS SPECIFIED. IF NO ERROR IS DETECTED BY A TEST I/O FOR ERROR, IT WILL BE SO NOTED. A SENSE IS ISSUED AND STATUS BYTE 1 BIT 2 IS TESTED FOR ON (END OF CYLINDER). IF THIS BIT IS NOT ON, IT WILL BE SO NOTED. ALSO TESTED ARE THE FOLLOWING:

1. THE READ DATA ADDRESS IS TESTED FOR AN INCREASE OF 256.
2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 01 TO 00.
3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD IS TESTED FOR ITS ORIGINAL VALUE OF DC.

## 4.7 SECTION A09, WRITE ID - DISK SELECT - AND DISK WRITE SWITCH

ALL ROUTINES IN THIS SECTION DO A SEEK TO THE CE TRACK AS THE FIRST OPERATION OF EACH ROUTINE. HERE THE CYLINDER ID IS READ AND COMPARED WITH THE KNOWN ID OF THE CE TRACK. IN THE EVENT THAT THIS SEEK FAILS TO POSITION THE ACCESS MECHANISM AT THE CE TRACK OR GIVES ANY ERRORS WHILE DOING SO, THE PRINTOUT THAT FOLLOWS WILL GIVE THE STATUS ERRORS THAT OCCURRED WHILE THE SEEK WAS BEING PERFORMED AND MAY TELL THE CE TO RUN ONE OF THE SEEK FUNCTION TESTS BEFORE CONTINUING WITH THIS TEST. WITH THE EXCEPTION OF SEEK ERRORS, THE FUNCTIONS OF THIS SECTION ARE NOT DEPENDENT ON THE FUNCTIONS PERFORMED IN ANY OTHER SECTIONS. THE TESTS ARE HOWEVER, ORDERED IN A BUILDING BLOCK APPROACH AND ANY DEVIATION FROM THE NATURAL ORDER OF RUNNING MAY PRODUCE MISLEADING RESULTS.

- ROUTINE 01, CHECK OF WRITE ID USING HEAD 0**  
 AFTER A SUCCESSFUL SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0, A 24 SECTOR WRITE ID IS INITIATED. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE WRITE ID, THE STATUS BITS FROM THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS A HEX REPRESENTATION. AFTER THE WRITE HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:  
 1. THE SECTOR COUNTER (BYTE 3), IS TESTED FOR STEPPING DOWN FROM 17 TO FF.  
 2. THE SECTOR ADDRESS (BYTE 2), IS TESTED FOR STEPPING UP FROM 00 TO 5C.  
 3. THE DATA ADDRESS IS TESTED FOR NO CHANGE.  
 THE SECOND PORTION OF THIS ROUTINE CONSISTS OF A SERIES OF 24 ONE SECTOR VERIFY COMMANDS WHICH WILL CHECK THE VALIDITY OF EACH OF THE IDS JUST WRITTEN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE VERIFY OPERATION, THE STATUS BITS FROM THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. ALSO PRINTED OUT WILL BE THE SECTOR NUMBER IN ERROR.
- ROUTINE 02, CHECK OF WRITE ID USING HEAD 1**  
 AFTER A SUCCESSFUL SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 1, A 24 SECTOR WRITE ID IS INITIATED. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE WRITE ID, THE STATUS BITS FROM THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS A HEX REPRESENTATION. AFTER THE WRITE HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:  
 1. THE SECTOR COUNTER (BYTE 3), IS TESTED FOR STEPPING DOWN FROM 17 TO FF.  
 2. THE SECTOR ADDRESS (BYTE 2), IS TESTED FOR STEPPING UP FROM 80 TO DC.  
 3. THE DATA ADDRESS IS TESTED FOR NO CHANGE.  
 THE SECOND PORTION OF THIS ROUTINE CONSISTS OF A SERIES OF 24 ONE SECTOR VERIFY COMMANDS WHICH WILL CHECK THE VALIDITY OF EACH OF THE IDS JUST WRITTEN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE VERIFY OPERATION, THE STATUS BITS FROM THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. ALSO PRINTED OUT WILL BE THE SECTOR NUMBER IN ERROR.
- ROUTINE 03, CHECK OF WRITE ID USING HEAD 2**  
 AFTER A SUCCESSFUL SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 2, A 24 SECTOR WRITE ID IS INITIATED. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE WRITE ID, THE STATUS BITS FROM THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS A HEX REPRESENTATION. AFTER THE WRITE HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:  
 1. THE SECTOR COUNTER (BYTE 3), IS TESTED FOR STEPPING DOWN FROM 17 TO FF.  
 2. THE SECTOR ADDRESS (BYTE 2), IS TESTED FOR STEPPING UP FROM 00 TO 5C.  
 3. THE DATA ADDRESS IS TESTED FOR NO CHANGE.  
 THE SECOND PORTION OF THIS ROUTINE CONSISTS OF A SERIES OF 24 ONE SECTOR VERIFY COMMANDS WHICH WILL CHECK THE VALIDITY OF EACH OF THE IDS JUST WRITTEN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE VERIFY OPERATION, THE STATUS BITS FROM THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. ALSO PRINTED OUT WILL BE THE SECTOR NUMBER IN ERROR.
- ROUTINE 04, CHECK OF WRITE ID USING HEAD 3**  
 AFTER A SUCCESSFUL SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 3, A 24 SECTOR WRITE ID IS INITIATED. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE WRITE ID, THE STATUS BITS FROM THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS A HEX REPRESENTATION. AFTER THE WRITE HAS BEEN COMPLETED, THE FOLLOWING FUNCTIONS ARE TESTED:  
 1. THE SECTOR COUNTER (BYTE 3), IS TESTED FOR STEPPING DOWN FROM 17 TO FF.  
 2. THE SECTOR ADDRESS (BYTE 2), IS TESTED FOR STEPPING UP FROM 80 TO DC.  
 3. THE DATA ADDRESS IS TESTED FOR NO CHANGE.  
 THE SECOND PORTION OF THIS ROUTINE CONSISTS OF A SERIES OF 24 ONE SECTOR VERIFY COMMANDS WHICH WILL CHECK THE VALIDITY OF EACH OF THE IDS JUST WRITTEN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE VERIFY OPERATION, THE STATUS BITS FROM THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. ALSO PRINTED OUT WILL BE THE SECTOR NUMBER IN ERROR.
- ROUTINE 05, CHECK THE ABILITY TO SELECT BOTH THE UPPER AND LOWER DISK**  
 AFTER A SUCCESSFUL SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0, OF THE REMOVABLE DISK, A ONE SECTOR WRITE ID COMMAND IS INITIATED. THE DATA PATTERN USED FOR THE WRITE IS 256 BYTES OF THE CHARACTER R. IF ANY ERRORS OCCUR WHILE WRITING, ERROR MESSAGES WILL RESULT. THE SECOND PORTION OF THE TEST CONSISTS OF SELECTING THE FIXED DISK AND WRITING ONE SECTOR OF DATA THAT IS 256 BYTES OF THE CHARACTER P. THE THIRD PORTION OF THE TEST CONSISTS OF SELECTING THE REMOVABLE DISK AND READING ONE SECTOR OF DATA. IF THE READ DATA COMMAND PRODUCES A READ FIELD OF THE CHARACTER R, THEN WE KNOW THAT WE CAN SELECT BOTH DISKS. IF IT DOES NOT, THEN THERE IS AN ERROR SINCE EACH SELECT ALWAYS SELECTED THE SAME DISK.
- ROUTINE 06, A TEST OF THE LOGICAL END OF CYLINDER.**  
 AFTER A SUCCESSFUL SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0, OF THE REMOVABLE DISK, A 24 SECTOR WRITE ID COMMAND IS INITIATED WHERE THE IDS THAT ARE WRITTEN ARE FOR TRACK 1. IF ANY ERRORS OCCUR WHILE WRITING, ERROR MESSAGES WILL RESULT. THE SECOND PORTION OF THE TEST CONSISTS OF ISSUING A 24 SECTOR VERIFY DATA COMMAND WHICH SHOULD SET THE END OF CYLINDER CONDITION. A SENSE COMMAND IS ISSUED AND THIS BIT IS TESTED FOR ON. IF IT IS, THE ROUTINE PROCEEDS TO PART 3, OTHERWISE AN ERROR MESSAGE WILL RESULT. PART 3 CONSISTS OF RESTORING THE IDS FOR TRACK 0 TO THEIR CORRECT FORMAT WITH ANOTHER 24 SECTOR WRITE ID COMMAND.
- ROUTINE 07, UTILITY ROUTINE**  
 THIS ROUTINE PERFORMS NO TESTS, BUT DOES INITIALIZE CERTAIN PROGRAM CONTROLS SO THAT THIS SECTION MAY BE PERFORMED ON ANOTHER DISK DRIVE WITHOUT RELOADING THE PROGRAM.
- ROUTINE 08, CHECK THE FUNCTION OF THE FILE WRITE SWITCH**  
 AFTER A SUCCESSFUL SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OF THE REMOVABLE DISK, A ONE SECTOR WRITE ID COMMAND IS INITIATED. THE DATA PATTERN USED FOR THE WRITE IS 256 BYTES OF FF. IF ANY ERRORS OCCUR WHILE WRITING, ERROR MESSAGES WILL RESULT. AT THIS POINT A PRINTOUT AND HALT P8 OCCURS TO TELL THE OPERATOR TO TURN OFF THE FILE WRITE SWITCH AND RESET THE HALT. NOW THE PROGRAM DOES A ONE SECTOR WRITE DATA COMMAND USING A DATA FIELD OF 00. NEXT A ONE SECTOR READ DATA COMMAND IS INITIATED AND THE READ FIELD IS TESTED FOR FF. IF IT IS THEN THE FILE WRITE SWITCH FUNCTIONED CORRECTLY. IF IT IS NOT, THEN AN ERROR MESSAGE WILL RESULT SAYING THAT WHEN THE FILE WRITE SWITCH WAS TURNED OFF, WRITING WAS NOT INHIBITED. ANOTHER P8 HALT WILL OCCUR TO TELL THE OPERATOR TO TURN ON THE FILE WRITE SWITCH AGAIN.

## 4.4 SECTION A0A, SCAN EQUAL

IF THIS PROGRAM IS RUNNING ON BOTH THE FIXED AND THE REMOVABLE DISK, (SSW'S 15 AND 16 BOTH OFF), EACH ROUTINE WILL BE RUN TWICE IN SUCCESSION, FIRST ON THE REMOVABLE DISK AND THEN ON THE FIXED DISK. ALL ROUTINES IN THIS SECTION DO A SEEK TO THE CE TRACK AS THE FIRST OPERATION OF EACH ROUTINE. HERE THE CYLINDER ID IS READ AND COMPARED WITH THE KNOWN ID OF THE CE TRACK. IN THE EVENT THAT THIS SEEK FAILS TO POSITION THE ACCESS MECHANISM AT THE CE TRACK OR GIVES ANY ERRORS WHILE DOING SO, THE PRINTOUT THAT FOLLOWS WILL GIVE THE STATUS ERRORS THAT OCCURRED WHILE THE SEEK WAS BEING PERFORMED AND MAY TELL THE CE TO RUN ONE OF THE SEEK FUNCTION TESTS BEFORE CONTINUING WITH THIS TEST. WITH THE EXCEPTION OF SEEK ERRORS, THE FUNCTIONS OF THIS SECTION ARE NOT DEPENDENT ON THE FUNCTIONS PERFORMED IN ANY OTHER SECTIONS. THE TESTS ARE HOWEVER, ORDERED IN A BUILDING BLOCK APPROACH AND ANY DEVIATION FROM THE NATURAL ORDER OF RUNNING MAY PRODUCE MISLEADING RESULTS.

**ROUTINE 01,** CHECK OF THE NO RECORD FOUND SENSE BIT USING THE SCAN EQUAL COMMAND. AFTER AN ERROR FREE SEEK TO THE CE TRACK, A ONE SECTOR SCAN EQUAL COMMAND IS INITIATED WHERE THE CYLINDER BYTE OF THE DISK CONTROL FIELD IS SET TO FF. THIS SHOULD CAUSE AN ERROR CONDITION TO BE GENERATED AFTER 2 REVOLUTIONS OF THE DISK. WHEN THIS IS DETECTED BY A TEST I/O COMMAND, A SENSE IS ISSUED. DEVICE STATUS BYTE 0 BIT 5 IS TESTED FOR ON. THIS IS THE NO RECORD FOUND SENSE BIT. IF EITHER THE TEST I/O COMMAND FAILS TO DETECT AN ERROR OR THE NO RECORD FOUND SENSE BIT IS NOT ON, ERROR MESSAGES WILL RESULT.

**ROUTINE 02,** A TEST OF SCAN FOUND USING A SCAN EQUAL CONDITION. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IN MEMORY IS ALSO 256 BYTES OF 00. IF ANY ERRORS OCCUR WHILE DOING THE SCAN OPERATION THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. AFTER THE SCAN EQUAL COMMAND HAS BEEN COMPLETED AND IF A SCAN FOUND CONDITION IS GENERATED, THE FOLLOWING FUNCTIONS ARE TESTED FOR.  
 1. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 00 TO FF.  
 2. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD, (BYTE 2), IS TESTED FOR NO CHANGE.  
 3. THE SCAN DATA FIELD IS TESTED FOR NO CHANGE.

**ROUTINE 03,** A TEST OF THE SCAN EQUAL SENSE BIT USING A SCAN EQUAL COMMAND AND AN EQUAL CONDITION. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IN MEMORY IS ALSO 256 BYTES OF 00. IF ANY ERRORS OCCUR WHILE DOING THE SCAN OPERATION THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. AFTER THE SCAN EQUAL COMMAND HAS BEEN COMPLETED, THE SCAN EQUAL SENSE BIT, (BYTE 1 BIT 0), IS TESTED FOR ON. IF IT IS NOT AN ERROR MESSAGE WILL RESULT.

**ROUTINE 04,** A TEST OF RESETTING OF THE SCAN EQUAL SENSE BIT USING THE SCAN EQUAL COMMAND AND AN UNEQUAL CONDITION. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IN MEMORY IS 255 BYTES OF 00 AND ONE BYTE WHICH IS X'FF'. IF ANY ERRORS OCCUR WHILE DOING THE SCAN OPERATION, THE STATUS BIT FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. AFTER THE SCAN EQUAL COMMAND HAS BEEN COMPLETED, THE SCAN EQUAL SENSE BIT, (BYTE 1 BIT 0), IS TESTED FOR OFF. IF IT IS NOT, AN ERROR MESSAGE WILL RESULT.

**ROUTINE 05,** A TEST OF A 24 SECTOR SCAN EQUAL OPERATION WHERE 23 SECTORS ARE WRITTEN WITH 256 BYTES OF 00 AND THE 24<sup>TH</sup> IS WRITTEN WITH 255 BYTES OF 00 AND ONE BYTE OF X'AA'. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A SERIES OF 24 ONE SECTOR WRITE DATA COMMANDS ARE ISSUED WHERE 23 SECTORS ARE WRITTEN WITH 256 BYTES OF 00, AND 1 SECTOR IS WRITTEN WITH 255 BYTES OF 00 AND ONE BYTE OF X'AA'. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE SCAN OPERATION, THE STATUS BITS FROM THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. AFTER EACH SCAN HAS BEEN COMPLETED A CHECK IS MADE TO INSURE THAT THE SCAN FOUND CONDITION OCCURRED ON THE CORRECT SECTOR. THIS SEQUENCE OF WRITE AND SCAN OPERATIONS IS REPEATED 24 TIMES WITH THE EQUAL SECTOR BEING WRITTEN AT EACH OF THE 24 POSSIBLE POSITIONS.

**ROUTINE 06,** A CHECK OF THE END OF CYLINDER SENSE BIT USING THE SCAN EQUAL COMMAND. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 1 OR 3, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 23 WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A 2 SECTOR SCAN EQUAL COMMAND IS ATTEMPTED WHICH BEGINS WITH SECTOR 23 OF HEAD 1 OR SECTOR 23 OF HEAD 3. THE SCAN FIELD IN MEMORY IS 255 BYTES OF 00 AND ONE BYTE OF X'AA'. THIS OPERATION SHOULD PRODUCE AN ERROR SINCE THE END OF CYLINDER WILL HAVE BEEN REACHED AFTER SCANNING JUST ONE OF THE 2 SECTORS SPECIFIED. IF NO ERROR IS DETECTED BY A TEST I/O FOR ERROR, IT WILL BE SO NOTED. A SENSE IS ISSUED AND STATUS BYTE 1 BIT 2 IS TESTED FOR ON, (END OF CYLINDER). IF THIS BIT IS NOT ON, IT WILL BE SO NOTED.  
 ALSO TESTED ARE THE FOLLOWING:  
 1. THE SCAN DATA ADDRESS IS TESTED FOR NO CHANGE.  
 2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 01 TO 00.  
 3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD IS TESTED FOR ITS ORIGINAL VALUE OF DC.

**ROUTINE 07,** A TEST OF A SCAN EQUAL OPERATION USING A DATA FIELD OF 256 BYTES OF 55. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 256 BYTES OF 55. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IN MEMORY IS ALSO 256 BYTES OF 55. IF ANY ERRORS OCCUR WHILE DOING THE SCAN OPERATION THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. IF A SCAN FOUND CONDITION IS GENERATED, THE ROUTINE WILL TERMINATE, OTHERWISE AN ERROR MESSAGE WILL RESULT.

**ROUTINE 08,** A TEST OF A SCAN EQUAL OPERATION USING A DATA FIELD OF 255 BYTES OF FF AND ONE BYTE OF 00. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IN MEMORY IS 255 BYTES OF FF AND 1 BYTE OF 0. IF ANY ERRORS OCCUR WHILE DOING THE SCAN OPERATION, THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. IF A SCAN FOUND CONDITION IS GENERATED, THE ROUTINE WILL TERMINATE, OTHERWISE AN ERROR MESSAGE WILL RESULT.

4.9 SECTION A0B, SCAN LOW OR EQUAL

IF THIS PROGRAM IS RUNNING ON BOTH THE FIXED AND THE REMOVABLE DISK, (SSW'S 15 AND 16 BOTH OFF), EACH ROUTINE WILL BE RUN TWICE IN SUCCESSION, FIRST ON THE REMOVABLE DISK AND THEN ON THE FIXED DISK. HERE THE CYLINDER ID ALL ROUTINES IN THIS SECTION DO A SEEK TO THE CE TRACK AS THE FIRST OPERATION OF EACH ROUTINE. HERE THE CYLINDER ID IS READ AND COMPARED WITH THE KNOWN ID OF THE CE TRACK. IN THE EVENT THAT THIS SEEK FAILS TO POSITION THE ACCESS MECHANISM AT THE CE TRACK OR GIVES ANY ERRORS WHILE DOING SO, THE PRINTOUT THAT FOLLOWS WILL GIVE THE STATUS ERRORS THAT OCCURRED WHILE THE SEEK WAS BEING PERFORMED AND MAY TELL THE CE TO RUN ONE OF THE SEEK FUNCTION TESTS BEFORE CONTINUING WITH THIS TEST. WITH THE EXCEPTION OF SEEK ERRORS, THE FUNCTIONS OF THIS SECTION ARE NOT DEPENDENT ON THE FUNCTIONS PERFORMED IN ANY OTHER SECTIONS. THE TESTS ARE HOWEVER, ORDERED IN A BUILDING BLOCK APPROACH AND ANY DEVIATION FROM THE NATURAL ORDER OF RUNNING MAY PRODUCE MISLEADING RESULTS.

ROUTINE 01, CHECK OF THE NO RECORD FOUND SENSE BIT USING THE SCAN LOW OR EQUAL COMMAND. AFTER AN ERROR FREE SEEK TO THE CE TRACK, A ONE SECTOR SCAN LOW OR EQUAL COMMAND IS INITIATED WHERE THE CIL. BYTE OF THE DISK CONTROL FIELD IS SET TO FF. THIS SHOULD CAUSE AN ERROR CONDITION TO BE GENERATED AFTER 2 REVOLUTIONS OF THE DISK. WHEN THIS IS DETECTED BY A TEST I/O COMMAND, A SENSE IS ISSUED. DEVICE STATUS BYTE 0 BIT 5 IS TESTED FOR ON. THIS IS THE NO RECORD FOUND SENSE BIT. IF EITHER THE TEST I/O COMMAND FAILS TO DETECT AN ERROR OR THE NO RECORD FOUND SENSE BIT IS NOT ON, ERROR MESSAGES WILL RESULT.

ROUTINE 02, A TEST OF SCAN FOUND USING A SCAN LOW OR EQUAL COMMAND AND AN EQUAL CONDITION. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN LOW OR EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IN MEMORY IS ALSO 256 BYTES OF 00. IF ANY ERRORS OCCUR WHILE DOING THE SCAN OPERATION, THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. AFTER THE SCAN LOW OR EQUAL COMMAND HAS BEEN COMPLETED AND IF A SCAN FOUND CONDITION IS GENERATED, THE FOLLOWING FUNCTIONS ARE TESTED FOR:  
1. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 00 TO FF.  
2. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD, (BYTE 2), IS TESTED FOR NO CHANGE.  
3. THE SCAN DATA FIELD IS TESTED FOR NO CHANGE.

ROUTINE 03, A TEST OF THE SCAN EQUAL SENSE BIT USING A SCAN LOW OR EQUAL COMMAND AND AN EQUAL CONDITION. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN LOW OR EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IN MEMORY IS ALSO 256 BYTES OF 00. IF ANY ERRORS OCCUR WHILE DOING THE SCAN LOW OR EQUAL OPERATION, THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. AFTER THE SCAN LOW OR EQUAL COMMAND HAS BEEN COMPLETED, THE SCAN EQUAL SENSE BIT, (BYTE 1 BIT 0), IS TESTED FOR ON. IF IT IS NOT, AN ERROR MESSAGE WILL RESULT.

ROUTINE 04, A TEST OF RESETTING OF THE SCAN EQUAL SENSE BIT USING THE SCAN LOW OR EQUAL COMMAND A LOW CONDITION. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN LOW OR EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IN MEMORY IS 255 BYTES OF 00 AND ONE BYTE WHICH IS 'FF'. IF ANY ERRORS OCCUR WHILE DOING THE SCAN LOW OR EQUAL OPERATION, THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. AFTER THE SCAN LOW OR EQUAL COMMAND HAS BEEN COMPLETED, THE SCAN EQUAL SENSE BIT, (BYTE 1 BIT 0), IS TESTED FOR OFF. IF IT IS NOT, AN ERROR MESSAGE WILL RESULT.

ROUTINE 05, A TEST OF A 24 SECTOR SCAN LOW OR EQUAL OPERATION WHERE 23 SECTORS ARE WRITTEN WITH 256 BYTES OF 01 AND THE 24TH IS WRITTEN WITH 256 BYTES OF 00. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A SERIES OF 24 ONE SECTOR WRITE DATA COMMANDS ARE ISSUED WHERE 23 SECTORS ARE WRITTEN WITH 256 BYTES OF 01, AND 1 SECTOR IS WRITTEN WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE SCAN LOW OR EQUAL OPERATION, THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. AFTER EACH SCAN LOW OR EQUAL HAS BEEN COMPLETED, A CHECK IS MADE TO INSURE THAT THE SCAN FOUND CONDITION OCCURRED ON THE CORRECT SECTOR. THIS SEQUENCE OF WRITE AND SCAN OPERATIONS IS REPEATED 24 TIMES WITH THE EQUAL SECTOR BEING WRITTEN AT EACH OF THE 24 POSSIBLE POSITIONS.

ROUTINE 06, A CHECK OF THE END OF CYLINDER SENSE BIT USING THE SCAN LOW OR EQUAL COMMAND. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 1 OR 3, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 23 WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN LOW OR EQUAL COMMAND IS INITIATED WHICH BEGINS WITH SECTOR 23 OF HEAD 1 OR SECTOR 23 OF HEAD 3. THE SCAN FIELD IN MEMORY IS 255 BYTES OF 00 AND ONE BYTE OF 'AA'. THIS OPERATION SHOULD PRODUCE AN ERROR SINCE THE END OF CYLINDER WILL HAVE BEEN REACHED AFTER SCANNING JUST ONE OF THE 2 SECTORS SPECIFIED. IF NO ERROR IS DETECTED BY A TEST I/O FOR ERROR, IT WILL BE SO NOTED. A SENSE IS ISSUED AND STATUS BYTE 1 BIT 2 IS TESTED FOR ON. (END OF CYLINDER). IF THIS BIT IS NOT ON, IT WILL BE SO NOTED. ALSO TESTED ARE THE FOLLOWING:  
1. THE SCAN DATA ADDRESS IS TESTED FOR NO CHANGE.  
2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 01 TO 00.  
3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD IS TESTED FOR ITS ORIGINAL VALUE OF DC.

ROUTINE 07, A TEST OF A SCAN LOW OR EQUAL OPERATION USING A DATA FIELD OF 256 BYTES OF 55. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 256 BYTES OF 55. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN LOW OR EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IN MEMORY IS ALSO 256 BYTES OF 55. IF ANY ERRORS OCCUR WHILE DOING THE SCAN LOW OR EQUAL OPERATION, THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. IF A SCAN FOUND CONDITION IS GENERATED, THE ROUTINE WILL TERMINATE, OTHERWISE AN ERROR MESSAGE WILL RESULT.

ROUTINE 08, A TEST OF A SCAN LOW OR EQUAL OPERATION USING A DATA FIELD OF 255 BYTES OF FF AND ONE BYTE OF 00. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN LOW OR EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IN MEMORY IS 255 BYTES OF FF AND 1 BYTE OF 00. IF ANY ERRORS OCCUR WHILE DOING THE SCAN LOW OR EQUAL OPERATION, THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. IF A SCAN FOUND CONDITION IS GENERATED, THE ROUTINE WILL TERMINATE, OTHERWISE AN ERROR MESSAGE WILL RESULT.

#### 4.10 SECTION AOC, SCAN HIGH OR EQUAL

IF THIS PROGRAM IS RUNNING ON BOTH THE FIXED AND THE REMOVABLE DISK (ISSN'S 15 AND 16 BOTH OFF), EACH ROUTINE WILL BE RUN TWICE IN SUCCESSION, FIRST ON THE REMOVABLE DISK AND THEN ON THE FIXED DISK. EACH ROUTINE, HERE THE CYLINDER ID IS READ AND COMPARED WITH THE KNOWN ID OF THE CE TRACK. IN THE EVENT THAT THIS SEEK FAILS TO POSITION THE ACCESS MECHANISM AT THE CE TRACK OR GIVES ANY ERRORS WHILE DOING SO, THE PRINTOUT THAT FOLLOWS WILL GIVE THE STATUS ERRORS THAT OCCURRED WHILE THE SEEK WAS BEING PERFORMED AND MAY TELL THE CE TO RUN ONE OF THE SEEK FUNCTION TESTS BEFORE CONTINUING WITH THIS TEST. WITH THE EXCEPTION OF SEEK ERRORS, THE FUNCTIONS OF THIS SECTION ARE NOT DEPENDENT ON THE FUNCTIONS PERFORMED IN ANY OTHER SECTIONS. THE TESTS ARE HOWEVER, ORDERED IN A BUILDING BLOCK APPROACH AND ANY DEVIATION FROM THE NATURAL ORDER OF RUNNING MAY PRODUCE MISLEADING RESULTS.

ROUTINE 01, CHECK OF THE NO RECORD FOUND SENSE BIT USING THE SCAN HIGH OR EQUAL COMMAND. AFTER AN ERROR FREE SEEK TO THE CE TRACK, A ONE SECTOR SCAN HIGH OR EQUAL COMMAND IS INITIATED WHERE THE CYL. BYTE OF THE DISK CONTROL FIELD IS SET TO FF. THIS SHOULD CAUSE AN ERROR CONDITION TO BE GENERATED AFTER 2 REVOLUTIONS OF THE DISK. WHEN THIS IS DETECTED BY A TEST I/O COMMAND, A SENSE IS ISSUED. DEVICE STATUS BYTE 0 BIT 5 IS TESTED FOR ON. THIS IS THE NO RECORD FOUND SENSE BIT. IF EITHER THE TEST I/O COMMAND FAILS TO DETECT AN ERROR OR THE NO RECORD FOUND SENSE BIT IS NOT ON, ERROR MESSAGES WILL RESULT.

ROUTINE 02, A TEST OF SCAN FOUND USING A SCAN HIGH OR EQUAL COMMAND AND AN EQUAL CONDITION. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN HIGH OR EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IN MEMORY IS ALSO 256 BYTES OF 00. IF ANY ERRORS OCCUR WHILE DOING THE SCAN OPERATION, THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. AFTER THE SCAN HIGH OR EQUAL COMMAND HAS BEEN COMPLETED AND IF A SCAN FOUND CONDITION IS GENERATED, THE FOLLOWING FUNCTIONS ARE TESTED FOR:  
1. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3) IS TESTED FOR HAVING STEPPED DOWN FROM 00 TO FF.  
2. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD, (BYTE 2), IS TESTED FOR NO CHANGE.  
3. THE SCAN DATA FIELD IS TESTED FOR NO CHANGE.

ROUTINE 03, A TEST OF THE SCAN EQUAL SENSE BIT USING A SCAN HIGH OR EQUAL COMMAND AND AN EQUAL CONDITION. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN HIGH OR EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IN MEMORY IS ALSO 256 BYTES OF 00. IF ANY ERRORS OCCUR WHILE DOING THE SCAN HIGH OR EQUAL OPERATION, THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. AFTER THE SCAN HIGH OR EQUAL COMMAND HAS BEEN COMPLETED, THE SCAN EQUAL SENSE BIT, (BYTE 1 BIT 0), IS TESTED FOR ON. IF IT IS NOT, AN ERROR MESSAGE WILL RESULT.

ROUTINE 04, A TEST OF RESETTING OF THE SCAN EQUAL SENSE BIT USING THE SCAN HIGH OR EQUAL COMMAND AND A HIGH CONDITION. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 255 BYTES OF 00 AND ONE BYTE OF 'FF'. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN HIGH OR EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IS 256 BYTES OF 00. IF ANY ERRORS OCCUR WHILE DOING THE SCAN HIGH OR EQUAL COMMAND, THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. AFTER THE SCAN HIGH OR EQUAL COMMAND HAS BEEN COMPLETED, THE SCAN EQUAL SENSE BIT, (BYTE 1 BIT 0), IS TESTED FOR OFF. IF IT IS NOT, AN ERROR MESSAGE WILL RESULT.

ROUTINE 05, A TEST OF A 24 SECTOR SCAN HIGH OR EQUAL OPERATION WHERE 23 SECTORS ARE WRITTEN WITH 256 BYTES OF 00 AND THE 24TH IS WRITTEN WITH 256 BYTES OF 01. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A SERIES OF 24 ONE SECTOR WRITE DATA COMMANDS ARE ISSUED WHERE 23 SECTORS ARE WRITTEN WITH 256 BYTES OF 00, AND 1 SECTOR IS WRITTEN WITH 256 BYTES OF 01. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. IN THE EVENT THAT ANY ERRORS OCCUR WHILE DOING THE SCAN HIGH OR EQUAL OPERATION, THE STATUS BITS FROM THAT ERROR WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. AFTER EACH SCAN HIGH OR EQ. HAS BEEN COMPLETED, A CHECK IS MADE TO INSURE THAT THE SCAN FOUND CONDITION OCCURRED ON THE CORRECT SECTOR. THIS SEQUENCE OF WRITE AND SCAN OPERATIONS IS REPEATED 24 TIMES WITH THE EQUAL SECTOR BEING WRITTEN AT EACH OF THE 24 POSSIBLE POSITIONS.

ROUTINE 06, A CHECK OF THE END OF CYLINDER SENSE BIT USING THE SCAN HIGH OR EQUAL COMMAND. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 1 OR 3, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 23 WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A 2 SECTOR SCAN HIGH OR EQUAL COMMAND IS ATTEMPTED WHICH BEGINS WITH SECTOR 23 OF HEAD 1 OR SECTOR 23 OF HEAD 3. THE SCAN FIELD IN MEMORY IS 255 BYTES OF 00 AND ONE BYTE OF 00. THIS OPERATION SHOULD PRODUCE AN ERROR SINCE THE END OF CYLINDER WILL HAVE BEEN REACHED AFTER SCANNING JUST ONE OF THE 2 SECTORS SPECIFIED. IF NO ERROR IS DETECTED BY A TEST I/O FOR ERROR, IT WILL BE SO NOTED. A SENSE IS ISSUED AND STATUS BYTE 1 BIT 2 IS TESTED FOR ON, (END OF CYLINDER). IF THIS BIT IS NOT ON, IT WILL BE SO NOTED. ALSO TESTED ARE THE FOLLOWING:  
1. THE SCAN DATA ADDRESS IS TESTED FOR NO CHANGE.  
2. THE SECTOR COUNTER IN THE DISK CONTROL FIELD (BYTE 3), IS TESTED FOR HAVING STEPPED DOWN FROM 01 TO 00.  
3. THE HEAD AND SECTOR BYTE OF THE DISK CONTROL FIELD IS TESTED FOR ITS ORIGINAL VALUE OF DC.

ROUTINE 07, A TEST OF A SCAN HIGH OR EQUAL COMMAND USING A DATA FIELD OF 256 BYTES OF 55. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 256 BYTES OF 55. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN HIGH OR EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IN MEMORY IS ALSO 256 BYTES OF 55. IF ANY ERRORS OCCUR WHILE DOING THE SCAN HIGH OR EQUAL OPERATION, THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. IF A SCAN FOUND CONDITION IS GENERATED, THE ROUTINE WILL TERMINATE, OTHERWISE AN ERROR MESSAGE WILL RESULT.

ROUTINE 08, A TEST OF A SCAN HIGH OR EQUAL COMMAND USING A DATA FIELD OF 255 BYTES OF FF AND ONE BYTE OF 00. AFTER AN ERROR FREE SEEK TO THE CE TRACK WHICH WILL SELECT HEAD 0 OR 2, A ONE SECTOR WRITE DATA COMMAND IS INITIATED WHICH WILL WRITE SECTOR 0 WITH 256 BYTES OF 00. IN THE EVENT THAT ANY ERRORS OCCUR WHILE WRITING, AN ERROR MESSAGE WILL RESULT AND IT IS RECOMMENDED THAT SECTION A05 BE RUN. AFTER THE WRITE IS COMPLETED, A ONE SECTOR SCAN HIGH OR EQUAL COMMAND IS INITIATED WHERE THE SCAN FIELD IN MEMORY IS 255 BYTES OF FF AND 1 BYTE OF 00. IF ANY ERROR OCCUR WHILE DOING THE SCAN HIGH OR EQUAL OPERATION, THE STATUS BITS FROM THAT OPERATION WILL BE DECODED AND PUT OUT VIA ENGLISH MESSAGES AS WELL AS HEX REPRESENTATION. IF A SCAN FOUND CONDITION IS GENERATED, THE ROUTINE WILL TERMINATE, OTHERWISE AN ERROR MESSAGE WILL RESULT.



4.11 SECTION AOD, SPEED TEST

4.11.1 ROUTINE 01 -DISK DRIVE 1  
 THE PURPOSE OF THIS SECTION IS TO TIME THE ROTATIONAL SPEED OF THE DISK FOR A SPECIFIED NUMBER OF REVOLUTIONS AND TO PRINT OUT THE MINIMUM, AVERAGE, AND MAXIMUM SPEED (TIME PER REVOLUTION) OF THE DISK. THE NUMBER OF REVOLUTIONS TO BE TIMED CAN BE CHOSEN BY THE CE BY SETTING THE DATA SWITCHES. THE NUMBER OF REVOLUTIONS TO BE TIMED WILL BE CHOSEN IN INCREMENTS OF 100 FROM 100 TO 1500.

THE FOLLOWING TABLE WILL BE PRINTED TO LET THE CE KNOW THE RUNNING TIMES FOR THE NUMBER OF REVOLUTIONS TO BE TESTED (HIS SELECTION WILL BE PRINTED BELOW):

DISK DRIVE 1

```

ID A0F9.  PROG A0D0-01.  SSWS
*****
*DATA *NUMBER*APPROX TIME*DATA *NUMBER*APPROX TIME*
*SWITCH*OF REV*TO COMPLETE*SWITCH*OF REV*TO COMPLETE*
*ENTRY *TESTED*CALCULATION*ENTRY *TESTED*CALCULATION*
*****I*****I*****I*****I*****I*****I*****
*00-01 I 100 I 12 SEC* 09 I 900 I 1 M 43 SEC*
* 02 I 200 I 25 SEC* 0A I 1000 I 1 M 55 SEC*
* 03 I 300 I 36 SEC* 0B I 1100 I 2 M 06 SEC*
* 04 I 400 I 48 SEC* 0C I 1200 I 2 M 17 SEC*
* 05 I 500 I 59 SEC* 0D I 1300 I 2 M 28 SEC*
* 06 I 600 I 1 M 10 SEC* 0E I 1400 I 2 M 39 SEC*
* 07 I 700 I 1 M 21 SEC* 0F I 1500 I 2 M 50 SEC*
* 08 I 800 I 1 M 32 SEC*10-PP I ONLY TEST 100 REV*
*****
  
```

NUMBER OF REVOLUTIONS TIMED= 0100

METHOD OF TESTING: THE PRESENCE OF THE INDEX SENSE BIT WILL BE CHECKED. IF THE INDEX BIT IS NOT SENSED WITHIN FOUR SECONDS (100 REVOLUTIONS) AN ERROR MESSAGE WILL BE PRINTED:

DISK DRIVE 1  
 \*ID A094. PROG A0D0-01. SSWS  
 INDEX BIT HAS NOT APPEARED IN LAST 4 SECONDS

THE PROGRAM WILL GO TO A 'HALT'. UPON RESETTING THE HALT, THE PROGRAM AGAIN WILL CHECK FOR THE PRESENCE OF THE INDEX SENSE BIT. IF THE INDEX BIT IS SENSED A 30.40 MICROSECOND TIMING LOOP IS ENTERED AND THE AMOUNT OF ELAPSED TIME BETWEEN INDEX PULSES IS RECORDED IN A TABLE. WHEN THE SPECIFIED NUMBER OF REVOLUTIONS ARE TIMED, THE MINIMUM, AVERAGE, AND MAXIMUM TIME/REVOLUTION IS CALCULATED AND PRINTED OUT.

MIN REV TIME= 040.249 MILLISEC (MIN TOLERANCE= 039.040 MILLISEC)  
 AVE REV TIME= 040.261 MILLISEC (NORMAL SPEED = 040.000 MILLISEC)  
 MAX REV TIME= 040.280 MILLISEC (MAX TOLERANCE= 040.960 MILLISEC)

SPECIFICATIONS: SPEED OF DISK 1500 +- 30 RPM.      LENGTH OF INDEXING PULSE 42.0 +- 10.5 MICROSECONDS.

ACCURACY: THE PROGRAM MEASURES THE TIME BETWEEN INDEXING PULSES WITHIN 30.40 MICROSECONDS (WITHIN 0.1%).

4.11.2 ROUTINE 02 -DISK DRIVE 2

SEE DESCRIPTION FOR DISK DRIVE 1

4.12 SECTION AOE, SEEK TEST

ROUTINE 01, SEEK FORWARD ONE CYLINDER AT A TIME FROM 0 TO THE CE CYLINDER.  
 A SERIES OF ONE TRACK SEEKS BEGINNING WITH CYLINDER 0 AND ENDING WITH THE CE CYLINDER ARE ISSUED. AFTER EACH SEEK ANY STATUS ERRORS ARE NOTED. A READ ID COMMAND IS GIVEN SO THAT THE ID READ CAN BE COMPARED AGAINST THE ID EXPECTED. IF THESE ID FIELDS DO NOT COMPARE, THE FOLLOWING INFORMATION ABOUT THE SEEK IS PRINTED OUT:  
 1. THE CYLINDER NUMBER PRIOR TO BEGINNING THE SEEK,  
 2. THE DESIRED CYLINDER NUMBER,  
 3. THE ACTUAL CYLINDER NUMBER ARRIVED AT,  
 4. THE DIRECTION OF THE SEEK AT THE TIME OF THE FAILURE.

ROUTINE 02, SEEK IN REVERSE ONE CYLINDER AT A TIME FROM THE CE CYLINDER TO CYLINDER 0.  
 A SERIES OF ONE TRACK SEEKS BEGINNING WITH THE CE CYLINDER AND ENDING WITH CYLINDER 0 ARE ISSUED. SEE THE DESCRIPTION OF ROUTINE 01 FOR ADDITIONAL DETAILS

ROUTINE 03, SEEK FORWARD TWO CYLINDERS AT A TIME FROM 0 TO THE CE CYLINDER.  
 A SERIES OF TWO TRACK SEEKS BEGINNING WITH CYLINDER 0 AND ENDING WITH THE CE CYLINDER ARE ISSUED. SEE THE DESCRIPTION OF ROUTINE 01 FOR ADDITIONAL DETAILS.

ROUTINE 04, SEEK IN REVERSE TWO CYLINDERS AT TIME FROM THE CE CYLINDER TO CYLINDER 0.  
 A SERIES OF TWO TRACK SEEKS BEGINNING WITH THE CE CYLINDER AND ENDING WITH CYLINDER 0 ARE ISSUED. SEE THE DESCRIPTION OF ROUTINE 01 FOR ADDITIONAL DETAILS.

ROUTINE 05, SEEK FORWARD NINE CYLINDERS AT A TIME FROM 0 TO THE CE CYLINDER.  
 A SERIES OF NINE TRACK SEEKS BEGINNING WITH CYLINDER 0 AND ENDING WITH THE CE CYLINDER ARE ISSUED. SEE THE DESCRIPTION OF ROUTINE 01 FOR ADDITIONAL DETAILS.

ROUTINE 06, SEEK IN REVERSE NINE CYLINDERS AT A TIME FROM THE CE CYLINDER TO CYLINDER 0.  
 A SERIES OF NINE TRACK SEEKS BEGINNING WITH THE CE CYLINDER AND ENDING WITH CYLINDER 0 ARE ISSUED. SEE THE DESCRIPTION OF ROUTINE 01 FOR ADDITIONAL DETAILS.

ROUTINE 07, A SERIES OF SEEKS BOTH LONG AND SHORT, FORWARD AND REVERSE  
 A TABLE OF PIPED SEEK ADDRESSES IS USED TO DETERMINE WHICH CYLINDERS ARE TO BE SEEKED TO. IN MOST CASES THE SEEKS WILL ALTERNATE BETWEEN A FORWARD DIRECTION AND A REVERSE DIRECTION. THE FIRST SEEKS WILL BE QUITE LONG AND THE LAST ONES WILL BE QUITE SHORT. SEE ROUTINE 01 FOR ADDITIONAL DETAILS.

ROUTINE 08, A 100 TRACK SEEK IS PERFORMED IF THE HIGH ACCESS FEATURE IS PRESENT. A TIME OUT CHECKS FOR PROPER HIGH SPEED OPERATION.

ROUTINE 09, UTILITY ROUTINE  
 THIS ROUTINE PERFORMS NO TESTS, BUT DOES INITIALIZE CERTAIN PROGRAM CONTROLS SO THAT THIS SECTION MAY BE PERFORMED ON ANOTHER DISK DRIVE WITHOUT RELOADING THE PROGRAM.

4.13 SECTION B03

ROUTINE 01, DISK IPL FUNCTION TEST. THE PROGRAM FIRST ISSUES A RECALIBRATE SIO TO PLACE THE DISK HEADS OVER TRACK 0. STATUS BIT 3 (CYLINDER 0) IS TESTED TO INSURE CORRECT RECALIBRATION. A READ DATA SIO IS ISSUED TO READ SECTOR 00 (IPL SECTOR) AND THE PROGRAM STORES THE CONTENTS OF THIS SECTOR. NEXT THE OPERATOR MUST BE FOLLOWED CAREFULLY. THE PROGRAM THEN ISSUES A SEEK SIO TO PLACE THE HEADS OVER TRACK 50. THIS WILL AID THE CE IN TESTING THE MECHANICAL MOTION OF THE HEADS BACK TO TRACK 0 DURING AN IPL OPERATION. BEFORE THE PROGRAM HALTS, THE BOTTOM 256 BYTES OF CORE ARE STORED SO THAT THIS DATA IS NOT LOST AFTER AN IPL OPERATION. THE PROGRAM THEN FILLS BOTTOM CORE WITH A TEST PATTERN. NOTE - A BRANCH INSTRUCTION IS STORED AT LOCATION -0000- TO PREVENT BOMBING OUT THE PROGRAM IF THE CE DOES SYSTEM RESET. START. AFTER THE PROGRAM HALTS, THE CE WILL IPL THE DISK. NEXT, THE CE WILL ALTER SAR TO LOCATION -0C00-. AT THIS LOCATION, THE PROGRAM 'PATCHES' ITSELF UP SO THAT IT CAN RUN AGAIN. THE PROGRAM THEN STORES THE BOTTOM 256 BYTES (NOW THE IPL DATA FROM SECTOR 00) AND REPLACES BOTTOM CORE WITH THE ORIGINAL CODE. THE IPL DATA IS FIRST CHECKED TO SEE IF IT IS THE SAME AS THE TEST PATTERN LOADED INTO BOTTOM CORE. IF IT IS, THE PROGRAM PRINTS A 'NO DATA TRANSFERRED' ERROR MESSAGE AND HALTS. OTHERWISE THE IPL DATA IS COMPARED AGAINST THE DATA THAT WAS PROGRAMMED READ FROM SECTOR 00. IF THE DATA IS AS EXPECTED, THE PROGRAM PRINTS OUT 'DATA OK'. OTHERWISE AN 'IPL DATA CHECK' ERROR MESSAGE IS PRINTED WITH THE EXPECTED AND ACTUAL DATA DUMPED IN HEX FORMAT. THIS ROUTINE IS EXECUTED TWICE. THE FIRST TIME THE PROGRAM TESTS THE REMOVABLE DISK AND THE SECOND TIME THE FIXED DISK IS TESTED.

4.14 SECTION B04

ROUTINE 01, BUILDING AN OPTION TABLE. WHEN FIRST LOADED, THE PROGRAM CHECKS DCP'S UDT TABLE FOR THE CORE SIZE AND FOR THE DISK CONFIGURATION OF THE SYSTEM. THEN OPERATOR INSTRUCTIONS ARE PRINTED TO TELL THE OPERATOR TO SET THE CONSOLE SWITCHES TO THE VARIOUS OPTIONS (SEE BELOW) AND TO RESET THE HALT. THE PROGRAM ALSO INFORMS THE OPERATOR ON THE MAXIMUM NUMBER OF SECTORS THAT CAN BE READ OR WRITTEN, ACCORDING TO THE CORE SIZE AVAILABLE. WHEN THE SWITCHES ARE SET AND THE HALT RESET, THE PROGRAM FIRST CHECKS FOR -0000- THAT DESIGNATES THE LAST OPTION. IF THE SWITCHES ARE NOT -0000-, CONSOLE SWITCH 1 (LEFTMOST) IS CHECKED FOR A VALUE OF 1 TO 9 & SWITCH 2 IS CHECKED FOR A VALUE OF 1 TO 8. IF THESE SWITCHES ARE NOT SET OK, AN ERROR MESSAGE IS PRINTED. IF BOTH SWITCHES 1 AND 2 ARE OK, SWITCH 2 IS CHECKED TO SEE IF DRIVE 2 IS SPECIFIED. IF SO, THE PROGRAM CHECKS THE UDT TABLE TO SEE IF DRIVE 2 IS DEFINED TO THE SYSTEM. IF NOT, A CORRESPONDING ERROR MESSAGE IS PRINTED. NEXT SWITCH 2 IS TESTED TO SEE IF THE CORRECT DISK HEAD IS SELECTED. THE PROGRAM LOOKS AT THESE SITUATIONS - THE PREVIOUS HEAD SELECTION IN THE SEEK MUST CORRESPOND TO THE CURRENT HEAD SELECTION IF THIS OPTION IS A READ/WRITE OR IF LAST OPTION WAS A READ/WRITE. CHECK FOR SAME HEAD SELECTIONS OR FOR HEAD SWITCHING DURING THE LAST READ/WRITE OPTION. AN ERROR MESSAGE IS PRINTED IF ANY OF THESE CONDITIONS IS IN ERROR. IF BOTH SWITCHES 1 AND 2 ARE OK THE PROGRAM ANALYZES SWITCHES 3 AND 4. IF SWITCH 1 IS A SEEK OPTION, SWITCHES 3 AND 4 ARE CHECKED FOR A CORRECT TRACK ID VALUE (TRACK ID IS SPECIFIED IN HEX). LIKEWISE IF SWITCH 1 SPECIFIES A READ/WRITE COMMAND SWITCHES 3 AND 4 ARE CHECKED FOR A CORRECT SECTOR ID. NOTE - IF SWITCH 1 SPECIFIES A MULTIPLE READ/WRITE OPERATION, SWITCHES 3 AND 4 ARE TAKEN AS THE STARTING SECTOR ID (ALSO SPECIFIED IN HEX). IN THIS CASE THE PROGRAM ASKS THE OPERATOR TO DESIGNATE THE NUMBER OF SECTORS TO BE READ OR WRITTEN. WHEN THE OPERATOR ENTERS THIS VALUE IN SWITCHES 3 AND 4 AND RESETS THE HALT, THE PROGRAM CHECKS THIS VALUE TO MAKE SURE THAT IT DOES NOT EXCEED THE REMAINING SECTORS ON THE TRACK. ALSO THIS SECTOR NUMBER VALUE IS CHECKED AGAINST THE AVAILABLE CORE SIZE OF THE MACHINE. AN ERROR MESSAGE IS PRINTED IF THE NUMBER OF SECTORS EXCEEDS EITHER THE CORE SIZE OR OVERFLOWS THE SECTOR COUNT. ONE LAST CHECK IS MADE ON SWITCHES 3 AND 4 IF SWITCH 2 SPECIFIES A REMOVABLE DISK. THIS CHECK MAKES SURE THAT THE OPERATOR DOES NOT USE TRACKS 4 - 6 NOR TRACKS 71 - 75, SINCE THESE ARE THE TRACKS WHERE DISK DIAGNOSTIC PATTERNS ARE STORED. AFTER ALL OPTIONS ARE ENTERED, THE CURRENT OPTION TABLE IS PRINTED ALONG WITH THE ENGLISH INTERPRETATION OF EACH OPTION. THE PROGRAM THEN HALTS TO ALLOW THE OPERATOR TO 'VERIFY' HIS TABLE OF OPTIONS. WHEN THIS HALT IS RESET THE PROGRAM GOES TO ROUTINE 02.

SWITCH 1	CONSOLE SWITCH OPTIONS SWITCH 2	SWITCHES 3 + 4
1 - ISSUE A SEEK	1 - DRIVE 1 - RMVBL - HD 0	XX - SPECIFY, IN HEX, TRACK OR SECTOR ID.
2 - READ DATA FROM SECTOR	2 - DRIVE 1 - RMVBL - HD 1	
3 - READ TRACK ID	3 - DRIVE 1 - FIXED - HD 2	
4 - READ DIAGNOSTIC	4 - DRIVE 1 - FIXED - HD 3	
5 - READ VERIFY	5 - DRIVE 2 - RMVBL - HD 0	
6 - WRITE DATA ON SECTOR	6 - DRIVE 2 - RMVBL - HD 1	
7 - WRITE ID ON TRACK	7 - DRIVE 2 - FIXED - HD 2	
8 - DO MULTI-SECTOR READ	8 - DRIVE 2 - FIXED - HD 3	
9 - DO MULTI-SECTOR WRITE		
A - ONE-TIME SEEK		

NOTE - THE PROGRAM ALLOWS 38 BYTES OF STORAGE FOR THE CONSOLE SWITCH OPTIONS. THEREFORE THE PROGRAM WILL ALLOW 19 OPTION ENTRIES (OR LESS). THE EXACT NUMBER DEPENDS ON THE USE OF THE MULTI-SECTOR READS OR WRITES (EACH MULTI-SECTOR REQUIRES 4 STORAGE BYTES). THE PROGRAM KEEPS TRACK OF THE STORAGE LIMITS AND WILL SELF-TERMINATE WHEN FILLED.

- OPTION A (SWITCH 1), THE ONE-TIME SEEK, SHOULD BE USED FOR SELECTING AND POSITIONING A DISK HEAD. THE REMAINING OPTIONS SHOULD DEAL ONLY WITH DATA TRANSFER. THIS SEEK WILL ONLY BE ISSUED ONCE AND THE PROGRAM WILL LOOP ON THE REMAINING DATA TRANSFERRING OPTIONS.
- THE PROGRAM DOES NOT AUTOMATICALLY DO A READ ID AFTER A SEEK COMMAND. THEREFORE TO VERIFY A SEEK, A READ ID MUST BE ENTERED AS AN OPTION. IF THE TRACK IS AN ALTERNATE OR DEFECTIVE TRACK THE PROGRAM ASSUMES THAT THE HEADS ARE AT THE CORRECT TRACK POSITION. TO FIND OUT IF IT IS AN ALTERNATE OR DEFECTIVE TRACK, SET SSW 19 ON AND EXAMINE THE CONTROL FIELD PRINTOUT FOR THE READ ID COMMAND.
- IF A WRITE ID OPTION IS SELECTED, THE PROGRAM AUTOMATICALLY SELECTS SECTOR 00 TO PREVENT 'MESSING UP' THE TRACK IDS.
- THE DIAGNOSTIC READ OPTION STARTS AT SECTOR 00 AND WILL READ ALL SECTORS UP TO AND INCLUDING THE SECTOR SELECTED IN SWITCHES 3,4. IF SSW 19 IS ON, THE SECTOR THAT IS DUMPED IS THE LAST SECTOR READ (THE ONE SELECTED IN SWITCHES 3,4).

ROUTINE 02, EXECUTE OPTION TABLE. THIS ROUTINE CONTINUALLY LOOPS ON THE ENTERED OPTION TABLE. BEFORE THE TABLE IS EXECUTED, THE DISKS ARE RECALIBRATED TO 'INITIALIZE' THE DISK HEAD'S LOCATION. EACH OPTION IS THEN EXECUTED SEQUENTIALLY. NOTE - IF SSW 17 IS ON THE PROGRAM DUMPS THE CURRENT MAKE UP OF EACH OPTION (THE START I/O AND ITS CONTROL FIELD) BEFORE THE COMMAND IS ACTUALLY EXECUTED. EACH OPTION IS ANALYZED INDIVIDUALLY AND THE ACTUAL SIO COMMAND AND CORRESPONDING CONTROL FIELD ARE 'CUSTOM MADE' FOR EACH OPTION AS THE PROGRAM RUNS. BEFORE EACH COMMAND IS ISSUED, THE READ/WRITE DATA FIELD IS FILLED WITH FF'S TO AID IN DETERMINING VALID DATA TRANSFERRING. NOTE - IF SSW 19 IS ON, THE DATA READ IN AFTER A READ SIO IS PRINTED OUT IN HEX FORMAT ALONG WITH THE SECTOR ID FROM WHICH IT WAS READ. EACH COMMAND ISSUED TO THE DISK IS CHECKED FOR TIMING OUT, THAT IS TO SEE IF THE BUSY CONDITION DROPS WITHIN LIMITS. IF SSW 1A IS ON THE PROGRAM WILL HALT -E4- AFTER ISSUING THE LAST OPTION STORED IN THE TABLE. WHEN THIS HALT IS RESET, THE PROGRAM STARTS OVER WITH THE FIRST OPTION AGAIN. NOTE - IF SSW 1B IS ON, THE PROGRAM WILL READ THE CONSOLE SWITCHES AND USE THEM AS A DELAY BETWEEN SIO'S.

ROUTINE 03, SUMMARY DUMP OF OPTION TABLE. THIS ROUTINE MUST BE DIALED IN VIA DCP'S SWITCHES -F203-. THIS ROUTINE IS THE SUMMARY DUMP OF THE OPTION TABLE. THIS ROUTINE LISTS, IN TABLE FORM, EACH OPTION AND THE NUMBER OF TIMES THE OPTION WAS EXECUTED AS WELL AS THE NUMBER OF TIMES THE OPTION CAUSED AN ERROR.

THE FIRST LINE OF THE TABLE IS CALLED 'STATUS CHECKS, INITIAL.' THE ERRORS SHOWN HERE WERE ENCOUNTERED WHILE ATTEMPTING, OR AFTER DOING A RECALIBRATE TO INITIALIZE THE DISK HEAD POSITION PRIOR TO EXECUTING THE OPTIONS IN THE TABLE.

4.15 SECTION BOA, CYLINDER 0 RESTORE PROGRAM

4.15.1 GENERAL PROGRAM DESCRIPTION.

4.15.1.1 'SAVE' CYLINDER 0 BY WRITING IT ON CYLINDER 3.  
 4.15.1.2 WRITE A ONE SECTOR RESTORE PROGRAM ON CYLINDER 3, SECTOR DC.  
 4.15.1.3 PRINTOUT THE FOLLOWING 22 BYTE MANUAL ROUTINE:

```

0000 31 A6 0007
0004 31 A4 0012
0008 F3 A0 00
000B 3C DC 0014
000F F3 A1 00
0012 00 03 8103
    
```

THE PROGRAM SHOULD BE RUN WHEN THE SYSTEM IS FUNCTIONING PROPERLY AND THE DISK PACK IS IN WORKING ORDER. IF CYLINDER 00 IS ALTERED OR DESTROYED, AFTER BOA HAS BEEN RUN, THE FOLLOWING 3 STEPS WILL RESTORE CYLINDER 00.

1. WITH FAULTY CE PACK ON R1, IPL FROM R1. THIS WILL POSITION CARRIAGE TO CYLINDER 00. IGNORE PROCESS CHECK, IF ANY.
2. TURN OFF I/O OVERLAP SWITCH.
3. ENTER AND EXECUTE THE 22 BYTE ROUTINE SHOWN IN STEP 3 ABOVE.

4.15.2 PROGRAM HALTS

MOD 10 HALT	MOD 6 HALT	DESCRIPTION
*** **	AA (A C 1 3)	BOOTSTRAP SECTOR HAS LOADED CORRECTLY FROM CYL/SEC 03DC. HALT RESET. EXPECT HALT 44 (B2 ON 5406).
* *	44 (B 2)	CYLINDER 0 HAS BEEN RESTORED, SEE IF YOU CAN IPL FROM R1 NOW.
*** **	88 (A 1 )	MANUAL ROUTINE HAS BEEN RESTORED TO 0000. TO RESTART HIT SYSTEM RESET AND START.
* *	DD (AD D12 4)	DISK ERROR - CHECK ARR IN TABLE BELOW TO FIND WHAT OPERATION FAILED. ALSO CHECK TABLE FOR OTHER INFORMATION THAT IS AVAILABLE IN CORE LOCATIONS 0003 TO 000E.
<p>ERROR ROUTINE - STORES ERROR INFORMATION STARTING AT X'0003'</p> <pre> 0000 - 0002 RESTART BRANCH 0003 - 0004 DISK SENSE BYTES 0 AND 1 0005 - 0006 DISK SENSE BYTES 2 AND 3 0007 - 0008 ARR - VALUE INDICATES WHICH ROUTINE FAILED 0013 - PROCESS CHECK - TURN ON I/O OVERLAP SW AND MAKE SURE THE CARRIAGE IS AT CYL 0 WHEN YOU START. 0030 - NO MOTION SEEK, OR READ CYLINDER 3, HEAD 1 0040 - NOT AT CYLINDER 0 AFTER SEEK TO CYL 0, HEAD 1 004A - WRITE ID ON CYLINDER 0, HEAD 1 0057 - WRITE DATA ON CYLINDER 0, HEAD 1 006B - SEEK TO OR READ CYLINDER 0, HEAD 0 007B - NOT AT CYLINDER 0 AFTER SEEK TO CYL 0, HEAD 0 0085 - WRITE ID ON CYLINDER 0, HEAD 0 0092 - WRITE DATA ON CYLINDER 0, HEAD 0 009C - READ VERIFY ON CYLINDER 0, HEAD 0 AND HEAD 1 0009 - 000C LAST USED DISK CONTROL FIELD 000C - 000E DATA REGISTER CONTENTS AT TIME OF ERROR                     </pre>		
*** **	PD (ABCD )	DISK ERROR WHEN TRANSFERRING CYL 0 TO CYL 3. RUN YOUR DISK DIAGNOSTICS TO LOCATE TROUBLE.

4.16 SECTION BOB, 5444 ADJUSTMENT ROUTINES

4.16.1 GENERAL PROGRAM DESCRIPTION FOR ROUTINES 01 THRU 06 (5444 FRICTION CLUTCH DRIVE).

THESE ROUTINES ARE USED WITH THE 5444 MAP CHARTS, PAGE 514 TO ADJUST THE FWD AND REV CLUTCHES FOR OPTIMUM OPERATION. AS A PREVENTIVE MAINTENANCE TOOL, THE PROGRAM IS USED TO CHECK FOR DETERIORATION OF CLUTCH OPERATION, SO THAT ADJUSTMENTS CAN BE MADE BEFORE THE CUSTOMER HAS ANY SEEK PROBLEMS. SINCE THIS IS AN ADJUSTMENT PROGRAM, THE NORMAL MODE OF OPERATION IS TO LOOP IN THE SELECTED ROUTINE, ON THE SELECTED DRIVE. DRIVE AND DISK ARE SELECTED WITH SENSE SWITCHES 10, 11, 12, AND 13.

FORWARD AND REVERSE CLUTCH ADJUSTMENT OBJECTIVES

THE FORWARD AND REVERSE CLUTCHES SHOULD OPERATE RELIABLY OVER THE WIDEST POSSIBLE RANGE OF DRIVE GAPS, FOR ALL LENGTHS OF SEEKS. ONE TRACK SEEKS ARE THE MOST CRITICAL AND ARE USED BY THE PROGRAM FOR THE BASIC MEASUREMENTS. THE DRIVE GAP WILL INCREASE WITH WEAR, SO IT SHOULD BE ADJUSTED FOR THE SMALLEST GAP THAT WILL GIVE RELIABLE OPERATION.

WHAT IS RELIABLE OPERATION?

IF THE PROGRAM PRINTOUT IS WITHIN SPECIFICATIONS, AND THE ADJUSTMENTS ARE AS SPECIFIED IN THE PFORM, THE CLUTCH OPERATION SHOULD BE CONSIDERED RELIABLE. WITH THESE CONDITIONS MET, CUSTOMER PROBLEMS ARE NOT LIKELY TO BE CAUSED BY THE CLUTCHES.

ROUTINE 01 ONE PASS OF THE ROUTINE WILL:

1. RECALIBRATE.
2. DO 1 TRACK, FORWARD SEEKS UNTIL RD ID INDICATES ARRIVAL AT THE HIGHEST POSSIBLE CYLINDER ADDRESS.
3. PRINT RESULTS OF THE FORWARD SEEKS.
4. DO 1 TRACK, REVERSE SEEKS UNTIL RD ID INDICATES ARRIVAL AT CYLINDER 00.
5. PRINT RESULTS OF THE REVERSE SEEKS.
6. HALT 11 OR 21.

FOR EACH SEEK, THE PROGRAM MEASURES HOW LONG IT TAKES FOR THE FLEXIBLE DISK TO COVER THE TRACK CROSSING CYL AFTER THE SIO INSTRUCTION WAS STARTED. IF THE CLUTCHES ARE ADJUSTED PROPERLY, THIS TIME WILL VARY LESS THAN 1 MS FOR ALL OF THE SEEKS. HOWEVER, IF THE CLUTCHES NEED ATTENTION, SLIPPAGE MAY OCCUR, CAUSING THE TIME TO VARY MORE THAN 3 MS.

THE PRINTOUT IS IN THE FORM OF A BAR GRAPH DISTRIBUTION CURVE. THE GRAPH SHOWS TIMINGS MEASURED IN ONE DIRECTION (FWD OR REV). SEE EXAMPLE OF AN ACCEPTABLE PRINTOUT AT THE END OF THE PROGRAM DESCRIPTION. EACH PRINTOUT IS CHECKED AGAINST LIMITS. IF THE LIMITS ARE EXCEEDED, APPROPRIATE MESSAGES WILL PRINT AFTER THE GRAPH.

ROUTINE 02 - 06

GOES THRU THE SAME 6 STEPS AS IN ROUTINE 01, EXCEPT THAT THE ROUTINE NUMBER BECOMES THE NUMBER OF TRACKS PER SEEK. THE TIME MEASURED IS FROM THE START OF THE SIO OPERATION TO THE TRACK CROSSING PULSE JUST BEFORE THE ACCESS IS SUPPOSED TO STOP. EACH ROUTINE BRINGS IN ITS OWN LIMITS, SO THAT THE PRINTOUT CAN BE CHECKED AGAINST THE PROPER LIMITS.

ROUTINE 07 PRINTOUT STATUS, AND THE ID FIELD FOR THE CURRENT POSITION OF THE CARRIAGE.

ROUTINE 08 QUICK SEEK CHECK ROUTINE.

THIS ROUTINE RECALIBRATES AND SEEKS TO CYLINDER 101. IT THEN SEEKS ALTERNATELY BETWEEN 100 AND 101. A PRINTOUT WILL OCCUR IF ANY READ ID INDICATES THE CARRIAGE DID NOT ARRIVE AT THE EXPECTED CYLINDER. AFTER THE INITIAL HALT 18 OR 28, THERE CAN BE ONLY ONE OTHER HALT. THIS IS THE ERROR HALT E. PRINTOUT WILL GIVE STATUS, EXPECTED CYLINDER ADDRESS, AND ACTUAL CYLINDER ADDRESS AT THE TIME OF THE ERROR.

ROUTINE 09 MINI - FRIEND

THIS ROUTINE CAN BE USED TO CAUSE THE CARRIAGE TO MOVE BACK AND FORTH BETWEEN ANY TWO CYLINDERS. THE CONSOLE SWITCHES ARE SET TO A VALID S & N BYTE FOR A SEEK DISK CONTROL FIELD, THUS SELECTING THE HEAD DIRECTION, AND NUMBER OF TRACKS TO SEEK. SEE SECTION 5.1.5, BYTES 2 & 3 FOR EXPLANATION OF CONTROL FIELD S & N BYTES.

AT ANY HALT IN THIS ROUTINE, XR2 WILL CONTAIN THE CYL/SEC FROM THE LAST READ ID OPERATION.

WITH THE PRINTER NOT READY, ONE SEEK WILL BE PERFORMED, USING THE S & N BYTE FROM THE CONSOLE SWITCHES. XR2 CAN THEN BE CHECKED TO FIND THE POSITION OF THE CARRIAGE.

IF THE PRINTER IS READY, THE SEEK WILL BE PERFORMED, FOLLOWED BY ANOTHER SEEK IN THE OPPOSITE DIRECTION FOR THE SAME NUMBER OF TRACKS. THIS WILL CONTINUE UNTIL THE PRINTER IS MADE NOT READY OR UNTIL THERE IS A DISK ERROR. HALT E WILL INDICATE DISK ERROR. SEC PRINTOUT FOR STATUS ETC.

ROUTINE 0A SCAN DISK FOR ERRORS & FLAGGED TRACKS.

VERIFY 48 SECTORS ON EACH TRACK. AFTER THE HEADING FOR EACH DETECTED ERROR THERE IS A PRINTOUT AS FOLLOWS:

```
*ID A000. PROG B0B3-A. SSNS 07,10
RXP ACT
CYL--CYL--CTRL  PLD--RD ID  PLD--STATUS BYTES--FIRST 12 BYTES FROM BAD SECTOR
004 003 0004002F 010JFF 24 00 00 51 00CDCE800CF4633C0C000601 * 4
072 003 00047002F 010JFF 24 00 00 51 8C341828466B465DE06B3013 *NO DATA READ *
```

ACTUAL CYLINDER IS THE DECIMAL EQUIVALENT OF THE CYLINDER ADDRESS TAKEN FROM THE READ ID FIELD. IF THE THIRD BYTE OF THE ID FIELD IS FF, IT MEANS THAT THE READ ID DID NOT WORK PROPERLY, THEREFORE, THE ACTUAL CYLINDER SHOULD BE DISREGARDED.

ROUTINE 0B ADJUST DATA SEPARATOR. (EQUIVALENT TO 5444 PETOMN SCOPE PROCEDURE FOR DATA SEPARATOR).

ROUTINE DOES A CONTINUOUS VERIFY OPERATION ON THE CE TRACK. IF THERE IS ANY KIND OF DISK ERROR THE PRINTER WILL PRINT A LINE. IF THE PRINTER WILL NOT STOP PRINTING IN STEP 3, CALL IN ROUTINE 07 AND CHECK THE STATUS TO FIND OUT WHAT KIND OF ERROR IS PRESENT. WITH ROUTINE 0B RUNNING, ADJUST THE DATA SEPARATOR AS FOLLOWS:

1. LOCATE POT ON E4 CARD ON THE DISK ATTACHMENT BOARD.
2. TURN POT CCW UNTIL PRINTER PRINTS CONTINUOUSLY.
3. TURN POT CW UNTIL PRINTER STOPS PRINTING.
4. COUNT THE NUMBER OF CW TURNS NECESSARY TO CAUSE THE PRINTER TO START PRINTING.
5. TURN AT LEAST 1 MORE TURN CW (PRINTER WILL CONTINUE TO PRINT).
6. TURN POT CCW UNTIL PRINTER STOPS PRINTING.
7. TURN POT CCW 1/2 THE NUMBER OF TURNS RECORDED IN STEP 4. DATA SEPARATOR IS NOW ADJUSTED.

ROUTINE 0C ENCODE PLATE ADJUSTMENT. (EQUIVALENT TO 5444 PETOMN SCOPE PROCEDURE FOR SYMMETRY).

THIS ROUTINE REQUIRES 1 JUMPER ON THE DISK ATTACHMENT BOARD. THERE ARE TWO JUMPER LOCATIONS, DEPENDING ON WHICH DISK DRIVE IS SELECTED (SSW 12 OR 13). IF THE JUMPER IS NOT ON, OR FALLS OFF DURING THE MEASUREMENT, A MESSAGE WILL PRINT GIVING THE CORRECT LOCATION FOR THE SELECTED DISK DRIVE.

JUMPER IS FROM: W3G2G04 TO W3R2P12 FOR DRIVE 1.  
W3P2G04 TO W3R2P10 FOR DRIVE 2.

IF HIGH SPEED DRIVE REMOVE Y GATE CARD E6 BEFORE RUNNING THIS ROUTINE.

STARTING AT CYL 0, THE CARRIAGE DOES ALTERNATE FWD AND REV 100 TRACK SEEKS. IF THE PRINTER PRINTS LINES OF \*'S FOLLOWED BY FOUR DIGITS THE ENCODE PLATE IS TOO FAR TO THE LEFT. IF THE ENCODE PLATE IS ADJUSTED CORRECTLY AND THE HOLDING SCREWS ARE TIGHT, MODERATE PRESSURE TO THE RIGHT OR LEFT WILL CAUSE CONTINUOUS PRINTOUTS, CORRESPONDING TO THE DIRECTION OF PRESSURE.

THE FOUR DIGIT INDICATES THE DIFFERENCE BETWEEN THE FWD AND REV SPEED, NO PRINTING INDICATES EQUAL FWD AND REV SPEED.

ROUTINE 0D SPEED ADJUSTMENT (EQUIVALENT TO 5444 PETOMN SCOPE PROCEDURE FOR SPEED ADJUSTMENT).

SAME JUMPER AND MESSAGES AS RTN 0C. THIS ROUTINE SETS THE POT ON THE B6 CARD IN THE Y GATE IN THE DISK DRIVE.

WITH THE ROUTINE RUNNING:

1. TURN POT CCW UNTIL PRINTER PRINTS CONTINUOUS FOUR DIGIT LINES.
2. SLOWLY TURN THE POT CW UNTIL YOU HEAR A LONG PRINT LINE. THE POT IS NOW ADJUSTED.

THE TRACK TO TRACK SPEED FROM 2 TO 3 AND 52 TO 53 IS COMPARED AND THE DIFFERENCE INDICATED BY THE FOUR DIGIT PRINTOUT.

ROUTINE OF SCOPING LOOP TO READ ANYTHING ON THE DISK.

THIS ROUTINE PROVIDES A TIGHT SCOPE LOOP FOR ANY KIND OF READ OPERATION. DRIVE SELECTION IS CONTROLLED BY SSW 11. SSW 11 ON FOR DRIVE 2, AND OFF FOR DRIVE 1. DISK SELECTION IS CONTROLLED BY SSW 10. SSW 10 ON FOR REMOVABLE, AND OFF FOR FIXED. HEAD SELECTION IS DETERMINED BY BIT 0 IN THE SECTOR ADDRESS (SEE TABLE BELOW). USE THE TABLE BELOW TO SELECT THE DESIRED OPTION. YOU WILL NOTE THE SWITCH SETTINGS DO NOT SELECT THE TRACK ADDRESS. THEREFORE, IF YOU WANT TO READ A PARTICULAR CYLINDER, YOU MUST POSITION THE CARRIAGE TO THAT CYLINDER USING ROUTINE 09 OR THE OFF LINE CE SWITCHES ON THE DISK DRIVE. THE PROGRAM DOES A READ ID TO DETERMINE CARRIAGE LOCATION. THE FLAG AND CYLINDER BYTE FROM THE READ ID ARE PLUGGED INTO THE DISK CONTROL FIELD USED BY THE LOOP. TO CHANGE SW SET UP. SET SW 1 TO F WHILE LOOPING. THIS WILL GIVE HALT HF (PF5 ON 5406). SET SW 1 TO 0 AND RESET HALT TO 05 TO HALT 1B OR 2E. OPTIONS ARE SET ONLY WHEN HALT 1B OR 2E IS RESET. IF YOU MUST LOOP ON A WRITE OP, CHANGE THE Q CODE OF THE STO INSTRUCTION AT 'SIO18' TO 'A0'. USE SCAN EQU SETTING FOR WRITE DATA. USE SCAN LOW/EQU FOR WRITE ID.

\*\*\*\*\* CAUTION \*\*\*\*\*

IN THIS MODE YOU CAN WIPE OUT CUSTOMER DATA OR ALIGNMENT TRACKS - BE CAREFUL

THE CARRIAGE MUST BE ACCESSED TO THE THE DESIRED TRACK MANUALLY. AT THE 1B OR 2E HALT SET THE SWITCHES AS FOLLOWS:

		SWITCH 3 6 4						
		1	5	2				0
		0	1	2	3	4	5	6
SECTOR ADDRESS	OPERATION	SECTOR COUNT MAY BE 00 THRU 2F						
UPPER HEAD	DATA	0	0	0	0	0	0	0
00 THRU 5C	ID	0	1	0	0	0	0	0
	DIAG	1	0	1	0	0	0	0
LOWER HEAD	VERIFY	1	1	1	0	0	0	0
80 THRU DC	EQU	0	0	0	1	0	0	0
	LOW/EQU	0	1	1	0	0	0	0
	HIGH/EQU	1	0	1	0	0	0	0
	NOT USED	1	1	1	1	1	1	1

NOTE: AT ANY TIME, WHILE RUNNING ANY ROUTINE YOU MAY TURN SW 1 TO F. YOU WILL EITHER GET THE DCP HALT HF (ABCD12345) OR THE CURRENT ROUTINE HALT. IN EITHER CASE P2IX WILL CALL IN ANY OTHER DESIRED ROUTINE OR ANY APPLICABLE SSW SETTING MAY BE MADE.

NOTE: WHEN RUNNING ROUTINES 0C AND 0D THE I/O OVERLAP SWITCH MUST BE ON.

4.16.2 HALT TABLE

HALT ID	TENS	UNITS	HALT MEANING
11 OR 21	DRIVE	RTN 01	HALT ID FOR FRICTION CLUTCH ADJUSTMENT ROUTINES.
12 OR 22	DRIVE	RTN 02	
13 OR 23	DRIVE	RTN 03	
14 OR 24	DRIVE	RTN 04	
15 OR 25	DRIVE	RTN 05	
16 OR 26	DRIVE	RTN 06	SEE SSW 2E & 2F FOR LINKING RTNS 01 THRU 06 TOGETHER.
17 OR 27	DRIVE	RTN 07	PRINT STATUS, READ ID AND PRINT IT.
18 OR 28	DRIVE	RTN 08	INITIAL HALT FOR QUICK CHECK ROUTINE.
19 OR 29	DRIVE	RTN 09	INITIAL AND NORMAL HALT WHEN NOT LOOPING IN MINI - FRIEND.
1A OR 2A	DRIVE	RTN 0A	INITIAL HALT. RTN A RESET TO RUN.
1B OR 2B	DRIVE	RTN 0B	INITIAL HALT. RTN B RESET TO RUN.
1C OR 2C	DRIVE	RTN 0C	INITIAL HALT. RTN C RESET TO RUN.
1D OR 2D	DRIVE	RTN 0D	INITIAL HALT. RTN D RESET TO RUN.
1E OR 2E	DRIVE	RTN 0E	INITIAL HALT. RTN E RESET TO RUN. SWITCHES ARE SET AT THIS HALT.
0E			ERROR HALT FOR ROUTINE 08 & 09, CHECK PRINTOUT - RESET TO RETURN.
FF			INTERVENTION REQUIRED - SEE PRINTOUT. (RESET TO TRY AGAIN)

4.16.3 SENSE SWITCH OPTIONS

SENSE SWITCH	COMMENTS	ROUTINE
10	PROGRAM WILL USE REMOVABLE DISK WHEN RUNNING.	ALL
11	PROGRAM WILL USE FIXED DISK WHEN RUNNING.	ALL
12	PROGRAM WILL USE DRIVE 1 WHEN RUNNING.	ALL
13	PROGRAM WILL USE DRIVE 2 WHEN RUNNING.	ALL
20	CAUSES "PER CYCLE" OPTION TO PRINT. WITH 1 TRACK SEEKS, THIS OPTION WILL PRINT OVER 400 LINES. THIS OPTION SHOULD BE USED ONLY WHEN THE DATA IS NEEDED FOR ANALYSIS. THIS OPTION CAN BE RESET BY - STOP - SYSTEM RESET - TURN OFF SSW 20 - RESTART DESIRED ROUTINE (SSW 28 OVERRIDES THIS OPTION).	1 - 6
23	CHECK FORWARD CLUTCH ONLY - ELIMINATES REVERSE MEASUREMENTS AND PRINTOUT.	1 - 6
24	CHECK REVERSE CLUTCH ONLY - ELIMINATES FORWARD MEASUREMENTS AND PRINTOUT.	1 - 6
27	USE LOWER HEAD WHEN RUNNING PROGRAM. (RTN 1 THRU 6 ONLY).	1 - 6
28	SNAPSHOT MODE - RUN 3 MEASUREMENTS AND RETURNS TO START HALT (OVERRIDES SSW 20).	1 - 6
2D	REPEAT LAST PRINTOUT (PWD - REV)	1 - 6
2E	RUN ROUTINE 01 THRU 06 IF SSW 2F IS ON.	1 - 6
2F	RUN MULT. ROUTINES - ROUTINE 01 THRU 03 IF SSW 2E IS OFF. ROUTINE 01 THRU 06 IF SSW 2F ON.	1 - 6

4.16.4 EXAMPLE OF AN ACCEPTABLE PRINTOUT

```

ID A011. PROG BOB3-01. SSW5
DIRECTION SIO CYCLES, SEEK LENGTH, DISK ... LIMITS - LOW VAR HIGH ... STATUS BYTES
FORWARD 203 1 TRACK P1 ... IN MS 4.3 .9 8.7 ... 00 00 03 51

5.7
5.8 1 *
5.9 9 *****
6.0 69 *****
6.1 68 *****
6.2 41 *****
6.3 12 *****
6.4 1 ***
6.5
    
```

FOR MORE INFORMATION ABOUT INTERPRETING THE PRINTOUT, SEE THE SEEK FAILURE MAPS.



5.1.4 SENSE I/O COMMANDS

```

*****
* SECOND BYTE *
* 1 I O I 1 I X X M X X N I I N *
* I I I I I I I I I I I I I I I *
* D E V I C E A D D R E S S N O T R E G I S T E R C O D E *
* . . . . . *
* I I I I I I I I I I I I I I I *
* D E V I C E S T A T U S B Y T E S 0, 1 N O 1 0 1 I I I *
* D E V I C E S T A T U S B Y T E S 2, 3 1 0 1 0 0 I I I *
* D A T A A D D R E S S R E G I S T E R 1 0 1 0 0 I I I *
* C C N T R O L F I E L D A D D R E S S R E G. 1 1 0 0 I I I *
*
* O P E R A N D 1 A D D R E S S *
*
* A D D R E S S I N C O R E W H E R E T H E *
* D A T A T O B E S E N S E D F R O M T H E *
* D E V I C E I S T O B E P L A C E D *
*
* X B I T = 0, U S E D I S K 1 *
* X B I T = 1, U S E D I S K 2 *
*
*****
* D E V I C E S T A T U S B Y T E 0 *
* B I T 0 N O O P *
* 1 I N T E R V E N T I O N R E Q U I R E D *
* 2 M I S S I N G A D D R E S S M A R K E R *
* 3 E Q U I P M E N T C H P C K *
* 4 D A T A C H P C K *
* 5 N O R E C O R D F O U N D *
* 6 T R A C K C O N D I T I O N C H E C K *
* 7 S E E K C H E C K *
*
* D E V I C E S T A T U S B Y T E 1 *
* B I T 0 S C A N E Q U A L *
* 1 C Y L I N D E R Z E R O *
* 2 E N D O F C Y L I N D E R *
* 3 S E E K B U S Y *
* 4 1/2 C A P A C I T Y *
* 5 O V E R R U N *
* 6 S T A T U S A D D R E S S A *
* 7 S T A T U S A D D R E S S B *
*
* D E V I C E S T A T U S B Y T E 2 *
* B I T 0 U N S A F E *
* 1 T A P L I N E A *
* 2 T A P L I N E B *
* 3 T A P L I N E C *
* 4 I N D E X *
* 5 H E A D S E T T L I N G *
* 6 C E S E N S E B I T *
* 7 5406 *
*
* D E V I C E S T A T U S B Y T E 3 *
* B I T 0 N O T U S E D *
* 1 C E S E N S E B I T *
* 2 C E S E N S E B I T *
* 3 N O T B I T R I N G I N H I B I T *
* 4 S T A N D A R D W R I T E T R I G G E R *
* 5 C O N D I T I O N P R I O R I T Y R E Q U E S T *
* 6 B I T R I N G 0 *
* 7 N O T C C R E G. P O S I T I O N 7 *
*****
    
```

5.1.5 5444 DISK CONTROL FIELD

```

*****
* B Y T E 0 * B Y T E 1 * B Y T E 2 * B Y T E 3 *
* F L A G * C Y L I N D E R * H E A D & S E C T O R * N U M B E R *
*
* N O R M A L L Y S E T T O Z E R O. * T H E C Y L I N D E R N U M B E R * B I T 16 = H E A D, (0 O R 1) * T H I S N U M B E R M U S T B E O N E *
* F O R D E F E C T I V E T R A C K, * R A N G E S F R O M 0 - 203 * B I T S 17-21 = S E C T O R S 0 -23 * L E S S T H A N T H E D E S I R E D *
* B I T 6 = 1. * * B I T S 22-23 B O T H Z E R O S F O R * N U M B E R O F S E C T O R S T O B E *
* F O R A L T E R N A T E T R A C K, * * F O R R E A D, W R I T E O R S C A N. * T R A N S F E R R E D O N A R E A D, W R I T E *
* B I T 7 = 1. * F O R S E E K F O R W A R D, B I T 23=1 * O R S C A N, O R E Q U A L T O T H E *
* * F O R S E E K R E V E R S E, B I T 23=0 * N U M B E R O F T R A C K S T O B E *
* * * * * C R O S S E D O N A S E E K O P. *
*****
    
```

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1. PROGRAM SUMMARY

1.1 PURPOSE - 5203 PRINTER FUNCTION TESTS AND FAULT ISOLATION PROGRAMS.

SECTION	ROUTINE DESCRIPTIONS	SENSE SWITCH OPTIONS	
<b>E01 - FUNCTION AND PERFORMANCE TEST.</b> NOTE - EXECUTION OF THIS SECTION ON THE LEFT OR RIGHT CARRIAGE IS DETERMINED BY SSW-08.  NOTE - RESTORE CARRIAGE(S) BEFORE STARTING THIS SECTION.  NOTE - ROUTINE '0E' IS RUN ONLY WHEN SELECTED VIA DATA SWITCH OPTION 'F20E'. THIS ROUTINE IS USED FOR A RUN-IN PROCEDURE FOR P.M. ON THE CARR CLUTCHES. AFTER GREASING CARR CLUTCHES, SELECT ROUTINE '0E' AT AN 'EAT' OR 'EC' HALT, SET ADDRESS SW'S TO E001 FOR LEFT CARR, RESET HALT, AND, IF DFC, SET ADDRESS SW'S TO E001 FOR RIGHT CARR, RESET HALT, ENTER 0000 IN ADDRESS SW'S, DISENGAGE FORMS TRACTORS, RESET HALT TO GO. ( RUN FOR APPROXIMATELY 90 SEC)	01 - TEST FOR PROPER DECODE OF PRINTER COMMAND CODE 'E0'. CHECK TO MAKE SURE THAT THE CHAIN IMAGE STORED IN CORE CORRESPONDS TO THE PRINT CHAIN. 02 - CHECKS THE RESPONSE TO A TEST I/O NOT READY, WHILE THE PRINTER IS NOT READY. 03 - CHECKS THE RESPONSE TO A TEST I/O PRINTER BUSY, WHILE THE PRINTER IS NOT READY. 04 - CHECKS THE RESPONSE TO A TEST I/O NOT READY WHILE THE PRINTER IS READY. 05 - CHECKS THE RESPONSE TO A TEST I/O PRINTER BUSY, WHILE THE PRINTER IS READY. 06 - CHECKS THE RESPONSE TO LOAD I/O COMMANDS TO THE IMAGE AND DATA ADDRESS REGISTERS, AND ALSO THE NO-OP STATUS BIT. 07 - SIO COMMANDS TEST. ALL VALID START I/O COMMANDS ARE ISSUED TO THE PRINTER AND CHECKED FOR PROPER EXECUTION. THE PRINTOUT SHOULD BE EXAMINED FOR UNDETECTED ERRORS. 08 - CARRIAGE SPACE-SKIP TEST. SOME PARTICULAR SPACE AND SKIP COMMANDS ARE ISSUED TO THE PRINTER AND CHECKED FOR PROPER CARRIAGE OPERATION. THE PRINTOUT SHOULD BE EXAMINED FOR UNDETECTED ERRORS. 09 - H & T PRINT TEST. LINES OF H'S AND T'S ARE PRINTED FOR CHECKING PRINT QUALITY. 0A - PAPER SETTling TEST. A PRINT COMMAND IS ISSUED IMMEDIATELY AFTER THE CARRIAGE DROPS BUSY FROM A SPACE COMMAND. VERTICAL MISALIGNMENT INDICATES EXCESSIVE SETTling TIME. 0B - WORSE CASE PRINT TEST. CHECKS THE PRINTERS RESPONSE TO FIRING THE MAXIMUM NUMBER OF HAMMERS IN THE SHORTEST POSSIBLE TIME. 0C - RIPPLE PRINT TEST. THE CHAIN IMAGE IS PRINTED IN A LEFT TO RIGHT RIPPLE PATTERN. THE PRINTOUT SHOULD BE EXAMINED FOR ERRORS ON ANY CHARACTER OR PRINT POSITION. IF USED FOR CHAIN CLEANING, DISENGAGE THE CARR. CLUTCH AND ADVANCE FORMS MANUALLY. 0D - UNPRINTABLE CHAR TEST. CHECKS PRINTER RESPONSE TO A PRINT COMMAND WITH UNPRINTABLE CHARACTERS IN DATA FIELD. *0E OPERATOR ENTRY COMMANDS TEST. ANY COMMAND OR SERIES OF COMMANDS UP TO 20, ENTERED THRU CONSOLE SWITCHES WILL BE EXECUTED, AND ANY DETECTED ERRORS INDICATED. PRINTOUT SHOULD BE EXAMINED FOR UNDETECTED ERRORS.	11,12 11,12 11,12 11,12 11,12 11,12 11,12 11,12 11,12 11,12 11,12	
	<b>E02 - PRINTER FUNCTION TEST</b>	01 - SENSE ANALYSIS TEST. FOUR SENSE COMMANDS ARE ISSUED AND THEIR RESPONSES ANALYZED TO CHECK FOR PROPER SENSE COMMAND DECODE AND DATA TRANSFER. 02 - SENSE TIMING BITS TEST. A PRINT AND SPACE COMMAND IS ISSUED AND ALL BITS OF SENSE CODE 'E2' ARE CHECKED TO BE SURE THEY GO UP AND DOWN DURING THE COMMAND.	11,12
	<b>E03 - CHAIN CHARACTER COUNTER TEST.</b>	01 - SAMPLES OF THE PRINTER TIMING BYTES AND THE CHAIN CHARACTER COUNTER ARE SAVED AND ANALYZED FOR THE PROPER CHAIN EMITTER PULSES, HOME PULSES AND THE CHAIN CHARACTER COUNTER INCREMENTING AND RESETTING.	
	<b>E04 - CYCLE STEAL AND HAMMER ADDRESS TEST.</b>	01 - THE 3 PRINT CYCLE AND HAMMER SET LINES ARE CHECKED FOR BEING ON AND OFF AT THE PROPER TIMES WHILE PRINTING BLANKS, UNPRINTABLE DATA, THEN, PRINTABLE. 02 - STARTING WITH HAMMER NO.1, EACH HAMMER PRINTS X'S IN ITS 4 POSITIONS. ANY HAMMER ADDRESSING ERRORS CAN EASILY BE NOTICED ON THE PRINTED PATTERN.	
	<b>E05 - IMAGE AND DATA ADDRESS REGISTER TESTS.</b>	01 - CHECKS FOR PROPER INITIALIZATION, INCREMENTING AND RESETTING OF THE DATA ADDRESS REGISTER WHILE PRINTING BLANKS. 02 - CHECKS FOR PROPER INCREMENTING AND DECREMENTING OF THE IMAGE ADDRESS REGISTER WHILE PRINTING BLANKS.	20
	<b>E06 - CHAIN EMITTER TIMING TEST.</b>	01 - CHAIN EMITTER PULSES ARE SAMPLED AND CHECKED FOR PROPER PULSE WIDTH AND TIMING. HOME PULSE TIMING IS ALSO CHECKED.	
	<b>E07 - DUAL FEED CARRIAGE FEATURE TEST</b>	01 - LEFT AND RIGHT CARRIAGE TEST. PRINTER RESPONSE TO SIMULTANEOUS CARRIAGE OPERATION IS CHECKED BY A PARTICULAR SEQUENCE OF COMMANDS ISSUED TO BOTH CARRIAGES.	11,12

OPTIONS - 5203 PRINTER FUNCTION AND (FIP) TESTS.

SENSE SWITCHES MAY BE SET BY PUTTING 'F1XX' IN CONSOLE ADDRESS SWITCHES, THEN RESETTING THE HALT. 'F0XX' TURNS IT OFF. 'XX' IS THE SSW NUMBER.

SENSE SW. NUMBER	OPTION IN EFFECT WHEN THE SWITCH IS ON	PROGRAM CONTROLLING THE SWITCH
11	HALT BEFORE ISSUING EACH START I/O COMMAND	E01, E07
12	DELAY BEFORE ISSUING EACH START I/O COMMAND. THE HEX VALUE IN THE THREE RIGHT-MOST CONSOLE ADDRESS SWITCHES DETERMINES THE NUMBER OF MILLISECONDS TO DELAY.	E01, E07
20	LPDAR OPTION 1 - PROMPT OPERATOR WITH MESSAGES AND/OR HALTS TO PRESS CHECK RESET AND MAKE PRINTER READY BEFORE DOING EACH PHASE OF THE DATA ADDRESS REGISTER TEST.	E05

Mod. 3. 732. Char. 300 LPM

1.2 PURPOSE - 5203 PRINTER TIMING ANALYSIS PROGRAMS(TAPS).

FF4

1.2.1 TAP TEST DECK LOADING FROM EITHER CARD, OR DISK IS DESCRIBED IN THE MASTER TIMING ANALYSIS PROGRAM (MTAP) USER'S GUIDE.

EACH OF THE FOLLOWING TAP TESTS RUN UNDER THE CONTROL OF MTAP (MASTER TIMING ANALYSIS PROGRAM). PRINTER TAPS SHOULD BE RUN WITH MTAP SSW-29 (TABULAR PRINTOUT), AND DCP SSW-05 (USE ALTERNATE PRINTER) ON.

TAP TEST	TEST DESCRIPTION	SENSE SWITCH OPTIONS
060 * - LEFT CARR RESPONSE TEST	THIS TAP ISSUES SPACE COMMANDS TO THE PRINTER, THEN CHECKS THE TIME FROM THE PICK OF THE CARRIAGE CLUTCH TO THE CARRIAGE EMITTER PULSE.	28,29
061 * DFC - RIGHT CARR RESPONSE TEST	THIS TAP PERFORMS THE SAME CHECK AS TAP 060 ABOVE, BUT ON THE RIGHT CARRIAGE.	28,29
062 * - LEFT CARRIAGE SKIP TEST	THIS TAP ISSUES A SKIP COMMAND TO THE PRINTER, THEN CHECKS THE TIME FROM ONE CARRIAGE EMITTER PULSE TO THE NEXT.	28,29
063 * DFC - RIGHT CARRIAGE SKIP TEST	THIS TAP PERFORMS THE SAME CHECK AS TAP 062 ABOVE, BUT ON THE RIGHT CARRIAGE.	28,29
064 * 100,200 - HAMMER INCREMENTOR CLUTCH RESPONSE TIME 074 * 300 LPM	THIS TAP ISSUES PRINT COMMANDS TO THE PRINTER, THEN CHECKS THE TIME FROM THE PICK OF THE HAMMER INCREMENT CLUTCH TO THE PRINT START PULSE SS.	28,29
065 * 200 LPM 48 CHAR - LEFT CARRIAGE TO INCREMENTOR SAFETY TIME 075 * 300 LPM 48 CHAR	THIS TAP ISSUES PRINT AND SPACE COMMANDS TO THE PRINTER, THEN CHECKS THE TIME FROM THE DROPPING OF CARRIAGE BUSY TO THE NEXT PRINT START PULSE SS.	28,29
066 * 200, DFC 48 CHAR - RIGHT CARRIAGE TO INCREMENTOR SAFETY TIME 076 * 300, DFC 48 CHAR	THIS TAP PERFORMS THE SAME CHECK AS TAP 065 AND 075, ABOVE, BUT ON THE RIGHT CARRIAGE.	28,29
067 * 100, 200 - HAMMER BAR RIGHT SWITCH OPENING TEST 077 * 300 LPM	THIS TAP ISSUES A PRINT COMMAND TO THE PRINTER, THEN CHECKS THE TIME FROM OPENING OF THE HAMMER BAR RIGHT, TO THE PRINT START PULSE SS.	28,29
068 * 200 LPM - HAMMER BAR RIGHT SWITCH CLOSING TEST 078 * 300 LPM	THIS TAP ISSUES 2 PRINT COMMANDS TO THE PRINTER, AND DURING THE 2ND COMMAND CHECKS THE TIME FROM THE CLOSING OF HAMMER BAR RIGHT, TO THE PRINT START PULSE SS.	28,29
069 * 100, 200 UCS - U.C.S. HOME TO CHAIN HOME TEST 079 * 300 LPM UCS	THIS TAP ISSUES SPACE COMMANDS TO THE PRINTER, THEN CHECKS THE TIME FROM LEADING EDGE OF U.C.S. HOME PULSE TO HOME LATCH TIME.	28,29
06A * - LEFT CARRIAGE SETTling TEST	THIS TAP ISSUES SPACE 1 COMMANDS TO THE PRINTER, THEN CHECKS THE TIME FROM THE DROP OF CARRIAGE CLUTCH TO THE STOP OF CARRIAGE MOVEMENT.	28,29
06C * DFC - RIGHT CARRIAGE SETTling TEST	THIS TAP PERFORMS THE SAME CHECK AS TAP 06A ABOVE, BUT ON THE RIGHT CARRIAGE.	28,29
06E * - GENERAL TIMING TEST	THIS TAP ISSUES A PRINT AND SPACE COMMAND TO THE PRINTER, THEN SAMPLES AND LOGS OUT (SSH-29 OFF), 6 SIGNIFICANT PRINTER TIMINGS FOR THE ENTIRE COMMAND.	28,29
06F * 100 LPM - HAMMER BAR RIGHT SW. CLOSING TEST	THIS TAP ISSUES A PRINT COMMAND TO THE PRINTER, DELAYS 450 USEC. THEN CHECKS THE TIME FROM THE CLOSING OF HAMMER BAR RIGHT, TO THE PRINT START PULSE SS.	28,29
070 * 200 LPM - PRINT START TIMING TEST 07F * 300 LPM	THIS TAP CHECKS THE TIME FROM ONE PRINT START PULSE SS TO THE NEXT.	28,29

OPTIONS - 5203 PRINTER TAPS

TO LOOP ON A TAP, SET 'AA' IN THE LEFT-MOST 2 CONSOLE ADDRESS SWITCHES AFTER READING THE TAP DECK IN AND PRINTING THE RESULTS ONE TIME.

SENSE SWITCHES MAY BE SET BY PUTTING 'FLXX' IN CONSOLE ADDRESS SWITCHES, THEN RESETTing THE HALT. 'FOXX' TURNS IT OFF. 'XX' IS THE SSW NUMBER.

SENSE SW. NUMBER	OPTION IN EFFECT WHEN THE SWITCH IS ON	PROGRAM CONTROLLING THE SWITCH
28	LOOP ON A TAP TEST, AND PRINT RESULTS OF THE LAST COMMAND WHEN PRINTER DROPS READY.	FF4(MTAP)
29	PRINT RESULTS IN TABULAR FORM (NOTE: A SCOPE TYPE PRINTOUT OF THE SAME DATA MAY BE OBTAINED AFTER THE TABULAR FORM IF THE RIGHT-MOST 2 CONSOLE ADDRESS SWITCHES ARE AT 'FF' WHEN THE TABULAR FORM IS COMPLETED.)	FF4(MTAP)

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1.3 PURPOSE - 5203 STAND-ALONE PROGRAMS

1.3.1 LOADING - REMOVE HEADER CARD, PLACE DECK IN MFCU PRIMARY HOPPER, MAKE READY AND PRESS PROGRAM LOAD.

```
*****
*                                     *
*          STAND ALONE TEST          * TEST DESCRIPTION
*                                     *
* E0A0 - 1 CARD RIPPLE PRINT        * THIS TEST PRINTS THE CHAIN IMAGE IN A LEFT TO RIGHT
* (CHAIN CLEANER)                   * RIPPLE PATTERN.
*                                     *
*****
```

OPTIONS - 5203 STAND-ALONE PROGRAMS  
NONE

2. OPERATING PROCEDURES (DCP CONTROLLED SECTIONS)

THIS SECTION DESCRIBES THE USER INTERFACE FOR ALL PROGRAMS OPERATING UNDER THE DIAGNOSTIC CONTROL PROGRAM (DCP). MORE DETAIL IS PROVIDED IN THE DCP USERS GUIDE.

2.1 LOADING

THE CE MODE SELECTOR SWITCH MUST BE IN THE 'PROCESS' POSITION. ALL CE CONTROL PANEL TOGGLE SWITCHES SHOULD BE IN THE NORMAL (DOWN) POSITION.

*****		LOADING FROM CARDS	*****	LOADING FROM DISK	*****
1.	IF DCP LOADED, SKIP TO STEP 5.			1.	SKIP TO STEP 5 IF DCP ALREADY LOADED.
2.	IF DISK SYSTEM - PLACE IPL SELECTOR IN 'MFCU' POSITION.			2.	LOAD THE CE PACK AND MAKE FILE READY.
3.	PLACE DCP FOLLOWED BY TEST SECTION/S INTO MFCU PRIMARY HOPPER. MAKE MFCU READY.			3.	PLACE THE IPL SELECTOR IN THE PROPER POSITION. (NORMALLY - REMOVABLE DISK).
4.	DEPRESS PROGRAM LOAD.			4.	DEPRESS PROGRAM LOAD. (IF SYSTEM HAS NO MFCU, SET DATA SWITCHES TO 00FE, THEN CPU AND MEMORY TESTS WILL RUN. THE ORDER OF HALTS WILL BE --GC--LL--BP--HE-- IF THE HALTS AREN'T IN THIS ORDER, REFER TO BLOCK 5.)
	AFTER DCP IS LOADED, HALT 'HA' WILL OCCUR. COMMON SENSE SWITCHES MAY BE SET AT THIS TIME.				A -HA- HALT WILL OCCUR ON AN MFCU SYSTEM. WHEN DCP IS LOADED THE COMMON SENSE SWITCHES MAY BE SET.
5.	PLACE TEST SECTION/S INTO MFCU PRIMARY HOPPER AND MAKE MFCU READY (IF NOT ALREADY DONE).			5.	USE CONSOLE SWITCHES ENTRY 'DXXX' TO SPECIFY THE PROGRAMS TO BE LOADED. (SEE SECTION 2.4)
6.	IF CPU IS HALTED WITH 'HA' OR 'HE' DISPLAYED, SKIP TO STEP 8.			6.	SET LEFTMOST SWITCH TO '0' AND RESET HALT.
7.	DEPRESS PROGRAM LOAD KEY.			7.	MAKE ANY CONSOLE SWITCH ENTRY DESIRED AND/OR RESET HALT.
	DCP WILL PRINT SECTION TERMINATE MESSAGE AND HALT, DISPLAYING 'HE'.				
8.	RESET THE HALT.				
	DCP WILL LOAD THE SECTION AND PERFORM HALT 'HA'.				
9.	MAKE DESIRED CONSOLE SWITCH ENTRIES, IF ANY, AND RESET THE HALT.				

2.2 PROGRAM RESTART

DCP STORES INSTRUCTIONS STARTING AT LOCATION '0000' TO PROVIDE FOR A PROGRAM RESTART. THESE INSTRUCTIONS ALSO CHECK THE CONSOLE SWITCHES FOR A VALID ENTRY. TO PERFORM A PROGRAM RESTART, SIMPLY DEPRESS SYSTEM RESET FOLLOWED BY CPU START.

2.3 TERMINATION

NORMAL DCP-CONTROLLED CHAINING FROM ROUTINE TO ROUTINE PROVIDES AN AUTOMATIC TERMINATION OF A SECTION. IN ADDITION, THE CE MAY TERMINATE A SECTION AT ANY TIME BY (1) ENTERING 'EE00' IN THE CONSOLE SWITCHES, OR BY (2) LOADING THE NEXT SECTION. IN ALL CASES, DCP PRINTS A MESSAGE AND PERFORMS HALT 'HE'. THE SECTION CAN STILL BE RESTARTED AT THIS TIME BY USING THE PROGRAM RESTART PROCEDURE. IF NO RESTART IS DESIRED, RESET THE HALT TO LOAD THE NEXT SECTION.

2.4 CONSOLE ADDRESS/DATA SWITCH COMMUNICATIONS

THE ROTARY DATA SWITCHES ARE THE MEANS BY WHICH THE CE CAN COMMUNICATE WITH THE DIAGNOSTICS. ENTRIES ARE MADE AS FOLLOWS--

1. STOP CPU.

2. SET UP ROTARY SWITCHES FOR ONE OF THE FOLLOWING OPTIONS. X'S INDICATE POSITIONS WHICH VARY WITH THE NEED.

	SWITCHES				
	1	2	3	4	
F	0	X	X		- TURN OFF SENSE SWITCH 'XX'. (F008 WOULD TURN OFF SSW 08).
F	1	X	X		- TURN ON SENSE SWITCH 'XX'. (F108 WOULD TURN ON SSW 08).
F	2	X	X		- GO TO ROUTINE 'XX' AFTER CONSOLE ENTRY FINISHED. (F202 WOULD GO TO ROUTINE 2).
E	E	0	0		- TERMINATE THE CURRENT SECTION.
D	X	X	0		- DISK--EXECUTE SECTIONS FOR DEVICE WITH UNIT CODE 'XX'. (DE00 - EXECUTE ALL 5203 PRINTER PROGRAMS)
D	X	X	X		- DISK--EXECUTE SECTION XXX. (DE01 - SECTION E01). (DE01 - EXECUTE SECTION E01)

NOTE - UP TO FOUR DISK INSTRUCTIONS MAY BE ENTERED DURING ONE ENTRY PHASE.

3. DEPRESS CPU START. (SYSTEM RESET FOLLOWED BY START WILL CALL IMMEDIATE ATTENTION TO THE SWITCHES--SEE NOTE BELOW).

4. WHEN DCP RECEIVES CONTROL, IT HALTS WITH 'HF' DISPLAYED. RESET THE HALT TO ENTER THE FIRST OPTION.

5. DCP WILL PERFORM HALT 'HU' OR 'HP'. LOAD THE NEXT OPTION AND RESET THE HALT.

6. REPEAT STEP 5 FOR AS MANY OPTIONS AS DESIRED. ALTERNATING CODES 'HU' AND 'HP' WILL SIGNAL DCP ACCEPTANCE.

7. WHEN DONE, SET LEFTMOST SWITCH TO '0' AND RESET THE HALT.

NOTE - WHEN USING F2XX IN THE SWITCHES TO GO TO A ROUTINE AFTER A SECTION HAS BEGUN, SYSTEM RESET/START SHOULD BE PERFORMED BEFORE MAKING THE ENTRY. (THIS PREVENTS ERRORS FOUND IN ONE ROUTINE FROM BEING DETECTED IN SOME OTHER ROUTINE. IT SHOULD NOT BE PERFORMED IF OTHERWISE SPECIFIED IN THE MAPS.)

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2.5 COMMON SENSE SWITCHES

SENSE SWITCHES ARE EQUIVALENT TO 48 TOGGLE SWITCHES NUMBERED HEXADEcimALLY 00-2F.  
SENSE SWITCHES 00-0F ARE RESERVED FOR STANDARD OPTIONS PROVIDED BY DCP (LISTED BELOW).  
SENSE SWITCHES 10-2F ARE SIGNIFICANT TO THE PARTICULAR SECTION BEING RUN.  
INSTRUCTIONS FOR SETTING SENSE SWITCHES ARE CONTAINED IN SECTION 2.4.

COMMON SENSE SWITCHES		
SSW NUMBER	ON	OFF (NORMAL)
00	LOOP ON SECTION.	GO TO NEXT SECTION.
01	LOOP ON ROUTINE.	GO TO NEXT ROUTINE.
02	BYPASS MANUAL INTERVENTION ROUTINES.	EXECUTE ALL ROUTINES.
03	BYPASS ERROR PRINTING.	PRINT ERROR MESSAGES.
04	BYPASS NON-ERROR PRINTING.	PRINT NON-ERROR MESSAGES.
05	USE ALTERNATE PRINTER. PRINTER KEYBOARD, IF ATTACHED. OTHERWISE, MFCU.	NORMAL PRINTER.
06	BYPASS ERROR HALTS.	HALT AFTER ERROR.
07	LOAD AND GO. BYPASS COMMENTS AND PROMPTING HALTS.	PROMPTING MODE.
08	USE 5203 RIGHT CARRIAGE.	USE LEFT CARRIAGE.
09	DON'T CLEAR SECTION SENSE SWITCHES AFTER LOADING	CLEAR SECTION SENSE SWITCHES AFTER LOADING
0A-0F	RESERVED	

2.6 CONTROL PROGRAM HALTS.

ALL CONTROL PROGRAM (DCP) HALTS USE THE CHARACTER 'H' AS THE FIRST DIGIT OF THE HALT CODE. THE SECOND DIGIT IDENTIFIES THE CONDITION ACCORDING TO THE FOLLOWING TABLE.

HALT CODES MODEL	CONDITION	ACTION REQUIRED
6 10	INVALID RECORD FOUND WHILE LOADING.	CORRECT INVALID RECORD AND RELOAD.
F05 H0	INVALID RECORD FOUND WHILE LOADING.	CORRECT INVALID RECORD AND RELOAD.
F15 H1	A DEVICE CALLED FOR BY THE TEST SECTION WAS NOT DEFINED IN THE UDT CARDS.	CHECK UDT CARDS AND RELOAD OR RESET HALT TO BYPASS THE ERROR (ERRORS COULD RESULT).
F25 H2	DATA SWITCH ENTRY ERROR.	CORRECT DATA SWITCHES AND RESET HALT.
F35 H3	INVALID ROUTINE PREFIX FOUND DURING CHAINING FROM ONE ROUTINE TO NEXT.	ENTER ROUTINE SELECT OPTION 'F2XX' IN DATA SWITCHES AND RESET HALT. IF THIS DOES NOT WORK, RELOAD SECTION.
F55 H5	MFCU NOT READY OR ERROR. ERROR INDICATION SHOULD BE DISPLAYED IN THE MFCU LIGHTS.	DO A NON-PROCESS RUN-OUT, RELOAD DECK STARTING WITH RUNOUT CARD/S AND RESET THE HALT.
F65 H6	PRINTER NOT READY OR ERROR.	CLEAR CONDITION AND RESET THE HALT. IF FAILURE PERSISTS, RUN PRINTER FUNCTION TEST. SENSE SWITCHES 03 AND 04 MAY BE USED TO BYPASS PRINTING. SET SENSE SWITCH 05 TO USE ALTERNATE PRINTER.
F75 H7	DISK ERROR.	RESET HALT TO RETRY. IF ERROR PERSISTS, RELOAD.
F85 HA	CONTROL PROGRAM IS PREPARED TO RECEIVE DATA SWITCH ENTRY. OCCURS AFTER DCP AND SECTION LOADING.	RESET THE HALT IF NO ENTRY DESIRED. TO LOAD OPTIONS, SET UP DATA SWITCHES AND RESET THE HALT. SSW 07 MAY BE USED TO BYPASS THIS HALT.
FC5 HC	DISK LOADER REQUIRES SPECIFICATION OF SECTIONS TO BE LOADED FROM DISK.	IF NO ENTRY HAS BEEN MADE PREVIOUSLY, LOAD PROGRAM SELECTION ENTRY 'DXXX' AND RESET THE HALT. UP TO EIGHT ENTRIES MAY BE MADE. IF ENTRIES HAVE EVER BEEN MADE, THE PROGRAMS MAY BE REPEATED BY RESETTING THE HALT.
FD5 HD	SECTION RUNNING OR LOAD TABLE HAS SPECIFIED NEXT SECTION TO BE RUN. ARR CONTAINS -DXXX- WHERE XXX IS THE PROGRAM ID TO BE RUN.	DISK SYSTEM - DXXX IS NOT ON DISK PACK, RESET THE HALT AND THE NEXT PROGRAM IN THE LOAD TABLE WILL BE LOADED. CARD SYSTEM - PLACE DECK XXX IN THE MFCU HOPPER AND RESET THE HALT.
FE5 HE	CURRENT SECTION TERMINATED.	RESET HALT TO LOAD NEXT SECTION. SECTION MAY BE RESTARTED BY SYSTEM RESET/START.
FF5 HF	DCP HALTS WITH 'HF' DISPLAYED WHENEVER A VALID DATA SWITCH ENTRY IS RECOGNIZED. AS DCP ACCEPTS ENTRIES, ALTERNATING HALTS 'HU' AND 'HP' OCCUR.	LOAD A VALID DATA SWITCH ENTRY AND RESET THE HALT. REPEAT FOR ALTERNATING HALTS 'HU' AND 'HP'. TO TERMINATE ENTRY PROCEDURE, ROTATE LEFT-MOST SWITCH TO ZERO AND RESET HALT.
F05 HU-HP	DCP HALTS WITH 'HF' DISPLAYED WHENEVER A VALID DATA SWITCH ENTRY IS RECOGNIZED. AS DCP ACCEPTS ENTRIES, ALTERNATING HALTS 'HU' AND 'HP' OCCUR.	LOAD A VALID DATA SWITCH ENTRY AND RESET THE HALT. REPEAT FOR ALTERNATING HALTS 'HU' AND 'HP'. TO TERMINATE ENTRY PROCEDURE, ROTATE LEFT-MOST SWITCH TO ZERO AND RESET HALT.
D1 D1	IPL LOADER CAN'T LOAD DCP BECAUSE OF A DISK ERROR.	RESET HALT TO RETRY. IF HALT PERSISTS, GET A NEW DISK PACK.

3.0 INDEX OF HALTS AND PRINTOUTS

***** HALT IDENTIFIER TABLE *****			
HALT ID	MEANING	MAP CHART REFERENCE	TEST SECTION REFERENCE
01	CARRIAGE SYNC CHECK.	11	E01, E02 E07
02	CARRIAGE SPACE CHECK.	11	E01, E02 E07
03	FORMS JAM CHECK.	11	E01, E02 E07
04	CHAIN SYNC CHECK.	11	E01, E02 E07
05	INCREMENTOR SYNC OR SLIP CHECK.	11	E01, E02 E07
06	INCREMENTOR FAILURE CHECK.	11	E01, E02 E07
07	HAMMER UNIT THERMAL CHECK.	11	E01, E02 E07
09	HAMMER ECHO CHECK. CHECK THE PRINTOUT FOR THE FAILING HAMMER NUMBER. (IF NO ALTERNATE PRINTER, SET SSH-13 ON, THEN RESET THIS HALT TO DISPLAY THE FAILING HAMMER NUMBER IN THE HALT INDICATORS. SECTION E01 ONLY.)	11	E01, E02 E07
0A	ANY HAMMER ON CHECK.	11	E01, E02 E07
0C	UNPRINTABLE CHARACTER IN DATA FIELD.	16	E01, E02 E07
0E	CHAIN CHECK. THE CHAIN IMAGE IN MEMORY DOES NOT MATCH THE CHAIN MOUNTED ON THE PRINTER.	19	E01, E03
10	5203 PRINTER IS NOT READY.	10	E01, E02 E04, E05 E07
11	5203 PRINTER IS BUSY, BUT NO SIO COMMAND WAS ISSUED BY THIS PROGRAM.	17	E01, E02 E04, E05 E07
12	PRINTER BUFFER WAS BUSY LONGER THAN 3 SECONDS AFTER THE PRINTER ACCEPTED A COMMAND.	17	E01, E02 E04, E07
13	PRINTER CARRIAGE WAS BUSY LONGER THAN 3 SECONDS AFTER THE PRINTER ACCEPTED A COMMAND.	17	E01, E02 E07
14	PRINTER WAS BUSY LONGER THAN 3 SECONDS AFTER THE PRINTER ACCEPTED A COMMAND.	17	E01, E02 E07
16	PRINTER DID NOT BECOME BUSY AFTER ACCEPTING A COMMAND OTHER THAN A NO-OP. (IF NO ALTERNATE PRINTER, SET SSH-13 ON, RESET THIS HALT TO DISPLAY THE LAST COMMAND ISSUED IN THE HALT LIGHTS. THE 1ST RESET DISPLAYS THE FUNCTION CODE AND THE 2ND, THE CONTROL CODE. SECTION E01 ONLY.)	17	E01, E02 E04, E05 E07
30	COMMAND DECODE ERROR. CARRIAGE(S) SHOULD BE AT LINE 1 FOR THIS TEST. IF NOT, RESTORE CARRIAGE(S) AND RETRY TEST.	13	E01
31	PRINTER INDICATES READY TO A TEST I/O WHEN SHOULD BE NOT READY.	10	E01
32	PRINTER INDICATES BUSY TO A TEST I/O WHILE NOT READY.	17	E01
33	CARRIAGE LINE COUNTER IS IN ERROR AFTER EXECUTING A CARRIAGE COMMAND.	14	E01
34	DATA ADDRESS REGISTER DOES NOT CONTAIN THE ADDRESS JUST LOADED WITH A LIO.	13	E01
37	PRINTER BUFFER IS BUSY, BUT NO SIO COMMAND WAS ISSUED BY THIS PROGRAM.	17	E01
38	PRINTER LEFT CARRIAGE IS BUSY, BUT NO SIO COMMAND WAS ISSUED BY THIS PROGRAM.	17	E01
39	PRINTER RIGHT CARRIAGE IS BUSY, BUT NO SIO COMMAND WAS ISSUED BY THIS PROG.	17	E01
3A	IMAGE ADDRESS REGISTER DOES NOT CONTAIN THE ADDRESS JUST LOADED WITH A LIO.	13	E01
3C	NO-OP LATCH IS SET, BUT NO SIO COMMAND WAS ISSUED BY THIS PROGRAM.	13	E01
3E	UNPRINTABLE CHARACTER BIT WAS NOT SET AFTER PRINT COMMAND WITH UN-PRINTABLE DATA FIELD.	16	E01

HALT ID	MEANING	MAP CHART REFERENCE	TEST SECTION REFERENCE
41	DATA TRANSFERRED BY ALL 4 SENSE COMMANDS ISSUED WAS IN ERROR.	13	E1,2
42	EB1 OR EB2 BYTE IS IN ERROR FOR ALL SENSE COMMANDS.	13	E02
43	SENSE N CODE XX IS IN ERROR. SEE PRINTOUT. (IF NO ALTERNATE PRINTER, SET SSM-13, THEN RESET THIS HALT TO FURTHER DEFINE SENSE CODE ERROR IN THE SECONDARY HALTS LISTED BELOW.	13	E02
83	MORE THAN 1 SENSE CODE IN ERROR.	13	E02
84	SENSE CODE 'E0', BYTE EB1 (RIGHT CARR. LINE LOCATION) IN ERROR.	13	E02
85	SENSE CODE 'E0', BYTE EB2 (LEFT CARR. LINE LOCATION) IN ERROR.	13	E02
86	SENSE CODE 'E0', BOTH EB1 AND EB2 (LEFT & RIGHT CARR. LINE LOCATIONS) ARE IN ERROR.	13	E02
87	SENSE CODE 'E1', BYTE EB1 (CHAIN CHAR. COUNTER) IN ERROR.	13	E02
88	SENSE CODE 'E1', BYTE EB2 (LPDAR INCREMENT FACTOR) IN ERROR.	13	E02
89	SENSE CODE 'E1', BOTH EB1 & EB2 (CHAIN CHAR. COUNTER & LPDAR INCREMENT FACTOR) IN ERROR.	13	E02
8A	SENSE CODE 'E2' (TIMING INFO) IN ERROR.	13	E02
8C	SENSE CODE 'E3' (STATUS CHECK INFO) IN ERROR.	13	E02
44	INVALID COMMAND WAS ENTERED. RESET HALT TO TRY ANOTHER.	NONE	E01
45	BIT X OF EBX IS FAILING. THIS SENSE CODE 'E2' BIT DID NOT GO UP AND DOWN DURING A PRINT AND SPACE COMMAND. (IF NO ALTERNATE PRINTER, SET SSM-13 ON, THEN RESET THIS HALT TO DEFINE THE BIT AND BYTE IN ERROR BY THE SECONDARY HALTS LISTED BELOW.	13	E02
20	SENSE CODE 'E2', BYTE EB1, BIT 0 (HAMMER INCREMENTOR CLUTCH) IN ERROR.	13	E02
21	SENSE CODE 'E2', BYTE EB1, BIT 1 (PRINT START S.S.) IN ERROR.	13	E02
22	SENSE CODE 'E2', BYTE EB1, BIT 2 (L/R CARR. CLUTCH) IN ERROR.	13	E02
23	SENSE CODE 'E2', BYTE EB1, BIT 3 (PRINT CYCLE 1) IN ERROR.	13	E02
24	SENSE CODE 'E2', BYTE EB1, BIT 4 (PRINT CYCLE 2) IN ERROR.	13	E02
25	SENSE CODE 'E2', BYTE EB1, BIT 5 (PRINT CYCLE 3) IN ERROR.	13	E02
26	SENSE CODE 'E2', BYTE EB1, BIT 6 (HAMMER SET PULSE) IN ERROR.	13	E02
27	SENSE CODE 'E2', BYTE EB1, BIT 7 (HAMMER BAR RIGHT) IN ERROR.	13	E02
2A	SENSE CODE 'E2', SAME BIT FAILED IN BOTH EB1 & EB2.	13	E02
90	SENSE CODE 'E2', BYTE EB2, BIT 0 (L/R CARR. EMITTER) IN ERROR.	13	E02
91	SENSE CODE 'E2', BYTE EB2, BIT 1 (EXECUTE PRINT LATCH) IN ERROR.	13	E02
92	SENSE CODE 'E2', BYTE EB2, BIT 2 (CHAIN EMITTER S.S.) IN ERROR.	13	E02
93	SENSE CODE 'E2', BYTE EB2, BIT 3 (PSS-1) II' ERROR.	13	E02
94	SENSE CODE 'E2', BYTE EB2, BIT 4 (PRINT TIME) IN ERROR.	13	E02
96	SENSE CODE 'E2', BYTE EB2, BIT 6 (M1, LEFTMOST HAMMER POSITION) IN ERROR.	13	E02
97	SENSE CODE 'E2', BYTE EB2, BIT 7 (HOME LATCH) IN ERROR.	13	E02

***** HALT IDENTIFIER TABLE *****			
HALT ID	MEANING	MAP CHART REFERENCE	TEST SECTION REFERENCE
4A	LEFT CARRIAGE DROPPED BUSY TOO SOON, OR RIGHT CARRIAGE WAS BUSY TOO LONG.	17	E07
4C	RIGHT CARRIAGE DROPPED BUSY TOO SOON, OR LEFT CARRIAGE WAS BUSY TOO LONG.	17	E07
4E	LEFT CARRIAGE LINE COUNTER IS IN ERROR.	13	E07
4F	RIGHT CARRIAGE LINE COUNTER IS IN ERROR.	13	E07
51	NO CHAIN EMITTER PULSES DURING 1.94 MSEC. OF SAMPLING.	11B	E03
52	MISSED A CHAIN EMITTER PULSE. THERE WAS OVER 413 USEC (243 USEC ON 300 LPM) BETWEEN 2 EMITTERS.	11B	E03
53	NO HOME LATCH OCCURRED OR ONE IS MISSING. TIME BETWEEN HOMES WAS OVER 56.63 MSEC (35.33 MSEC ON 300 LPM) ON A 48 CHARACTER SET CHAIN.	11B	E03
54	TOO MANY HOME LATCHES OCCURRED. THERE WAS LESS THAN 55.36 MSEC (34.68 MSEC ON 300 LPM) BETWEEN 2 HOMES ON A 48 CHAR SET CHAIN. (SHOULD NOT FIND MORE THAN 1 HOME LATCH WITH USC FEATURE).	11B	E03
55	CHAIN CHARACTER COUNTER DID NOT RESET.	11B	E03
56	CHAIN CHARACTER COUNTER IS IN ERROR.	11B	E03
57	PRINT SUBSCAN 1 PULSE DID NOT OCCUR.	11B	E03
58	CHAIN CHARACTER COUNTER DID NOT SHIFT.	11B	E03
59	EXTRA EMITTER PULSES OCCURRED CAUSING CHAIN CHARACTER COUNTER ERROR.	11B	E03
61	RIGHT-MOST BYTE OF DATA ADDRESS REGISTER WAS NOT SET TO '7C' FOR HAMMER POSITION M1 OR '7F' FOR M4 ON A 200 OR 300 LPH PRINTER ('7C' IN M4 ON A 100 LPH PRINTER), AFTER BEING PRE-LOADED WITH AN INVALID ADDRESS AND A PRINT COMMAND EXECUTED.	15	E04
62	PRINT CYCLE 1 DID NOT OCCUR WHILE PRINTING A BLANK FIELD.	15	E04
63	PRINT CYCLE 2 OCCURRED WHILE PRINTING A BLANK FIELD.	15	E04
64	PRINT CYCLE 3 OCCURRED WHILE PRINTING A BLANK FIELD.	15	E04
65	HAMMER SET LATCH WAS ON AFTER PRINTING A BLANK FIELD.	15	E04
66	PRINT CYCLE 1 DID NOT OCCUR WHILE PRINTING AN UNPRINTABLE CHARACTER FIELD.	15	E04
67	PRINT CYCLE 2 DID NOT OCCUR WHILE PRINTING AN UNPRINTABLE CHARACTER FIELD.	15	E04
68	PRINT CYCLE 3 OCCURRED WHILE PRINTING AN UNPRINTABLE CHARACTER FIELD.	15	E04
69	HAMMER SET LATCH WAS ON AFTER PRINTING AN UNPRINTABLE CHARACTER FIELD.	15	E04
6A	PRINT CYCLE 1 DID NOT OCCUR WHILE PRINTING A PRINTABLE FIELD.	15	E04
6C	PRINT CYCLE 2 DID NOT OCCUR WHILE PRINTING A PRINTABLE FIELD.	15	E04
6E	PRINT CYCLE 3 DID NOT OCCUR WHILE PRINTING A PRINTABLE FIELD.	15	E04
6F	HAMMER SET LATCH WAS NOT ON AFTER PRINTING A PRINTABLE FIELD.	15	E04



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***** HALT IDENTIFIER TABLE *****		
HALT ID	MEANING	MAP CHART REFERENCE * TEST SECTION REFERENCE *
70	RIGHT-MOST BYTE OF DATA ADDRESS REGISTER WAS NOT INITIALLY A '7F' FOR HAMMER POSITION M4 ON A 200 OR 300 LPM PRINTER, OR '7C' IN M4 ON A 100 LPM PRINTER.	15 E05
71	DATA ADDRESS REGISTER DID NOT INCREMENT BY 12.	15 E05
72	DATA ADDRESS REGISTER DID NOT SUBTRACT AFTER A PRINT SUBSCAN.	15 E05
73	DATA ADDRESS REGISTER SUBTRACTED INCORRECTLY AFTER A PRINT SUBSCAN.	15 E05
74	VALUE IN RIGHT-MOST BYTE OF DATA ADDRESS REGISTER WAS NOT '85' OR '91' FOR HAMMER POSITION M2.	15 E05
75	VALUE IN RIGHT-MOST BYTE OF DATA ADDRESS REGISTER WAS NOT '82' OR '8E' FOR HAMMER POSITION M3.	15 E05
76	INITIAL VALUE IN RIGHT-MOST BYTE OF IMAGE ADDRESS REGISTER WAS NOT '02' WHEN PRINTING FROM HAMMER POSITION M4.	15 E05
77	IMAGE ADDRESS REGISTER DID NOT INCREMENT PROPERLY DURING A PRINT SUB-SCAN.	15 E05
78	THE IMAGE ADDRESS REGISTER DID NOT RESET TO THE PROPER INITIAL VALUE FOR ANOTHER PRINT SUB-SCAN.	15 E05
79	VALUE IN RIGHT-MOST BYTE OF DATA ADDRESS REGISTER WAS NOT '7C' OR '88' FOR HAMMER POSITION M1.	15 E05
80	TIME BETWEEN CHAIN EMITTER PULSES IS NOT WITHIN 365 TO 410 USEC, OR 356 TO 410 USEC AT HOME TIME. (228 TO 255 USEC, OR 214 TO 255 USEC FOR 300 LPM).	11B E06
81	CHAIN EMITTER PULSE WIDTH IS NOT WITHIN 100 TO 250 USEC (33 TO 150 USEC FOR 300 LPM) FOR EMITTERS 1 THRU 143, OR 50 TO 133 USEC (17 TO 83 USEC FOR 300 LPM) FOR EMITTERS 144 AND 145.	11B E06
82	TIME BETWEEN CHAIN EMITTER PULSES 144 AND 145 (HOME PULSE) IS NOT WITHIN 150 TO 234 USEC (67 TO 133 USEC ON 300 LPM).	11B E06

***** OPERATOR INSTRUCTION HALTS *****		
ID	MEANING	TEST SECTION REFERENCE *
E0	MAKE THE 5203 PRINTER NOT READY.	E01
E1	MAKE THE 5203 PRINTER READY.	E01, E02, E04, E05, E06, E07
E2	JUMPER A-B1E5D10 TO A-B1D2S05, RESTORE THE LEFT AND/ OR RIGHT CARRIAGE(S), PRESS CHECK RESET, AND THEN RESET HALT.	E02
E3	REMOVE JUMPER INSERTED DURING HALT E2, THEN RESET HALT.	E02
E4	HALT BEFORE ISSUING A SIO COMMAND TO THE PRINTER. (SSW-11 OPTION)	E01
E6	LOAD FORMS INTO BOTH CARRIAGES, ALIGNING THE LEFT IN PRINT POSITION 1, AND THE RIGHT IN THE LAST PRINT POSITION OF THIS PARTICULAR PRINTER. THEN MAKE THE 5203 READY.	E07
E7	PRESS CHECK RESET, MAKE SURE THE 5203 IS READY, THEN RESET THIS HALT (SSW-20 LPDAR OPTION 1).	E05
EA	ENTER A PRINTER COMMAND CODE -EXXX-, OR A MILLISECOND DELAY TIME -OXXX-, IN THE CONSOLE ADDRESS SWITCHES AND RESET THE HALT.	E01
EC	ENTER ANOTHER COMMAND OR DELAY, AND RESET HALT, OR ENTER -0000- AT ANY TIME AND RESET HALT TO START EXECUTION OF ENTRIES. EXECUTION WILL ALSO BEGIN IF 20 ENTRIES ARE MADE.	E01

## 4. DETAILED DESCRIPTION OF TESTS

## 4.1 SECTION E01

- 4.1.1 ROUTINE 1 - SENSE COMMAND DECODE TEST. THE CARRIAGE(S) MUST BE RESTORED AND THE PRINTER MUST BE DEFINED CORRECTLY ON THE UDT CARD BEFORE RUNNING THIS TEST. THE PROGRAM SENSES THE CARRIAGE LINE COUNTER(S). IF THE DATA SENSED IS NOT X'0100', OR X'0101' FOR A DUAL CARRIAGE, THE COMMAND CODE WAS NOT DECODED CORRECTLY AND SOME OTHER SENSE DATA WAS TRANSFERRED INSTEAD. THIS ROUTINE ALSO CHECKS TO SEE IF THE CHAIN IMAGE LOADED BY DCP MATCHES THE CHAIN CURRENTLY MOUNTED ON THE PRINTER.
- 4.1.2 ROUTINE 2 - TIO NOT READY TO NOT READY PRINTER. IF THE PRINTER INDICATES READY TO A TEST I/O FOR NOT READY, A MESSAGE AND/OR HALT 'E0' WILL OCCUR ASKING FOR THE 5203 TO BE MADE NOT READY. AFTER HALT 'E0' IS RESET AND THE PRINTER STILL INDICATES READY TO A TIO FOR NOT READY, AN ERROR IS DISPLAYED.
- 4.1.3 ROUTINE 3 - TIO BUSY TO NOT BUSY PRINTER. IF THE 5203 INDICATES PRINTER BUSY TO A TEST I/O FOR BUSY, WHILE THE 5203 IS NOT READY, AN ERROR IS DISPLAYED.
- 4.1.4 ROUTINE 4 - TIO NOT READY TO A READY PRINTER. IF THE 5203 INDICATES NOT READY TO A TEST I/O FOR NOT READY, A MESSAGE AND/OR HALT 'E1' WILL OCCUR ASKING FOR THE 5203 TO BE MADE READY. WHEN HALT 'E1' IS RESET AND THE PRINTER STILL INDICATES NOT READY TO A TEST I/O FOR NOT READY, AN ERROR IS DISPLAYED.
- 4.1.5 ROUTINE 5 - TIO BUSY TO READY PRINTER. THE 5203 IS READY, AND NO START I/O COMMAND ISSUED. IF THE 5203 INDICATES PRINTER BUSY TO A TIO FOR BUSY, AN ERROR IS DISPLAYED. THE ERROR MESSAGE AND/OR HALT WILL SPECIFY WHETHER THE ERROR IS PRINTER BUFFER BUSY, LEFT OR RIGHT CARRIAGE BUSY, OR SIMPLY, PRINTER BUSY.
- 4.1.6 ROUTINE 6 - LOAD I/O'S TO A READY, NOT BUSY PRINTER. THIS TEST WILL NOT EXECUTE UNTIL THE 5203 IS NOT BUSY. FIRST, A LOAD I/O TO THE IMAGE ADDRESS REG. IS ISSUED AND THEN THE REGISTER IS SENSED AND THE RESULTS COMPARED TO THE ADDRESS JUST LOADED. IF THE ADDRESSES ARE NOT EQUAL AN ERROR MESSAGE AND/OR HALT WILL BE DISPLAYED. THE MESSAGE WILL CONTAIN THE ACTUAL AND EXPECTED RESULTS OF THE IAR. THE SAME TEST IS PERFORMED ON THE DATA ADDRESS REGISTER (DAR). FINALLY, THE NO-OP CHECK LATCH IS TESTED. IT SHOULD NOT BE ON SINCE NO START I/O WAS ISSUED. HALT '3C' IS DISPLAYED IF IT IS.
- 4.1.7 ROUTINE 7 - START I/O COMMANDS TEST. THE 5203 CARRIAGE SHOULD BE RESTORED TO LINE 1 BEFORE RUNNING THIS TEST. IF NOT, THE TEST SKIPS THE CARRIAGE TO LINE 1. THE TEST THEN BEGINS EXECUTION OF EACH COMMAND IN THE FOLLOWING TABLE:

COMMAND	CODE (HEX)
PRINT	E200
SPACE 0	E000
PRINT	E200
SPACE 1	E001
PRINT	E200
SPACE 2	E002
PRINT	E200
SPACE 3	E003
PRINT AND SPACE 1	E201
PRINT AND SPACE 2	E202
PRINT AND SPACE 3	E203
PRINT	E200
SKIP TO LINE 17	E411
PRINT AND SKIP TO LINE 22	E616
PRINT AND SKIP TO LINE 1	E601

DURING AND AFTER EXECUTION OF EACH COMMAND, ALL POSSIBLE ERROR CONDITIONS (BUSY ERRORS, STATUS ERRORS, ETC.) ARE CHECKED. ANY ERRORS FOUND WILL PRINT OUT WITH ALL PERTINENT INFORMATION ABOUT THE CONDITION, AND THE APPROPRIATE HALT ID DISPLAYED. IF NO ALTERNATE PRINTER (SSW-3 & 4 ON) AND A HAMMER ECHO CHECK OCCURS, RESET THE '09' HALT TO DISPLAY THE FAILING HAMMER NUMBER (DECIMAL) IN THE HALT INDICATORS. THE DATA PRINTED DURING EXECUTION CONTAINS THE LINE NUMBER AND THE NAME OF EACH COMMAND. FOR EXAMPLE:

LINE 001/ PRINT / SPACE 0/ PRINT / SPACE 1  
 LINE 002/ PRINT / SPACE 2

LINE 004/ PRINT / SPACE 3

LINE 013/ PRINT / SKIP TO 017

LINE 017/ PRINT & SKIP TO 022

ETC.  
 THE CARRIAGE MOVEMENT COMMAND(S) IN EACH LINE PRINTED DETERMINES THE SPACING TO THE NEXT LINE PRINTED.

- 4.1.8 ROUTINE 8 - CARRIAGE SPACE/SKIP TEST. FIRST THE PROGRAM RESTORES THE CARRIAGE TO LINE 1 IF IT IS NOT ALREADY THERE. NEXT, IT BEGINS EXECUTION OF EACH COMMAND IN THE FOLLOWING TABLE:

COMMAND	CODE (HEX)
SKIP TO LINE 42	E42A
SPACE 1	E001
SKIP TO LINE 85	E455
SPACE 1	E001
SKIP TO LINE 112	E470
SPACE 1	E001
SPACE 2	E002
SPACE 3	E003
SPACE 0	E000

PRIOR TO EXECUTION OF EACH OF THESE CARRIAGE COMMANDS, THE NAME OF THE COMMAND, THE FORM LENGTH CURRENTLY IN EFFECT, AND THE LINE NUMBER OF THE CURRENT POSITION OF THE CARRIAGE ARE PRINTED. DURING AND AFTER EXECUTION OF COMMANDS, ALL STATUS CONDITIONS ARE CHECKED AND ANY ERRORS INDICATED. IN ADDITION, THE CARRIAGE LINE COUNTER IS SAMPLED AFTER EACH CARRIAGE COMMAND AND ANALYZED FOR CORRECT CARRIAGE MOVEMENT. ANY CARRIAGE/LINE COUNTER DISCREPANCIES WILL BE INDICATED, HOWEVER THE PRINTED OUTPUT SHOULD BE CHECKED FOR HARDWARE UNDETECTABLE CARRIAGE ERRORS.

- 4.1.9 ROUTINE 9 - H & T PRINT TEST. FIRST THE HAMMER POSITION IS CHECKED. IF THEY ARE NOT IN POSITION M4, THEY ARE MOVED THERE BY A PRINT BLANKS COMMAND. THEN THE DATA AREA IS FILLED WITH 'H'S AND A PRINT COMMAND ISSUED AT THE NEXT HAMMER LATCH TIME. AFTER 25 LINES OF 'H'S ARE PRINTED IN THIS MANNER, THE HAMMER NUMBERS ARE PRINTED. EACH IS PRINTED IN THE MIDDLE TWO PRINT POSITIONS OF THE FOUR THAT IT SERVICES. THE HAMMER POSITION IS CHECKED AGAIN AND MOVED IF NECESSARY. THEN, 25 LINES OF 'T'S ARE PRINTED IN THE SAME MANNER AS THE 'H'S. IF ANY ERRORS OCCUR DURING THE ROUTINE, THEY WILL BE INDICATED. THE LINES OF 'H'S & 'T'S SHOULD BE EXAMINED FOR PRINT QUALITY. A BAD HAMMER OR ADJUSTMENT IS READILY APPARENT WITH THIS PATTERN.

**4.1.10 ROUTINE A - PAPER SETTLING TEST.**

THE HAMMERS MUST BE IN POSITION M4 (TO THE RIGHT), IF NOT, A PRINT BLANKS COMMAND IS ISSUED TO MOVE THEM THERE. THEN EVERY FOURTH PRINT POSITION (FROM 4 THRU 96) OF THE DATA AREA IS FILLED WITH A '48'. THE CHAIN IMAGE AREA IS ENTIRELY FILLED WITH THE SAME VALUE, SO THAT THE HAMMERS 1 THRU 24 WILL FIRE DURING THE 3 PRINT SUB-SCANS OF POSITION M4. NOW, A SPACE 1 COMMAND IS ISSUED, AND AS SOON AS THE CARRIAGE DROPS BUSY, THE COMMAND IS ISSUED TO PRINT THE PREVIOUSLY SET UP DATA AREA. THEREFORE, PRINTING BEGINS AS SOON AS POSSIBLE AFTER CARRIAGE MOVEMENT. THEN, AFTER ALL BUSY CONDITIONS HAVE DROPPED, A COMMAND IS ISSUED TO PRINT 3 T'S BETWEEN THE PREVIOUSLY PRINTED CHARACTERS AS A REFERENCE TO COMPARE THE EARLIER CHARACTERS FOR ALIGNMENT. AFTER 20 SUCH LINES ARE PRINTED, THEY SHOULD BE CAREFULLY SCANNED FOR MISALIGNMENT OF EVERY 4TH CHARACTER WITH THE 3 T'S BETWEEN THEM, PARTICULARLY ON THE LEFT PRINT POSITIONS SINCE THEIR HAMMERS FIRE EARLIEST.

**4.1.11 ROUTINE B - MORSE CASE PRINT TEST.**

FIRST A LINE (1ST 72 POSITIONS) OF H'S ARE PRINTED AS A REFERENCE LINE. THEN A PRINT PATTERN IS SET UP IN THE DATA AREA SUCH THAT 6 HAMMERS WILL FIRE 31 USECS APART (19 USEC ON 300 LPM), IN EACH PRINT SUB-SCAN (389 OR 243 USEC ON 300 LPM), OF ALL FOUR HAMMER POSITIONS. THIS, 18 HAMMERS WILL FIRE IN 1 PRINT SCAN (1167 OR 729 USEC ON 300 LPM) AND 72 HAMMERS DURING THE ENTIRE PRINT COMMAND. THE PRINT PATTERN THAT CAUSES THIS, IS AS FOLLOWS:

```
123345567789900112//STTUVVWXX---ETC.
25 OF THESE LINES ARE PRINTED. ALL ERROR CONDITIONS ARE CHECKED DURING AND AFTER EACH COMMAND, AND ANY ERRORS INDICATED.
```

**4.1.12 ROUTINE C - RIPPLE PRINT.**

THIS TEST FILLS THE DATA AREA WITH THE CHAIN IMAGE. AFTER PRINTING A LINE, THE DATA FIELD IS SHIFTED 1 POSITION TO THE RIGHT, UNTIL EACH CHARACTER OF THE IMAGE HAS BEEN PRINTED IN EVERY PRINT POSITION. ALL ERROR CONDITIONS ARE CHECKED DURING AND AFTER EACH COMMAND AND ANY ERRORS INDICATED. IF THE ROUTINE IS TO BE USED FOR CHAIN CLEANING, THE CARRIAGE CLUTCH MUST BE IN NEUTRAL AND THE FORMS ADVANCED BY THE OPERATOR.

**4.1.13 ROUTINE D - UNPRINTABLE CHAR. TEST.**

THIS TEST FIRST INSERTS AN UNPRINTABLE CHARACTER IN PRINT POSITION 2 OF THE DATA AREA, AND ISSUES A PRINT COMMAND. ALL ERROR CONDITIONS ARE CHECKED DURING AND AFTER THE COMMAND AND ANY ERRORS INDICATED. IF NO OTHER STATUS ERRORS EXIST, THE UNPRINTABLE CHARACTER BIT IS CHECKED TO BE SURE IT IS ON. IF IT IS NOT, A MESSAGE AND/OR HALT IS DISPLAYED. THIS IS REPEATED IN PRINT POSITIONS 10, 44, 92, 86, AND 94 ON A 96 POSITION MACHINE. ON A 120 POSITION MACHINE, PRINT POSITION 120 IS ALSO INCLUDED, AND ON A 132 POSITION MACHINE, 120 AND 128 ARE INCLUDED. THE DATA AREA IS CLEARED OF UNPRINTABLE CHARACTERS AFTER EACH COMMAND.

**4.1.14 ROUTINE E - OPERATOR ENTRY COMMANDS TEST.**

(EXECUTED AT OPERATOR REQUEST THRU THE CONSOLE ADDRESS SWITCHES) THE PROGRAM FIRST GIVES THE OPERATOR INSTRUCTIONS, TO ENTER THE COMMANDS AND/OR DELAYS DESIRED, FOLLOWED BY AN 'EA' HALT. AT THIS TIME THE OPERATOR MAY ENTER A COMMAND 'EXXX' OR DELAY 'OXXX' AND RESET THE HALT. AN 'EC' HALT WILL THEN APPEAR AND ANOTHER COMMAND OR DELAY ENTERED. ALTERNATING 'EA' AND 'EC' HALTS OCCUR UNTIL UP TO 20 ENTRIES ARE MADE, OR A '0000' IS ENTERED. ANY INVALID ENTRY WILL BE INDICATED WITH A '44' ERROR HALT. BEFORE EXECUTION OF ENTRIES BEGINS, THE LIST OF ENTRIES IS PRINTED. DURING AND AFTER EXECUTION OF EACH COMMAND, ALL POSSIBLE ERROR CONDITIONS ARE CHECKED. ANY ERRORS FOUND WILL BE INDICATED BY A MESSAGE AND/OR THE APPROPRIATE HALT ID. THE DATA PRINTED DURING EXECUTION WILL CONTAIN THE LINE NUMBER AND THE NAME OF EACH COMMAND EXECUTED. THE TEST CONTINUES LOOPING ON THE ENTERED LIST UNTIL STOPPED BY THE OPERATOR.

**4.2 SECTION E02****4.2.1 ROUTINE 1 - SENSE COMMANDS ANALYSIS TEST.**

(BEFORE RUNNING THIS ROUTINE SSW-05 MUST BE ON).

THE OPERATOR IS INSTRUCTED TO PUT THE PRINTER INTO A PARTICULAR CONDITION, SO THAT THE SENSE INFORMATION CAN BE PREDICTED. AN EXPECTED SENSE BYTE TABLE IS SET UP ACCORDING TO THE OPTIONS DEFINED IN OCP'S UDT CARD. AFTER THE OPERATOR EXECUTES THE MANUAL INSTRUCTIONS AND RESETS THE 'E2' HALT, SENSE CODES 'E0' - LINE COUNTERS, 'E1' - D.A.R. INCREMENT VALUE AND CHAIN CHAR. COUNTER, 'E2' - PRINTER TIMINGS, AND 'E3' - PRINTER CHECK STATUS, ARE SAMPLED, AND COMPARED TO THE EXPECTED SENSE TABLE. THE CHAIN EMITTER SS, PSS-1, AND MORE LATCH TIMINGS OF SENSE CODE 'E2' (BITS 2, 3, AND 7 OF BYTE EB2), AND THE C.E. SENSE BIT OF SENSE CODE 'E3' (BIT 7 OF BYTE EB1), ARE IGNORED, BECAUSE THEY ARE UNPREDICTABLE. IN THE EVENT A SENSE BYTE, OR BYTES, DO NOT COMPARE WITH THE EXPECTED TABLE, AN ERROR MESSAGE IS PRINTED ON THE MFCU CONTAINING THE SENSE CODE THAT FAILED, AND THE ACTUAL AND EXPECTED DATA. IF THERE IS NO ALTERNATE PRINTER ON THE SYSTEM, SET SSW-3 & 4 ON, AND RESET HALT '43' TO GET ANOTHER HALT TO INDICATE WHICH SENSE CODE(S) AND BYTE(S) FAILED. (REF. HALT ID CHART)

**4.2.2 ROUTINE 2 - SENSE TIMING BIT TEST.**

(IF THE PRINTER IS NOT READY UPON ENTRY TO THIS ROUTINE, A MESSAGE AND/OR HALT WILL INDICATE THIS).

AFTER RESETTING THIS INSTRUCTION HALT, A PRINT AND SPACE COMMAND IS ISSUED AND ALL TIMING BITS ARE SAMPLED FOR 1 SECOND TO ASSURE THAT THEY GO OFF, AND ON, DURING THE COMMAND EXECUTION. C.E. SENSE BIT AND CHAIN EMITTER (BITS 2 & 5 OF EB2) ARE IGNORED. IF ANY BITS FAILED TO CHANGE STATE, THEY WILL BE INDICATED WITH A PRINTOUT AND ERROR HALT '45'. IF THERE IS NO ALTERNATE PRINTER AVAILABLE, SET SSW-3 & 4 ON, AND RESET HALT '45' TO GET ANOTHER HALT WHICH INDICATES THE FAILING BYTE AND BIT OF SENSE CODE 'E2'. (REF. HALT ID CHART) IF DUAL CARRIAGE IS DEFINED IN THE UDT, THE SAME TEST WILL BE EXECUTED WITH A COMMAND TO THE RIGHT CARRIAGE.

## 4.3 SECTION E03

4.3.1 ROUTINE 1 - CHAIN CHARACTER COUNTER TEST.  
THE PROGRAM FIRST CHECKS TO SEE IF THE CHAIN IMAGE LOADED BY DCP MATCHES THE CHAIN CURRENTLY MOUNTED ON THE PRINTER. IF THE CHAIN AND ITS IMAGE DO NOT AGREE, ERRORS WILL OCCUR ON THIS TEST. NEXT, THE CHAIN EMITTER IS SAMPLED AT A 24.3 USEC RATE FOR ABOUT 37 MSEC. (1550 SAMPLES), AND THE FOLLOWING 2 TESTS ARE PERFORMED ON THE DATA SAMPLED.

STEP 1. FIND A CHAIN EMITTER PULSE WITHIN 1.94 MSEC (80 SAMPLES) OF THE START OF SAMPLING. HALT '51' IF NO PULSE.

STEP 2. FIND CHAIN EMITTER PULSES EVERY 413 USEC (17 SAMPLES) ( 243 USEC AND 10 SAMPLES FOR 300 LPM) THROUGH THE ENTIRE SAMPLE TIME. HALT '52' IF A PULSE IS MISSING.

THE TEST THEN GOES INTO A LOOP SEARCHING FOR HOME LATCH. IF NOT FOUND IN 350 MSEC, THE TEST SAMPLES THE CHAIN CHARACTER COUNTER AND TIMING BYTE ED2 AT A 91.2 USEC RATE ANYWAY. WHEN HOME LATCH IS FOUND, THE TEST DELAYS 255 MSEC (150 MSEC FOR 300 LPM) AND IMMEDIATELY FOLLOWING THIS DELAY, THE TEST GOES INTO A 91.2 USEC LOOP (73 USEC FOR 300 LPM) SAMPLING THE CHAIN CHAR.COUNT. AND THE ED2 BYTE OF THE PRINTER TIMING UNTIL 1550 SAMPLES OF EACH ARE TAKEN. THE FOLLOWING ARE TESTS PERFORMED ON THE DATA SAMPLED, THE ORDER IN WHICH THEY ARE PERFORMED, AND THE ASSOCIATED HALT IN THE EVENT OF A FAILURE.

STEP 3. FIND A HOME LATCH AND CHECK THE TIME TO THE NEXT HOME TO BE LESS THAN 56.63 MSEC (621 SAMPLES) (35.33 MSEC AND 484 SAMPLES FOR 300 LPM) ON A 48 CHARACTER CHAIN. (ONLY 1 HOME WITH UCS). HALT '53' IF NO HOME FOUND OR TOO LONG BETWEEN HOMES.

STEP 4. CHECK THE TIME FROM ONE HOME LATCH TO THE NEXT TO BE GREATER THAN 55.36 MSEC (607 SAMPLES) (34.68 MSEC AND 475 SAMPLES FOR 300 LPM) ON A 48 CHARACTER CHAIN. (ONLY 1 HOME LATCH WITH UCS). HALT '54' IF TOO MANY HOME LATCHES ARE FOUND.

STEP 5. CHECK THE CHAR COUNTER FOR CORRECT INCREMENTING AND RESETING AT HOME LATCH TIME. THE FOLLOWING TABLE ILLUSTRATES THE POSSIBLE ERRORS AND HOW THE CHECKING IS DONE:

CHARACTER COUNTER VALUES AROUND HOME LATCH (RESET)  
TIME WHEN ERRORS OCCUR. EACH VALUE SHOULD REMAIN IN  
THE COUNTER FOR 1 PRINT SCAN (1167 USEC 729 USEC FOR 300 LPM).

NOTE- HOME LATCH OCCURS ABOUT 270 USEC (220 USEC FOR 300 LPM) BEFORE THE CHAR COUNTER RESETS.

-NORMAL-  
48 CHAR SET    --2D-----2E-----2F---H-00-----01-----02--  
UCS            --75-----76-----77---H-00-----01-----02--

-ERRORS-  
(48 CHAR. SET SHOWN ONLY)  
NO CHAR. CTR. --6E-----6F-----70---H-71-----72-----73--  
RESET

NO CHAR. CTR. --7F-----7F-----7F---H-7F-----7F-----7F--  
SHIFT OR NO  
PSS1 PULSE

EXTRA EMITTER  
PULSES        --2F-----30-----31---H-00-----01-----02--

CHAR. CTR. ERROR  
(BIT ALWAYS ON) --06-----07-----04---H-04-----05-----04--  
(BIT ALWAYS OFF) --02-----03-----00---H-00-----01-----02--

- (A) IS CHAR. COUNTER AT '00', 270 USEC (219 USEC FOR 300 LPM) (3 SAMPLES) AFTER HOME LATCH? IF NOT GO TO (D).
- (B) IS CHAR. COUNTER AT '2F' ('77' FOR UCS), AT HOME LATCH TIME? IF NOT GO TO (D).
- (C) THE CHAR. COUNTER IS CORRECT. GO TO STEP 6.
- (D) IS CHAR. COUNTER HIGHER THAN '2F' ('77' FOR UCS), AT 270 USEC (219 USEC FOR 300 LPM) (3 SAMPLES) AFTER HOME LATCH? IF NOT, GO TO (J).
- (E) IS CHAR. COUNTER AT '7F', 270 USEC (219 USEC FOR 300 LPM) (3 SAMPLES) AFTER HOME LATCH? IF NOT, GO TO (J).
- (F) DID PSS1 OCCUR 270 TO 460 USEC (219 USEC TO 365 USEC FOR 300 LPM) (3 TO 5 SAMPLES) AFTER HOME LATCH? IF NOT GO TO (H).
- (G) HALT 58, NO CHAR. COUNTER SHIFT.
- (H) HALT 57, PSS1 DID NOT OCCUR.
- (J) IS THE CHAR. COUNTER VALUE AT 365 USEC (292 USEC FOR 300 LPM) (4 SAMPLES) BEFORE HOME LATCH 1 LESS THAN 365 USEC (292 USEC FOR 300 LPM) AFTER HOME LATCH? IF NOT, GO TO (I).
- (K) HALT 55, CHAR. COUNTER DID NOT RESET.
- (L) CHECK THE VALUES IN THE CHAR. COUNTER EVERY 1.17 MSEC (.73 MSEC FOR 300 LPM) (13 SAMPLES, 10 FOR 300 LPM) FOR 47.4 MSEC, (30 MSEC FOR 300 LPM) STARTING AT HOME LATCH. IF ANY CHAR. COUNTER VALUE IS MORE THAN 2 HIGHER THAN THE PREVIOUS VALUE, GO TO (N). IF THE CHAR. COUNTER VALUE IS 2 HIGHER THAN THE PREVIOUS VALUE MORE THAN 10 TIMES, GO TO (N).
- (M) HALT 59, CHAR. COUNTER ERROR DUE TO EXTRA CHAIN EMITTERS OR NOISE.
- (N) HALT 56, CHAR. COUNTER ERROR.

STEP 6. THE ENTIRE SAMPLING AND CHECKING PROCEDURE IS DONE 50 TIMES BEFORE THE TEST IS COMPLETED.

## 4.4 SECTION E04

## 4.4.1 ROUTINE 1 - CYCLE STEAL TEST.

THIS TEST FIRST SETS UP TO ISSUE A PRINT AND SPACE COMMAND USING A BLANK DATA FIELD, AND THE DATA ADDRESS REGISTER IS LOADED WITH AN INVALID ADDRESS. THE COMMAND IS THEN EXECUTED, AND THE DATA ADDRESS CHECKED TO SEE IF THE CORRECT ADDRESS, '7C' IN M1 AND '7F' IN M4 OF A 200 OR 300 LPM PRINTER, (OR '7C' IN M4 ON A 100 LPM PRINTER) HAS FORCED INTO THE REGISTER. IF NOT, HALT '61' OCCURS. THE FOLLOWING SIGNALS ARE CHECKED AFTER PRINTING THE BLANK FIELD.

- (A) PRINT CYCLE 1 OCCURRED, IF NOT, HALT '62'.  
(B) PRINT CYCLE 2 DID NOT OCCUR, IF IT DID, HALT '63'.  
(C) PRINT CYCLE 3 DID NOT OCCUR, IF IT DID, HALT '64'.  
(D) HAMMER SET LATCH DID NOT OCCUR, IF IT DID, HALT '65'.

IF THE PRINT BLANKS FIELD EXECUTED CORRECTLY, AN UNPRINTABLE FIELD IS SET UP, AND A PRINT AND SPACE COMMAND ISSUED. THE FOLLOWING SIGNALS ARE CHECKED AFTER EXECUTION:

- (A) PRINT CYCLE 1 OCCURRED, IF NOT, HALT '66'.  
(B) PRINT CYCLE 2 OCCURRED, IF NOT, HALT '67'.  
(C) PRINT CYCLE 3 DID NOT OCCUR, IF IT DID, HALT '68'.  
(D) HAMMER SET LATCH DID NOT OCCUR, IF IT DID, HALT '69'.

IF THE PRINT UNPRINTABLE FIELD TEST EXECUTED CORRECTLY, A PRINTABLE FIELD (H'S) IS SET UP, AND A PRINT AND SPACE COMMAND ISSUED. THE FOLLOWING SIGNALS ARE CHECKED AFTER EXECUTION:

- (A) PRINT CYCLE 1 OCCURRED, IF NOT, HALT '6A'.  
(B) PRINT CYCLE 2 OCCURRED, IF NOT, HALT '6C'.  
(C) PRINT CYCLE 3 OCCURRED, IF NOT, HALT '6E'.  
(D) HAMMER SET LATCH OCCURRED, IF NOT, HALT '6F'.

THE ROUTINE ISSUES, EXECUTES AND CHECKS THESE 3 COMMANDS 20 TIMES BEFORE EXITING.

## 4.4.2 ROUTINE 2 - HAMMER ADDRESSING TEST.

THIS TEST SETS 4 X'S IN PRINT POSITIONS 1 - 4 (HAMMER NO. 1) AND ISSUES A PRINT AND SPACE. THE PATTERN OF X'S IS MOVED FROM LEFT TO RIGHT THROUGH ALL THE HAMMERS SO THAT EACH HAMMER IS FIRED IN EACH OF ITS 4 POSITIONS. THE TEST GOES THROUGH ALL THE HAMMERS 3 TIMES.

## 4.5 SECTION E05

## 4.5.1 ROUTINE 1 - DATA ADDRESS INCREMENTING TEST.

FIRST, THE HAMMER POSITION IS CHECKED. IF THEY ARE NOT IN M4, THEY ARE MOVED THERE BY A PRINT BLANK COMMAND. THEN THE DATA ADDRESS REGISTER IS SAMPLED TO ASSURE STARTING AT '7F' FOR A 200 OR 300 LPM PRINTER OR '7C' ON A 100 LPM DEVICE. IF THE D A R VALUE DOES NOT END IN '7F' OR '7C', A '70' HALT WILL BE DISPLAYED. WHEN THE D A R INITIAL VALUE IS CORRECT, THE PROGRAM WAITS FOR PRINT SUB-SCAN 1, THEN HOME LATCH. WHEN FOUND, IT ISSUES A PRINT AND SPACE COMMAND AND STARTS SAMPLING THE D A R EVERY 7.62 USEC FOR 1295 USEC (170 SAMPLES). THIS COVERS PRINT SUB-SCANS 1, 2 AND 3 OF HAMMER POSITION 4. THE FOLLOWING VALUES AND TIMINGS ARE CHECKED IN THESE M4 SAMPLES:

- (A) THAT THE INITIAL D A R VALUE ('7F' OR PSS-1) WAS INCREMENTED BY 12 WITHIN 251 USEC (33 SAMPLES) (175 USEC FOR 300 LPM AND 23 SAMPLES) AFTER THE 1ST SAMPLE. IF NOT, HALT '71' OCCURS.
- (B) THAT THE D A R VALUE INCREMENTED BY 12 EVERY 31 USEC (4 SAMPLES) (19 USEC FOR 300 LPM AND 2 SAMPLES). IF THE SAME VALUE REMAINED FOR MORE THAN 61 USEC (8 SAMPLES) (38 USEC FOR 300 LPM AND 5 SAMPLES), HALT '71' OCCURS. ALL 11 INCREMENTS OF EACH SUB-SCAN ARE CHECKED THUS.
- (C) THAT THE D A R VALUE AT THE END OF A SUB-SCAN WAS INCREMENTED WITHIN 61 USEC (8 SAMPLES) (38 USEC FOR 300 LPM AND 5 SAMPLES) AFTER THE LAST INCREMENT OCCURRED. IF NOT, HALT '72' OCCURS.
- (D) THAT THE D A R VALUE AFTER SUBTRACTION IS EQUAL TO THE INITIAL VALUE OF THE NEXT PRINT SUB-SCAN. IF NOT, HALT '73' OCCURS.
- (E) THAT THE INITIAL D A R VALUE ('83' FOR PSS-2 AND '87' FOR PSS-3) BETWEEN SUB-SCANS WAS INCREMENTED BY 12 WITHIN 99 USEC (13 SAMPLES) (61 USEC AND 8 SAMPLES FOR 300 LPM) AFTER THE INITIAL D A R VALUE OCCURED. IF NOT, HALT '71' OCCURES.

WHEN THE D A R IS CORRECT FOR POSITION M4, THE HAMMER POSITION IS AGAIN CHECKED. IF THEY ARE NOT IN M4, THEY ARE MOVED THERE. THEN A PRINT AND SPACE IS ISSUED, AND AS SOON AS THE NEXT PRINT START PULSE SS OCCURS, THE D A R IS SAMPLED. THE HAMMERS ARE IN POSITION M3 WHEN THIS SAMPLE IS TAKEN. IF THE VALUE IN THE RIGHT-MOST BYTE OF THE D A R IS NOT '82' OR '8E', HALT '75' OCCURS.

WHEN THE D A R IS CORRECT FOR M3, THE HAMMERS ARE AGAIN MOVED TO M4 IF NECESSARY. A PRINT AND SPACE COMMAND IS ISSUED AND THEN THE TEST WAITS FOR THE SECOND PRINT START PULSE SS TO OCCUR, WHICH MEANS THE HAMMERS ARE IN M2, THEN THE D A R IS SAMPLED. IF THE VALUE IN THE RIGHT-MOST BYTE OF THE D A R IS NOT '85' OR '91' AT THIS TIME, HALT '74' OCCURS.

FINALLY, WHEN THE D A R IS CORRECT IN M2, M3 AND M4, THE HAMMERS ARE AGAIN MOVED TO M4 IF NECESSARY. ANOTHER PRINT AND SPACE COMMAND IS ISSUED AND THE PROGRAM WAITS FOR THE HAMMERS TO REACH POSITION M1, THEN SAMPLES THE D A R. IF THE VALUE IN THE RIGHT-MOST BYTE OF THE D A R IS NOT '7C' OR '88', HALT '79' OCCURS. THE TEST GOES THRU ALL THESE HAMMER POSITIONS 10 TIMES. THE ONLY OPTION IN THIS ROUTINE IS SSW-20. IF THIS IS ON, THE PROGRAM PRINTS OPERATOR INSTRUCTIONS TO MANUALLY SET THE HAMMERS IN M4 BEFORE TESTING, INSTEAD OF MOVING THEM WITH A PRINT COMMAND. ALSO, EACH HAMMER POSITION IS ONLY CHECKED 1 TIME INSTEAD OF 10.

## 4.5.2 ROUTINE 2 - IMAGE ADDRESS INCREMENTING TEST.

(THIS ROUTINE IS BYPASSED IF THE SSW-20 OPTION IS ON IN ROUTINE 1).

FIRST THE PROGRAM CHECKS TO SEE IF THE CHAIN IMAGE LOADED BY DCP MATCHES THE CHAIN CURRENTLY MOUNTED ON THE PRINTER. IF THEY ARE NOT MADE TO AGREE, ERRORS WILL OCCUR ON THIS TEST. THE HAMMER POSITION IS CHECKED. IF THEY ARE NOT IN M4, THEY ARE MOVED THERE BY A PRINT BLANKS COMMAND. AN UNPRINTABLE CHARACTER IS SET IN PRINT POSITION 4 (M4 POSITION OF HAMMER 1). THEN, AS SOON AS THE NEXT PRINT SUB-SCAN 1 FOLLOWED BY HOME LATCH OCCURS, A PRINT AND SPACE COMMAND IS ISSUED. THE PROGRAM IMMEDIATELY STARTS SAMPLING THE IMAGE ADDRESS REGISTER EVERY 7.62 USEC FOR 1372 USEC (180 SAMPLES). THIS COVERS PRINT SUB-SCANS 1, 2 AND 3 OF HAMMER POSITION M4. THE FOLLOWING CHECKS ARE DONE ON THE SAMPLED DATA:

- (A) THAT THE RIGHT-MOST BYTE OF THE I A R CHANGED TO THE INITIAL VALUE '02' FOR PSS-1, WITHIN 251 USEC (33 SAMPLES) (175 USEC FOR 300 LPM AND 23 SAMPLES) AFTER THE FIRST SAMPLE TAKEN. IF NOT, HALT '76' OCCURS.
- (B) THAT THE I A R VALUES DURING A PRINT SUB-SCAN MATCH THE CORRECT TABLE OF VALUES. IF A VALUE REMAINS IN THE REGISTER FOR MORE THAN 61 USEC (8 SAMPLES) (38 USEC FOR 300 LPM AND 5 SAMPLES) A '77' HALT OCCURS.
- (C) THAT THE I A R RESTORED TO THE INITIAL VALUE FOR THE NEXT SUB-SCAN WITHIN 99 USEC (13 SAMPLES) (61 USEC FOR 300 LPM AND 8 SAMPLES) AFTER THE LAST VALUE OF A SUB-SCAN APPEARED IN THE I A R. IF NOT, HALT '78' OCCURS. ALL 3 PRINT SUB-SCANS OF HAMMER POSITION M4 ARE CHECKED IN THIS MANNER. THE TEST TAKES BATCHES OF SAMPLES, AND CHECKS THESE SAMPLES 10 TIMES BEFORE EXITING.

## 4.6 SECTION E06

## 4.6.1 ROUTINE 1- CHAIN EMITTER TIMING TEST.

AFTER INITIALIZING, THIS TEST WAITS FOR HOME LATCH TO OCCUR, DELAYS 4 MSEC, THEN SAMPLES THE CHAIN EMITTER TIMING EVERY 9.12 USEC FOR 10 MSEC (1100 BYTES). THE TIME FROM CHAIN EMITTER TO CHAIN EMITTER IS THEN CHECKED TO BE BETWEEN 365 USEC (40 SAMPLES) AND 410 USEC (45 SAMPLES). (228 USEC AND 25 SAMPLES TO 255 USEC AND 28 SAMPLES FOR 300 LPM). THE LOWER LIMIT IS DECREASED TO 356 USEC WHEN WRAPPING AROUND FROM 144TH EMITTER TO EMITTER NUMBER 1. IF ANY EMITTER TIME FALLS OUTSIDE THESE TOLERANCES, HALT '80' OCCURS. THIS SAMPLING AND CHECKING CONTINUES UNTIL 8 BATCHES OF SAMPLES ARE CHECKED. EACH TIME THE DELAY AFTER HOME LATCH IS INCREASED BY 9 MSEC SO THAT ALL EMITTERS FROM ONE HOME THRU THE NEXT HOME (48 CHAR SET), ARE CHECKED. WHEN HOME DOES OCCUR IN THE SAMPLES TAKEN, EMITTER PULSES 1, 2, 142, 143, 144, AND HOME PULSE 145 ARE CHECKED TO ASSURE THE PULSE WIDTH TO BE 18.2 USEC (2 SAMPLES) OR MORE, AND THAT THE GAP BETWEEN PULSES IS 18.2 USEC (2 SAMPLES) OR MORE. IF NOT HALT '81' OCCURS. THEN, THE TIME FROM EMITTER PULSE 144 TO 145 IS CHECKED TO BE WITHIN 146 USEC (16 SAMPLES) TO 246 USEC (27 SAMPLES) (173 USEC AND 8 SAMPLES TO 137 USEC AND 15 SAMPLES FOR 300 LPM). IF NOT, HALT '82' OCCURS. THE PULSE WIDTHS AND HOME PULSE TIME ARE SAMPLED AND CHECKED 10 TIMES, THEN THE ROUTINE IS EXITED.

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4.7 SECTION E07 (DUAL CARR. FEATURE ONLY).

4.7.1. ROUTINE 1 - LEFT/RIGHT CARR. SPACE/SKIP TEST  
FIRST, A MESSAGE AND/OR HALT OCCURS WHICH INSTRUCTS THE OPERATOR TO MAKE BOTH CARRIAGES READY TO OPERATE, ALIGN FORMS, AND MAKE PRINTER READY. WHEN THIS 'E6' HALT IS RESET, THE TEST RESTORES THE LEFT, THEN THE RIGHT CARRIAGE TO LINE 1. IF NO ERRORS OCCUR RESTORING CARRIAGES, THE PROGRAM STARTS TO EXECUTE THE FOLLOWING LIST OF COMMANDS:

COMMAND CODE	DESCRIPTION
(A) E202	LEFT CARR. PRINT & SPACE 2
(B) E802	RIGHT CARR. SPACE 2
(A) EA02	RIGHT CARR. PRINT & SPACE 2
(B) E002	LEFT CARR. SPACE 2
(A) EA01	RIGHT CARR. PRINT & SPACE 1
(B) E003	LEFT CARR. SPACE 3
(A) E201	LEFT CARR. PRINT & SPACE 1
(B) E803	RIGHT CARR. SPACE 3
(A) E60F	LEFT CARR. PRINT & SKIP TO 15
(B) EC0F	RIGHT CARR. SKIP TO 15
(A) EE1E	RIGHT CARR. PRINT & SKIP TO 30
(B) E41E	LEFT CARR. SKIP TO 30
(A) EE27	RIGHT CARR. PRINT & SKIP TO 39
(B) E42A	LEFT CARR. SKIP TO 42
(A) E62D	LEFT CARR. PRINT & SKIP TO 45
(B) EC2D	RIGHT SKIP TO 45
(*) E200	PRINT ONLY
(A) E441	LEFT CARR. SKIP TO 65
(B) EC32	RIGHT CARR. SKIP TO 50
(*) EA00	PRINT ONLY
(A) EC55	RIGHT CARR. SKIP TO 85
(B) E446	LEFT CARR. SKIP TO 70
(*) EA00	PRINT ONLY
(A) EC58	RIGHT CARR. SKIP TO 88
(B) E458	LEFT CARR. SKIP TO 88

THE COMMANDS ARE ARRANGED IN PAIRS(A AND B), ONE COMMAND FOR EACH CARRIAGE, TO ATTEMPT SIMULTANEOUS CARRIAGE OPERATION. THE (\*) INDICATES A PRINT ONLY COMMAND, NOT PART OF THE TEST, USED TO PRINT THE COMMAND DESCRIPTION BECAUSE BOTH COMMANDS OF THE FOLLOWING PAIR ARE CARRIAGE MOVEMENT COMMANDS ONLY. IN THE EXECUTION OF EACH PAIR, THE (A) COMMAND IS ISSUED FIRST, AND AS SOON AS THE PRINTER IS BUSY THE (B) COMMAND IS ISSUED AND SHOULD BE EXECUTED IF A PRINT OPERATION IS NOT IN PROGRESS, OR ACCEPTED AND EXECUTED LATER IF THE PRINTER IS PRINTING. THE PROGRAM CHECKS FOR THE DROPPING OF BUSY CONDITIONS IN THE PROPER SEQUENCE, DEPENDING ON THE COMMANDS ISSUED. ALL ERROR CONDITIONS, INCLUDING LINE COUNTER ERRORS, ARE CHECKED DURING AND AFTER EXECUTION OF EACH PAIR OF COMMANDS AND ANY DISCREPANCIES DISPLAYED WITH THE APPROPRIATE HALT ID. THE DATA PRINTED ON EACH CARRIAGE CONTAINS THE LINE NUMBER AND NAME OF EACH COMMAND EXECUTED. FOR EXAMPLE:

LEFT CARRIAGE	RIGHT CARRIAGE
LINE 001/PRINT&SPACE 2	LINE 001/SPACE 2
LINE 003/SPACE 2	LINE 003/PRINT&SPACE 2
LINE 005/SPACE 3	LINE 005/PRINT&SPACE 1
	LINE 006/SPACE 3
LINE 008/PRINT&SPACE 1	
LINE 009	LINE 009
ETC.	ETC.

THE CARRIAGE MOVEMENT COMMANDS IN EACH LINE PRINTED DETERMINES THE SPACING TO THE NEXT LINE PRINTED.

5. GENERAL 5203 PRINTER INFORMATION

5.1 5203 PRINTER COMMANDS

5.1.1 START I/O COMMANDS

SIO COMMAND CODES		SIO COMMAND DEFINITION	
FUNCTION CODE	CONTROL CODE	FUNCTION	CONTROL
E0	0X	SPACE ONLY (LEFT CARRIAGE)	X = 0,1,2 OR 3 SPECIFYING THE NUMBER OF LINES TO SPACE.
E8	0X	SPACE ONLY (RIGHT CARRIAGE)	X = 0,1,2 OR 3 SPECIFYING THE NUMBER OF LINES TO SPACE.
E2	0X	PRINT AND SPACE (LEFT CARRIAGE)	X = 0,1,2 OR 3 SPECIFYING THE NUMBER OF LINES TO SPACE.
EA	0X	PRINT AND SPACE (RIGHT CARRIAGE)	X = 0,1,2 OR 3 SPECIFYING THE NUMBER OF LINES TO SPACE.
E4	XX	SKIP ONLY (LEFT CARRIAGE)	XX = A HEX VALUE, NOT TO EXCEED THE CURRENT FORM LENGTH, SPECIFYING WHICH LINE TO SKIP TO.
EC	XX	SKIP ONLY (RIGHT CARRIAGE)	XX = A HEX VALUE, NOT TO EXCEED THE CURRENT FORM LENGTH, SPECIFYING WHICH LINE TO SKIP TO.
E6	XX	PRINT AND SKIP (LEFT CARRIAGE)	XX = A HEX VALUE, NOT TO EXCEED THE CURRENT FORM LENGTH, SPECIFYING WHICH LINE TO SKIP TO.
EE	XX	PRINT AND SKIP (RIGHT CARRIAGE)	XX = A HEX VALUE, NOT TO EXCEED THE CURRENT FORM LENGTH, SPECIFYING WHICH LINE TO SKIP TO.

5.1.2 TEST I/O AND APL COMMANDS

CONDITION CODE	CONDITION DEFINITION
E0	TEST FOR PRINTER NOT READY
E2	TEST FOR PRINT BUFFER BUSY
E4	TEST FOR PRINTER LEFT CARRIAGE BUSY
EC	TEST FOR PRINTER RIGHT CARRIAGE BUSY
E6	TEST FOR PRINTER BUSY

5.1.3 LOAD I/O COMMANDS

REGISTER CODE	DATA ADDRESS	REGISTER DEFINITION	DATA DEFINITION
E0	XXXX	FORMS LENGTH	XXXX POINTS TO TWO BYTES OF DATA. THE LEFT BYTE CONTAINS THE FORM LENGTH FOR THE LEFT CARRIAGE, AND THE RIGHT BYTE THE FORM LENGTH FOR THE RIGHT CARRIAGE. FORM LENGTHS CANNOT EXCEED HEX '70'.
E4	XXXX	IMAGE ADDRESS	XXXX POINTS TO TWO BYTES OF DATA CONTAINING THE ADDRESS OF THE FIRST CHARACTER OF THE CHAIN IMAGE IN CORE. THE RIGHT BYTE OF THIS ADDRESS MUST BE '00'.
E6	XXXX	DATA ADDRESS	XXXX POINTS TO TWO BYTES OF DATA CONTAINING THE ADDRESS OF THE FIRST POSITION OF THE PRINT FIELD IN CORE. THE RIGHT BYTE OF THIS ADDRESS MUST BE '7C'.

5.1.4 SENSE I/O COMMANDS

DATA SOURCE CODE	STORAGE ADDRESS	DATA SOURCE DEFINITION	STORAGE ADDRESS DEFINITION (AFTER EXECUTION)
E0	XXXX	SAMPLE THE LEFT AND RIGHT CARRIAGE LINE LOCATIONS.	ADDRESS 'XXXX' (BYTE 1) WILL CONTAIN THE RIGHT CARRIAGE LINE LOCATION, AND ADDRESS 'XXXX' MINUS 1 (BYTE 2) WILL CONTAIN THE LEFT.
E1	XXXX	SAMPLE THE DATA ADDRESS REGISTER INCREMENT FACTOR, AND THE CHAIN CHARACTER COUNTER.	ADDRESS 'XXXX' (BYTE 1) WILL CONTAIN THE CHAIN CHARACTER COUNTER, AND ADDRESS 'XXXX' MINUS 1 (BYTE 2) WILL CONTAIN THE D.A.R. INCREMENT FACTOR.
E2	XXXX	SAMPLE THE PRINTER TIMING INFORMATION.	ADDRESS 'XXXX' (BYTE 1) WILL CONTAIN TIMING INFORMATION 1, AND ADDRESS 'XXXX' MINUS 1 (BYTE 2) WILL CONTAIN TIMING INFORMATION 2.
E3	XXXX	SAMPLE THE PRINTER STATUS INFORMATION.	ADDRESS 'XXXX' (BYTE 1) WILL CONTAIN STATUS INFORMATION 1, AND ADDRESS 'XXXX' MINUS 1 (BYTE 2) WILL CONTAIN STATUS INFORMATION 2.
E4	XXXX	SAMPLE THE PRINTER IMAGE ADDRESS REGISTER.	ADDRESS 'XXXX' (BYTE 1) WILL CONTAIN THE LOW ORDER BYTE OF THE I.A.R., AND ADDRESS 'XXXX' MINUS 1 (BYTE 2) WILL CONTAIN THE HIGH ORDER BYTE.
E6	XXXX	SAMPLE THE PRINTER DATA ADDRESS REGISTER.	ADDRESS 'XXXX' (BYTE 1) WILL CONTAIN THE LOW ORDER BYTE OF THE D.A.R., AND ADDRESS 'XXXX' MINUS 1 (BYTE 2) WILL CONTAIN THE HIGH ORDER BYTE.







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1. GENERAL PROGRAM SUMMARY

1.1 DEVICE TESTS AND OPTIONS

1.1.1 DEVICE TESTS

SECTION	ROUTINE	INTENT	APPLICABLE SENSE SWITCHES
F01 - FUNCTION TEST	01	I CHECKS FOR PROPER TIO RESPONSE FROM A NOT READY DEVICE.	NONE
	02	I CHECKS FOR PROPER TIO RESPONSE FROM A READY DEVICE.	NONE
	03	I STATUS AND SPECIAL INDICATORS TEST.	NONE
	04	I COMMANDS TEST - FROM COMMANDS TABLE.	11,12,19,1B,1F
	05	I STACKER SELECT TEST.	11,12,18,19,1B,1D,1E
	06	I STATUS AND SPECIAL INDICATORS OPERATIONAL TEST.	NONE
	07	I COMMANDS TEST - FROM SWITCHES.	11,12,19,1A
F02 - FUNCTION TEST	01	I RIPPLE PUNCH TEST.	
	02	I RIPPLE READ TEST.	11,12,18,20,21,22
	03	I RIPPLE PRINT TEST.	11,12,18,23,24,25,26
	04	I PRINT H IN ALL POSIITONS.	11,12
	05	I PRINT - IN ALL POSITIONS.	11,12
	06	I PRINT I IN ALL POSITIONS.	11,12
	07	I PRINT CARD FULL OF CHARACTER ENTERED IN DATA SWITCHES.	01,11,12
	08	I PRINT CHARACTERS ENTERED THRU DATA SWITCHES.	11,12
	09	I PRINT CHARACTERS ENTERED BY DATA CARD.	11,12
*NOTE - ROUTINES RUN ONLY WHEN SELECTED VIA SWITCH OPTION 'F2XX'			
F03 - READ EVALUATION AND ADJUSTMENT DIAGNOSTIC -READ-	01	I RECORD AND INDICATE, BY PRINTOUT, CARD MOVEMENT THROUGH THE MFCU READ STATION. INDICATES SKEW AND HOLE LOCATION RELATIVE TO GEAR COUNT EMITTER PULSES.	18
F05 - KATAKANA RIPPLE PRINT TEST	01	I KATAKANA RIPPLE PRINT TEST	11,12

1.1.2 SENSE SWITCH OPTIONS

SENSE SWITCH NUMBER	OPTION PROVIDED WHEN SENSE SWITCH IS ON	SECTIONS WHERE USED
11	HALT BETWEEN START I/O COMMANDS.	F01,F02,F05
12	DELAY BETWEEN COMMANDS. HEX VALUE IN RIGHT CONSOLE SWITCHES DETERMINE NUMBER OF MILLISECOND INCREMENTS OF DELAY. SWITCHES ARE CHECKED DYNAMICALLY.	F01,F02,F05
18	FEED DATA OR BLANK CARDS FROM PRIMARY HOPPER INSTEAD OF SECONDARY HOPPER.	F01,F02,F03
19	BYPASS WAITING FOR ALL BUSY INDICATORS TO DROP WHEN CHECKING STATUS.	F01
1A	EXIT THE ROUTINE AT THE COMPLETION OF EXECUTION OF THE LAST COMMAND IN THE TABLE.	F01
1B	LOOP ON EXECUTION OF COMMANDS.	F01
1D	PUNCH UNIQUE STACKER IDENTIFICATION INTO CARD BEFORE SELECTING IT THERE.	F01
1E	SELECT CARDS INTO STACKER ACCORDING TO PUNCHED STACKER IDENTIFICATION.	F01
1F	PRINT EACH COMMAND -IN HEX- BEFORE IT IS EXECUTED.	F01
20	LOOP ON PUNCHING THE SAME RIPPLE DECK.	F02
21	LOOP ON PUNCHING THE SAME RIPPLE CARD.	F02
22	LOOP ON PUNCHING MORE CARDS LIKE THE ONE READ.	F02
23	COMPARE ANY GROUP OF CARDS WITH THE FIRST ONE OF THE GROUP.	F02
24	READ AND COMPARE MULTIPLE RIPPLE DECKS.	F02
25	BYPASS ANY DATA COMPARISON.	F02
26	PERFORM DATA COMPARE EVEN THOUGH RIPPLE CARDS ARE NOT SEQUENTIAL.	F02

1.2 TAPS AND OPTIONS  
 1.2.1 TAPS

\*\*\*\*\*  
 \* THE FOLLOWING CONTROL MODULES RUN UNDER CONTROL OF MTAP (FF4) \*  
 \*\*\*\*\*

SECTION NO. MOD 1    MOD 2	TITLE	PURPOSE
001    021	PRI HOPPER TO WAIT TIMINGS	SHOW TIMING RELATED TO FEED CHECKS 1,2 OR 4 ON A PRI READ OR FEED CYCLE.
002    022	SEC HOPPER TO WAIT TIMINGS	SHOW TIMING RELATED TO FEED CHECKS 1,2 OR 4 ON A SEC READ OR FEED CYCLE.
003    023	PRI WAIT TO CORNER TIMINGS	SHOW TIMING RELATED TO FEED CHECKS 6,9,11, OR 13 ON A PRI READ OR FEED CYCLE.
004    024	SEC WAIT TO CORNER TIMINGS	SHOW TIMING RELATED TO FEED CHECKS 6,9,11, OR 13 ON A SEC READ OR FEED CYCLE.
005    025	CORNER TO STACKER TIMINGS	SHOW TIMING RELATED TO FEED CHECKS 14, 16, OR 18 ON A READ OR FEED CYCLE.
006    026	PRI PUNCH OP START TIMINGS	SHOW TIMING RELATED TO FEED CHECK 7 ON A PRI PUNCH CYCLE AND TO SHOW MAGNET SIGNALS RELATED TO THE PUNCH OPERATION.
007    027	SEC PUNCH OP START TIMINGS	SHOW TIMING RELATED TO FEED CHECK 7 ON A SEC PUNCH CYCLE AND TO SHOW MAGNET SIGNALS RELATED TO THE PUNCH OPERATION.
008    028	PRI PUNCH OP END TIMINGS	SHOW TIMING RELATED TO FEED CHECKS 8, 10, OR 12 ON A PRI PUNCH CYCLE AND TO SHOW MAGNET SIGNALS RELATED TO THE PUNCH OPERATION.
009    029	SEC PUNCH OP END TIMINGS	SHOW TIMING RELATED TO FEED CHECKS 8, 10, OR 12 ON A SEC PUNCH CYCLE AND TO SHOW MAGNET SIGNALS RELATED TO THE PUNCH OPERATION.
00A    02A	PRINT 3 LINES START TIMINGS	SHOW TIMING RELATED TO FEED CHECK 15 ON A PRINT 3 LINES CYCLE AND TO SHOW CB AND MAGNET SIGNALS RELATED TO THE PRINT OPERATION.
00B    02B	PRINT 3 LINES FINISH TIMINGS	SHOW TIMING RELATED TO FEED CHECKS 17 OR 18 ON A PRINT 3 LINES CYCLE AND TO SHOW CB, PRINT MAGNET ONE OPERATION, AND OTHER SIGNALS RELATED TO PRINTING
00C    02C	PRINT 4 LINES FINISH TIMINGS	SHOW TIMING RELATED TO FEED CHECKS 17 OR 18 ON A PRINT 4 LINES CYCLE AND TO SHOW CB AND OTHER SIGNALS RELATED TO PRINTING
00D    02D	INJECT, KICK & STEP CB,S CHECK	SHOW TIMING AND EXISTANCE OF THESE CB S RELATED TO PRINTING
00E    02E	PUNCH CB, PUNCH MAG 1 TIMINGS	SHOW TIMING AND EXISTANCE OF PUNCH CB S AND SHOW PUNCH MAG 1 OPERATION
00F    02F	PRINT CLUTCH CHECK 3 LINE PRINT	SHOW TIMING RELATED TO A PRINT CLUTCH CHECK WHEN PRINTING 3 LINES
010    030	PRINT CLUTCH CHECK 4 LINE PRINT	SHOW TIMING RELATED TO A PRINT CLUTCH CHECK WHEN PRINTING 4 LINES
011    031	PRINT DATA CHECK	SHOW TIMING RELATED TO PRINT DATA CHECKS
013    033	PRINT 3 LINES COMPLETE CYCLE	SHOW TIMING RELATED TO CLUTCH CHECKS AND FEED CHECK 17 ON A COMPLETE 3 LINE PRINT CYCLE
014    034	PRINT 4 LINES COMPLETE CYCLE	SHOW TIMING RELATED TO CLUTCH CHECKS AND FEED CHECK 17 ON A COMPLETE 4 LINE PRINT CYCLE

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1.2.2 SENSE SWITCH OPTIONS

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SENSE SWITCH NUMBER	OPTION PROVIDED WHEN SENSE SWITCH IS ON	SECTIONS WHERE USED
28	PRINT DATA ONLY WHEN THERE IS A STATUS ERROR OR THE DEVICE BECOMES NOT READY.	FF4
29	PRINT THE DATA IN A TABULAR FORM.	FF4
2B	BYPASS THE INITIAL EXECUTION OF SAMPLE COMMAND WITHOUT SAMPLING.	FF4

\*\*\*\*\*

1.3 STAND ALONE TESTS

\*\*\*\*\*

TEST	INTENT
FOA - 1 CARD READ CHECK TEST	READ CARDS AND CHECK FOR READ CHECK.
FOB - 1 CARD READ ANALYSIS PROGRAM	INDICATES SKEW.

\*\*\*\*\*

2. OPERATING PROCEDURES (DCP CONTROLLED SECTIONS)

THIS SECTION DESCRIBES THE USER INTERFACE FOR ALL PROGRAMS OPERATING UNDER THE DIAGNOSTIC CONTROL PROGRAM (DCP). MORE DETAIL IS PROVIDED IN THE DCP USERS GUIDE.

2.1 LOADING

THE CE MODE SELECTOR SWITCH MUST BE IN THE 'PROCESS' POSITION. ALL CE CONTROL PANEL TOGGLE SWITCHES SHOULD BE IN THE NORMAL (DOWN) POSITION.

LOADING FROM CARDS		LOADING FROM DISK	
1.	IF DCP LOADED, SKIP TO STEP 5.	1.	SKIP TO STEP 5 IF DCP ALREADY LOADED.
2.	IF DISK SYSTEM - PLACE ILP SELECTOR IN 'MFCU' POSITION.	2.	LOAD THE CE PACK AND MAKE FILE READY.
3.	PLACE DCP FOLLOWED BY TEST SECTION/S INTO MFCU PRIMARY HOPPER. MAKE MFCU READY.	3.	PLACE THE IPL SELECTOR IN THE PROPER POSITION. (NORMALLY - REMOVABLE DISK).
4.	DEPRESS PROGRAM LOAD KEY.	4.	DEPRESS PROGRAM LOAD.
	AFTER DCP IS LOADED, HALT 'HA' WILL OCCUR. COMMON SENSE SWITCHES MAY BE SET AT THIS TIME.		AFTER DCP IS LOADED, HALT 'HA' OCCURS. COMMON SENSE SWITCHES MAY NOW BE SET.
5.	PLACE TEST SECTION/S INTO MFCU PRIMARY HOPPER AND MAKE MFCU READY (IF NOT ALREADY DONE).	5.	USE CONSOLE SWITCH ENTRY 'DXXX' TO SPECIFY THE PROGRAM/S TO BE LOADED. (SEE SECTION 2.4)
6.	IF CPU IS HALTED WITH 'HA' OR 'HE' DISPLAYED, SKIP TO STEP 8.	6.	SET LEFTMOST SWITCH TO '0' AND RESET THE HALT.
7.	DEPRESS PROGRAM LOAD KEY.		DCP WILL LOAD THE FIRST SECTION SPECIFIED AND PERFORM HALT 'HA'
	DCP WILL PRINT SECTION TERMINATE MESSAGE AND HALT, DISPLAYING 'HE'.	7.	MAKE ANY CONSOLE SWITCH ENTRIES DESIRED AND/OR RESET THE HALT.
8.	RESET THE HALT.		
	DCP WILL LOAD THE SECTION AND PERFORM HALT 'HA'.		
9.	MAKE DESIRED CONSOLE SWITCH ENTRIES, IF ANY, AND RESET THE HALT.		

2.2 PROGRAM RESTART

DCP STORES INSTRUCTIONS STARTING AT LOCATION '0000' TO PROVIDE FOR A PROGRAM RESTART. THESE INSTRUCTIONS ALSO CHECK THE CONSOLE SWITCHES FOR A VALID ENTRY. TO PERFORM A PROGRAM RESTART, SIMPLY DEPRESS SYSTEM RESET FOLLOWED BY CPU START.

2.3 TERMINATION

NORMAL DCP-CONTROLLED CHAINING FROM ROUTINE TO ROUTINE PROVIDES AN AUTOMATIC TERMINATION OF A SECTION. IN ADDITION, THE CE MAY TERMINATE A SECTION AT ANY TIME BY (1) ENTERING 'EE00' IN THE CONSOLE SWITCHES, OR BY (2) LOADING THE NEXT SECTION. IN ALL CASES, DCP PRINTS A MESSAGE AND PERFORMS HALT 'HE'. THE SECTION CAN STILL BE RESTARTED AT THIS TIME. IF NO RESTART IS DESIRED, RESET THE HALT TO LOAD THE NEXT SECTION.

2.4 CONSOLE ADDRESS/DATA SWITCH COMMUNICATIONS

THE ROTARY DATA SWITCHES ARE THE MEANS BY WHICH THE CE CAN COMMUNICATE WITH THE DIAGNOSTICS. ENTRIES ARE MADE AS FOLLOWS--

- STOP CPU.
- SET UP ROTARY SWITCHES FOR ONE OF THE FOLLOWING OPTIONS. X'S INDICATE POSITIONS WHICH VARY WITH THE NEED.
 

SWITCHES			
1	2	3	4
F	0	X	X
F	1	X	X
F	2	X	X
E	E	0	0
D	X	X	0
D	X	X	X

- DEPRESS CPU START. (SYSTEM RESET FOLLOWED BY START WILL CALL IMMEDIATE ATTENTION TO THE SWITCHES).
- WHEN DCP RECEIVES CONTROL, IT HALTS WITH 'HF' DISPLAYED. RESET THE HALT TO ENTER THE FIRST OPTION.
- DCP WILL PERFORM HALT 'HU' OR 'HP'. LOAD THE NEXT OPTION AND RESET THE HALT.
- REPEAT STEP 5 FOR AS MANY OPTIONS AS DESIRED. ALTERNATING CODES 'HU' AND 'HP' WILL SIGNAL DCP ACCEPTANCE.
- WHEN DONE, SET LEFTMOST SWITCH TO '0' AND RESET THE HALT.

2.5 COMMON SENSE SWITCHES

SENSE SWITCHES ARE EQUIVALENT TO 48 TOGGLE SWITCHES NUMBERED HEXADECIMALLY 00-2F. SENSE SWITCHES 00-0F ARE RESERVED FOR STANDARD OPTIONS PROVIDED BY DCP (LISTED BELOW). SENSE SWITCHES 10-2F ARE SIGNIFICANT TO THE PARTICULAR SECTION BEING RUN. INSTRUCTIONS FOR SETTING SENSE SWITCHES ARE CONTAINED IN SECTION 2.4.

COMMON SENSE SWITCHES		
SSW NUMBER	ON	OFF (NORMAL)
00	LOOP ON SECTION.	GO TO NEXT SECTION.
01	LOOP ON ROUTINE.	GO TO NEXT ROUTINE.
02	BYPASS MANUAL INTERVENTION ROUTINES.	EXECUTE ALL ROUTINES.
03	BYPASS ERROR PRINTING.	PRINT ERROR MESSAGES.
04	BYPASS NON-ERROR PRINTING.	PRINT NON-ERROR MESSAGES.
05	USE ALTERNATE PRINTER. PRINTER KEYBOARD, IF ATTACHED. OTHERWISE, MFCU.	NORMAL PRINTER.
06	BYPASS ERROR HALTS.	HALT AFTER ERROR.
07	LOAD AND GO. BYPASS COMMENTS AND PROMPTING HALTS.	PROMPTING MODE.
08	USE 5203 RIGHT CARRIAGE.	USE LEFT CARRIAGE.
09-0F	RESERVED	

2.6 CONTROL PROGRAM HALTS.

ALL CONTROL PROGRAM (DCP) HALTS USE THE CHARACTER 'H' AS THE FIRST DIGIT OF THE HALT CODE. THE SECOND DIGIT IDENTIFIES THE CONDITION ACCORDING TO THE FOLLOWING TABLE.

* HALT * CODE	CONDITION	ACTION REQUIRED
H0	INVALID RECORD FOUND WHILE LOADING.	CORRECT INVALID RECORD AND RELOAD.
H1	A DEVICE CALLED FOR BY THE TEST SECTION WAS NOT DEFINED IN THE UDT CARDS.	CHECK UDT CARDS AND RELOAD OR RESET HALT TO BYPASS THE ERROR (ERRORS COULD RESULT).
H2	DATA SWITCH ENTRY ERROR.	CORRECT DATA SWITCHES AND RESET HALT.
H3	INVALID ROUTINE PREFIX FOUND DURING CHAINING FROM ONE ROUTINE TO NEXT.	ENTER ROUTINE SELECT OPTION 'F2XX' IN DATA SWITCHES AND RESET HALT. IF THIS DOES NOT WORK, RELOAD SECTION.
H5	MFCU NOT READY OR ERROR. ERROR INDICATION SHOULD BE DISPLAYED IN THE MFCU LIGHTS.	DO A NON-PROCESS RUN-OUT, RELOAD DECK STARTING WITH RUNOUT CARD/S AND RESET THE HALT.
H6	PRINTER NOT READY OR ERROR.	CLEAR CONDITION AND RESET THE HALT. IF FAILURE PERSISTS, RUN PRINTER FUNCTION TEST. SENSE SWITCHES 03 AND 04 MAY BE USED TO BYPASS PRINTING. SET SENSE SWITCH 05 TO USE MFCU AS PRINTER.
H7	DISK ERROR.	RESET HALT TO RETRY. IF ERROR PERSISTS, RELOAD.
HA	CONTROL PROGRAM IS PREPARED TO RECEIVE DATA SWITCH ENTRY. OCCURS AFTER DCP AND SECTION LOADING.	RESET THE HALT IF NO ENTRY DESIRED. TO LOAD OPTIONS, SET UP DATA SWITCHES AND RESET THE HALT. SSW 07 MAY BE USED TO BYPASS THIS HALT.
HC	DISK LOADER REQUIRES SPECIFICATION OF SECTIONS TO BE LOADED FROM DISK.	IF NO ENTRY HAS BEEN MADE PREVIOUSLY, LOAD PROGRAM SELECTION ENTRY 'DXXX' AND RESET THE HALT. UP TO EIGHT ENTRIES MAY BE MADE. IF ENTRIES HAVE EVER BEEN MADE, THE PROGRAMS MAY BE REPEATED BY RESETTING THE HALT.
HD	SECTION JUST TERMINATED HAS SPECIFIED NEXT SECTION TO BE RUN. ARR CONTAINS -DXXX- WHERE -XXX- IS THE PROGRAM IDENTIFICATION.	LOAD SPECIFIED SECTION IN MFCU PRIMARY HOPPER AND RESET THE HALT.
HE	CURRENT SECTION TERMINATED.	RESET HALT TO LOAD NEXT SECTION. SECTION MAY BE RESTARTED BY SYSTEM RESET/START.
HF	DCP HALTS WITH 'HF' DISPLAYED WHENEVER A VALID DATA SWITCH ENTRY IS RECOGNIZED. AS DCP ACCEPTS ENTRIES, ALTERNATING HALTS 'HU' AND 'HP' OCCUR.	LOAD A VALID DATA SWITCH ENTRY AND RESET THE HALT. REPEAT FOR ALTERNATING HALTS 'HU' AND 'HP'. TO TERMINATE ENTRY PROCEDURE, ROTATE LEFT-MOST SWITCH TO ZERO AND RESET HALT.

3. INDEX TABLE FOR HALTS AND PRINTOUTS

HALT/PRINTOUT  
 INDEX TABLE

INDEX NUMBER	MEANING OF HALT	SECTIONS WHERE USED
01	A TIO INDICATES MFCU PRIMARY IS READY WHEN IT SHOULD NOT BE.	F01
02	A TIO INDICATES MFCU SECONDARY IS READY WHEN IT SHOULD NOT BE.	F01
03	STATUS ERROR FOUND WHILE CHECKING ON VALIDITY OF A TIO TO INDICATE READY OR NOT READY.	F01
04	A TIO INDICATES MFCU PRIMARY IS NOT READY WHEN IT SHOULD BE.	F01
05	A TIO INDICATES MFCU SECONDARY IS NOT READY WHEN IT SHOULD BE.	F01
06	A CARD WITHOUT A STACKER ID PUNCHED IN IT WAS FOUND WHILE USING THE SELECT BY ID OPTION.	F01
10	THE REQUIRED HOPPER WAS FOUND TO BE NOT READY.	F01, F02, F05
11	THERE WAS A STATUS ERROR.	F01, F02, F05
25	THE DATA READ WAS NOT AS EXPECTED.	F02
26	READ AND READ CHECK OR PUNCH AND PUNCH CHECK AREAS DID NOT COMPARE.	F02, F05
27	THE LSR WAS INITIALLY INCORRECT.	F02, F05
28	AT LEAST 1 CYCLE STEAL WAS MISSING. NOTE: MAY ALSO BE CAUSED BY INCORRECT UDT CARD.	F02, F05
29	AT LEAST 1 EXTRA CYCLE STEAL. NOTE: MAY ALSO BE CAUSED BY INCORRECT UDT CARD.	F02
30	NOT ALL -F0- BITS OFF THAT SHOULD BE.	F01
31	NOT ALL -F1- BITS OFF THAT SHOULD BE.	F01
32	NO-OP DIDN'T COME UP WHEN PRINT ISSUED WITH NO CD IN WAIT.	F01
33	NOT ALL -F3- BITS OFF THAT SHOULD BE.	F01
34	HPR CYCLE NOT COMPLETE DID NOT COME ON FOLLOWING READ FROM PRIM.	F01
35	HPR MAG 1 DID NOT COME ON FOLLOWING READ FROM PRIM.	F01
36	HPR MAG 1 DID NOT GO DOWN FOLLOWING READ FROM PRIM.	F01
37	AN UNPRINTABLE CHARACTER WAS ENTERED.	F02
38	HPR MAG 2 DID NOT COME ON FOLLOWING RD FROM SECD.	F01
39	HPR MAG 2 DID NOT GO DOWN FOLLOWING RD FROM SECD.	F01
3A	CD IN WAIT 2 DID NOT COME ON WHEN BUSY DROPEd FROM RD SECD.	F01
3B	UP-DOWN COUNTER (CD IN TRANS/COUNTER BIT 1 & 2) NOT DOWN INITIALLY.	F01
3C	CD IN TRANS/COUNTER BIT 1 NOT ON AFTER PUNCH/PRINT PRIM.	F01
3E	CD IN T/C BIT 2 NOT OFF AFTER PUNCH/PRINT PRIM 1 CD.	F01
3F	CD IN T/C BIT 2 NOT ON AFTER PUNCH/PRINT SECD.	F01
40	CD IN T/C BIT 1 NOT OFF AFTER PUNCH/PRINT SECD.	F01
41	CD IN T/C BIT 1 DID NOT COME ON WHILE WAITING FOR UP-DOWN COUNTER TO DECREMENT.	F01
42	CD IN T/C BIT 2 DID NOT GO OFF WHILE WAITING FOR UP-DOWN COUNTER TO DECREMENT.	F01
43	CD IN T/C BIT 1 DID NOT GO OFF WHILE WAITING FOR UP-DOWN COUNTER TO DECREMENT.	F01
44	CD IN T/C BIT 2 DID NOT STAY OFF WHILE WAITING FOR UP-DOWN COUNTER TO DECREMENT.	F01
45	ALL OF THE -F0- SPECIAL INDICATOR BITS DID NOT COME ON AT SOME TIME DURING A PRINT/PUNCH COMMAND.	F01
46	ALL OF THE -F1- SPECIAL INDICATOR BITS DID NOT COME ON AT SOME TIME DURING A PRINT/PUNCH COMMAND.	F01
47	CD IN WAIT 1 DID NOT COME ON WHEN BUSY DROPEd FROM RD PRIM.	F01

A3	NPRO BOTH FEEDS-MAKE BOTH FEEDS READY WITH BLANK CARDS.	F01
A4	NPRO BOTH FEEDS, EMPTY ALL STACKERS, LOAD AT LEAST 100 BLANK CARDS IN SECD AND MAKE RDY.	F01
C0	NPRO BOTH FEEDS, PUT BLANK CARDS IN SECONDARY HOPPER AND MAKE READY.	F02
C1	NPRO BOTH FEEDS, PUT RIPPLE DECK IN SECONDARY HOPPER AND MAKE READY.	F02
C2	NPRO BOTH FEEDS, MAKE BOTH MFCU FEEDS READY WITH BLANK CARDS.	F02
C3	LOAD DATA CARDS IN SECONDARY AND BLANK CARDS IN PRIMARY.	F02
C4	NPRO, MAKE PRIMARY FEED READY WITH AT LEAST 100 BLANK CARDS.	F05
E0	ENTER NUMBER OF CARDS TO BE CHECKED.	F03
E1	ENTER NUMBER OF COLUMN TO BE CHECKED.	F03
E2	ENTER NUMBER OF 100 MSEC DELAY LCOPS BETWEEN COMMANDS.	F03
E3	A CONTROL CARD WAS READ BUT THE INFORMATION WAS INVALID.	F03
E4	DATA CARDS MUST BE LOADED INTO SPECIFIED HOPPER. A REMINDER THAT UDT CARD MUST BE CORRECT.	F03
E5	DEVICE DROPPED READY BEFORE REQUIRED NUMBER OF CARDS WERE READ.	F03
E6	THE DATA HAS BEEN PRINTED OUT.	F03
E7	ENTER PRINTABLE CHARACTER INTO DATA SWITCHES.	F02
E8	ENTER PRINTABLE CHARACTERS INTO DATA SWITCHES.	F02
F0	HALT BEFORE EACH COMMAND IS ISSUED.	F01,F02,F05
F1	MAKE THE MFCU NOT READY.	F01
F2	MAKE BOTH MFCU FEEDS READY WITH BLANK CARDS.	F01
F3	LOAD MORE CARDS TO CONTINUE, OR TURN OFF OPTION SELECTED TO END TEST.	F01
F4	SET DATA SWITCHES TO CC TO COUNT CARDS WITH MFCU.	F01
F5	DO SINGLE NPRO FROM PRIMARY HOPPER.	F01
F6	ENTER CMND IN DATA SW'S--PUSH START--REPEAT FOR MORE CMNDS--END WITH 0000. ALSO AFTER EVERY-OTHER COMMAND ENTRY.	F01
F7	AFTER EVERY-OTHER COMMAND ENTRY.	F01
F8	ROUTINE 3 INSTRUCTIONS.	F01



4. DETAILED DESCRIPTIONS OF TESTS

4.1 SECTION F01

NOTE: REFER TO PAGES 2-7 FOR SENSE SWITCH OPTIONS, HALTS, ETC.  
 DO NOT PRESS CPU STOP WHILE A SECTION IS RUNNING. THE RESULT WILL OFTEN BE INVALID.

4.1.1 ROUTINE 1 - DEVICE NOT READY TEST

THE PROGRAM INSTRUCTS THE OPERATOR TO MAKE THE DEVICE NOT READY AND PERFORMS AN -F1- HALT. WHEN THE HALT IS RESET, THE PROGRAM CHECKS FOR ANY STATUS ERROR AND INSTRUCTS THE OPERATOR TO ELIMINATE THE ERRORS AND CONTINUE. WHEN ALL STATUS ERRORS HAVE BEEN ELIMINATED, A TEST I/O IS ISSUED TO THE PRIMARY AND AN ERROR MESSAGE OCCURS IF IT APPEARS TO BE READY. A TEST I/O IS THEN ISSUED TO THE SECONDARY, AND ANOTHER ERROR MESSAGE OCCURS IF IT APPEARS TO BE READY. IF ALL CONDITIONS APPEAR AS EXPECTED, THERE WILL BE NO MESSAGES AFTER THE INITIAL OPERATOR INSTRUCTION MESSAGE.

4.1.2 ROUTINE 2 - DEVICE READY TEST

THIS ROUTINE PERFORMS SIMILAR TO ROUTINE 1 EXCEPT THAT THE DEVICE IS TO BE MADE READY, AND THE INDICATION OF ANY NOT READY CONDITION WILL CAUSE AN ERROR MESSAGE.

4.1.3 ROUTINE 3 - STATUS AND SPECIAL INDICATORS TEST

THE PROGRAM INSTRUCTS THE OPERATOR TO MAKE THE DEVICE NOT READY AND PERFORM AN NPRO. WHEN THE -F8- HALT FOLLOWING THE MESSAGE IS RESET, THE PROGRAM SENSES THE STATUS AND SPECIAL INDICATORS. ANY VARIATION FROM THE EXPECTED DATA RESULTS IN A PRINTOUT OF THE ACTUAL AND EXPECTED CONTENTS.

4.1.4 ROUTINE 4 - COMMANDS TEST FROM TABLE

THE PROGRAM INSTRUCTS THE OPERATOR TO DO AN NPRO AND MAKE BOTH FEEDS READY WITH BLANK CARDS. THE PROGRAM THEN LOOPS UNTIL BOTH FEEDS GO NOT READY AND THEN READY. THE PROGRAM THEN ISSUES THE FOLLOWING 24 COMMANDS TO THE MFCU AND CHECKS FOR PROPER BUSY AND STATUS CONDITIONS. THE TABLE BELOW IS INTENDED ONLY TO EXPLAIN THE FUNCTIONS OF THE COMMANDS. THERE WILL BE A TOTAL OF 22 CARDS STACKED AND 1 LEFT IN EACH WAIT STATION.

```

*****
* COMMAND * FROM * FUNCTION * FEED * STACKER *
* Q AND R * PRINT * * FROM *
* BYTES * BUFFER * * HOPPER *
*****
* F0-04 * * FEED * PRIMARY * 4 *
* F1-04 * * READ * PRIMARY * 4 *
* F2-05 * * PUNCH * PRIMARY * 1 *
* F3-05 * * RD/PU * PRIMARY * 1 *
* F4-06 * 1 * PRINT * PRIMARY * 2 *
* F5-06 * 1 * RD/PR * PRIMARY * 2 *
* F6-07 * 1 * PU/PR * PRIMARY * 3 *
* F7-07 * 1 * RD/PU/PR * PRIMARY * 3 *
* F8-04 * * FEED * SECONDARY * 4 *
* F9-04 * * READ * SECONDARY * 4 *
* FA-05 * * PUNCH * SECONDARY * 1 *
* FB-05 * * RD/PU * SECONDARY * 1 *
* FC-06 * 1 * PRINT * SECONDARY * 2 *
* FD-06 * 1 * RD/PR * SECONDARY * 2 *
* FE-07 * 1 * PU/PR * SECONDARY * 3 *
* FF-07 * 1 * RD-PU/PR * SECONDARY * 3 *
* F4-A6 * 2 * PRINT * PRIMARY * 2 *
* F5-A6 * 2 * RD/PR * PRIMARY * 2 *
* F6-A7 * 2 * PU/PR * PRIMARY * 3 *
* F7-A7 * 2 * RD/PU/PR * PRIMARY * 3 *
* FC-A6 * 2 * PRINT * SECONDARY * 2 *
* FD-A6 * 2 * RD/PR * SECONDARY * 2 *
* FE-A7 * 2 * PU/PR * SECONDARY * 3 *
* FF-A7 * 2 * RD-PU/PR * SECONDARY * 3 *
*****
    
```

THERE ARE 2 OPTIONS UNIQUE TO THIS ROUTINE.

OPTION 1 IS TO PRINT THE Q AND R BYTE OF EACH COMMAND -IN HEX- PRIOR TO IT'S EXECUTION. THIS OPTION IS SELECTED BY TURNING ON SENSE SWITCH -1F-. WITH THIS PRINTOUT, IT IS POSSIBLE TO KNOW WHAT COMMAND WAS ISSUED EVEN THOUGH THE PROGRAM MAY INHIBIT COMPLETION OF THE START I/O COMMAND AND THEREFORE INHIBIT AN ERROR MESSAGE WHICH WOULD HAVE NORMALLY INDICATED THE COMMAND WHICH CAUSED THE ERROR CONDITION.

OPTION 2 IS TO LOOP ON EXECUTION OF THE COMMANDS WITHOUT THE ROUTINE INSTRUCTION MESSAGE. THIS OPTION IS SELECTED BY TURNING ON SENSE SWITCH 1B. IF THE SWITCH IS TURNED OFF, NORMAL ROUTINE TERMINATION WILL OCCUR AT THE END OF THE THEN CURRENT PASS THROUGH THE COMMAND TABLE.

4.1.5 ROUTINE 5 - STACKER SELECT TEST

THE PROGRAM PRINTS INSTRUCTIONS AND THEN WAITS FOR THE PROPER FEED TO BE MADE READY. THE ROUTINE WILL THEN SELECT A TOTAL OF 22 CARDS INTO EACH STACKER IN A SPECIFIC SEQUENCE. THERE WILL BE A PRINTOUT OF THE NUMBER OF CARDS WHICH SHOULD HAVE BEEN SELECTED INTO EACH STACKER. THE CARDS MAY BE COUNTED BY HAND OR THEY MAY BE COUNTED BY THE MFCU UNDER PROGRAM CONTROL BY SETTING THE DATA SWITCHES TO -CC-. FOLLOWING THE COUNTING OF THE CARDS AND THE SINGLE NPRO AS INSTRUCTED BY MESSAGES, THERE WILL BE ANOTHER CARD COUNT PRINTOUT. THE TWO CARD COUNT PRINTOUTS MUST BE COMPARED BY THE OPERATOR.

THERE ARE 4 OPTIONS UNIQUE TO THIS ROUTINE.

OPTION 1 IS TO LOOP ON REPEATEDLY SELECTING CARDS IN THE SAME SPECIFIC SEQUENCE BY TURNING ON SENSE SWITCH -1B-. WHEN THE SENSE SWITCH IS TURNED OFF, THE PROGRAM WILL COMPLETE THE SELECTION SEQUENCE CURRENTLY IN PROGRESS. THERE WILL THEN BE A SUMMARY PRINTOUT OF THE STACKER COUNTS AND THE COUNTING OF THE CARDS IN THE STACKER MAY AGAIN BE DONE ACCORDING TO THE PRINTED INSTRUCTIONS.

OPTION 2 WILL CAUSE THE CARDS TO HAVE ALL SIX HOLES PUNCHED IN THE COLUMN WHICH CORRESPONDS TO THE STACKER NUMBER TO WHICH IT WILL THEN BE SELECTED. TURNING ON SENSE SWITCH -1D- WILL SELECT THIS OPTION. THE SPEED AT WHICH STACKER SELECTION WILL BE PERFORMED IS GREATLY REDUCED WHEN THE CARD IS BEING PUNCHED, BUT PROPER SELECTION MAY BE CHECKED BY SIGHTING THROUGH THE CARD HOLES IN EACH STACKER. THESE CARDS WILL BE USED IN THE FOLLOWING OPTION.

OPTION 3 WILL CAUSE THE ROUTINE TO READ THE CARDS PUNCHED BY OPTION 2 AND SELECT THEM INTO THE PROPER STACKER ACCORDING TO THE COLUMN IN WHICH THEY WERE PUNCHED. THE CARDS WILL NOT BE COUNTED WHEN THIS OPTION IS USED. PROPER SELECTION MAY BE CHECKED BY SIGHTING THROUGH THE CARDS AS WAS DONE WHEN THEY WERE PUNCHED. OPTION 3 TAKES PRECEDENCE OVER OPTION 2 SO THAT IF BOTH SENSE SWITCHES WERE ON, THE PROGRAM WOULD TRY TO SELECT RATHER THAN DOUBLE PUNCH SOME PREVIOUSLY PUNCHED CARDS. SENSE SWITCH -1E- WILL SELECT THIS OPTION.

OPTION 4 ALLOWS COUNTING OF THE CARDS SELECTED BY SETTING THE DATA SWITCHES TO -CC- AS DESCRIBED ABOVE.

4.1.6 ROUTINE 6 - STATUS AND SPECIAL INDICATORS OPERATIONAL TEST

THE PROGRAM INSTRUCTS THE OPERATOR TO NPRO AND MAKE BOTH MFCU FEEDS READY WITH BLANK CARDS AND THEN PERFORMS AN -F2- HALT. WHEN THE HALT IS RESET, A PRINT COMMAND IS ISSUED AND A CHECK IS MADE FOR THE EXPECTED 'NO-OP' BIT. A READ FROM PRIMARY IS ISSUED AND A CHECK FOR 'HOPPER CYCLE NOT COMPLETE' IS MADE. THE RISE AND FALL OF THE 'HOPPER MAGNET' BIT IS THEN CHECKED. THE PROGRAM THEN WAITS UNTIL BUSY DROPS AND CHECKS FOR 'CARD IN WAIT 1'. A READ FROM SECONDARY IS ISSUED AND THE 'HOPPER MAGNET' IS CHECKED AGAIN. AFTER BUSY DROPS, 'CARD IN WAIT 2' IS CHECKED. THE 'CARD IN TRANS/COUNTER' IS CHECKED FOR A COUNT OF ZERO. A PUNCH/PRINT PRIMARY IS ISSUED AND THE 'CARD IN TRANS/COUNTER' IS CHECKED FOR A COUNT OF ONE ONLY. A PUNCH/PRINT PRIMARY IS ISSUED AND THE 'CARD IN TRANS/COUNTER' IS CHECKED FOR A COUNT OF TWO ONLY. THE COUNTER IS THEN MONITORED AS IT DECREASES DOWN TO ONE AND THEN TO ZERO. A PUNCH/PRINT COMMAND IS ISSUED AND THE SPECIAL INDICATORS ARE CHECKED TO SEE THAT ALL BITS COME ON DURING COMMAND EXECUTION. ANY DEVIATION FROM EXPECTED RESULTS IN THE ROUTINE WILL RESULT IN A PRINTOUT AND A HALT. IN MOST CASES THE PROGRAM WILL TERMINATE FOLLOWING AN ERROR BECAUSE OF THE TIME AND SEQUENCE REQUIREMENTS BETWEEN CHECKS.

4.1.7 ROUTINE 7 - COMMANDS TEST FROM SWITCHES

NOTE - THIS ROUTINE WILL NOT BE EXECUTED UNLESS SELECTED VIA SWITCH OPTION -F207-.

THIS ROUTINE WILL STORE AND EXECUTE UP TO 64 COMMANDS AND/OR DELAYS WHICH ARE ENTERED THROUGH THE CONSOLE SWITCHES. THE ROUTINE PRINTS INSTRUCTIONS FOR ENTERING THE COMMANDS AND THEN HALTS. AS COMMANDS ARE ENTERED, THE HALT IDENTIFIER GOES FROM -F6- TO -F7- TO -F6- ETC. TO ENTER A DELAY ONLY, IN PLACE OF A COMMAND, THE LEFT ADDRESS SWITCH MUST BE SET TO ZERO, AND THE CONTENTS OF THE OTHER THREE SWITCHES WILL BE THE AMOUNT OF DELAY (IN HEX) IN MILLISECONDS. THE DELAY MAY APPEAR TO VARY DEPENDING ON THE COMMANDS BEING ISSUED. THE END OF THE COMMAND TABLE BEING ENTERED WILL BE INDICATED BY AN ENTRY OF -0000-. WHEN ENTRY HAS BEEN TERMINATED, THE PROGRAM WILL PRINTOUT THE COMMANDS JUST ENTERED AND THEN PROCEED TO ISSUE THE COMMANDS TO THE MFCU AND CHECK FOR PROPER EXECUTION. THIS ROUTINE WILL CONTINUE TO LOOP ON ISSUING THE COMMANDS IN THE TABLE UNTIL SENSE SWITCH -1A- IS TURNED ON. THE PROGRAM WILL THEN CONTINUE TO THE END OF THE TABLE AND THEN EXIT THE ROUTINE.

#### 4.2 SECTION F02

NOTE: REFER TO PAGES 2-7 FOR SENSE SWITCH OPTIONS, HALTS, ETC.  
DO NOT PRESS CPU STOP WHILE A SECTION IS RUNNING. THE RESULT WILL OFTEN BE INVALID.

##### 4.2.1 ROUTINE 1 - RIPPLE PUNCH TEST

THIS ROUTINE WILL PUNCH A RIPPLE PATTERN OF ALL POSSIBLE PUNCH PATTERNS. THE PATTERN WILL BEGIN WITH NO PUNCHES IN COLUMN ONE OF THE FIRST CARD AND RIPPLE THROUGH ALL 96 COLUMNS. THERE WILL BE A 64 CARD DECK PUNCHED. THIS PROGRAM WILL ALSO CHECK FOR CORRECT LSR MODIFICATION DURING THE PUNCH OPERATION AND INDICATE ANY ERRORS. THE PROGRAM WILL RUN IN DIAGNOSTIC MODE AND A PUNCH CHECK WILL CAUSE A PRINTOUT OF THE ACTUAL PUNCH DATA AND THE PUNCH CHECK DATA FOR THE COLUMNS WHICH DO NOT COMPARE. A PUNCH CHECK INDICATION WITH NO DIFFERENCE IN THE DATA IN THE TWO AREAS WILL RESULT IN A FALSE PUNCH CHECK ERROR MESSAGE. THE LACK OF A PUNCH CHECK INDICATION WHEN THE AREAS DO NOT COMPARE WILL RESULT IN AN UNDETECTED PUNCH CHECK ERROR MESSAGE AND A PRINTOUT OF THE DATA IN THE COLUMNS WHICH DO NOT COMPARE.

THERE ARE 4 OPTIONS UNIQUE TO THIS ROUTINE.

OPTION 1 WILL CAUSE THE PROGRAM TO LOOP ON PUNCHING MULTIPLE RIPPLE DECKS UNTIL THE SENSE SWITCH IS TURNED OFF. THIS OPTION IS SELECTED BY TURNING ON SENSE SWITCH -20-.

OPTION 2 WILL ALLOW THE PROGRAM TO READ A CARD AND PUNCH ALL OF THE BLANK CARDS BEHIND IT WITH A RIPPLE PATTERN WHICH BEGINS IN COLUMN 1 WITH THE SAME PUNCH PATTERN WHICH WAS IN COLUMN 1 OF THE FIRST NON-BLANK CARD. ANOTHER NON-BLANK CARD WITH SOMETHING DIFFERENT IN COLUMN 1 WILL CAUSE IT TO PUNCH A NEW RIPPLE PATTERN. THIS OPTION IS SELECTED BY TURNING ON SENSE SWITCH -21-.

OPTION 3 CAUSES THE PROGRAM TO DUPLICATE ANY CARD INTO THE BLANK CARDS FOLLOWING IT. IF ANOTHER NON-BLANK CARD IS READ, ITS CONTENTS WILL IN TURN BE PUNCHED INTO THE NON-BLANK CARDS FOLLOWING IT. THIS OPTION IS SELECTED BY TURNING ON SENSE SWITCH -22-.

OPTION 4 IS TO PRINT THE CARD NUMBER (CONTENTS OF FIRST COLUMN) ON THE CARD WHEN PUNCHING IT. THIS OPTION IS SELECTED BY SETTING THE DATA SWITCHES TO -00-. A SWITCH MAY BE CHANGED WHILE RUNNING AND THE OPTION WILL BE ACTIVATED OR DE-ACTIVATED.

##### 4.2.2 ROUTINE 2 - RIPPLE READ TEST

THIS ROUTINE WILL NORMALLY READ AND COMPARE FOR CORRECTNESS THE SEQUENTIAL CARD RIPPLE DECK WHICH IS THE STANDARD OUTPUT FROM THE RIPPLE PUNCH TEST. A NON-COMPARE WILL RESULT IN AN ERROR PRINTOUT OF THE EXPECTED AND ACTUAL DATA AND THE COLUMN NUMBERS OF THE COLUMNS IN ERROR. THIS PROGRAM WILL ALSO CHECK FOR CORRECT LSR MODIFICATION DURING THE READ OPERATION AND INDICATE ANY ERRORS. THE PROGRAM WILL RUN IN DIAGNOSTIC MODE AND A READ CHECK WILL CAUSE A PRINTOUT OF THE ACTUAL READ DATA AND THE READ CHECK DATA FOR THE COLUMNS WHICH DO NOT COMPARE. A READ CHECK INDICATION WITH NO DIFFERENCE IN THE DATA IN THE TWO AREAS WILL RESULT IN A FALSE READ CHECK ERROR MESSAGE. THE LACK OF A READ CHECK INDICATION WHEN THE AREAS DO NOT COMPARE WILL RESULT IN AN UNDETECTED READ CHECK ERROR MESSAGE AND A PRINTOUT OF THE DATA IN THE COLUMNS WHICH DO NOT COMPARE.

THERE ARE 4 OPTIONS UNIQUE TO THIS ROUTINE.

OPTION 1 WILL ALLOW THE READING AND COMPARING FOR CORRECT DATA OF MULTIPLE SEQUENTIAL RIPPLE DECKS UNTIL THE SENSE SWITCH IS TURNED OFF. THIS OPTION IS SELECTED BY TURNING ON SENSE SWITCH -24-.

OPTION 2 WILL ALLOW THE READING AND COMPARING FOR CORRECT DATA FROM NON-SEQUENTIAL RIPPLE CARDS. THE RIPPLE PATTERN WILL BE ASSUMED BASED ON THE CONTENTS OF COLUMN 1. TURNING ON SENSE SWITCH -26- WILL SELECT THIS OPTION.

OPTION 3 WILL ALLOW READING AND COMPARING OF THE DATA FROM EACH CARD WITH THE FIRST CARD OF THE GROUP. TO CHANGE THE MASTER AGAINST WHICH THE OTHER CARDS ARE BEING COMPARED, IT IS ONLY NECESSARY TO ALLOW THE MFCU TO BECOME NOT READY, AND THEN LOAD THE NEW CARDS TO BE COMPARED AGAINST THE FIRST ONE OF THAT GROUP. IF A NON-COMPARE OCCURS, THE MASTER CARD DATA WILL BE PRINTED ON ONE LINE, FOLLOWED BY A PRINTOUT OF THE CARD IN ERROR ON THE NEXT LINE. THIS WILL BE A DIRECT PRINT FROM DATA READ, SO ONLY PRINTABLE CHARACTERS WILL APPEAR. THIS OPTION IS SELECTED BY TURNING ON SENSE SWITCH -23-.

OPTION 4 WILL JUST READ CARDS WITHOUT ANY CHECKING OF THE DATA. THIS OPTION IS SELECTED BY TURNING ON SENSE SWITCH -25-.

##### 4.2.3 ROUTINE 3 - RIPPLE PRINT TEST

THIS ROUTINE PRINTS 64 CARDS WITH A RIPPLE PATTERN OF ALL PRINTABLE CHARACTERS. THE CARDS ARE PRINTED ALTERNATELY FROM BUFFER 1 AND BUFFER 2.

THERE IS 1 OPTION UNIQUE TO THIS ROUTINE.

THIS OPTION CAUSES 3 LINES OF PRINT ON THE CARD IF THE DATA SWITCHES ARE SET TO -03-. ANY OTHER SETTING CAUSES 4 LINES OF PRINT. A MESSAGE IS PRINTED TO THAT EFFECT.

##### 4.2.4 ROUTINE 4 - PRINT H IN ALL POSITIONS

THIS ROUTINE PRINTS 10 CARDS FULL OF H'S AND GOES TO THE NEXT ROUTINE.

##### 4.2.5 ROUTINE 5 - PRINT - IN ALL POSITIONS

THIS ROUTINE PRINTS 10 CARDS FULL OF -'S AND GOES TO THE NEXT ROUTINE.

##### 4.2.6 ROUTINE 6 - PRINT 1 IN ALL POSITIONS

THIS ROUTINE PRINTS 10 CARDS FULL OF 1'S AND GOES TO THE NEXT ROUTINE.

##### 4.2.7 ROUTINE 7 - PRINT CARD FULL OF CHARACTER ENTERED IN DATA SWITCHES.

THIS ROUTINE INSTRUCTS THE OPERATOR TO ENTER A PRINTABLE CHARACTER INTO THE DATA SWITCHES AND PERFORMS AN -E7- HALT. THE ENTRY IS NOT CHECKED FOR VALIDITY, BUT IF THE DATA SWITCHES WERE SET TO -00- THE ROUTINE IS ABORTED. A VALID PRINTABLE CHARACTER WILL CAUSE 10 CARDS TO BE PRINTED FULL OF THAT CHARACTER.

THERE IS 1 OPTION UNIQUE TO THIS ROUTINE.

THIS OPTION CAUSES THE ROUTINE TO LOOP ON PRINTING CARDS UNTIL THE SENSE SWITCH IS TURNED OFF OR THE ROUTINE IS TERMINATED. THIS OPTION IS SELECTED BY TURNING ON SENSE SWITCH -01-. SENSE SWITCH -01- NORMALLY LOOPS ON THE TOTAL ROUTINE INCLUDING INITIAL INSTRUCTIONS, SO CARE MUST BE TAKEN TO TURN OFF THIS SWITCH BEFORE GOING TO SOME OTHER ROUTINE.

##### 4.2.8 ROUTINE 8 - PRINT CARD FULL OF CHARACTERS ENTERED THRU DATA SWITCHES.

NOTE - THIS ROUTINE WILL NOT BE EXECUTED UNLESS SELECTED VIA SWITCH OPTION -F208-.  
NOTE - IF KATAKANA PRINT FEATURE IS SPECIFIED IN THE UOT CARD, CHARACTERS ARE NOT CHECKED FOR VALIDITY.

THIS ROUTINE PRINTS THE CARD FULL OF REPEATED SETS OF THE PRINTABLE CHARACTER ENTERED THRU THE DATA SWITCHES. EACH CHARACTER ENTERED IS CHECKED FOR BEING A VALID PRINTABLE CHARACTER AND THEN ENTERED AS THE NEXT CHARACTER IN THE SET. AN UNPRINTABLE ENTRY WILL RESULT IN AN ERROR MESSAGE TO THAT EFFECT. UP TO 128 ENTRIES MAY BE MADE THRU THE DATA SWITCHES. AFTER AT LEAST ONE CHARACTER IS ENTERED AND THE DATA SWITCHES ARE SET TO -00- ALL PREVIOUSLY ENTERED CHARACTERS ARE FORMED INTO A SET AND THE SET IS REPEATED AS MANY TIMES AS POSSIBLE TO FILL THE CARD. THE PROGRAM WILL CONTINUE TO LOOP ON PRINTING THE SAME PATTERN AS LONG AS THE DATA SWITCHES REMAIN AT -00-. CHANGING THE DATA SWITCHES WILL CAUSE THE PROGRAM TO GO BACK TO THE BEGINNING OF THE ROUTINE WHERE THE -E8- HALT WILL INDICATE THAT A PRINTABLE CHARACTER SHOULD BE ENTERED. THE NEW PATTERN MAY NOW BE ENTERED. EXIT FROM THIS ROUTINE IS BY ROUTINE TERMINATION OR BY SELECTION OF A DIFFERENT ROUTINE.

##### 4.2.9 ROUTINE 9 - PRINT CHARACTERS ENTERED BY DATA CARD

NOTE - THIS ROUTINE WILL NOT BE EXECUTED UNLESS SELECTED VIA SWITCH OPTION -F209-.

THIS ROUTINE PRINTS INSTRUCTIONS TO LOAD DATA CARDS IN THE SECONDARY AND BLANK CARDS IN THE PRIMARY AND WAITS FOR BOTH FEEDS TO GO NOT READY AND THEN READY. THE PROGRAM WILL CONTINUE TO PRINT THE CONTENTS OF THE DATA CARD INTO THE BLANK CARDS UNTIL THE ROUTINE IS TERMINATED.

4.3 SECTION F03

4.3.1 ROUTINE 1 - READ EVALUATION AND ADJUSTMENT DIAGNOSTIC (READ)

THIS ROUTINE WILL RECORD AND INDICATE, BY PRINTOUT, CARD MOVEMENT THROUGH THE MFCU READ STATION. THE PRIMARY PURPOSE OF THE TEST IS TO SHOW CARD SKEW.

NOTE: REFER TO PAGES 2-7 FOR SENSE SWITCH OPTIONS, HALTS, ETC.  
 DO NOT PRESS CPU STOP WHILE A SECTION IS RUNNING. THE RESULT WILL OFTEN BE INVALID.

THE 3 MAIN PROGRAM AREAS ARE AS FOLLOWS.

4.3.1.1 DATA CARDS

THE CARDS USED FOR DATA COLLECTION MUST BE PUNCHED IN ROWS 1 AND 18 (BOTTOM AND TOP ROWS). THEY MUST BE PUNCHED IN COLUMNS 1, 15, AND 32 FOR PROPER OPERATION OF ONE OF THE PROGRAM DEFAULT FEATURES. THEY MAY BE PUNCHED IN ALL 32 COLUMNS, WHICH WILL ALLOW FOR CHECKING OF ANY CARD COLUMN. THESE CARDS MUST HAVE GOOD PUNCH REGISTRATION TO ASSURE VALIDITY OF DATA OUTPUT.

4.3.1.2 PROGRAM CONTROL

THERE ARE 2 METHODS OF SELECTING THE NUMBER OF CARDS TO PROCESS, THE COLUMN TO CHECK AND THE AMOUNT OF DELAY BETWEEN FEEDING OF CARDS. THE METHODS ARE AS FOLLOWS.

4.3.1.2.1 CONTROL CARDS

CONTROL CARDS, IF USED, WILL BE READ FROM THE SAME HOPPER AS THE PROGRAM. IF CONTROL CARDS ARE NOT USED, THERE MUST BE A SUFFICIENT NUMBER OF BLANK CARDS IN THE HOPPER BEHIND THE PROGRAM DECK TO ALLOW THE PROGRAM TO READ AND CHECK FOR A CONTROL CARD EACH TIME THE -E6- HALT IS RESET FOLLOWING THE PRINTOUT OF THE PREVIOUS RUN.

```
*****
* COLUMN
* 01 -C-
* 02 -BLANK-
* 03 -BLANK-
* 04 * NUMBER OF
* 05 * CARDS TO BE CONTROL
* .6 * SAMPLED
* 07 -BLANK- CARD
* 08 -BLANK-
* 09 * NUMBER OF COLUMN FORMAT
* 10 * TO BE CHECKED
* 11 -BLANK-
* 12 -BLANK-
* 13 * NUMBER (IN DEC) OF 100 MSEC INCREMENTS
* 14 * OF DELAY BETWEEN CARDS SAMPLED
* 15-96 -BLANK-
*****
```

4.3.1.2.2 ADDRESS SWITCH ENTRY

THE FIRST PASS FOLLOWING LOADING OF THE PROGRAM WILL RESULT IN 3 MESSAGES, EACH FOLLOWED BY A HALT. THESE MESSAGES WILL NOT OCCUR DURING ANY SUBSEQUENT PASSES BUT THE SAME 3 HALTS WILL OCCUR WITH THE SAME ACTION REQUIRED. THERE WILL BE A PRINTOUT OF THE ENTRY FOR CARDS, COLUMN AND DELAY FOLLOWING THE LAST ENTRY.

THERE ARE CERTAIN ENTRIES WHICH WILL CAUSE THE PROGRAM TO DEFAULT TO A SPECIFIC TEST PATTERN.

IF THE CARD COUNT ENTERED IS A ZERO, THE PROGRAM WILL FEED AND PRINT THE DATA FROM 1 CARD. IF THE COLUMN COUNT ENTERED IS A ZERO, OR ANY NUMBER LARGER THAN 32, THE PROGRAM WILL FEED THE SELECTED NUMBER OF CARDS CHECKING COLUMN 1 AND PRINTING THE RESULTS. IT WILL THEN FEED THE SAME NUMBER OF CARDS AGAIN AND PRINT THE RESULTS FOR COLUMN 15 AND FOR COLUMN 32 BEFORE HALTING FOR NEW CONTROL INFORMATION.

4.3.1.3 PRINTOUT

FOLLOWING IS THE INFORMATION WHICH APPEARS IN THE PRINTOUT.

1. COUNT OF CARDS ACTUALLY FED AND SAMPLED.
2. CARD COLUMN BEING SAMPLED.
3. THE RELATIVE POSITION OF THE HOLES AT CELLS 1 AND 18 WITH DASHES REPRESENTING THE HOLES.
4. THE 6 EMITTER PULSES WHICH ARE PRESENT AT EACH HOLE LOCATION. THESE ARE REPRESENTED BY E'S.
5. ANY VARIATION IN HOLE LOCATION AS SEEN BY CELLS 1 AND 18. THIS WILL BE RELATIVE TO THE LEADING EDGE OF THE FIRST OF THE 6 EMITTER PULSES. ANY APPARENT EMITTER PULSE VARIATION IS ALSO INDICATED. VARIATION IS INDICATED BY SLASHES.
6. SPARE CELL PROBE OUTPUT. THIS IS A SPARE POSITION TO WHICH ANY SIGNAL MAY BE PLUGGED. ANY OTHER LINE ATTACHED TO THE SPARE POSITION WILL INDICATE A DOWN LINE LOGIC LEVEL WITH A DASH AND AN UP LEVEL WITH A BLANK. IF NO LEVEL CHANGE IS DETECTED, THE PRINTOUT WILL INDICATE WHETHER THE LINE WAS UP OR DOWN DURING THE TIME BEING MEASURED. SPARE LOCATION IS A-A3L2S13, FE ALD PAGE FD162.
7. THE LENGTH OF TIME FROM THE LEADING EDGE OF THE CARD TO ALLOW READ. THIS IS MEASURED FOR THE FIRST CARD ONLY, AND NO OTHER SAMPLES ARE TAKEN FOR THIS CARD. THIS INFORMATION IS ONLY PRINTED AT THE TIME OF THE FIRST DATA OUTPUT FOLLOWING LOADING OF THE PROGRAM OR FOLLOWING A RESTART OF THE PROGRAM FROM THE BEGINNING.
8. THE POSITION OF THE DATA PULSES FOR THE CARD WHICH HAD THE MOST LEADING OR TRAILING EDGE SKEW. NOTE: WHAT APPEARS TO BE SKEW MAY BE OFF-PUNCHED CARDS.
9. THE NUMBER OF CARDS OF THE SAMPLE GROUP WHICH EXCEED SKEW SPECIFICATIONS AND WHAT THE SPECIFICATION IS WILL BE PRINTED.
10. THE NUMBER OF CELL 18 AND/OR CELL 1 DATA PULSES WHICH ARE BELOW THE SPECIFIED LENGTH. EITHER OF THESE LINES WILL BE PRINTED ONLY IF A PULSE IS BELOW MINIMUM.
11. THE SPECIFICATIONS WILL VARY WITH THE DEVICE MODEL, AND THEREFORE THE UDT CARD IN DCP MUST BE CORRECT.
12. SAMPLE PRINTOUT. NUMBERS REFER TO ITEM NUMBERS ABOVE. EACH PRINT POSITION REPRESENTS 9.12 MICROSECONDS, UNLESS RUNNING A MOD 1 WITH A 96 POSITION PRINTER, IN WHICH CASE IT IS 18.24.

```
ID F0E6, PROG F030-01, SSWS
CARDS READ 005 (1)
COLUMN CHECKED 20 (2)
CELL 18 //----- (5)
* //----- (8) *
CELL 1 //----- (8) *
* //----- (8) *
EMITTER EEEE (4) EEEE (8) EEEE (5)
        EEEE /EEE
SPARE CELL PROBE DOWN (6)
LEADING EDGE TO ALLOW READ IS 1915 MICRO-SEC (7)
CELL 18 DATA PULSES LESS THAN XXX MICRO-SEC MINIMUM 001 (10)
CELL 1 DATA PULSES LESS THAN XXX MICRO-SEC MINIMUM 001 (11)
EACH POSITION REPRESENTS 9.12 MICRO-SEC (12)
CARDS EXCEEDING XXX MICROSECOND SKEW 000 (9)
(11)
```

13. VERY MISLEADING DATA WILL BE PRINTED IF THE UDT DOES NOT REFLECT THE FEATURES PRESENT.

#### 4.4 SECTION F05

##### 4.4.1 KATAKANA RIPPLE PRINT TEST

THIS ROUTINE PRINTS 64 CARDS WITH A RIPPLE PATTERN OF ALL KATAKANA CHARACTERS. THE CARDS ARE PRINTED ALTERNATELY FROM BUFFER 1 AND BUFFER 2.

THERE IS 1 OPTION UNIQUE TO THIS ROUTINE.

THIS OPTION CAUSES 3 LINES OF PRINT ON THE CARD IF THE DATA SWITCHES ARE SET TO -03-. ANY OTHER SETTING CAUSES 4 LINES OF PRINT. A MESSAGE IS PRINTED TO THAT EFFECT.

#### 4.5 SECTION F0A

##### 4.5.1 1 CARD READ CHECK

THIS PROGRAM READS DATA CARDS AND TESTS FOR A READ CHECK. THE PRIMARY HOPPER MUST BE LOADED WITH THE PRE-PUNCHED DATA CARDS TO BE READ. THE SECONDARY MUST CONTAIN BLANK CARDS FOR PUNCHING. THE DATA CARDS ARE READ INTO STACKER 1.

IF A READ CHECK OCCURS, THE DATA FROM THE READ AREA IS PUNCHED INTO A BLANK CARD FROM THE SECONDARY HOPPER AND SELECTED INTO STACKER 2. THE DATA FROM THE READ CHECK AREA IS PUNCHED INTO A BLANK CARD AND SELECTED INTO STACKER 3.

THE PUNCHED CARDS MUST BE COMPARED TO DETERMINE THE TYPE OF ERROR.

DATA CARDS SHOULD CONSIST OF A REPETITIVE -08421- PATTERN.

#### 4.5 SECTION F0B

##### 4.5.1 1 CARD READ ANALYSIS PROGRAM

THIS PROGRAM INDICATES THE SKEW BETWEEN CELL 18 AND ANOTHER CELL, NORMALLY CELL 1.

CLEAR CORE TO HEX 40 BEFORE LOADING THE PROGRAM.

JUMPER +PTX1 (A-A3L2S03) TO (A-A3L2S13). S13 IS SPARE PROBE.

ANY OTHER CELL (2-17 OR 19-24) MAY BE WIRED TO S13 AS DESIRED.

THIS PROGRAM PRINTS 1 LINE PER CARD.

DATA IS FOR COLUMNS 1-6 FOR MOD 2 AND 1-3 FOR MOD 1.

EACH CHARACTER IN THE PRINTOUT REPRESENTS 38 MICROSECONDS.

PRINTOUT LEGEND - WITH PTX1 PLUGGED TO SPARE PROBE.

A = CELL PLUGGED TO A-A3L2S13 IS LIGHT.  
B = CELL 18 AND CELL PLUGGED TO A-A3L2S13 ARE BOTH LIGHT.  
C = CELL 18 IS LIGHT.

THE BLANK AREAS ARE WHERE THE CARD COVERS THE CELLS.



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1. GENERAL PROGRAM SUMMARY

1.1 PROGRAM DESCRIPTION

1.1.1 UTILITY ROUTINES

SECTION	ROUTINE	INTENT	APPLICABLE SENSE SWITCHES
* FF5- CE DISK CARTRIDGE INITIALIZATION * SEE NOTE BELOW:	01	THIS ROUTINE WILL WRITE CYLINDER ID'S ON AND TEST THE SURFACE OF EACH DATA AND ALTERNATE TRACK ON THE CE CARTRIDGE OR THE FIXED DISK. THE NORMAL OPERATION OF THIS ROUTINE WILL BYPASS WRITING ON THE ALIGNMENT TRACKS.	10 11 12 13 14 16
	02	THIS ROUTINE OPERATES AS ROUTINE 1, SECTION FF5 EXCEPT THAT THE CE TRACK ONLY IS INITIALIZED. SELECTION OF THIS ROUTINE IS VIA OPTION 'P202' (SEE SECTION 2.4 OF THE USER'S GUIDE FOR AN EXPLANATION OF THE OPTION).	10 11 12 13 14
* FF6- CE DISK CARTRIDGE DIAGNOSTIC EDITOR	01	THIS PROGRAM CONSISTS OF JUST ONE ROUTINE WHICH WILL PERFORM VARIOUS EDIT FUNCTIONS AS SPECIFIED VIA CONTROL CARD RECORDS.	10 11 12 13 14 15 17 18

NOTE: 1. BEFORE INITIALIZING A REMOVABLE DISK, THE FIXED DISK MUST HAVE ALREADY BEEN INITIALIZED.  
 2. IF RUNNING ON A SYSTEM WITH A MODEL 3 DISK, (NO FIXED DISK ON DISK DRIVE 2), PROGRAM FF5 CANNOT INITIALIZE A CARTRIDGE MOUNTED ON DRIVE 2. ALL CARTRIDGES MUST BE INITIALIZED ON DRIVE 1. THIS RESTRICTION IS IMPOSED UPON PROGRAM FF5 BECAUSE OF THE NECESSITY TO DO A 'READ ID' TO THE FIXED DISK AFTER EACH SEEK TO DETERMINE THAT THIS SEEK DID IN FACT POSITION THE ACCESS MECHANISM AT THE CORRECT CYLINDER.

1.1.2 OPTIONS

SENSE SWITCH OPTIONS		
SENSE SWITCH NUMBER	OPTION PROVIDED WHEN SENSE SWITCH IS ON	SECTIONS WHERE USED
10	THIS PROGRAM WILL USE THE REMOVABLE DISK WHEN RUNNING	FF5 FF6
11	THIS PROGRAM WILL USE THE FIXED DISK WHEN RUNNING	FF5 FF6
12	THIS PROGRAM WILL USE DRIVE 1 WHEN RUNNING.	FF5 FF6
13	THIS PROGRAM WILL USE DRIVE 2 WHEN RUNNING	FF5 FF6
14	THIS PROGRAM WILL WRITE CYLINDER ID'S ON ALL CYLINDERS	FF5
14	THIS WILL ALLOW THE TAPE CASSETTE AS THE INPUT DEVICE FOR THE EDITOR.	FF6
15	PROGRAM FF6 WILL GENERATE A DISK FOR MODEL 6 (B).	FF6
16	THIS PROGRAM WILL WRITE AND VERIFY 5 TIMES FOR EACH TRACK.	FF5
17	THIS WILL ALLOW THE USE OF THE 5471 AS THE INPUT DEVICE ON THE MODEL 10 (D).	FF6
18	THIS WILL ALLOW THE USE OF THE 1802 AS THE INPUT DEVICE ON THE MODEL 10 (D).	FF6

1.1.3 EDITOR INPUT DEVICES.

THE EDITOR (FP6) IS PROGRAMMED TO ACCEPT INPUT RECORDS FROM MANY INPUT DEVICES. EACH INPUT RECORD IS BASED ON 96 BYTES. FOR THE FORMAT AND DESCRIPTION OF THE INPUT RECORDS SEE PARAGRAPH 1.1.4 THRU 1.1.9.

INPUT DEVICE	MODEL USED ON	HOW TO USE
5424 (MPCU)	5410	1. THE MPCU IS THE DEFAULT INPUT DEVICE FOR THE EDITOR, IF THE MPCU IS DEFINED IN THE UDT. 2. PLACE ALL INPUT RECORDS IN THE PRIMARY HOPPER AND MAKE READY.
5471	5410	1. IF THE 5471 IS NOT DEFINED IN THE UDT, THEN TURN ON SENSE SWITCH 17. 2. IF THE MPCU IS DEFINED IN THE UDT, THEN SET SSW 17 ON. YOU CAN SWITCH BACK TO THE MPCU BY TURNING SSW 17 OFF AT A -E1- HALT. 3. WHEN THE -PROCEED LIGHT- LIGHTS UP ON THE 5471 THEN TYPE IN A RECORD. WHEN FINISHED WITH THE INPUT RECORD PUSH -ENTER- ON THE 5471. 4. IF AN TYPING ERROR OCCURS WHILE INPUTTING A RECORD THEN PUSH -CANCEL- OR -RETURN- ON THE 5471 AND RE-TYPE IN THE INPUT RECORD.
MODEL 6 CONSOLE	5406	THE CONSOLE IS THE DEFAULT INPUT DEVICE FOR MODEL 6. 1. WHEN THE -KEYBOARD READY LIGHT- LIGHTS UP ON THE KEYBOARD TYPE IN THE INPUT RECORD. 2. IF A TYPING ERROR OCCURS WHILE INPUTTING AN INPUT RECORD, THEN PRESS THE -BACKSPACE- KEY AND THEN ENTER THE CORRECT CHARACTER AND CONTINUE. 3. WHEN FINISHED WITH AN INPUT RECORD PRESS -PROGRAM START-.
TAPE CASSETTE	5410 AND 5406	SET SSW 14 ON AND REFER TO PARAGRAPH 1.1.10 FOR MODEL 10, AND PARAGRAPH 1.1.11 FOR MODEL 6.
1442 80 COLUMN CARD RDR	5410	1. THE 1442 IS THE DEFAULT INPUT DEVICE, IF THERE IS NO MPCU OR 5471 DEFINED IN THE UDT. SSW 14 CAN BE SET ON IF THE 1442 IS WANTED TO BE USED AS THE INPUT DEVICE WHEN THE MPCU OR 5471 IS DEFINED IN THE UDT. 2. INPUT RECORDS CAN BE 76 OR 96 BYTES IN LENGTH. IF THE INPUT RECORD IS LESS THAN 77 BYTES THEN USE ONE 80-COLUMN CARD PER RECORD. IF GREATER THAN 76 THEN YOU MUST USE 2 80-COLUMN CARDS PER RECORD. THE FORMAT FOR EACH RECORD IS GIVEN BELOW. 76-BYTE RECORD: IN COLUMN 1 THRU 76 PLACE THE INPUT DATA AND LEAVE COLUMN 77 BLANK. 96-BYTE RECORD: IN COLUMN 1 THRU 76 OF CARD 1 PLACE THE FIRST 76 BYTES OF DATA AND IN COLUMN 77 PLACE A 'C'. IN COLUMN 1 THRU 20 OF CARD 2 PLACE THE LAST 20 BYTES (BYTES 77 THRU 96) OF DATA. 3. PLACE ALL INPUT RECORDS IN THE 1442 FOLLOWED BY TWO BLANK CARDS AND MAKE READY.



1.1.4 CONTROL CARD RECORDS

\* SINCE PROGRAM PFG HAS THE CAPABILITY TO PERFORM SEVERAL DIFFERENT FUNCTIONS, THESE FUNCTIONS MUST BE SELECTED BY THE PE AS THEY ARE NEEDED BY THE USE OF CONTROL CARD INPUT RECORDS. THESE RECORDS BECOME PART OF THE INPUT STREAM TO PROGRAM PFG.

1.1.4.1 ADD CONTROL RECORD  
 COLUMN 1 2 3 4 5 THRU END OF RECORD  
 \$ A D D (BLANK)  
 ALL PROGRAM DECKS AND TAP DECKS WILL BE PLACED ON THE CE DISK AFTER THE LAST EXISTING PROGRAM

1.1.4.2 CMP CONTROL RECORD  
 COLUMN 1 2 3 4 5 THRU END OF RECORD  
 \$ C M P (BLANK)  
 THE SCMP FUNCTION WILL REMOVE ALL DEAD SPACE ON THE DISK PACK. THE SCMP FUNCTION SHOULD BE RUN WHEN EITHER THE NUMBER OF PROGRAM ENTRIES OR THE SPACE AVAILABLE FOR PROGRAMS APPROACHES ZERO. THE SLST FUNCTION WILL GIVE YOU THE ABOVE VALUES. AT MOST THERE IS 192 PROGRAM ENTRIES, AND EACH PROGRAM ADDED WILL USE UP ONE OF THESE ENTRIES. EACH PROGRAM ADDED WILL ALSO USE UP APPROXIMATE (THE NUMBER OF BYTES IN THE PROGRAM DIVIDED BY 200) SECTOR(S).

1.1.4.3 DEL CONTROL RECORD  
 COLUMN 1 2 3 4 5 6 7 8 9 10 11 12 THRU END OF RECORD  
 \$ D E L X X X X X X AS MANY GROUPS OF XXX AS NEEDED  
 EACH PROGRAM THAT IS DEFINED BY AN ID XXX WILL BE DELETED FROM THE CE DISK.

1.1.4.4 LST CONTROL RECORD  
 COLUMN 1 2 3 4 5 THRU END OF RECORD  
 \$ L S T (BLANK)  
 THE ID OF EACH DIAGNOSTIC OR UTILITY PROGRAM RESIDING ON THE CE DISK WILL BE PRINTED ON THE SELECTED OUTPUT DEVICE, ALONG WITH ITS PART NUMBER AND EC. THE LAST STATEMENT PRINTED WILL TELL YOU HOW MANY MORE PROGRAM ENTRIES AND PROGRAM SPACE ARE AVAILABLE.  
 NOTE: PROGRAM ID'S CPU TST, PFA, PFB, AND PFP WILL NEVER BE LISTED EVEN THOUGH THEY MAY RESIDE ON THE DISK.

1.1.4.5 DUP CONTROL RECORD  
 COLUMN 1 2 3 4 5 6 7 8 9 10 THRU END OF RECORD  
 \$ D U P S S D D (BLANK)  
 THIS OPTION WILL ALLOW DUPLICATION OF THE CE PACK.  
 SS - SOURCE PACK  
 DD - DESTINATION PACK

DRIVE	VALUE FOR SS OR DD
* R1 *	X'AB'
* F1 *	X'AG'
* R2 *	X'BB'
* F2 *	X'BY'

1.1.4.6 REP CONTROL RECORD  
 COLUMN 1 2 3 4 5 6 7 8 9 THRU END OF RECORD  
 \$ R E P X X X S (BLANK) XXX-PROGRAM ID S-SUFFIX LEVEL OF EC  
 THIS CONTROL RECORD IS THE FIRST ONE OF A SERIES THAT WILL ALLOW ENTRY OF 'REP' RECORDS FOLLOWING IT. COLUMNS 5 6 AND 7 MUST CONTAIN THE PROGRAM ID OF THE PROGRAM TO WHICH THE 'REP' RECORDS WILL BE ADDED. THE TYPE OF RECORDS THAT CAN BE INPUTED ARE:  
 1. R (REPLACE RECORD)  
 2. T (TEXT RECORD)  
 3. SSW (SSW RECORD)  
 4. \* (COMMENT RECORD)  
 5. E (END RECORD)  
 FOR THE FORMAT OF THE ABOVE RECORD SEE BLOCK 10 OF THE USER GUIDE.  
 THE FINAL RECORD MUST CONSIST OF AN 'E' IN COLUMN 1, WHICH TERMINATE THIS FUNCTION.

1.1.4.7 CONFIG CONTROL RECORD  
 COLUMN 1 2 3 4 5 6 7 8 THRU END OF RECORD  
 \$ C O N F I G (BLANK)  
 THIS CONTROL RECORD IS THE FIRST ONE OF A SERIES THAT WILL ALLOW ENTRY OF 'CPU', 'UDT' OR '// CHAIN' RECORDS FOLLOWING IT. AS MANY 'CPU', 'UDT', OR '// CHAIN' RECORDS MAY BE ENTERED. WHEN ALL ENTRIES HAVE BEEN MADE, A FINAL RECORD CONSISTING OF AN 'E' IN COLUMN 1 WILL TERMINATE THIS OPTION

1.1.4.8 /\* CONTROL RECORD  
 COLUMN 1 2 3 4 THRU END OF RECORD  
 /\* (BLANK)  
 THIS CONTROL RECORD WILL CAUSE THIS PROGRAM TO COME TO AN 'H' HALT. WHEN THIS HALT IS RESET, THE NEXT RECORD WILL BE READ FROM THE INPUT DEVICE.

1.1.4.9 /E CONTROL RECORD  
 COLUMN 1 2 3 4 THRU END OF RECORD  
 /E (BLANK)  
 THIS CONTROL RECORD WILL CAUSE THIS PROGRAM TO TERMINATE OPERATION.

1.1.5 A PROCEDURE FOR GENERATING A CE DIAGNOSTIC DISK CARTRIDGE BY CARDS.  
 NOTE: THE TERM 'CARDS' AS USED HERE IMPLIES USING THE MPCU AND 96 COLUMN CARDS OR THE 1442 AND 80 COLUMN CARDS, WHICHEVER IS ATTACHED TO THE SYSTEM YOU ARE USING.

1. PLACE CE DISK PACK ON DISK DRIVE 1 AND MAKE THE DRIVE READY. (DISK MUST BE INITIALIZED, IF NOT RUN PROG. PPS)
2. LOAD DCP (PROGRAM PFP) AND DISK EDITOR (PROGRAM PF6) FROM THE CARD INPUT DEVICE.

NOTE: IF LOADING DCP VIA 80 COLUMN CARDS FROM THE 1442, REFERENCE BLOCK 7 FOR ADDITIONAL INSTRUCTIONS REGARDING THE LOADING OF DCP AND PROGRAM PF6. WHEN PROGRAM PF6 IS LOADED AND READY TO USE, TURN ON SENSE SWITCH 18 AND RETURN TO STEP J OF PARAGRAPH 1.1.5 OF THIS BLOCK TO CONTINUE ON.

3. SET SENSE SWITCHES 10 AND 12 ON.
4. PLACE THE FOLLOWING CARDS IN THE MPCU PRIMARY HOPPER OR THE 1442 HOPPER AND MAKE IT READY.

```
$ADD CONTROL CARD
PPA DECK IPL LOADER
PPB DECK DCP LOADER
PPF DECK DCP
PF6 DECK EDITOR
OTHER
```

```
DECKS
$LIST CONTROL CARD TO LIST PROGRAMS ON DISK
/* CONTROL CARD ( E1 HALT)
```

5. RESET HA AND FO HALTS
6. CARDS WILL BE READ FROM THE CARD INPUT DEVICE AND PLACED ON THE DISK, FOLLOWED BY A LISTING OF THE PROGRAMS ON THE DISK. PROGRAMS PPA, PPB, AND PPF WILL NOT BE LISTED. AN -E1- HALT WILL OCCUR AFTER THE -/\*- CONTROL CARD HAS BEEN READ. NOW YOUR CE PACK IS READY TO BE IPL'ED FROM.

1.1.6 A PROCEDURE FOR ADDING OR RE-ADDING PROGRAMS TO THE CE DISK PACK BY CARDS.

1. PLACE CE DISK PACK ON DISK DRIVE 1 AND MAKE DRIVE READY.
2. LOAD DCP (PFP) AND DISK EDITOR (PF6) FROM DISK.
3. SET SENSE SWITCHES 10 AND 12. (SELECT R1) --ALSO 18 IF INPUT IS FROM THE 1442.
4. PLACE THE FOLLOWING CONTROL CARD AND YOUR PROGRAM DECKS IN THE CARD HOPPER AND MAKE IT READY.

```
$ADD CONTROL CARD, MUST BE FIRST
PROG 1 DECK
PROG 2 DECK
.
.
PROG N DECK
$CMP (OPTIONAL) COMPRESS DISK SPACE
$LIST (OPTIONAL) LIST PROGRAMS ON DISK
/*
```

5. RESET HALTS -HA- AND -FO-. CARDS WILL BE READ AND PROGRAMS WILL BE PLACED ON DISK, FOLLOWED BY A LISTING OF PROGRAM ON DISK AND A -E1- HALT.

1.1.7 PROCEDURE FOR DELETING PROGRAMS FROM THE CE DISK

BY USE OF THE \$DEL CONTROL CARD, UNWANTED PROGRAMS MAY BE DELETED FROM THE DISK. SEE PARAGRAPH 1.1.4.J FOR THE FORMAT OF THE \$DEL CONTROL CARD. AS MANY PROGRAM ID'S AS DESIRED, (UP TO THE LIMIT OF THE CAPACITY OF THE CARD), MAY BE ENTERED ON ONE CARD PROVIDED THAT EACH ENTRY IS SEPARATED BY A COMMA (,). ANOTHER METHOD OF MAKING MULTIPLE DELETIONS IS TO USE MULTIPLE \$DEL CONTROL CARDS WITH A NEW CARD USED FOR EACH PROGRAM TO BE DELETED. IF A NEW PROGRAM ID LIST IS DESIRED AFTER ANY OF THE DELETIONS HAVE BEEN MADE, IT MAY BE OBTAINED BY USE OF THE \$LIST CONTROL CARD. USE A /\* CONTROL CARD AFTER ALL OTHER \$DEL AND \$LIST CONTROL CARDS HAVE BEEN ENTERED. THIS WILL CAUSE PROGRAM PF6 TO COME TO THE 'E1' HALT SO THAT YOU CAN PREPARE FOR THE NEXT FUNCTION YOU WISH TO PERFORM.

1.1.8 PROCEDURE TO ADD REPLACE CARDS TO A PROGRAM RESIDING ON THE CE DISK

ANY PROGRAM RESIDING ON THE CE DISK MAY HAVE REPLACE CARDS ADDED TO IT BY USING THE REQUIRED CONTROL CARDS IN ADDITION TO AS MANY STANDARD REPLACE CARDS AS ARE DESIRED. THE FIRST CONTROL CARD REQUIRED IS A \$REPIX CARD, WHERE XXX IS THE ID OF THE PROGRAM ON THE DISK THAT YOU WISH TO ADD THE REPLACE CARDS TO. THE SECOND CARD ENTERED IS A REPLACE CARD OF THE STANDARD FORMAT. (SEE THE DCP USER'S GUIDE BLOCK 10, ENTITLED REPLACE CARDS FOR THE FORMAT OF THESE CARDS.) FOLLOW CARD 2 WITH AS MANY REPLACE CARDS AS ARE REQUIRED. AFTER THE LAST REPLACE CARD, ENTER A CARD WITH A 'B' IN COLUMN 1. FOLLOW THIS CARD WITH A /\* CONTROL CARD.

TO REP DCP, USE AN ID OF PFP.

SAMPLE INPUT FOR REP-ING DCP

```
$REPIFP
R ADDR XXXX...
SSW XX,XX,...
* COMMENTS IF WANTED
E
/*
```

SAMPLE INPUT FOR REP-ING OTHER PROGRAMS

```
$REPIYY YYY - PROG ID
R ADDR XXXX...
* COMMENT IF WANTED
SSW XX,XX,...
E
/*
```

1.1.9 PROCEDURE TO CONFIGURE THE DCP RESIDING ON THE DISK

THE SYSTEM CONFIGURATION AS DEFINED IN YOUR DCP BY THE CPU, UDT AND //CHAIN CARDS MAY BE CHANGED BY \$CONFIG CONTROL CARD. FOLLOWING THIS FIRST CONTROL CARD, ENTER AS MANY CARDS AS ARE REQUIRED TO PROPERLY CONFIGURE YOUR DCP. THESE CARDS MAY BE 'CPU', 'UDT' OR '//CHAIN' RECORDS (SEE DCP USER'S GUIDE, BLOCK 10, FOR THE FORMAT). AFTER THE LAST CONFIGURATION CARD, ENTER A CARD WITH AN -E- IN COLUMN 1, AND FOLLOW THIS WITH A /\* CARD.

SAMPLE INPUT TO CONFIGURE DCP

```
$CONFIG
UDT A0,E0,10,...
CPU D,4000
// CHAIN XXXX...
E
/*
```

1.1.10 5410 TAPE CASSETTE INPUT.

BEFORE ATTEMPTING A PACK UPDATE, BE SURE THAT THE SYSTEM IS IN GOOD RUNNING CONDITION. PERFORMING AN UPDATE WITH A MALFUNCTIONING SYSTEM COULD CONCEIVABLY DESTROY YOUR CE PACK.

THE FOLLOWING STEPS DESCRIBE HOW TO UPDATE A CE PACK FROM TAPE CASSETTE.

1. CONNECT THE TAPE READER TO THE TAPE JACK ON BOARD A-A3, TURN THE IDLE CONTROL OVERRIDE ON (5203 ONLY), AND CONNECT THE CE JUMPER TO THE FOLLOWING PINS:  
 SYSTEM WITH A 5203: A-B1M2G10 TO A-A3U4D13  
 SYSTEM WITH A 1403: A-B1F2S07 TO A-A3U4D13
2. INSERT THE CASSETTE 1 SIDE A UP AND REWIND THE TAPE.
3. SET VOLUME CONTROL AT 6 AND MAKE PRINTER READY.
4. INSTALL THE CE PACK TO BE UPDATED ON R1 AND LOAD PF6 (EDITOR). SET SSW 10, 12, AND 14 AT THE -FO- HALT.  
 \*\*\* -TAPE UNIT MUST ALWAYS BE IN MOTION MORE THAN 1 SECOND BEFORE STARTING THE CPU- \*\*\*  
 \*\*\* -ALWAYS HAVE THE PRINTER IN START MODE AND NEVER PUSH STOP ON THE PRINTER WHILE LOADING- \*\*\*  
 \*\*\* -THE PRINTER CHAIN SHOULD BE RUNNING CONTINUOUSLY. (ON THE 5203 PRINTER THIS IS DUE TO THE )- \*\*\*  
 \*\*\* (CE IDLE CONTROL OVERRIDE SWITCH BEING ON)- \*\*\*
5. AT THE -13- HALT, START THE TAPE DRIVE, WAIT 2 FULL SECONDS, THEN RESET THE -13- HALT.
6. FROM THIS POINT THE EDITOR WILL LEAD YOU THRU THE UPDATE BY A SERIES OF DIFFERENT HALTS. THE HALTS AND THEIR MEANINGS ARE LISTED BELOW.

IF THE PRINTER OR DISK DRIVE IS EVER WORKING CONTINUOUSLY FOR OVER 15 SEC. TURN THE TAPE UNIT OFF. WHEN THE PRINTER OR DISK DRIVE HAS CLEARLY CEASED OPERATION, PRESS CPU STOP. THEN RESTART THE TAPE READER AND PRESS CPU START.

NCT FOLLOWING THIS PROCEDURE CORRECTLY CAN LEAD TO -10- OR -11- HALTS. SEE THE BELOW PARAGRAPHS FOR PROPER RECOVERY PROCEDURE.

HALTS	MEANING	CE ACTION
10	TAPE READ ERROR  CAUSE: BAD RECORD OR VOLUME TOO HIGH, OR VOLUME TOO LOW, OR NOISE IN TAPE GAP, OR NOT WAITING 2 SEC.	1. STOP TAPE DRIVE 2. REWIND TAPE ABOUT 3 TO 4 INCHES SO THAT THE RECORD CAN BE RE-READ. REWINDING NOT ENOUGH WILL CAUSE A -11- HALT. 3. START THE TAPE DRIVE, WAIT 2 FULL SECONDS, THEN RESET THE -10- OR -11- HALT. 4. IF THE ERROR PERSISTS, RE-ADJUST THE VOLUME CONTROL BY INCREMENTS OF 1. IF THIS DOES NOT CORRECT THE PROBLEM GO TO BLOCK 7 (TAPE DIAGNOSTIC)
11	TAPE RECORD SKIP  CAUSE: A TAPE RECORD HAS BEEN SKIPPED	1. STOP TAPE DRIVE 2. GO TO STEP 2 OF THE -10- HALT.
12	STOP TAPE	1. STOP THE TAPE DRIVE 2. RESET THE HALT
13	START TAPE	1. MAKE PRINTER READY- CE IDLE CONTROL OVERRIDE SWITCH ON 2. START THE TAPE DRIVE- WAIT 2 SECONDS. 3. RESET THE HALT
E1	END TAPE CASSETTE	1. REMOVE OLD TAPE CASSETTE FROM TAPE DRIVE. 2. PLACE NEXT TAPE CASSETTE SIDE INTO TAPE DRIVE. 3. REWIND TAPE CASSETTE. 5. RESET HALT.
OTHER HALTS	SEE PARAGRAPH 3	SEE PARAGRAPH 3

6. THE TAPE CASSETTE UPDATE IS COMPLETED WHEN PF6 IS TERMINATED. THIS IS INDICATED BY A -ME- HALT. AT THIS TIME YOU MAY USE THE OTHER INPUT DEVICE AS INPUT TO THE EDITOR BY:
  - A) SYSTEM RESET
  - B) TURN OFF SSW 14
  - C) RESET THE HALT

## 1.1.11 UPDATING A 5406 CE PACK FROM THE TAPE CASSETTE.

BEFORE ATTEMPTING A PACK UPDATE BE SURE THAT THE SYSTEM (ESPECIALLY THE CPU, DISK AND THE PRINTER) ARE IN GOOD RUNNING CONDITION. PERFORMING AN UPDATE WITH A MALFUNCTIONING SYSTEM COULD CONCEIVABLY DESTROY GOOD INFORMATION AND MAKE IT NECESSARY TO RE-WRITE THE CE PACK COMPLETELY.

THE FOLLOWING DESCRIBES HOW TO UPDATE A CE PACK USING A PRERECORDED TAPE CASSETTE.

1. CONNECT THE TAPE READER TO THE CR CONSOLE TAPE JACK, INSERT THE TAPE CASSETTE AND VERIFY THAT IT IS COMPLETELY REWCUND. SET THE READER VOLUME CONTROL AT '6'.
2. INSTALL THE CE PACK TO BE UPDATED ON DISK DRIVE 1 AND LOAD PROGRAM ID PF6.
3. PRESS CPU START AND WHEN THE PRINTER MESSAGE TELLS YOU TO SELECT DISK AND SPINDLE, SET SENSE SWITCHES 10, 12, AND 14 ON.
4. START THE TAPE READER AND OBSERVE WHERE THE TAPE GOES BY THE READ HEAD. AS SOON AS THE LEADER IS PAST THE HEAD AND A FEW INCHES OF TAPE GO BY, PRESS CPU START.
5. AS SOON AS THE FIRST RECORD IS READ, THE FIELD INDICATORS WILL INDICATE HEX 01, AND THEN START INCREMENTING BY ONE AS EACH RECORD IS READ.
6. IF THE UPDATE CONSISTS OF MORE THAN ONE TAPE SIDE, EACH SIDE UNTIL THE LAST WILL STOP WITH A HALT 'E1' AND COMMAND LIGHT 01 WILL COME ON. WHEN THIS HAPPENS, TURN OFF THE TAPE UNIT. IF JUST READING SIDE A, TURN THE CASSETTE OVER TO READ SIDE B. IF JUST READING SIDE B, PROCEED TO SIDE A OF THE NEXT TAPE. RESTART BY POSITIONING THE LEADER PAST THE HEAD, START THE TAPE READER AND PRESS CPU START. THE UPDATE WILL NOW CONTINUE.
7. THE END OF UPDATE IS SIGNALLED BY THE NORMAL DCP SECTION TERMINATE MESSAGE. COMMAND LIGHT 01 WILL ALSO COME ON INDICATING THAT THE TAPE READER SHOULD BE STOPPED.
8. A HALT 'FP' INDICATES A DISK ERROR PERSISTED THROUGH OUT THE ERROR RECOVERY ROUTINE. IF THIS HAPPENS, DEPRESS CPU START AND THE OPERATION WILL BE TRIED AGAIN. CONTINUED 'FP' HALTS INDICATE A SERIOUS DISK PROBLEM. YOUR PACK MUST BE REWRITTEN AND THE TROUBLE CORRECTED.

IF A TAPE READ ERROR OCCURS, A HALT WILL OCCUR AND THE PRINTER WILL PRINT 'TAPE RECORD CHECK'. IF THIS HAPPENS STOP THE TAPE READER AND LOOK AT THE HALT INDICATORS.

A HALT OF 'P55' INDICATES A TAPE READ ERROR. IN THIS CASE, REWIND THE TAPE SLIGHTLY SO THAT THE ERROR RECORD CAN BE RE-READ. GENERALLY, ONLY A SLIGHT PUSH ON THE RE-WIND KEY IS NECESSARY TO DO THIS. START THE TAPE READER AGAIN AND PRESS CPU START. THE FIELD INDICATORS INDICATE THE RECORD NUMBER OF THE LAST TAPE RECORD SUCCESSFULLY READ. IF THE RECORD IS READ SUCCESSFULLY, THE FIELD INDICATORS WILL AGAIN START TO INCREMENT. REPEATED 'P55' HALTS INDICATE A MARGINAL TAPE OR READER. READJUST THE VOLUME CONTROL IN INCREMENTS OF 1 ON THE DIAL (TRY GOING HIGHER FIRST) AND REPEAT THIS PROCEDURE. IF THIS DOES NOT WORK, A NEW TAPE MUST BE TRIED.

IF UPON ATTEMPTING TO RECOVER FROM A 'P55' HALT, A 'P85' HALT OCCURS, IT MEANS THAT YOU DID NOT BACKSPACE FAR ENOUGH TO READ THE ERROR RECORD. SIMPLY REWIND A LITTLE FURTHER AND TRY AGAIN.

IF A 'P85' HALT OCCURS WHILE NOT TRYING TO RECOVER FROM FROM AN 'P55' HALT, IT MEANS THAT SOME UNUSUAL I/O CONDITION DELAYED THE PROGRAM SUCH THAT A TAPE RECORD WAS SKIPPED. THE TAPE UNIT IS BY ITS NATURE A REAL TIME DEVICE AND THE GAPS BETWEEN RECORDS ARE SUFFICIENT FOR MOST I/O OPERATIONS TO FINISH. HOWEVER UNUSUAL CONDITIONS MAKE I/O TIME UNPREDICTABLE AND IF IT EXCEEDS THE GAP TIME AN 'P85' HALT WILL OCCUR. IN THIS CASE, SIMPLY STOP THE TAPE UNIT, RE-WIND SLIGHTLY AND TRY AGAIN AS DESCRIBED IN THE ABOVE PARAGRAPHS. A FOLLOWING 'P85' HALT MEANS YOU HAVE NOT BACKSPACED FAR ENOUGH YET.

A 'P85' HALT WILL ALSO OCCUR IF DURING AN UPDATE USING MULTIPLE TAPE SIDES, YOU LOAD TAPE SIDES IN THE WRONG ORDER EACH TIME THE 5213 OR 2222 PRINTER STARTS A LISTING OPERATION OR THE DISK STARTS MOVING PROGRAMS, THERE WILL BE AN INDETERMINATE DELAY UNTIL THE PROGRAM IS READY TO START ACCEPTING DATA AGAIN. A 20 SEC. GAP IS LEFT IN THESE CASES. HOWEVER, THIS WILL SOMETIMES NOT BE LONG ENOUGH SO THE FOLLOWING PROCEDURE MUST BE USED.

IF THE PRINTER OR DISK DRIVE IS EVER WORKING CONTINUOUSLY FOR OVER 15 SEC. TURN THE TAPE UNIT OFF. WHEN THE PRINTER OR DISK DRIVE HAS CLEARLY CEASED OPERATION, PRESS CPU STOP. THEN RESTART THE TAPE READER AND PRESS CPU START.

NOT FOLLOWING THIS PROCEDURE CORRECTLY CAN LEAD TO 'P55' OR 'P85' HALTS. SEE THE ABOVE PARAGRAPHS FOR PROPER RECOVERY PROCEDURE. ONCE AN UPDATE FROM A TAPE CASSETTE HAS BEEN MADE, YOU MUST AGAIN IPL BEFORE ATTEMPTING TO LOAD ANY OTHER PROGRAMS. THIS IS BECAUSE THE TAPE READ ROUTINE HAS OVERLAYED THE DISK LOADER ROUTINE IN STORAGE.

**2. OPERATING PROCEDURES (DCP CONTROLLED SECTIONS)**

THIS SECTION DESCRIBES THE USER INTERFACE FOR ALL PROGRAMS OPERATING UNDER THE DIAGNOSTIC CONTROL PROGRAM (DCP). MORE DETAIL IS PROVIDED IN THE DCP USERS GUIDE (BLOCK 10).

**2.1 LOADING**

THE CE MODE SELECTOR SWITCH MUST BE IN THE 'PROCESS' POSITION. ALL CE CONTROL PANEL TOGGLE SWITCHES SHOULD BE IN THE NORMAL (DOWN) POSITION.

**2.1.1 LOADING ON A MODEL 10 FROM A MFCU.**

1. IF DCP IS LOADED, SKIP TO STEP 5.
2. IF A DISK SYSTEM, PLACE -PROGRAM LOAD SELECTOR- IN MFCU POSITION.
3. PLACE DCP FOLLOWED BY TEST SECTION/S INTO MFCU PRIMARY HOPPER. MAKE MFCU READY.
4. DEPRESS -PROGRAM LOAD- KEY. AFTER DCP IS LOADED, A -HA- HALT WILL OCCUR. COMMON SENSE SWITCHES MAY BE SET AT THIS TIME.
5. PLACE TEST SECTION/S INTO MFCU PRIMARY HOPPER AND MAKE MFCU READY (IF NOT ALREADY DONE).
6. IF A -HA- OR -HE- HALT OCCURS SKIP TO STEP 8.
7. DEPRESS -PROGRAM LOAD- KEY. DCP WILL PRINT SECTION TERMINATE MESSAGE AND HALT WITH A -HE-.
8. RESET THE HALT. DCP WILL LOAD THE SECTION AND DISPLAY A -HA- HALT.
9. MAKE DESIRED CONSOLE SWITCHES ENTRIES, IF ANY AND RESET THE HALT.

**2.1.2 LOADING ON A MODEL 10 FROM DISK WITH A 5424 (MFCU) ATTACHMENT.**

1. SKIP TO STEP 5 IF DCP IS ALREADY LOADED.
2. PLACE THE CE PACK ON R1 AND MAKE DRIVE 1 READY.
3. PLACE THE -PROGRAM LOAD SELECTOR- IN REMOVABLE POSITION.
4. DEPRESS -PROGRAM LOAD- KEY. AFTER DCP IS LOADED, A -HA- HALT WILL OCCUR. COMMON SENSE SWITCHES MAY BE SET AT THIS TIME.
5. USE CONSOLE SWITCHES ENTRY -DXXX- (XXX - PROG ID) TO SPECIFY THE PROGRAMS TO BE LOADED. (SEE SECTION 2.4)
6. SET LEFTHOST SWITCH TO -0- AND RESET HALT. DCP WILL LOAD THE SECTION AND DISPLAY A -HA- HALT.
7. MAKE ANY CONSOLE SWITCH ENTRY DESIRED AND/OR RESET HALT.

**2.1.3 LOADING ON A MODEL 10 FROM DISK WITH A 5422 ATTACHMENT.**

1. SKIP TO STEP 5 IF DCP IS ALREADY LOADED.
2. PLACE THE CE PACK ON R1 AND MAKE DRIVE 1 READY.
3. PLACE THE -PROGRAM LOAD SELECTOR- IN REMOVABLE POSITION.
4. PLACE -00FE- IN DATA SWITCHES AND DEPRESS -PROGRAM LOAD- KEY.

CPU AND MEMORY TEST ARE LOADED AND RUN BEFORE DCP IS LOADED. THE ORDER OF THE CPU AND MEMORY HALT ARE LISTED BELOW. RESET THE HALTS IF THEY OCCUR IN THE FOLLOWING ORDER. IF THE HALTS AREN'T IN THE PROPER ORDER REFER TO BLOCK 5. WHEN THE -HE- HALT OCCURS GO TO STEP 5.

- HALTS  
 A) -CC-  
 B) -LL-  
 C) -SP-  
 D) -HE-

5. USE CONSOLE SWITCHES ENTRY -DXXX- (XXX - PROG ID) TO SPECIFY THE PROGRAM/S TO BE LOADED. (SEE SECTION 2.4)
6. SET LEFTHOST SWITCH TO -0- AND RESET HALT. DCP WILL LOAD THE SECTION AND DISPLAY A -HA- HALT.
7. MAKE ANY CONSOLE SWITCH ENTRY DESIRED AND/OR RESET HALT.

**2.1.4 LOADING ON A MODEL 6 FROM DISK.**

1. SKIP TO STEP 8 IF DCP IS ALREADY LOADED.
2. LOAD THE CE PACK ON R1 AND MAKE DRIVE 1 READY.
3. PLACE THE -PROGRAM LOAD SELECTOR- IN REMOVABLE POSITION.
4. SET DATA SWITCHES TO -00FE- (-02FE- TO BYPASS STORAGE PROGRAMS OR -03PE- TO ALLOW SENSE SWITCH SETTING PRIOR TO PRINTING OR BYPASS THAT PORTION OF I/O LSRS INCLUDED IN THE CPU TESTS).
5. OPERATE PROGRAM LOAD.
6. THE FOLLOWING HALTS WILL OCCUR. AFTER EACH, OPERATE THE START KEY.

- |          |               |                         |
|----------|---------------|-------------------------|
| A) -EE-  | {ABC 123 }    |                         |
| B) -FF5- | {ABCD 12349 } |                         |
| C) -805- | {A 5 }        | STORAGE SEPARATOR HALT. |
| D) -805- | {A 5 }        | STORAGE SEPARATOR HALT. |

THE STORAGE SEPARATOR HALTS OCCUR ONLY IF THE DATA SWITCH ENTRIES ARE -00FE- OR -03PE-. OTHER HALTS OCCURRING AT THIS TIME SHOULD BE INVESTIGATED.

7. DCP WILL LOAD AND PERFORM A -PA5- (ABCD 1 3 5) HALT.
8. USE CONSOLE SWITCHES ENTRY -DXXX- (XXX -PROG ID) TO SPECIFY THE PROGRAM/S TO BE LOADED. (SEE SECTION 2.4)
9. SET LEFTHOST SWITCH TO -0- AND RESET HALT. DCP WILL LOAD THE SECTION AND DISPLAY A -PA5- (ABCD 1 3 5) HALT.
10. MAKE ANY CONSOLE DATA SWITCH ENTRY DESIRED AND/OR RESET HALT.

**2.2 PROGRAM RESTART**

DCP STORES INSTRUCTIONS STARTING AT LOCATION '0000' TO PROVIDE FOR A PROGRAM RESTART. THESE INSTRUCTIONS ALSO CHECK THE CONSOLE SWITCHES FOR A VALID ENTRY. TO PERFORM A PROGRAM RESTART, SIMPLY DEPRESS SYSTEM RESET FOLLOWED BY CPU START.

**2.3 TERMINATION**

NORMAL DCP-CONTROLLED CHAINING FROM ROUTINE TO ROUTINE PROVIDES AN AUTOMATIC TERMINATION OF A SECTION. IN ADDITION, THE CE MAY TERMINATE A SECTION AT ANY TIME BY (1) ENTERING 'RE00' IN THE CONSOLE SWITCHES, OR BY (2) LOADING THE NEXT SECTION. IN ALL CASES, DCP PRINTS A MESSAGE AND PERFORMS HALT 'HE'. THE SECTION CAN STILL BE RESTARTED AT THIS TIME BY USING THE PROGRAM RESTART PROCEDURE. IF NO RESTART IS DESIRED, RESET THE HALT TO LOAD THE NEXT SECTION.

2.4 CONSOLE ADDRESS/DATA SWITCH COMMUNICATIONS

THE ROTARY DATA SWITCHES ARE THE MEANS BY WHICH THE CE CAN COMMUNICATE WITH THE DIAGNOSTICS. ENTRIES ARE MADE AS FOLLOWS--

1. STOP CPU.
2. SET UP ROTARY SWITCHES FOR ONE OF THE FOLLOWING OPTIONS. X'S INDICATE POSITIONS WHICH VARY WITH THE NEED.

SWITCHES				
1	2	3	4	
F	0	X	X	- TURN OFF SENSE SWITCH 'XX'. (F008 WOULD TURN OFF SSW 08).
F	1	X	X	- TURN ON SENSE SWITCH 'XX'. (F108 WOULD TURN ON SSW 08).
F	2	X	X	- GO TO ROUTINE 'XX' AFTER CONSOLE ENTRY FINISHED. (F202 WOULD GO TO ROUTINE 2).
E	E	0	0	- TERMINATE THE CURRENT SECTION.
D	X	X	0	- DISK--EXECUTE SECTIONS FOR DEVICE WITH UNIT CODE 'XX'. (DE00 - EXECUTE ALL 5203 PRINTER PROGRAMS)
D	X	X	X	- DISK--EXECUTE SECTION XXX. (DE01 - SECTION E01). (DE01 - EXECUTE SECTION E01)

NOTE - UP TO FOUR DISK INSTRUCTIONS MAY BE ENTERED DURING ONE ENTRY PHASE.

3. DEPRESS CPU START. (SYSTEM RESET FOLLOWED BY START WILL CALL IMMEDIATE ATTENTION TO THE SWITCHES--SEE NOTE BELOW).
4. WHEN DCP RECEIVES CONTROL, IT HALTS WITH 'HP' DISPLAYED. RESET THE HALT TO ENTER THE FIRST OPTION.
5. DCP WILL PERFORM HALT 'HU' OR 'HP'. LOAD THE NEXT OPTION AND RESET THE HALT.
6. REPEAT STEP 5 FOR AS MANY OPTIONS AS DESIRED. ALTERNATING CODES 'HU' AND 'HP' WILL SIGNAL DCP ACCEPTANCE.
7. WHEN DONE, SET LEFTMOST SWITCH TO '0' AND RESET THE HALT.

NOTE - WHEN USING F2XX IN THE SWITCHES TO GO TO A ROUTINE AFTER A SECTION HAS BEGUN, SYSTEM RESET/START SHOULD BE PERFORMED BEFORE MAKING THE ENTRY. (THIS PREVENTS ERRORS FOUND IN ONE ROUTINE FROM BEING DETECTED IN SOME OTHER ROUTINE. IT SHOULD NOT BE PERFORMED IF OTHERWISE SPECIFIED IN THE MAPS.)

2.5 COMMON SENSE SWITCHES

SENSE SWITCHES ARE EQUIVALENT TO 48 TOGGLE SWITCHES NUMBERED HEXADECIMALLY 00-2F. SENSE SWITCHES 00-0F ARE RESERVED FOR STANDARD OPTIONS PROVIDED BY DCP (LISTED BELOW). SENSE SWITCHES 10-2F ARE SIGNIFICANT TO THE PARTICULAR SECTION BEING RUN. INSTRUCTIONS FOR SETTING SENSE SWITCHES ARE CONTAINED IN SECTION 2.4.

SSW NUMBER	ON	OFF (NORMAL)
00	LCOF ON SECTION.	GO TO NEXT SECTION.
01	LCCF ON ROUTINE.	GO TO NEXT ROUTINE.
02	BYPASS MANUAL INTERVENTION ROUTINES.	EXECUTE ALL ROUTINES.
03	BYPASS ERROR PRINTING.	PRINT ERROR MESSAGES.
04	BYPASS NON-ERROR PRINTING.	PRINT NON-ERROR MESSAGES.
05	USE ALTERNATE PRINTER. PRINTER KEYBOARD, IF ATTACHED. OTHERWISE, MFCU.	NORMAL PRINTER.
06	BYPASS ERROR HALTS.	HALT AFTER ERROR.
07	LOAD AND GO. BYPASS COMMENTS AND PROMPTING HALTS.	PROMPTING MODE.
08	USE 5203 RIGHT CARRIAGE.	USE LEFT CARRIAGE.
09	DON'T CLEAR SECTION SENSE SWITCHES AFTER LOADING	CLEAR SECTION SENSE SWITCHES AFTER LOADING
0A-0F	RESERVED	

2.6 CONTROL PROGRAM HALTS.

ALL CONTROL PROGRAM (DCP) HALTS USE THE CHARACTER 'H' AS THE FIRST DIGIT OF THE HALT CODE. THE SECOND DIGIT IDENTIFIES THE CONDITION ACCORDING TO THE FOLLOWING TABLE.

HALT CODES MODEL	CONDITION	ACTION REQUIRED
F05 H0	INVALID RECORD FOUND WHILE LOADING.	CORRECT INVALID RECORD AND RELOAD.
F15 H1	A DEVICE CALLED FOR BY THE TEST SECTION WAS NOT DEFINED IN THE UDT CARDS.	CHECK UDT CARDS AND RELOAD OR RESET HALT TO BYPASS THE ERROR (ERRORS COULD RESULT).
F25 H2	DATA SWITCH ENTRY ERROR.	CORRECT DATA SWITCHES AND RESET HALT.
F35 H3	INVALID ROUTINE PREFIX FOUND DURING CHAINING FROM ONE ROUTINE TO NEXT.	ENTER ROUTINE SELECT OPTION 'F2XX' IN DATA SWITCHES AND RESET HALT. IF THIS DOES NOT WORK, RELOAD SECTION.
F55 H5	MFCU NOT READY OR ERROR. ERROR INDICATION SHOULD BE DISPLAYED IN THE MFCU LIGHTS.	DO A NON-PROCESS RUN-OUT, RELOAD DECK STARTING WITH RUNOUT CARD/S AND RESET THE HALT.
F65 H6	PRINTER NOT READY OR ERROR.	CLEAR CONDITION AND RESET THE HALT. IF FAILURE PERSISTS, RUN PRINTER FUNCTION TEST. SENSE SWITCHES 03 AND 04 MAY BE USED TO BYPASS PRINTING. SET SENSE SWITCH 05 TO USE ALTERNATE PRINTER.
F75 H7	DISK ERROR.	RESET HALT TO RETRY. IF ERROR PERSISTS, RELOAD.
FA5 HA	CONTROL PROGRAM IS PREPARED TO RECEIVE DATA SWITCH ENTRY. OCCURS AFTER DCP AND SECTION LOADING.	RESET THE HALT IF NO ENTRY DESIRED. TO LOAD OPTIONS, SET UP DATA SWITCHES AND RESET THE HALT. SSW 07 MAY BE USED TO BYPASS THIS HALT.
PC5 HC	DISK LOADER REQUIRES SPECIFICATION OF SECTIONS TO BE LOADED FROM DISK.	IF NO ENTRY HAS BEEN MADE PREVIOUSLY, LOAD PROGRAM SELECTION ENTRY 'DXXX' AND RESET THE HALT. UP TO EIGHT ENTRIES MAY BE MADE. IF ENTRIES HAVE EVER BEEN MADE, THE PROGRAMS MAY BE REPEATED BY RESETTING THE HALT.
FD5 HD	SECTION RUNNING OR LOAD TABLE HAS SPECIFIED NEXT SECTION TO BE RUN. ARR CONTAINS -DXXX- WHERE XXX IS THE PROGRAM ID TO BE RUN.	DISK SYSTEM - DXXX IS NOT ON DISK PACK, RESET THE HALT AND THE NEXT PROGRAM IN THE LOAD TABLE WILL BE LOADED. CARD SYSTEM - PLACE DECK XXX IN THE MFCU HOPPER AND RESET THE HALT.
FE5 HE	CURRENT SECTION TERMINATED.	RESET HALT TO LOAD NEXT SECTION. SECTION MAY BE RESTARTED BY SYSTEM RESET/START.
FF5 HF	DCP HALTS WITH 'HP' DISPLAYED WHENEVER A VALID DATA SWITCH ENTRY IS RECOGNIZED. AS DCP ACCEPTS ENTRIES, ALTERNATING HALTS 'HU' AND 'HP' OCCUR.	LOAD A VALID DATA SWITCH ENTRY AND RESET THE HALT. REPEAT FOR ALTERNATING HALTS 'HU' AND 'HP'. TO TERMINATE ENTRY PROCEDURE, ROTATE LEFT-MOST SWITCH TO ZERO AND RESET HALT.
D1 D1	IPL LOADER CAN'T LOAD DCP BECAUSE OF A DISK ERROR.	RESET HALT TO RETRY. IF HALT PERSISTS, GET A NEW DISK PACK.

3. INDEX TABLE FOR HALTS AND PRINTOUTS

3.1 ERROR HALTS

INDEX NUMBER	MEANING OF HALT	SECTION WHERE USED
9C	ERROR OCCURRED WHILE DOING A WRITE ID COMMAND.	FF5
E0	A CONTROL CARD RECORD IS MISSING. (SEE PARAGRAPH 1.1.4.) CORRECT ERROR AND RESET HALT.	FF6
E1	THE EDITOR HAS REACHED AN /* RECORD. RESET THE HALT AND THE EDITOR WILL CONTINUE OPERATING.	FF6
E2	THE PREVIOUS CONTROL CARD RECORD ENTERED IS INVALID. ENTER ANY OF THE CONTROL CARDS DESCRIBED IN SECTION 1.1.4 AND RESET HALT	FF6
E3	THE INPUT DECK IS OUT OF SEQUENCE. CLEAR CARD INPUT DEVICE AND BEGIN WITH THE CARD NUMBER SPECIFIED IN THE PRINTOUT AND RESET HALT.	FF6
E4	THE PROGRAM ID IN COLUMNS 89-92 OF THE INPUT DECK DOES NOT AGREE WITH THE ID FOUND IN PREVIOUS CARDS OF THIS INPUT DECK. CORRECT AND BEGIN WITH THE CARD NUMBER THAT WAS PREVIOUSLY IN ERROR AND RESET HALT.	FF6
E5	AN ERROR OCCURRED WHILE THE EDITOR WAS DETERMINING THE PROGRAM TYPE JUST READ IN. START OVER FROM LAST HEADER CARD AND RESET HALT.	FF6
E6	THERE IS NOT ENOUGH SPACE LEFT ON THE CE CARTRIDGE TO ADD THE PROGRAM JUST READ IN. RUN THE \$CMP FUNCTION AND THEN \$ADD THE LAST PROGRAM.	FF6
E7	IN THE DUPLICATE DISK ROUTINE, THE ENTRY TO DEFINE THE READ SPINDLE IS INVALID. CORRECT THE \$DUP RECORD AND RESET HALT.	FF6
E8	IN THE DUPLICATE DISK ROUTINE, THE ENTRY TO DEFINE THE READ DISK IS INVALID. CORRECT THE \$DUP RECORD AND RESET HALT.	FF6
E9	IN THE DUPLICATE DISK ROUTINE, THE ENTRY TO DEFINE THE WRITE SPINDLE IS INVALID. CORRECT THE \$DUP RECORD AND RESET HALT	FF6
EA	IN THE DUPLICATE DISK ROUTINE, THE ENTRY TO DEFINE THE WRITE DISK IS INVALID. CORRECT THE \$DUP RECORD AND RESET HALT.	FF6
EC	THE CARD INPUT DEVICE IS EMPTY OR HAD AN ERROR. CORRECT ERROR AND RESET HALT.	FF6
EE	THERE WAS A SCAN ERROR IN THE REP CARD ROUTINE. START OVER FROM THE \$REP RECORD.	FF6
EF	A RECALIBRATE AND SEEK FAILED EACH TIME IT WAS ATTEMPTED RESET HALT TO RETRY. IF ERROR PERSIST RUN DISK DIAGNOSTICS.	FF5
F1	NO SENSE SWITCH HAS BEEN SET TO SPECIFY THE DISK (FIXED OR REMOVABLE) TO BE USED WHILE RUNNING. SET 10 TO SPECIFY REMOVABLE, 11 TO SPECIFY FIXED.	FF5 FF6
F2	NO SENSE SWITCH HAS BEEN SET TO SPECIFY THE DISK NUMBER OR SPINDLE TO BE USED WHILE RUNNING. SET 12 TO SPECIFY DISK 1, (SPINDLE A), OR 13 TO SPECIFY DISK 2, (SPINDLE B).	FF5 FF6
F4	AN ERROR HAS BEEN DETECTED IN THE ALTERNATE TRACK ASSIGNMENT. THIS DISK MUST BE INITIALIZED AGAIN.	FF5
F5	THERE ARE NO ALTERNATE TRACKS LEFT TO USE IN PLACE OF DEFECTIVE ONES.	FF5
F6	AN ERROR HAS OCCURRED WHILE DOING A 'READ ID' ON A DEFECTIVE TRACK	FF5
F7	AN EQUIPMENT CHECK OCCURRED WHILE SEEKING	FF5
F9	THE ACCESS MECHANISM DID NOT SEEK TO THE CORRECT CYLINDER PRIOR TO WRITING THE CYLINDER ID ON THE REMOVABLE DISK	FF5
FA	ERROR OCCURRED WHILE DOING A VERIFY DATA COMMAND ON THE CE TRACK.	FF5
FC	AN ERROR OCCURRED WHILE PROCESSING A 'REP' ENTRY. COLUMNS 2 AND 7 MUST BE BLANK. CORRECT THE ENTRY AND RESET THE HALT TO CONTINUE.	FF6
FE	INTERVENTION REQUIRED, MAKE DISK READY AND RESET HALT.	FF6
FF	UNRECOVERABLE DISK ERROR, RESET HALT TO TRY AGAIN. IF ERROR PERSISTS RUN DISK DIAGNOSTICS.	FF6

3.2 NCN ERROR HALTS

INDEX NUMBER 'XX'	MEANING OF HALT	SECTION NUMBER USED
F0	TO SELECT THE DISK TO BE INITIALIZED OR UPDATED, SET THE FOLLOWING SSW . ***** DRIVE        SENSE SSW ***** *    R1        *    10, 12    * *    P1        *    11, 12    * *    R2        *    10, 13    * *    P2        *    11, 13    * *****	PF5 PF6
F3	THE CE SHOULD CHECK THE PRINTOUT TO VERIFY THAT THE INITIALIZATION PROGRAM IS NOW READY TO WRITE ON THE DESIRED CARTRIDGE.	PF5
F8	INITIALIZATION OF THE DISK CARTRIDGE IS NOW COMPLETE, RESET THE HALT TO TERMINATE THE SECTION	PF5



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1. HEX TO TEXT PROGRAM

1.1 PROGRAM DESCRIPTION:

THIS PROGRAM CONVERTS HALF-BYTE PER COLUMN HEXADEcimal PATCH DATA TO THE 4 FOR 3 TEXT CARD FORMAT REQUIRED BY THE ABSOLUTE CARD LOADER.

INPUT CARDS HAVE THE FOLLOWING FORMAT:

- COL. 1 : CHARACTER 'P'.
- COL. 2-3: LENGTH OF STORAGE TO BE PATCHED, IN HEX, I.E. HALF THE LENGTH PATCH DATA FIELD. MAXIMUM LENGTH = X'28'.
- COL. 4-7: LEFT-MOST (HIGH-ORDER) STORAGE ADDRESS OF AREA TO BE PATCHED, IN HEX.
- COL. 8-87: PATCH DATA, HALF-BYTE PER COLUMN IN HEX (E.G. G=C7 , \*=5C.)
- COL. 88: BLANK.
- COL. 89-96: IDENTIFICATION AND SEQUENCE INFORMATION (DUPLICATED IN OUTPUT CARD).

OUTPUT CONSISTS OF TEXT CARDS IN THE 4 FOR 3 FORMAT THAT IS REQUIRED BY THE ABSOLUTE LOADER. THE OUTPUT DECK IS THE SAME SIZE AS THE INPUT DECK. SELF CHECK NUMBER IS GENERATED AND PUNCHED INTO COLUMNS 86-88 OF EACH CARD.

A CARD WITH A /\* IN CARD COLUMNS 1-2 CAUSES NORMAL END OF JOB (HALT DISPLAY 'EJ').

1.2 OPERATING PROCEDURE:

1. PLACE HEX TO TEXT OBJECT DECK FOLLOWED BY INPUT CARDS AND A /\* CARD IN THE PRIMARY HOPPER OF THE MFCU.
2. PLACE BLANK CARDS IN THE SECONDARY HOPPER OF THE MFCU AND READY MFCU.
3. PRESS THE IPL KEY ON THE CPU CONSOLE.

1.3 PROGRAM HALTS:

HALT CODE	CONDITION	ACTION REQUIRED
EC	PROGRAM EXCEEDS SYSTEM CORE SIZE	RUN SYSTEM INITIALIZATION PROGRAM AND RERUN THIS PROGRAM.
L1	READER ERROR WHILE LOADING PROGRAM	RE-LOAD PROGRAM
CL	INVALID HEX CHARACTER ON INPUT CARD. (VALID HEX CHARACTERS ARE 0-9 AND A-F).	NPRO PRIMARY HOPPER, CORRECT ERROR ON NPRO'D CARD, REPLACE CARDS IN PRIMARY HOPPER, AND PRESS START KEY ON CPU CONSOLE.
F3	READ ERROR	RERUN PROGRAM.
F4	PUNCH ERROR.	RERUN PROGRAM.
EJ	NORMAL END OF JOB.	

2.TEXT TO LIST PROGRAM

2.1 PROGRAM DESCRIPTION:

TEXT TO LIST GIVES A LISTING OF THE OBJECT DECK'S TEXT AND END CARDS. THERE ARE TWO FORMATS, 'A' AND 'B'. 'A' FORMAT GIVES A TWO LINE 'HEX' LISTING FOR EACH CARD. 'B' FORMAT GIVES A FOUR LINE LISTING FOR EACH CARD: THE HEX LIST AND A FORMATTED CHARACTER LIST OF THE CARD ITSELF. THE PROGRAM ACCEPTS ONLY TEXT AND END CARDS, IT IGNORES ALL OTHERS. WITH THE 'A' FORMAT, CARD COLUMNS 2-88 ARE COMPRESSED 4/3 AS IN THE ABSOLUTE LOADER INTO 66 CHARACTERS. COLUMN 1 AND COLUMNS 89-96 ARE LISTED AS THEY APPEAR ON THE CARD. THE 'B' FORMAT GIVES THE TWO 'HEX' LINES AND A CARD IMAGE LINE PRECEDING EACH HEX LINE. FOUR CARD COLUMNS ARE MATCHED WITH THREE COMPRESSED BYTES EXCEPT FOR THE LAST GROUP IN LINES THREE AND FOUR. HERE, THREE CARD COLUMNS ARE MATCHED WITH TWO COMPRESSED BYTES. THIS PROGRAM REQUIRES THE SYSTEM CHAIN IMAGE, WHICH IS SET BY THE SYSTEM INITIALIZATION PROGRAM. AT END OF JOB, IT COMES TO A RESTARTABLE HALT - 'EJ'. A CARD WITH A /\* IN COLUMNS 1-2 CAUSES NORMAL END OF JOB.

2.2 OPERATING PROCEDURE:

1. PLACE TEXT TO LIST OBJECT DECK IN PRIMARY HOPPER OF MFCU.
2. PLACE OBJECT DECKS TO BE LISTED IN SECONDARY HOPPER OF MFCU AND READY MFCU.
3. PRESS IPL KEY ON CPU CONSOLE. WHEN TEXT TO LIST PROGRAM HAS BEEN SUCCESSFULLY LOADED A HALT 'EE' SHOWS ON THE DISPLAY LIGHTS. IF A 'B' FORMAT LISTING IS DESIRED, A 1 SHOULD BE DIALED ON THE RIGHTMOST ADDRESS/DATA SWITCH. ANY OTHER SETTING RESULTS IN AN 'A' FORMAT LISTING.
4. PRESSING START KEY ON THE CPU CONSOLE CAUSES PROGRAM EXECUTION. THE TEXT TO LIST OBJECT DECK IS SELECTED TO STACKER 4 OF THE MFCU.

2.3 PROGRAM HALTS

HALT CODE	CONDITION	ACTION REQUIRED
EC	PROGRAM EXCEEDS SYSTEM CORE SIZE	RUN SYSTEM INITIALIZATION PROGRAM AND RERUN THIS PROGRAM.
L1	READER ERROR WHILE LOADING PROGRAM	RE-LOAD PROGRAM
F1 F3	READ ERROR	RERUN PROGRAM
P1 P3 P5 P6 P7 P8	CARRIAGE CHECK FORMS JAM SYNC CHECK INCREMENTER FAILURE THERMAL CHECK PRINT CHECK	REFER TO THE CARD SYSTEM OPERATOR'S GUIDE FOR PROPER ERROR RECOVERY OR READY PRINTER AND PRESS START KEY.
EE	FORMAT TYPE	SET RIGHT-MOST ADDRESS/DATA SWITCH.
EJ	NORMAL END OF JOB.	

3. TRACE PROGRAM

3.1 PROGRAM DESCRIPTION:

THE TRACE PROGRAM GIVES A LISTING IN HEX OF THE FOLLOWING INFORMATION AS EACH INSTRUCTION OF THE PROGRAM BEING TRACED IS EXECUTED: INSTRUCTION ADDRESS (IAR), CP CODE, Q CODE, OPERAND 1 ADDRESS OR R-BYTE, OPERAND 2 ADDRESS, CONTENTS OF INDEX REGISTER 1 BEFORE EXECUTION, CONTENTS OF INDEX REGISTER 2 BEFORE EXECUTION, CONDITION CODE AFTER TRACED INSTRUCTION HAS BEEN EXECUTED, CONTENTS OF ADDRESS RECALL REGISTER (ARR) AFTER TRACED INSTRUCTION HAS BEEN EXECUTED, CONTENTS OF OPERAND 1 BEFORE AND AFTER TRACED INSTRUCTION HAS BEEN EXECUTED, AND CONTENTS OF OPERAND 2. THE TRACE PROGRAM REQUIRES 2K OF CORE AND MUST BE LOADED ON A 256 BYTE BOUNDARY AT OR ABOVE X'0300'. THE FORMAT OF THE PRINTOUT IS:

LINE 1: (INDENTED 5 PRINT POSITIONS) IAR, OP CODE, OPERAND 1 ADDRESS OR R-BYTE, OPERAND 2 ADDRESS, CONTENTS OF XR1, CONTENTS OF XR2, CONDITION CODE, AND ARR. FOR INSTRUCTIONS HAVING ONLY OPERAND 1, THE CONTENTS OF THE OPERAND BEFORE AND AFTER EXECUTION ARE ALSO PRINTED ON THIS LINE.

LINE(S) 2: CONTENTS OF OPERAND 1 BEFORE EXECUTION.

LINE(S) 3: CONTENTS OF OPERAND 1 AFTER EXECUTION.

LINE(S) 4: CONTENTS OF OPERAND 2.

THIS PROGRAM REQUIRES THE SYSTEM CHAIN IMAGE WHICH IS SET BY THE SYSTEM INITIALIZATION PROGRAM (SIP) AND IS INTENDED TO ONLY TRACE PROGRAMS WHICH OPERATE UNDER SIP (SYSTEM DIAGNOSTIC PROGRAMS DO NOT OPERATE UNDER SIP). IF AN INVALID ADDRESS PROCESS CHECK IS INCOUNTERED WHILE LOADING THIS PROGRAM, IT HAS TO BE RELOADED AT A LOWER ADDRESS.

3.2 OPERATING PROCEDURE:

1. PLACE THE TRACE PROGRAM IN PRIMARY HOPPER OF MFCU AND READY MFCU.
2. PRESS IPL KEY ON CPU CONSOLE. A 'CU' WILL BE DISPLAYED IN THE HALT DISPLAY IN THE HALT DISPLAY LIGHTS.
3. DIAL THE ADDRESS AT WHICH TRACE IS TO BE LOADED INTO THE ADDRESS/DATA SWITCHES AND PRESS START. WHEN TRACE HAS BEEN SUCCESSFULLY LOADED AN 'AA' HALT WILL BE DISPLAYED.
4. PLACE PROGRAM TO BE TRACED IN PRIMARY HOPPER OF MFCU AND LOAD PROGRAM.
5. STOP EXECUTION OF THE PROGRAM MANUALLY. THIS CAN BE DONE EITHER BY USING ADDRESS COMPARE OR BY PRESSING THE STOP KEY ON CPU CONSOLE.
6. THE INSTRUCTION ADDRESS SHOULD BE NOTED.
7. MANUALLY BRANCH TO THE ADDRESS WHERE THE TRACE PROGRAM WAS LOADED. THE 'AA' HALT WILL BE DISPLAYED.
8. THE INSTRUCTION ADDRESS NOTED ABOVE IS DIALED IN THE ADDRESS/DATA SWITCHES AND THE START KEY IS PRESSED. THIS GIVES THE TRACE PROGRAM THE ADDRESS AT WHICH TRACING IS TO BEGIN. AN 'AL' IS THEN DISPLAYED.
9. THE LOW-CORE ADDRESS FOR WHICH PRINTING OF THE TRACED INSTRUCTIONS IS DESIRED IS DIALED IN THE ADDRESS/DATA SWITCHES AND THE START KEY IS PRESSED. A HALT 'AU' IS DISPLAYED.
10. THE UPPER CORE ADDRESS FOR WHICH PRINTING OF THE TRACED INSTRUCTIONS IS DESIRED IS DIALED ON THE ADDRESS/DATA SWITCHES AND THE START KEY IS PRESSED AND TRACING BEGINS.
11. SETTING THE LEFTMOST ADDRESS/DATA SWITCH TO 'F' CAUSES TRACE TO TURN CONTROL OVER TO THE PROGRAM BEING TRACED. THE TRACE PROGRAM CAN BE RE-ENTERED BY REPEATING THE ABOVE PROCEDURE BEGINNING WITH STEP 5.

3.3 PROGRAM HALTS:

HALT CODE	CONDITION	ACTION REQUIRED
L1	READER ERROR WHILE LOADING PROGRAM.	RELOAD PROGRAM
CU	RELOCATE	DIAL LOAD ADDRESS INTO ADDRESS/DATA SWITCHES.
AA	BEGINS TRACING	DIAL ADDRESS AT WHICH TRACING IS TO START INTO ADDRESS/DATA SWITCHES.
AL	LOW CORE ADDRESS	DIAL LOW CORE LIMIT IN ADDRESS/DATA SWITCHES.
AU	UPPER CORE ADDRESS	DIAL HIGH CORE LIMIT IN ADDRESS/DATA SWITCHES.
PO	PRINTER ERROR	READY PRINTER AND PRESS START KEY.

NOTE: THIS PROGRAM CANNOT BE USED IN A DUAL PROGRAM FEATURE ENVIRONMENT. HOWEVER, WHEN OPERATING THIS PROGRAM ON A DPE SYSTEM WITH DPE INACTIVE, PRESS THE HALT RESET KEY INSTEAD OF THE START KEY AS EXPLAINED IN OPERATING PROCEDURES 3, 8, 9, AND 10 ABOVE.

4. MNEMONIC DUMP PROGRAM:

4.1 PROGRAM DESCRIPTION:

THE MNEMONIC DUMP PROGRAM DUMPS CORE, INSTRUCTION BY INSTRUCTION WITHIN THE LIMITS WHICH ARE SET BY THE USER. THE PROGRAM SCANS CORE BYTE BY BYTE UNTIL IT FINDS A VALID OP-CODE. IF A BYTE OF CORE IS NOT A VALID OP-CODE OR PART OF AN INSTRUCTION, IT IS DATA AND IS PRINTED IN DATA FORMAT RATHER THAN IN INSTRUCTION FORMAT. FOR BOTH THE FORMATS, THE IAR IS PRINTED ON THE LEFT MARGIN AND POINTS TO THE LEFT-MOST BYTE OF EACH LINE OF THE DUMP. A MAXIMUM OF 24 BYTES OF DATA ARE PRINTED PER LINE. ON THE SAME LINE, A CHARACTER DISPLAY FOR EACH BYTE IS ALSO PRINTED. A PERIOD IS PRINTED FOR ALL UNPRINTABLE CHARACTERS. FOR THE INSTRUCTION FORMAT, ONE INSTRUCTION ALONG WITH THE MNEMONIC OP-CODE AND THE INDEX REGISTER ASSOCIATED WITH AN OPERAND ARE PRINTED PER LINE. A DUMP OF ALL THE LSR'S EXCEPT THE IAR AND ARR ARE PRINTED PRIOR TO THE CORE DUMP. THESE ARE, PSR, XR1, XR2, LPLCR, LPIAR, LPDAR, MFCU PUNCH DAR, MFCU PRINT DAR, AND MFCU READ DAR. THIS PROGRAM MUST BE LOADED ON A 256-BYTE BOUNDARY AT OR ABOVE X'0300'. IF AN INVALID ADDRESS PROCESS CHECK IS INCOUNTED WHILE LOADING THIS PROGRAM, IT HAS TO BE RELOADED AT A LOWER ADDRESS.

4.2 OPERATING PROCEDURE:

1. LOAD PROGRAM FROM PRIMARY HOPPER OF MFCU. A 'CU' HALT IS DISPLAYED.
2. DIAL THE ADDRESS AT WHICH THE DUMP IS TO BE LOADED IN THE ADDRESS/DATA SWITCHES AND PRESS START KEY. WHEN THE PROGRAM HAS BEEN LOADED, AN 'AL' HALT IS DISPLAYED.
3. RUN PROGRAM FOR WHICH A DUMP IS DESIRED.
4. BRANCH MANUALLY TO THE ADDRESS AT WHICH THE DUMP WAS LOADED. AN 'AL' HALT IS DISPLAYED.
5. DIAL THE LOW CORE LIMIT OF THE DUMP INTO THE ADDRESS/DATA SWITCHES AND PRESS START KEY. AN 'AU' HALT IS DISPLAYED.
6. DIAL UPPER CORE LIMIT OF DUMP INTO THE ADDRESS/DATA SWITCHES AND PRESS START KEY. AN 'EJ' HALT IS DISPLAYED WHEN THE UPPER CORE LIMIT IS REACHED. AT THIS POINT IF A DUMP OF ANOTHER AREA IS DESIRED, PRESS THE START KEY AND REPEAT THE PROCEDURE BEGINNING WITH STEP 5.

4.3 PROGRAM HALTS:

HALT CODE	CONDITION	ACTION REQUIRED
L1	READER ERROR WHILE LOADING PROGRAM.	RELOAD PROGRAM
CU	RELOCATE	DIAL LOAD ADDRESS INTO ADDRESS/DATA SWITCHES.
AL	LOW CORE LIMIT	DIAL LOW CORE LIMIT INTO ADDRESS DATA SWITCHES.
AU	UPPER CORE LIMIT	DIAL UPPER CORE LIMIT INTO ADDRESS/DATA SWITCHES.
EJ	NORMAL END OF JOB	
PO	PRINTER ERROR	READY PRINTER AND PRESS START KEY.

5. SNEAK-ON DUMP PROGRAM:

5.1 PROGRAM DESCRIPTION:

THE SNEAK-ON DUMP IS USED TO PRINT OUT, IN HEX, THE CONTENTS OF CORE STORAGE. IT IS LOADED IN IPL MODE, ALL CARDS ARE IN IPL FORMAT. THIS PROGRAM WILL OVERLAY THE FIRST 256 BYTES OF CORE, BUT FIRST PRINTS OUT THE CONTENTS OF THE PRINT BUFFER (THE ADDRESS OF THE LEFT-MOST BYTE IS IN THE LPDAR). IN MOST CASES THIS WILL BE X'007C'-X'00FF'. ALL LSR'S EXCEPT THE IAR AND ARR ARE PRINTED. THE REGISTERS PRINTED ARE, PSR, XR1, XR2, MFCU PRINT DAR, MFCU PUNCH DAR, LPLCR, LPDAR, AND LPIAR. THE CARD SYSTEM INITIALIZATION PROGRAM MUST HAVE BEEN RUN PRIOR TO RUNNING THE SNEAK-ON DUMP.

THE ADDRESS/DATA SWITCHES MAY BE USED TO SET LIMITS FOR THE DUMP. THE TWO LEFT-MOST ADDRESS/DATA SWITCHES ARE USED FOR THE LOW CORE LIMIT AND THE TWO RIGHT-MOST ARE USED FOR THE UPPER CORE LIMIT. THE DUMP WILL BEGIN ON A 256-BYTE BOUNDARY AND END ON A 255-BYTE BOUNDARY. IF THE LIMITS SET ARE INVALID, THE DUMP WILL BEGIN AT X'0000' AND END AT THE SYSTEM CORE SIZE VALUE.

5.2 OPERATING PROCEDURE:

1. LOAD PROGRAM BY PLACING DECK IN PRIMARY HOPPER OF MFCU AND PRESS IPL KEY ON CPU.

5.3 PROGRAM HALTS:

HALT CODE	CONDITION	ACTION REQUIRED
EJ	NORMAL END OF JOB	
PO	PRINTER ERROR	READY PRINTER AND PRESS START KEY.