NASA TECHNICAL MEMORANDUM

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SOFTWARE CONTROL PROGRAM FOR 25 kW BREADBOARD TESTING

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July 8, 1981

NASA

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama

SOFTWARE CONTROL PROGRAM

for

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EC12

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I. PROGRAM DESCRIPTION

A data acquisition software program has been developed to operate in conjuction with the automated control system of the 25kW PM EPS Breadboard Test facility. The program provides limited interactive control of the Breadboard Test while acquiring data and monitoring parameters, allowing unattended continuous operation.

The Breadboard Test facility has two positions for operating separate configurations. A block diagram of a typical test configuration is shown in Fig. 1. The main variable in each test setup is the high voltage battery. The initial test battery contains 112, 33 AH, NI-CD cells arranged in 4 modules of 28 cells each. The second test battery contains 88, 55 AH, NI-CD cells arranged in 4 modules of 22 cells each. Current testing will be limited to using a 28 vdc load bus, but the capability for testing with a high voltage bus (110v DC or higher) has been included in the facility and equipment design.

A. CONTROL SOFTWARE

The software was developed for a Vidar Data Acquisition System (DAS) which contains a PDP-8E Processor with 12K words of core memory. 8K words of storage is directly programmable with the VIDAR developed assembly language (VIDAC) and the remaining 4K words are available for data storage. The DAS contains a clock, a 6 digit Integrating Digital Voltmeter (IDVM), a high speed 16 column printer, an ICMR magnetic tape recorder, 600 channels of random scanning capacity, 300 independently addressable switch closures, and a teletype. All DAS components are integrated for computer control by software program control.

The software is composed of VIDAC subroutines, subroutines developed in-house and the main system control program. The VIDAC subroutines, which are described in the VIDAR systems manual, are used for arithmetic and input/output data manipulations. The developed subroutines are used for specific task control. The main program performs overall control and all other functions necessary to achieve effective and reliable test operations.

Effective and automatic operation is subdivided into three primary functions: data acquisition; automatic limit checking; and data recording. Details of each of the program features are tabulated below.

1. Data acquisition:
   a. Acquires cell data via the IDVM.
   b. Acquires system data via the IDVM.
   c. Acquires system control status via the IDVM.

2. Automatic limit checking:
   a. Tests incoming data for within limit status based on current status supplied by the system control signals.
   b. Closes contacts on interface panel of control system to initiate out-of-limit shutdowns, out-of-limit printouts and to acquire system orbit counts.

3. Data Recording
   a. Outputs to the teletype a summary of data at the end of each orbit and after BPRC limit is reached for capacity tests. (Fig.2)
   b. Outputs to the printer out-of-limit errors with time and orbit count. (Fig. 3)
   c. Outputs to the printer a battery summary when the first cell reaches 1.0 volts during a capacity test. (Fig
   d. Outputs to the printer the current scan values of orbit data,cell voltages, or temperature data on demand. (Fig. 4)
   e. Outputs to the ICMR the scanned data for every 10th orbit.

B. <u>OPERATOR CONTROL</u>

The options allowed for operator control while the program is running are limited to the following:

1. Directed program halt. (not to be confused with using the halt switch on the processor).
2. Print requests for an individual battery of orbit data, voltages, or temperatures.
3. Recording on the ICMR of the scan data.

NOTE: Orbit data consists of items such as battery voltage, battery current, charger current etc. that are used to calculate system performance over a 1 orbit period.

A. A power failure or system shutdown must be cleared and the program restarted only under the direction of the 25KW Breadboard lead engineer, as a properly sequenced startup is necessary to prevent possible equipment damage.

B. Operator options are all accomplished using the processor front panel switches and are explained under the program operating details.

The program functions discussed above are completely integrated

in the program and were subdivided for discussion purposes only.

II. CONTROL PROGRAM DETAILS

A simplified flow diagram is shown in Fig. 5. The program has two starting points. The first is an absolute start used for totally initializing the system. The second starting point is used to recover from a power failure and as a restart after an operator requested halt.

The general operations of the program are to test the operator set switch options, get the control signals and set the appropriate program flags, test the control signals for scan start, and set the program to scanning mode or to the flag test mode.

In the scanning mode the program acquires the time, then scans both test positions (hereinafter called BATT 1 and BATT 2)

III. CONTROL PROGRAM OPERATING PROCEDURE

A. Loading and starting the program

1. Clearing memory banks 0 and 1

a. Set bit 7 = 1, Depress EXTD ADDR. LOAD
b. Set switch register to 7600. Depress LOAD ADDR.
c. Depress CLEAR and CONT. (See NOTE 1)
d. Set bits 7 and 11 = 1. Depress EXTD ADDR. LOAD
e. Set switch register to 7600. Depress LOAD ADDR.
f. Depress CLEAR and CONT. (see NOTE 1) Banks 0 and 1 have effectively been "cleared".

NOTE 1: Proper operation of the program will be indicated by a momentary illumination of the RUN light. Failure for this to occur may necessitate reloading the executive programs. See section III. A.4 for further details.

2. Loading the program tape

a. Set bit 8 = 1. Depress EXTD ADDR. LOAD.
b. Set switch register to 7777. Depress LOAD ADDR.
c. Load tape JAP2/0 in high speed reader and switch to RUN.
d. Depress CLEAR and CONT. (Note 2)
e. When high speed reader halts, set bits 8 and 11 = 1. Depress EXTD ADDR. LOAD.
f. Set switch register to 7777. Depress LOAD ADDR.
g. Load tape JAP2/1 in high speed reader and switch to RUN.
h. Depress CLEAR and CONT.
i. When the high speed reader halts, set bit 8 and 10 = 1. Depress EXTD ADDR. LOAD.
j. Set switch register to 7777. Depress LOAD ADDR.

k. Load tape JAP2/2A in high speed reader.
l. Depress CLEAR and CONT. (see NOTE 2). The program is now loaded. Verify that all external devices are turned on and that the hardware clock exhibits the correct time.
m. Set the program options as described in section IV for the current test conditions.

NOTE 2: If the tape does not load or does not properly halt at the trailer code, see section III. A.5 for reloading the executive program.

3. Starting the program

a. Set bit 8 and 11 =1, depress EXTD ADDR LOAD.
b. Set the switch register to 0266 (the starting address) and depress LOAD ADDR.
c. Set switch register to 0000.
d. Turn TTY Manual/Auto switch to manual and the power switch to line.
e. Verify DDAS System Switches in the following positions:

1. System sw "ON"

2. Set clock to proper T.O.Y.

a. Power switch "ON".
b. Push Stop.
c. Push reset.
d. Set day, hours, min., and sec. using digit switch and set button.
e. Period switch position not critical mult. switch position not critical.
f. Remote - local switch to local.
g. Totalize - normal switch to normal.
h. Press start switch when time concides with actual time.

3. ICMR Power Switch (inside door) to off

4. 653-06 coupler switch to "ON"; selector switch to "Program Interrupt".

5. 653-060 coupler power switch to "ON"; "output select" switch to "print"-"record"

6. 16 column print power switch "ON" and verify printer paper is loaded

7. 13593-1 contact closure unit switch to "ON"

8. 13593-2 contact closure unit switch to "ON"

9. 531 OHMS converter power switch "ON"

10. 521C IDVM power switch "ON"

    a. "Rate" switch full CCW to "program".
    b. "Resolution" switch to "program".
    c. "Function" switch to "program".
    d. "Range" switch to "program".
    e. "IDVM Check" switch to "operate".

11. 610 Scanner

    a. Turn power switch to "ON".
    b. First channel thumb wheel switches set to "000".
    c. Last channel thumb wheel switches set to "399".
    d. "Mode" selector switch to "remote".
    e. Depress "clear" switch.
    f. Depress "reset" switch.

12. 13593-3 contact closure unit switch to "ON"

13. 663A ICMR
    a. Turn power switch to "ON".
    b. Load tape.
    c. Depress "LOAD FWD" switch.
    d. Wait for tape drive to halt and "READY" light to illuminate.

f. Depress CLEAR and CONT.
g. Verify that the program is operating.
h. Turn TTY to "Auto" mode.

4. Restarting the program

To restart the program after a power fail HALT or a DDAS room temperature overtemp HALT:

a. Reload bank 2 tape as described in par. III.A.1 through 11.
b. Start program as described in par. III.A.3.

b. Loading the executive program.

a. Set bit 8 and 11 = 1. Depress EXTD ADDR.
b. Deposit the listed instructions into the locations listed below. Instruction are deposited by setting the switch register to the first address and depressing the LOAD ADDR switch. The instructions are then deposited by setting the switch register to the instruction and depressing the DEP switch.

LOCATION	INSTRUCTION
7756	6014
7757	6011
7760	5357
7761	6016
7762	7106
7763	7006
7764	7510
7765	5374
7766	7006
7767	6011
7770	5367
7771	6016
7772	7420
7773	3776
7774	3376
7775	5357

c. Set switch register to 7756. Depress LOAD ADDR.
d. Load VIDAC BIN LOADER TAPE (Vidac No. 0005) in high speed reader.
e. Depress CLEAR and CONT.
f. When high speed reader finishes, (Tape will not stop at trailer code). Depress HALT.
g. Turn off reader, then set to LOAD position.
h. Set switch register bits 8 and 10 = 1. Depress EXTD ADDR LOAD.
i. Set switch register to 7777. Depress LOAD ADDR.
j. Load VIDAC CORE WIPE tape (Vidac No. 0003) in high speed reader and switch to RUN.
k. Depress CLEAR and CONT.
l. Go to step III. A.1

B. Switch Options

The switch options allow operator control of the program. The switch option are monitored continuously and may be set at any time. The switches are located on the PDP-8E control panel and are labled 0 through 11.

SWITCH NUMBER	FUNCTION
0	Halt
1	BATT 1
2	BATT 2
3	Orbit data print
4	Voltage data print
5	Temperature data print
10	Record BATT 2 on ICMR
11	Record BATT 1 on ICMR

NOTE: Switch 1 or 2 should be operated simultaneously with 3, 4 or 5.

1. Halt, switch 0

   The halt function is used to stop the operating program. to allow program changes to accommodate changing TEST SET-UPS.

NOTE: This switch will only function if the RUN/HOLD switch on the control panel is in the HOLD position

   Restart of the program is accomplished by setting bit 8 and 11 = 1 and depressing EXTD ADDR LOAD, then setting the switch register to 0331 and depressing LOAD ADDR. Set the switch register to 0000 and Depress CONT. The program should now be operating.

2. BATT 1, Switch 1

   This switch is used in conjunction with switches 3, 4 or 5 to initiate a print out of the selected data for battery position 1.

3. BATT 2, switch 2

   Has the same effect on Battery 2 position.

4. Orbit data print, switch 3.

   This switch, when used in conjunction with switch 1 or 2 (but not both), will initiate a printout of the orbit data taken for BATT. 1 or 2 during the next data scan. NOTE: The switches should be cleared after printing starts to prevent continuous printing.

5. Voltage data print, switch 4.

   This switch, when used in conjunction with switches 1 or 2 (but not both), will initiate a printout of the cell and module voltages for the selected battery

position during the data scan. (See note in 4 above).

6. Temperature data print, switch 5

This switch, when used in conjunction with switch 1 or 2 (but not both), will initiate a printout of the module and chamber temperatures for the selected battery position during the next data scan. NOTE: (See note in 4 above).

IV. CONTROL PROGRAM OPTIONS

1. The program will disregard out of limit conditions and calculatons when the battery is disconnected from the circuit using the DISCONNECT switch in the control pannel.

2. The faulty channel storage locations listed below provide a means of identifying those abnormal cells in a battery which are disregarded in limit testing without physically removing the cells from the battery. The numbers represented by "ccc" are the cell no. in octal notation.

BATTERY 1		BATTERY 2	
BANK 1 LOCATION	I.D.	BANK 2 LOCATION	I.D.
0253	ccc	0260	ccc
0254	ccc	0261	ccc
0255	ccc	0262	ccc
0256	ccc	0263	ccc
0257	ccc	0264	ccc

3. The number of cells in a battery and the number of modules may be changed to reflect the proper battery assembly. The proper storage locations are identified below. The no. of cells and modules are deposited in octal notation.

	BATTERY 1		BATTERY 2	
	BANK 1 LOCATION	NO.	BANK 2 LOCATION	NO.
NO. OF CELLS	0226	xxx	0227	xxx
NO. OF MODULES	0230	mmm	0231	mmm

APPENDIX A

BANK 2 STORAGE ASSIGNMENTS

DESCRIPTION	LOCATION
SCAN TIME	0201-0204

CONVERSION FACTORS

CF1 = 15.0	0301-0303	2047;	4000;	0000
CF2 = 4.0	0304-0306	2034;	0000;	0000
CF3 = 0.5	0307-0311	2004;	0000;	0000
CF4 = 10.0	0312-0314	2045;	0000;	0000
CF5 = 40.0	0315-0317	2065;	0000;	0000
CF6 = 50.0	0320-0322	2066;	2000;	0000
CF7 = 1.5	0323-0325	2016;	0000;	0000
CF8 = 60.0	0326-0330	2067;	4000;	0000
CF9 = 2.5	0331-0333	2025;	0000;	0000
CF10= 0.2	0334-0336	1766;	3146;	3146
CF11=500.0	0337-0341	2117;	6400;	0000
CF12= 5.0	0342-0344	2035;	0000;	0000

TTY HEADINGS

1st LINE	0401-0506
2nd LINE	0507-0614
3rd LINE	0615-0722

(NOTE SEE APPENDIX B)

APPENDIX A

BANK 2 STORAGE ASSIGNMENTS

DESCRIPTION	LOCATION BATTERY 1	LOCATION BATTERY 2
* CELL SCAN STORAGE FOR HI		
HI BATTERY VOLT	1001-1003	3001-3003
HI CELL PER BATTERY	1042-1044	3042-3044
BATTERY V AT HI CELL	1064-1066	3064-3066
AVE. CELL V AT HI	1067-1071	3067-3071
HI CELL NO. IN BATTERY	1104	3104

APPENDIX A

BANK 2 STORAGE ASSIGNMENTS

DESCRIPTION	LOCATION BATTERY 1	LOCATION BATTERY 2
* CELL SCAN STORAGE FOR LO		
LO BATTERY V. ----------	1201-1203 ---	3201-3203
LO CELL V. PER BATTERY ----	1242-1244 ---	3242-3244
BATTERY V. AT LO CELL -----	1264-1266 ---	3264-3266
AVE CELL V AT LO ----------	1267-1271 ---	3267-3271
LO CELL NO. IN BATTERY ----	1304 --------	3304

APPENDIX A

BANK 2 STORAGE ASSIGNMENTS

DESCRIPTION	LOCATION BATTERY 1	LOCATION BATTERY 2
* ORBIT DATA SCAN STORAGE		
V BATTERY (CHAN 000/200) ------	2001-2003 ---	4001-4003
I REG IN (CHAN 178/378) -------	2004-2006 ---	4004-4006
I REG OUT (CHAN 179/379) ------	2007-2011 ---	4007-4011
V REG OUT (CHAN 180/380) ------	2012-2014 ---	4012-4014
V BUS (CHAN 181/381) ----------	2015-2017 ---	4015-4017
I BPRC (CHAN 182/382) ---------	2020-2022 ---	4020-4022
I BATTERY (CHAN 183/383) ------	2023-2025 ---	4023-4025
I SAS (CHAN 184/384) ----------	2026-2030 ---	4026-4030
V EAS (CHAN 185/385) ----------	2031-2033 ---	4031-4033
I CHG OUT (CHAN [illegible]) ------	2034-2036 ---	4034-4036
* ORBIT DATA SUMMATION [illegible]		
A = (M179 x M180) ORBIT ---	2037-2041 ---	4037-4041
B = (M181 x M182) ORBIT ---	2042-2044 ---	4042-4044
C = (M000 x M178) ORBIT ---	2045-2047 ---	4045-4047
D = (M183) NIGHT ---	2050-2052 ---	4050-4052
E = (M183 x M000) NIGHT ---	2053-2055 ---	4053-4055
F = (M183) DAY -----	2056-2060 ---	4056-4060
G = (M183 x M000) DAY -----	2061-2063 ---	4061-4063
H = (M184 x M185) DAY -----	2064-2066 ---	4064-4066
I = (M186 x M000) DAY -----	2067-2071 ---	4067-4071
HI CHRG TEMP. (M187) ORBIT ----	2072-2074 ---	4072-4074
HI REG TEMP (M188) ORBIT ------	2075-2077 ---	4075-4077
HI BATTERY TEMP (M189) ORBIT --	2100-2102 ---	4100-4102
DCH C DISC. COUNTER ----------	2103 --------	4103
* ORBIT DATA TYPE STORAGE		
ORBIT NO. ----------	2104-2105 ---	4104-4105
SUNSET TIME ----------	2106-2111 ---	4106-4111
DCH ----------	2112 --------	4112
PPG WHO A/60 ----------	2113-2115 ---	4113-4115
PPG EFF A/H ----------	2116-2120 ---	4116-4120
BATTERY TEMP ----------	2121-2123 ---	4121-4123
BPRC WH B/60 ----------	2124-2126 ---	4124-4126
BATTERY AHO D/60 ----------	2127-2131 ---	4127-4131
RF F/D ----------	2132-2134 ---	4132-4134
BATTERY.WHO E/60 ----------	2135-2137 ---	4135-4137
BATTERY EFF G/ E ----------	2140-2142 ---	4140-4142
HI CELL V. ----------	2143-2145 ---	4143-4145
HI CELL NO. ----------	2146 --------	4146
AVE HI CELL V ----------	2147-2151 ---	4147-4151
LO CELL V ----------	2152-2154 ---	4152-4154
LO CELL NO. ----------	2155 --------	4155

APPENDIX A

BANK 2 STORAGE ASSIGNMENTS

AVE LO CELL V. ----------	2156-2160 ---	4156-4160
CHRGR. EFF I/ H ----------	2161-2163 ---	4161-4163
CHRGR TEMP ----------	2164-2166 ---	4164-4166
REG EFF A/ C ----------	2167-2171 ---	4167-4171
REG TEMP ----------	2172-2174 ---	4172-4174
E-O-C TIME ----------	2175-2200 ---	4175-4200
PET STO. ----------	2201-2204 ---	4201-4204
SUNSET TIME STO----------	2205-2210 ---	4205-4210

APPENDIX A

BANK 2 STORAGE ASSIGNMENTS

DESCRIPTION		LOCATION BATTERY 1		LOCATION BATTERY 2
* LIMITS				
BATTERY TEMP	(30.0)	2401-2403	(30.0)	4401-4403
BATTERY HI VOLT	(168.0)	2404-2406	(165.0)	4404-4406
BATTERY LO VOLT	(123.0)	2407-2411	(97.0)	4407-4411
MOD LO VOLT	(30.8)	2412-2414	(24.2)	4412-4414
CELL HI VOLT	(1.55)	2415-2417	(1.55)	4415-4417
CELL LO VOLT	(0.05)	2420-2422	(0.05)	4420-4422
CELL CAPTST LO VOLT	(0.05)	2423-2425	(0.05)	4423-4425
CELL RECOND LO VOLT	(0.0)	2426-2430	(0.0)	4426-4430
ROOM TEMP	(30.0)	2431-2433		
BATT FAULT LIMIT			(0.059	4431-4433
TEMP ERROR	(0.000)	2434-2436		
TEMP HI ERROR	(0.321)	2437-2441		
TEMP LO ERROR	(29.121)	2442-2444		
CAPTST 1.0V LIM>	(1.0)	2445-2447	(1.0)	4445-4447

```
30.0    2057; 6000; 0000
168.0   2105; 2000; 0000
165.0   2105; 1200; 0000
123.0   2077; 5400; 0000
121.0   2077; 4400; 0000
30.8    2057; 0314; 6314
24.2    2056; 1463; 1463
1.5     2016; 0000; 0000
1.0     2014; 0000; 0000
.2      1766; 3146; 3146
0.0     0000; 0000; 0000
35.0    2064; 3000; 0000
0.321   1775; 1055; 0345
29.121  2057; 2173; 7166
97.0    2076; 0400; 0000
1.55    2016; 1463; 1413
0.05    1746; 3146; 3200
```

APPENDIX B

LOCATION	INSTRUCTION	CHARACTER	LOCATION	INSTRUCTION	CHARACTER
401	0302	B	444	0327	W
402	0301	A	445	0310	H
403	0324	T	446	0317	O
404	0240	sp	447	0240	sp
405	0240	sp	450	0240	sp
406	0317	O	451	0320	P
407	0322	R	452	0320	P
410	0302	B	453	0307	G
411	0311	I	454	0240	sp
412	0324	T	455	0305	E
413	0240	sp	456	0306	F
414	0240	sp	457	0306	F
415	0240	sp	460	0240	sp
416	0240	sp	461	0240	sp
417	0240	sp	462	0302	B
420	0323	S	463	0301	A
421	0325	V	464	0324	T
422	0316	N	465	0240	sp
423	0323	S	466	0324	T
424	0305	E	467	0305	E
425	0324	T	470	0315	M
426	0240	sp	471	0320	P
427	0240	sp	472	0240	sp
430	0240	sp	473	0240	sp
431	0240	sp	474	0302	B
432	0240	sp	475	0320	P
433	0304	D	476	0257	/
434	0303	C	477	0322	R
435	0310	H	500	0303	C
436	0240	sp	501	0240	sp
437	0240	sp	502	0327	W
440	0320	P	503	0310	H
441	0320	P	504	0240	sp
442	0307	G	505	0240	sp
443	0340	sp	506	0240	sp

APPENDIX B

LOCATION	INSTRUCTION	CHARACTER	LOCATION	INSTRUCTION	CHARACTER
507	0302	B	552	0311	I
510	0301	A	553	0240	sp
511	0324	T	554	0303	C
512	0240	sp	555	0326	V
513	0301	A	556	0255	-
514	0310	H	557	0255	-
515	0317	O	560	0303	C
516	0240	sp	561	0316	N
517	0240	sp	562	0317	O
520	0240	sp	563	0255	-
521	0322	R	564	0255	-
522	0306	F	565	0301	A
523	0240	sp	566	0326	V
524	0240	sp	567	0240	sp
525	0240	sp	570	0303	C
526	0240	sp	571	0326	V
527	0302	B	572	0240	sp
530	0301	A	573	0240	sp
531	0324	T	574	0314	L
532	0240	sp	575	0317	O
533	0327	W	576	0240	sp
534	0310	H	577	0303	C
535	0317	O	600	0326	V
536	0240	sp	601	0255	-
537	0240	sp	602	0255	-
540	0302	B	603	0303	C
541	0301	A	604	0316	N
542	0324	T	605	0317	O
543	0240	sp	606	0255	-
544	0305	E	607	0255	-
545	0306	F	610	0301	A
546	0306	F	611	0326	V
547	0240	sp	612	0240	sp
550	0240	sp	613	0303	C
551	0310	H	614	0326	V

APPENDIX B

LOCATION	INSTRUCTION	CHARACTER	LOCATION	INSTRUCTION	CHARACTER
615	0303	C	660	0320	P
616	0310	H	661	0240	sp
617	0307	G	662	0240	sp
620	0240	sp	663	0240	sp
621	0305	E	664	0240	sp
622	0306	F	665	0240	sp
623	0306	F	666	0240	sp
624	0240	sp	667	0240	sp
625	0240	sp	670	0240	sp
626	0303	C	671	0240	sp
627	0310	H	672	0240	sp
630	0307	G	673	0240	sp
631	0240	sp	674	0240	sp
632	0324	T	675	0305	E
633	0305	E	676	0240	sp
634	0315	M	677	0317	O
635	0302	P	700	0240	sp
636	0240	sp	701	0303	C
637	0240	sp	702	0240	sp
640	0322	R	703	0324	T
641	0305	E	704	0311	I
642	0307	G	705	0315	M
643	0244	sp	706	0305	E
644	0305	E	707	0240	sp
645	0306	F	710	0240	sp
646	0306	F	711	0240	sp
647	0240	sp	712	0240	sp
650	0240	sp	713	0240	sp
651	0322	R	714	0240	sp
652	0305	E	715	0240	sp
653	0307	G	716	0240	sp
654	0240	sp	717	0240	sp
655	0324	T	720	0240	sp
656	0305	E	721	0240	sp
657	0315	M	722	0240	sp

APPENDIX C

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* BM
* Assigned Storage
FA:   BSS      1          BATT 1 Flags
FB:   BSS      1          BATT 2 Flags
      IFF      4               IDVM/Scanner Setup
CH:   BSS      1          Chan. No.
FU:   BSS      1          Function (DC or OHMS)
RA:   BSS      1          Range (1000mv, 10v, 100v, 1000v)
      2                  Resolution (.01%)
SR:   BSS      1          Switch Register Storage
      IFF      15              Type Indicator Storage
TP:   T1
T1:   BSS      14
TF:   BSS      1          "OK TO TYPE" Flag
I1:   BSS      1          Auto Index Address Pointer
CA:   0160                No. Of Cells In BATT 1 (112)
CB:   0130                No. Of Cells In BATT 2 (88)
CC:   4                   No. Of Modules In BATT 1
CD:   4                   No. Of Modules In BATT 2
      IFF      4               Time And Data Temporary
                               Storage
H1:   BSS      1          Days      Orbit No.  Chan. No.
H2:   BSS      1          Hours     Orbit No.  Data Word 1
H3:   BSS      1          Minutes   Minutes    Data Word 2
H4:   BSS      1          Seconds   Seconds    Data Word 3
C1:   BSS      1          "BATT Flags" Temporary Storage
C2:   BSS      1          "BATT No." Temporary Storage
C3:   BSS      1          "No. Of Cells" Temporary Storage
C4:   BSS      1          "No. Of Modules" Temporary Storage
SF:   BSS      1          "USE SUNSET TIME" Flag
PF:   BSS      1          "PRINT" Flag
      IFF      3
A:    BSS      3          Temporary Flt. Pt. Storage
TO:   BSS      1          "CAPACITY TEST OVER" Flag
DC:   BSS      1          Temporary Storage
C:    BSS      1          "First Chan No." Storage
      IFF      13
FP:   FC
FC:   1111; 1111; 1111; 1111; 1111;
      1111; 1111; 1111; 1111; 1111
TE:   BSS      1          Temporary Storage
```

```
*START OF MAIN OPERATING PROGRAM

      EXT       THERMO
      ENTRY     BM
BM:   CALL      0,\OP         Initialize System
      NOP
      CLA
      CALL      2,CLOSE
      PAR       =2
      JMS       WA
      CALL      2,CLOSE
      PAR       =D12
      JMS       WA
      CALL      2,CLOSE
      PAR       =D13
      JMS       WA
      CALL      2,CLOSE       Reset All
      PAR       =D14          Acknowledge Status
      JMS       WA            Signals
      CALL      2,CLOSE
      PAR       =D32
      JMS       WA
      CALL      2,CLOSE
      PAR       =D33
      JMS       WA
      CALL      2,CLOSE
      PAR       =D34
      JMS       WA
      CALL      2,CLOSE
      PAR       =4
      JMS       WA
      TAD       FA
      AND       =1777         Clear BATT Flags Of "1.0 VOLT. REACHED"
      DCA       FA            And "CAPTEST COMPLETE" Flags
      TAD       FB
      AND       =1777
      DCA       FB
      DCA       TO            Clear "CAPTEST OVER" flag
      CLA
B1:   LAS                     Load Switch Reg. Into Accum.
      DCA       SR            Store In "SR"
      CALL      2,CLOSE       Reset Switch Closures
      PAR       =0
      JMS       WA            Go Wait
      TAD       FA
      AND       =7077         Clear "PRINT REQUESTS"
      DCA       FA            From BATT 1 Flags
      TAD       FB
      AND       =7077         Clear "PRINT REQUESTS"
      DCA       FB                From BATT 2 Flags
      TAD       SR            Get "SR"
```

```
        AND     =3000       Mask Out All But BATT No.
        SNA                 Set?
        JMP     B3          No, Go Check For "HOLD"
        AND     =2000       Yes, Mask For BATT 2
        SNA                 BATT 2 Requested?
        JMP     B2          Yes, Go Merge Print Flags
        CLA                     For BATT 2
*SET-UP TO MERGE PRINT
        TAD     SR          Get "SR"
        AND     =0700       Mask Out All But "PRINT REQUESTS"
        DCA     C1          Store In "C1"
        TAD     FA          Get BATT 1 Flags
        AND     =7077       Mask Out Old "PRINT REQUESTS"
        TAD     C1          Add In New "PRINT REQUESTS"
        DCA     FA          Redeposit BATT 1 Flags
*HOLD TEST SET-UP
B3:     TAD     =D399       Load For Chan. 399
        DCA     CH          Set Up IDVM/Scanner
        TAD     =1              Control
        DCA     FU
        TAD     =4
        DCA     RA
        CALL    1,VIDAR     Initialize Acquisition
        PAR     CH
        TAD     =330        Set Pointer
        DCA     10          For Flt. Pt. 2.5
        JMS     D3          Go Get It
        CALL    1,\STO      Store In "A"
        PAR     A
        CALL    0,VRSLT     Get Data
        CLA                 Clear Accumalator
        CALL    1,\FSB      Subtract 2.5
        PAR     A
        TAD     0020        Get Sign Of Result
        SMA+CLA             Is "HOLD" On ?
        JMP     B4          Yes Go "HOLD" Branch
        TAD     SR          Get Switch Reg. Storage
        AND     =3703       Mask Out "HALT" Bit
        DCA     SR          Redeposit
*SET-UP TO GET CONTROL INFORMATION
        TAD     =D192       Load For Chan 192
        DCA     CH
        JMS     FS          Go Set Flags
        TAD     FA          Get BATT 1 Flag Storage
        AND     =6700       Mask Out Old "CONTROL" Flags
        TAD     C1          Merge In New "CONTROL" Flags
        DCA     FA          Redeposit Flag Word
        TAD     =D392       Load For Chan 392
        DCA     CH
        JMS     FS          Go Set Flags
        TAD     FB          Get BATT 2 Flag Storage
```

```
        AND     =6700       Mask Out Old "Control" Flags
        TAD     C1          Merge In New "Control" Flags
        DCA     FB          Redeposit
        TAD     =D199       Load For Chan 199
        DCA     CH
        CALL    1,VIDAR     Initialize Acquisition
        PAR     CH
        CALL    0,VRSLT     Get Data
        CLA
        CALL    1,\FSB      Subtract 2.5
        PAR     A
        TAD     0020        Get Sign Of Result
        SMA+CLA             Is "SCAN START" On
        JMP     SC          Yes, Go Scanning Branch
        TAD     FA          No, Get BATT 1 Flags
        DCA     C1          Store In "C1"
        TAD     CA          Get "No. Of Cells" For BATT 1
        DCA     C3          Store In "C3"
        TAD     =1          Load 1 For BATT 1
        DCA     C2          Store In "C2"
        TAD     =1000       Set Pointer For BATT 1
        DCA     I1              Storage
        JMS     FT          Go Flag Test
        TAD     C1          Get BATT Flags
        DCA     FA          Store In BATT 1 Flags
        TAD     FB          Get BATT 2 Flags
        DCA     C1          Store In "C1"
        TAD     CB          Get No. Of Cells For BATT 2
        DCA     C3          Store In "C3"
        TAD     =2          Load 2 For BATT 2
        DCA     C2          Store In "C2"
        TAD     =3000       Set Pointer For BATT 2
        DCA     I1
        JMS     FT          Go Flag Test
        TAD     C1          Get Flags
        DCA     FB          Deposit As BATT 2 Flags
        TAD     TF          Get "OK TO TYPE" Flag
        SNA+CLA             Is It Set?
        JMP     B1          No, Return To Beginning
B6:     TAD     T1          Yes, Get Next Type Indicator
        SZA+CLA             Typing Desired?
        JMP     B7          Yes, Go Type
        CLA                 No,
        DCA     TF          Clear "OK TO TYPE" Flag
        JMP     B1          Return To Beginning
* GO PRINT A LINE
B7:     CALL    1,TY        Go Type A Line
        PAR     T1
        CLA
        DCA     TF          Clear "OK TO TYPE" Flag
        JMP     B1          Return To Beginning
```

```
* SET UP TO MERGE BATT 2
B2:  CLA
     TAD       SR          Get "Switch Reg." Storage
     AND       =0700       Mask Out All But "PRINT REQUESTS"
     DCA       C1          Deposit Results In C1
     TAD       FB          Get BATT 2 Flags
     AND       =7077       Mask Out Previous "PRINT FLAGS"
     TAD       C1          Merge "PRINT REQUESTS"
     DCA       FB          Redeposit BATT 2 Flags
     JMP       B3          Return To Main Program
* SYSTEM ON HOLD OPTION
B4:  CALL      0,\CK       Wait For All Typing To Finish
     TAD       SR          Get "SR"
     SPA                   Halt Requested?
     HLT                   Yes, Halt
     TAD       =4000       No, Add "HOLD" Flag
     DCA       SR          Redeposit In Switch Reg Storage
     TAD       SR          Reload Switch Reg. Storage
     AND       =0700       Mask All But "PRINT REQUESTS"
     SZA+CLA               Print Requested?
     JMP       SC          Yes Go Scanning Branch
     TAD       =1          No, Set "OK TO TYPE" Flag
     DCA       TF
     JMP       B6          Return To Main Program
```

```
*PROGRAM BRANCH TO SCAN DATA
SC:   CALL      2,CLOSE     Acknowledge "Scan Start"
      PAR       =2
      JMS       WA          Go Wait
      CLA
      TAD       =1          Set "OK TO TYPE" Flag
      DCA       TF
      JMS       SS          Go Get Time And Pet's
      TAD       =D192       Set Up For BATT 1
      DCA       CH
      JMS       FS          Go Set BATT 1 Flags
      TAD       FA
      AND       =6700       Clear Control Flags
      TAD       C1          Add In New Control Flags
      DCA       FA          Redeposit Flags
      TAD       =D392       Set Up For BATT 2
      DCA       CH
      JMS       FS          Go Set BATT 2 Flags
      TAD       FB
      AND       =6700       Clear Control Flags
      TAD       C1          Add In New Control Flags
      DCA       FB          Redeposit Flags
      TAD       FA          Get BATT 1 Flags
      DCA       C1          Store In "C1"
      TAD       =1          Load 1 For BATT 1
      DCA       C2          Store In "C2"
      TAD       =1000       Set Pointer For BATT 1
      DCA       I1
      TAD       C1          Get BATT Flags
      AND       =0700       Mask Out All But "PRINT REQUESTS"
      SZA+CLA               Print Requested?
      JMS       HD          Yes, Go Print Header
      DCA       17          Set Starting Chan For BATT 1
      JMS       OD          Go Scan Orbit Data
      TAD       FB          Get BATT 2 Flags
      DCA       C1          Store In "C1"
      TAD       =2          Load 2 For BATT 2
      DCA       C2          Store In "C2"
      TAD       =3000       Set Pointer For BATT 2
      DCA       I1
      TAD       C1          Get Flags
      AND       =0700       Mask Out All But "PRINT REQUESTS"
      SZA+CLA               Print Requested?
      JMS       HD          Yes, Go Print Header
      TAD       =D200       Set Starting Chan. For BATT 2
      DCA       17
      JMS       OD          Go Scan Orbit Data
      TAD       FA          Get BATT 1 Flags
      DCA       C1          Store In "C1"
      TAD       =1          Load 1 For BATT 1
      DCA       C2          Store In "C2"
```

```
TAD       =1000      Set Pointer For BATT 1
DCA       I1
DCA       17         BATT 1 Starting Chan.
TAD       CA         Get "No. Of Cells"
DCA       C3         Store In "C3"
TAD       CC         Get "No. Of Modules"
DCA       16         Store In "16"
TAD       SR         Get "SR"
AND       =0001      Mask For ICMR
SZA+CLA              ICMR Requested?
JMS       IT         Yes, Go Record Orbit Data
JMS       VD         Go Scan Voltage Data
JMS       BF         Go Test Battery Fault
TAD       C1         Get BATT Flags
DCA       FA         Redeposit In BATT 1 Flags
JMS       TD         Go Scan Temp Data For BATT 1
TAD       FB         Get BATT 2 Flags
DCA       C1         Store In "C1"
JMS       IZ         Go Test For ICMR EOF
TAD       =2         Load 2 For BATT 2
DCA       C2         Store In "C2"
TAD       =3000      Set Pointer For BATT 2
DCA       I1
TAD       =D200      Set Starting Chan. For Cell 1
DCA       17             BATT 2
TAD       CB         Get No. Of Cells
DCA       C3         Store In "C3"
TAD       CD         Get No. Of Modules
DCA       16         Store In "16"
TAD       SR         Get "SR"
AND       =0002      Mask For ICMR
SZA+CLA              ICMR Requested?
JMS       IT         Yes, Go Record On ICMR
JMS       VD         Go Scan Voltage Data
JMS       BF         Go Test Battery Fault
TAD       C1         Get BATT Flags
DCA       FB         Redeposit In BATT 2 Flags
JMS       TD         Go Scan Temp Data For BATT 2
TAD       =2
DCA       FU         Set Range and Function
TAD       =5         For Room Temp.
DCA       RA
TAD       =D170      Set Scanner For Room Temperature
DCA       CH
CALL      1,VIDAR    Initialize Acquisition
PAR       CH
CALL      0,VRSLT    Get Data
DCA       H1         Store Chan No. In "H1"
CALL      0,\T       Change Sign Of Data
JMS       TX         Go Verify Data Within Limits
CALL      1,INTL1    Convert Data To Degrees
```

```
      AND       THERMO
      CALL      1,\STO      Store Results In "H2-H4"
      PAR       H2
      TAD       =2430       Set Auto Ind. To Room
      DCA       10              Temperature Limit
      JMS       D3          Go Get It
      CALL      1,\FSB      Subtract Current Temperature
      PAR       H2
      TAD       0020        Get Sign Of Results
      SPA+CLA               Too Hi?
      JMS       ER          Yes Go Error Routine
      TAD       SR          No, Get Switch Reg. Storage
      AND       =0100       Mask All But Temperature Print
      SZA+CLA               Print Requested?
      JMS       PR          Yes, Go Print
      JMS       IS          Go Test ICMR Request
      JMS       IZ          Go Test For ICMR EOF
      JMP       B6          No, Return To Main Program
* BF (Battery FFault Test)
* SUBROUTINE TO TEST FOR BATTERY FAULT CURRENT
BF:   BSS       1           Return Address
      TAD       =D171       Set Scanner To Fault Chan.
      TAD       17
      DCA       CH
      TAD       =4          Set Range
      DCA       RA
      CALL      1,VIDAR     Initiate Acquisition
      PAR       CH
      CALL      0,VRSLT     Get Data
      DCA       H1          Store Chann No. In "H1"
      TAD       0020        Get Sign Of Data
      AND       =3777       Take Absolute Value
      DCA       0020        Redeposit
      CALL      1,\STO      Store Data In "H2-H4"
      PAR       H2
      TAD       =4430       Set Pointer To Limit
      DCA       10
      JMS       D3          Get It
      CALL      1,\FSB
      PAR       H2          Subtract Data
      TAD       0020        Get Sign Of Results
      SPA+CLA               Over Limit?
      JMS       ER          Yes, Go Error
      JMS       IS          Go ICMR Test
      JMP*      BF          Return
* ROUTINE TO TEST FOR AND WRITE EOF
IZ:   BSS       1           Return Address
      TAD       SR          Get "SR"
      AND       C2          Mask To BATT No.
      SNA+CLA               Set?
      JMP*      IZ          No, Return
```

```
CMA                         Complement Accum.
CALL      0,\IMR            Write EOF Gap
JMP*      IZ                Return
```

```
* RS (RESET) ROUTINE TO RESET ORBIT DATA STORAGE
RS:   BSS     1          Return Address
      TAD     I1         Set Auto Index To
      DCA     10             Starting Address
      TAD     =1103      Load 1102
      CIA                Compliment
      DCA     H1         Store in "H1"
      CALL    0,\CL      Put Zeros In FPAC
RZ:   JMS     U1         Store Zero
      ISZ     H1         Last Storage?
      JMP     RZ         No, Do Again
      TAD     =1403      Set Pointer For A Hi Limit
      JMS     IB           Put It In FPAC
      TAD     =0044      Set Pointer For Low
      TAD     I1              Value Storage
      DCA     10
      TAD     =-5        Set Counter "H1"
      DCA     H1              For -5
      JMS     RL         Go Store In Lo Value Storage
      TAD     =0200      Set Pointer For Next
      TAD     I1              Group
      DCA     10
      TAD     =-D12      Set Counter H1
      DCA     H1               For -12
      JMS     RL         Go Store In Lo Value Storage
      JMP*    RS         Return
IA:   BSS     1
      TAD     I1
      DCA     10         Move Data From
      JMS     U3         Bank 1 To Bank 2
      JMP*    IA
IB:   BSS     1
      TAD     I1
      DCA     10         Move Data From
      JMS     D3         Bank 2 To Bank 1
      JMP*    IB
*SUB LOOP TO STORE HI VALUES
RL:   BSS     1          Return Address
RB:   JMS     U3         Store Limit
      ISZ     H1         Last Storage
      JMP     RB         No, Do Again
      JMP*    RL         Yes, Return
```

```
*FS (SET FLAGS) ROUTINE
*ROUTINE TO AQUIRE CONTROL DATA AND SET BATT. FLAGS
FS:   BSS      1          Return Address
      CLA
      TAD      =1         Set Function
      DCA      FU         To Volts.
      TAD      =-7        Set Counter "C2" To -7
      DCA      C2
      DCA      C1         Zero "C1"
      CALL     1,VIDAR    Initialize Acquisition
      PAR      CH
SA:   ISZ      CH         Increment Chan. No.
      CALL     0,VRSLT
      CLA
      CALL     1,VIDAR    Initialize Acquisition
      PAR      CH
      CALL     1,\FSB     Subtract 2.5
      PAR      A
      CLA+CLL
      TAD      0020       Get Sign Of Results
      SMA+CLA             Is Control Signal On
      STL                 Yes, Set Link
      TAD      C1         Get Flag Word
      RAR                 Rotate Link & Accum Right 1 Bit
      DCA      C1         Redeposit In "C1"
      ISZ      C2         Last Control Chan.?
      JMP      SA         No, Do Again
      TAD      C1         Yes Get "C1"
      RTR                 Rotate 6 Bits Right
      RTR
      RTR
      SZL                 Is Disconnect On?
      TAD      =1000      Yes, Set Flag
      AND      =1077      Mask Out Print Format Bits
      DCA      C1         Redeposit Flags
      CALL     0,VRSLT    Clr. VRSLT Routine
      CALL     0,\CL      Clr. FPAC
      CLA
      JMP*     FS         Return
```

```
*SS (SUNSET TIME)
*ROUTINE TO GET SCAN TIME AND PET
SS:   BSS      1          Return Address
      CLA
      CALL     2,CLOSE    Close "T.O.Y." Switch
      PAR      =1
      JMS      WA         Go Wait
      CALL     1,HTIME    Get "T.O.Y." And Store
      PAR      H1               In "H1-H4"
      CLA
      TAD      =0200      Set Pointer To Store Time
      DCA      10
      JMS      ST         Go Store Time
      TAD      SF         Get "SUNSET TIME" Flag
      AND      =0003      Mask For BATT No.
      SNA                 Is It Set
      JMP      SU         No, Continue
      AND      =0001      Yes, Mask For BATT 1
      SNA+CLA             BATT 1?
      JMP      SN         No, Go Do BATT 2
      TAD      =2204      Set Pointer For
      DCA      10               "BATT 1 SSTIME" Sto.
      JMS      ST         Go Store Time As SSTIME
      TAD      SF         Get "SUNSET TIME" Flag
      AND      =0002      Mask All But BATT 2 No.
      DCA      SF
      TAD      SF
      AND      =0002
      SZA+CLA             BATT 2?
      JMP      SN         Yes, Do BATT 2
SU:   CALL     2,CLOSE    Close Switch For
      PAR      =D11             "BATT 1 P.E.T."
      JMS      WA         Go Wait
      CALL     1,HTIME    Get "BATT 1 P.E.T."
      PAR      H1         And Store In "H1-H4"
      CLA
      TAD      =-D99      Test Last Two Digits
      TAD      H2         In Orbit Count For 99
      SMA+CLA             99?
      JMS      SY         Yes, Go Adjust First Three
      TAD      H2         Adjust For Current Orbit No.
      TAD      =1
      DCA      H2
      TAD      H2         Get Last Two Digits
      CALL     0,BNBCD    Convert To BCD
      AND      =0017      Mask All But Last Digit
      SNA+CLA             Zero?
      JMS      IF         Yes, Go Set ICMR Flag
      TAD      =2200      Set Pointer For
      DCA      10               "BATT 1 P.E.T." Sto.
      JMS      ST         Go Store P.E.T.
```

```
        CALL    2,CLOSE     Close Switch For
        PAR     =D31                "BATT 2 P.E.T."
        JMS     WA          Go Wait
        CALL    1,HTIME     Get "BATT 2 P.E.T."
        PAR     H1          And Store In "H1-H4".
        CLA
        TAD     =-D99       Test Last Two Digits
        TAD     H2          In Orbit Count For 99
        SMA+CLA             99?
        JMS     SY          Yes, Go Adjust First Three
        TAD     H2          Adjust For Current Orbit No.
        TAD     =1
        DCA     H2
        TAD     H2          Get Last Two Orbit Count Digits
        CALL    0,BNBCD     Convert To BCD
        AND     =0017       Mask To Last Digit
        SNA+CLA             Zero
        JMS     IG          Yes, Go Set ICMR Flag
        TAD     =4200       Set Pointer For
        DCA     10                  "BATT 2 P.E.T." Storage
        JMS     ST          Go Store P.E.T.
        CLA
        DCA     SF          Clear "SUNSET TIME" Flag
        JMP*    SS          Return
SN:     TAD     =4204       Set Pointer For
        DCA     10                  "BATT 2 SSTIME" Sto.
        JMS     ST          Go Store Time As SSTIME
        DCA     SF          Clear "SUNSET TIME" Flag
        JMP     SU          Continue
*SUBROUTINE TO STORE TIME OR P.E.T.
ST:     BSS     1           Return Address
        TAD     H1
        DCA     0020        Load "H1-H3" In FPAC
        TAD     H2
        DCA     0021
        TAD     H3
        DCA     0022
        JMS     U3          Store In Bank 2
        TAD     "H4"        Load "H4" In FPAC
        DCA     0020
        JMS     U1          Store In Bank 2
        JMP*    ST          Return
* SUBROUTINE TO OVERFLOW ORBIT COUNT
SY:     BSS     1           Return Address
        ISZ     H1          Add To First Three Digits
        TAD     =-1         Adjust Last Two Digits
        DCA     H2
        JMP*    SY          Return
* SUBROUTINE TO SET UP BATT 1 ICMR RECORDING
IF:     BSS     1           Return Address
        TAD     C1          Get BATT Flags
```

```
      AND       =1000       Mask For "HOLD"
      SZA+CLA               In HOLD?
      JMP*      IF          Yes, Return
      TAD       SR          Get "SR"
      AND       =7702       Mask Out Old Flag
      TAD       =0001       Set Flag
      DCA       SR          Redeposit "SR"
      JMP*      IF          Return
* SUBROUTINE TO SET UP BATT 2 ICMR RECORDING
IG:   BSS       1           Return Address
      TAD       C1          Get BATT Flags
      AND       =1000       Mask For "HOLD"

      SZA+CLA               In "HOLD"?
      JMP*      IF          Yes, Return
      TAD       SR          Get "SR"
      AND       =7701       Mask Out Old Flag
      TAD       =0002       Set Flag
      DCA       SR          Redeposit "SR"
      JMP*      IG          Return
```

```
*PR (PRINT A LINE)
*ROUTINE TO PRINT A LINE OF DATA (CHAN NO. AND VALUE)
PR:   BSS      1          Return Address
      CLA
      TAD      H1         Load Chan No.
      CALL     0,BNBCD    Convert To BCD
      CALL     0,\PTP     Load First Print Call (CCC)
      CALL     0,\CL      Clear FPAC
      CALL     1,\FAD     Put Results In FPAC
      PAR      H2
      CALL     0,FPBCD    Convert To BCD
      TAD      0020       Get Sign Word
      SMA+CLA             Sign Neg.?
      TAD      =-1        No, Add -1
      TAD      =5254      Add Spacing
      CALL     0,\PTP     Load Second Print Call (..±)
      TAD      0020       Get First Word
      RTL                 Rotate Into Position
      RTL
      AND      =7760      Mask Out Sign
      DCA      DC         Deposit Into Temporary Storage
      TAD      0021       Get 2nd Word
      RTR
      RTR                 Rotate Into Position
      RTR
      RTR
      AND      =0017      Mask Out Bits 0-7
      TAD      DC         Add In 1st Word
      CALL     0,\PTP     Load Third Print Call (xxx)
      TAD      0021       Get 2nd Word
      RTL
      RTL                 Rotate Into Position
      AND      =7760      Mask Out Bits 8-11
      DCA      DC         Store In "DC"
      TAD      0022       Get 3rd Word
      RTR
      RTR                 Rotate Into Position
      RTR
      RTR
      AND      =0017      Mask Out All But Bits 8-11
      TAD      DC         Add To "DC"
      CALL     0,\PTP     Load Fourth Print Call
      TAD      0022       Get 3rd Word
      AND      =0377      Mask Out Bits 0-3
      DCA      DC         Deposit In "DC"
      TAD      0020       Add First Word
      AND      =2000      Mask All But Exponent Sign
      SZA+CLA                  Plus?
      TAD      =0400      Yes Add 1
      TAD      =5400      No, Add 11
      TAD      DC         Add Exponent Value
```

```
CALL      0,\PTP      Load Fifth Print Call
TAD       =5000       Add Space
CALL      0,\PTP      Load Sixth Print Call And
                            Print Line
CALL      0,\CK
JMP*      PR          Return
```

```
*FT (FLAG TEST)
*ROUTINE TO TEST BATT. FLAGS
FT:   BSS      1          Return Address
      TAD      C1         Get BATT Flags
      AND      =1000      Mask All But "BATT DISCONNECTED" Flag
      SZA+CLA             Disconnected?
      JMP*     FT         Yes, Return
      TAD      C1         Get Flags
      AND      =0004      Mask Out All But Capacity
                               Test Flag
      SZA+CLA             On?
      JMP      CT         Yes, Go Captest Branch
      TAD      C1         Get Flags
      AND      =1777      Mask Out "1.0v RCHD" And
                               "BPRC ACKLDG" Flags
      DCA      C1
      TAD      C1         Restore Flags
      AND      =0002      Mask Out All But "ORBIT
                               COMPLETE" Flag
      SZA+CLA             On?
      JMP      OL         Yes, Go Orbit Complt. Branch
      TAD      C1         No, Restore Flags
      AND      =0001      Mask Out All But "NIGHT
                               COMPLETE" Flag
      SZA+CLA             On?
      JMP      NC         Yes, Go Night Complt. Branch
      TAD      C1         Restore Flags
      AND      =1777      Mask Out "BPRC ACKLDG" Flag
                          and "1.0 V LIMIT REACHED" Flag
      DCA      C1         Redeposit Flags
      TAD      C2         Get BATT No.
      TAD      =-1        Adjust
      CALL     2,\MPY     Multiply By 20
      PAR      =D20
      TAD      =D13       Add 13
      DCA      DC         Store Results In "DC"
      CALL     1,CLOSE    Close "BPRC Acknowledge" Switch
      PAR      DC
      JMS      WA         Go Wait
      JMP*     FT         Return
*SUBROUTINE FOR CAPTIST FLAG SET
CT:   TAD      TO         Get "CAPTEST OVER" Flag
      SNA+CLA             Set?
      JMP*     FT         No, Return
      TAD      C1         Yes, Get Flags
      AND      =2000      Mask All But "BPRC ACKLDG"
                               Flag
      SZA+CLA             Set?
      JMP*     FT         Yes, Return
      TAD      C2         No, Get BATT No.
      TAD      =-1        Adjust
```

```
        CALL    2,\MPY      Multiply By 20
        PAR     =D20
        TAD     =D13        Add 13
        DCA     DC          Store Results In "DC"
        CALL    1,CLOSE     Close "BPRC Acknowledged" Switch
        PAR     DC
        JMS     WA          Go Wait
        TAD     C1
        AND     =5777       Mask Out "BPRC ACKLDG"
                                Flag"
        TAD     =2000       Set "BPRC ACKLDG" Flag
        DCA     C1          Redeposit Flags
        TAD     =0200
        DCA     10          Set Pointer
        JMS     D3          Get 1st Part Of Scan Time
        TAD     =1174       Set Pointer For "E.O.C." Storage
        JMS     IA          Store It
        TAD     =0203       Set Pointer For Last
        DCA     10              Of Scan Time
        JMS     D1          Get It
        TAD     =1177       Set Pointer For Last Of
        TAD     I1          "E.O.C." Storage
        DCA     10
        JMS     U1          Store It
        DCA     TO          Clear"CAPTEST COMPLETE" Flag
        JMP     OK          Go Complete Branch
*SUBROUTINE FOR ORBIT COMPLETE FLAG SET
OL:     TAD     TP          Get "TYPE" Pointer
        DCA     H1          Store In "H1"
        TAD     =-7         Set "H2" To -7
        DCA     H2
OY:     TAD*    H1          Get "Type" Indicator
        SNA+CLA             Is It Set?
        JMP     OX          No, Try Next One
        TAD*    H1
        AND     =0003       Mask All But BATT No.
        CIA                 Compliment It
        TAD     C2          Add Current BATT No.
        SNA+CLA             Same?
        JMP*    FT          Yes, Return
        ISZ     H1          Increment "H1"
        ISZ     H2          Increment "H2"
        JMP     OY          Try Next Indicator
OX:     TAD     C2          Get "BATT No.
        TAD     SF          Add To "SSTIME" Flag
        DCA     SF          Redeposit As "SSTIME" Flag
OK:     TAD     C2          Get BATT No.
        TAD     =-1         Adjust
        CALL    2,\MPY      Multiply By 20
        PAR     =D20
        TAD     =D12        Add 12
```

```
        DCA     DC          Store In "DC"
        CALL    1,CLOSE     Close "Orbit Complete Ackldg"
                                Switch
        PAR     DC
        JMS     WA          Go Wait
        JMS     AC          Go Calculate Orbit Data
*SET UP TYPE POINTERS
OG:     TAD     C2          Get BATT No.
        TAD     =4000       Set Bit 0 And BATT No.
        DCA     CH          Storage In CH
        TAD     C2          Get BATT No.
        TAD     =2000       Set Bit 1 And BATT No.
        DCA     FU          Storage In FU
        TAD     C2          Get BATT No.
        TAD     =1000       Set Bit 2 And BATT No.
        DCA     RA          Dep. In RA.
*STORE TYPE INDICATORS
        TAD     TP          Get "TYPE INDICATOR" Pointer
        DCA     H1          Storage In "H1"
        TAD     =-7           Set "H2" To -7
        DCA     H2
OH:     TAD*    H1          Get "TYPE INDICATOR"
        SNA+CLA             Is It Loaded
        JMP     OI          No, Go Fill It
        ISZ     H2          Yes, Last Type Ind.?
        SKP                 No, Skip Next Instruction
        JMP     OJ          Yes, Get Out Of Routine
        ISZ     H1          Incrmnt Type Ind. Address
        JMP     OH          And Go Again
*FILL TYPE INDICATORS
OI:     TAD     CH          Get 1st Type Ind
        DCA*    H1          Store In First Open Ind.
        ISZ     H1          Incrmnt Address
        TAD     FU          Get 2nd Type Ind.
        DCA*    H1          Sto. In 2nd Open Ind.
        ISZ     H1          Incrmnt Address
        TAD     RA          Get 3rd Type Ind.
        DCA*    H1          Sto In 3rd Open Ind.
OJ:     JMS     RS          Go Reset Storage
        JMP*    FT          Return
*NIGHT COMPLETE ADKNOWLEDGE
NC:     TAD     C2          Get BATT No.
        TAD     =-1         Adjust
        CALL    2,\MPY      Multiply By 20
        PAR     =D20
        TAD     =D14        Add 14
        DCA     H1          Store In H1
        CALL    1,CLOSE     Close "Nght Complete Acknowledge"
                                Switch
        PAR     H1
        JMS     WA          Go Wait
```

```
*ADD NIGHT CALCULATIONS HERE IF ANY ARE REQUIRED
      JMP*      FT          Return
```

```
*ER (ERROR)
*ROUTINE TO INITIATE SHUTDOWN DUE TO OUT OF LIMIT CONDITIONS
ER:   BSS      1          Return Address
      TAD      C1         Get Flags
      AND      =1000      Mask All But "BATT DISCONNECTED" Flag
      SZA+CLA             Set?
      JMP*     ER         Yes, Return
      TAD      C2         Get BATT No.
      TAD      =-1        Adjust
      CALL     2,\MPY     Multiply By 5
      PAR      =5
      TAD      FP         Add First "Faulty Chan."
                            Storage
      DCA      DC         Deposit Address In "DC"
      TAD      =-5        Set Counter To -5
      DCA      TE
ES:   TAD*     DC         Get Faulty Chan. No.
      CIA                 Compliment It
      TAD      H1         Add Current Chan. No.
      SNA+CLA             Agree?
      JMP*     ER         Yes, Skip Error Routine
      ISZ      DC         No, Increment Fauty Chan.
                            Storage
      ISZ      TE         Last Storage
      JMP      ES         No, Go Again
      TAD      17         Yes, Get Starting Chan No.
      CIA                 Compliment It
      TAD      H1         Add Current Chan. No.
      SNA+CLA             Agree?
      JMP      EV         Yes, Go BATT Volt. Error
                            Branch
      TAD      =D170      Set Room Temperature Chan. No.
      CIA                 Compliment
      TAD      H1         Add Error Chan. No.
      SNA+CLA             Agree
      JMP      EY         Yes, Go Room Temperature Error
                            Branch
      TAD      17         No, Get Starting Chan. No.
      TAD      =D112      Add Last Cell Volt.
      CIA                 Compliment It
      TAD      H1         Add Current Error Chan.
      SPA+CLA             Cell Error
      JMP      EW         Yes, Go Cell Error Branch
      TAD      17         No, Get Starting Chan. No.
      TAD      =D140      Add Last Mod. Volt. Chan No.
      CIA                 Compliment
      TAD      H1         Add Error Chan.
      SPA+CLA             Less?
      JMP      EX         Yes, Go Mod. Volt. Error Branch
      TAD      17         No, Get Starting Chan. No.
      TAD      =D165      Add Last Mod. Temperature
```

```
                                    Chan. No.
      CIA                     Compliment
      TAD       H1            Add Error Chan. No.
      SMA+CLA                 More?
      JMP       EU            Yes, Go Chamber Temperature
                                  Error Branch
      TAD       16            Get No. Of Mods.
      TAD       =1            Add 1
      TAD       C4            Add Compliment Of Current Mod. No.
      DCA       DC            Set "DC" To Current Mod. No.
      TAD       C2
      CALL      2,\MPY        Adjust Switch Closure
      PAR       =D20          For BATT No.
      TAD       DC            Add Mod. No.
      DCA       DC            Deposit In DC.
      CALL      1,CLOSE       Close Switch For Mod. Error
      PAR       DC
      JMS       WA            Go Wait
* TEMPERATURE SHUTDOWN BRANCH
EU:   TAD       C2            Get BATT No.
      CALL      2,\MPY
      PAR       =D20          Adjust Switch Closure
      TAD       =D8           Add No. For Temperature Out
                                  Of Limit
      DCA       DC            Deposit In "DC"
      CALL      1,CLOSE       Close Switch For Temperature
                                  Error
      PAR       DC
      JMS       WA            Go Wait
ET:   TAD       C2            Get BATT No.
      CALL      2,\MPY        Adjust For Switch Closure
      PAR       =D20
      TAD       =D10          Add No. For BATT Error
      DCA       DC            Deposit In DC
      CALL      1,CLOSE       Close Switch For BATT
                                  Error
      PAR       DC
      JMS       WA
      JMS       HD            Go. Print Header
      JMS       ?R            Go, Print Error Line
      JMP*      ER            Return
*BATTERY VOLT OUT OF LIMIT BRANCH
EV:   TAD       C2            Get BATT No.
      CALL      2,\MPY
      PAR       =D20          Adjust For Switch Closure
      TAD       =6            Add 6 For BATT Volt Error
      DCA       DC
      CALL      1,CLOSE       Close Switch
      PAR       DC
      JMS       WA            Go Wait
      JMP       ET            Close Other Switches
```

```
*CELL VOLT OUT OF LIMIT BRANCH
EW:   TAD      C2          Get BATT No.
      CALL     2,\MPY
      PAR      =D20        Adjust For Switch Closure
      TAD      =7          Add 7 For Cell Volt. Error
      DCA      DC
      CALL     1,CLOSE     Close Switch
      PAR      DC
      JMS      WA          Go Wait
      JMP      ET          Go, Close Other Switches
*MODULE VOLT OUT OF LIMIT BRANCH
EX:   TAD      C2          Get BATT No.
      CALL     2,\MPY
      PAR      =D20        Adjust For Switch Closure
      TAD      C4          Add Module No.
      TAD      =6
      DCA      DC
      CALL     1,CLOSE     Close Switch
      PAR      DC
      JMS      WA          Go Wait
      JMP      ET
*ROOM TEMPERATURE OUT OF LIMIT BRANCH
EY:   CALL     2,CLOSE     Closer Switch For Temperature
                                Error BATT 1
      PAR      =D28
      JMS      WA          Go Wait
      CALL     2,CLOSE     Close Switch For Temperature
                                Error BATT 2
      PAR      =D48
      JMS      WA          Go Wait
      CALL     2,CLOSE       Close Switch For System Shutdown
      PAR      =D10
      JMS      WA          Go Wait
      HLT                  Halt
```

```
*RV REPLACE VALUE
*REPLACE OLD HIGHEST / LOWEST VALUE WITH CURRENT DATA
RV:   BSS      1          Return Address
      JMS      RP         Store New Value
      TAD      =37
      TAD      10
      DCA      10         Set Pointer For Chan. No.
                            Storage
      TAD      H1
      DCA      0020       Load Chan No.
      JMS      U1         Store It
      TAD      =1000      Set Pointer For BATT Volt.
      JMS      IB         Get It
      TAD      C1         Get Flags
      AND      =0024      Mask All But Captst And Recond
      SZA+CLA             Captest, Or Recond.?
      JMP      RW         Yes, Go Lo Storage
      TAD      C1         Get Flags
      AND      =0040      Mask All But "DAY" Flag
      SNA+CLA             Day
      JMP      RW         No, Go Lo Store
      TAD      =0063      Set Pointer For Hi Storage
      JMS      IA         Store It
      JMP*     RV         Return
*LO STORE
RW:   TAD      =0263      Set Pointer For Lo Storage
      JMS      IA         Store It
      JMP*     RV         Return
```

```
*ROUTINE TO PRINT A STANDARD HEADER ON LINE PRINTER
HD:   BSS      1          Return Address
      CLA
      JMS      LF         Go Print A Spacing Line
      JMS      LF         Go Print A Spacing Line
      TAD      =0200        Set Pointer For
      DCA      10               Scan Time
      JMS      D1         Get 1st Word
      TAD        0020
      CALL     0,BNBCD    Convert To BCD
      CALL     0,\PTP     Load First Print Call
      JMS      D1         Get 2nd Word
      TAD      0020
      CALL     0,BNBCD    Convert To BCD
      TAD      =5000      Add Leading Period
      CALL     0,\PTP     Load Second Print Call
      JMS      D1         Get 3rd Word
      TAD      0020
      CALL     0,BNBCD    Convert To BCD
      TAD      =5000      Add Leading Period
      CALL     0,\PTP     Load Third Print Call
      JMS      D1         Get 4th Word
      TAD      0020
      CALL     0,BNBCD    Convert To BCD
      TAD      =5000      Add Leading Period
      CALL     0,\PTP     Load 4th Print Call
      TAD      C2         Get BATT No.
      TAD      =5240      Add 2 Leading Periods
      CALL     0,\PTP     Load 5th Print Call
      TAD      =5000
      CALL     0,\PTP     Load 6th Print Call And Print Line
      JMS      LF         Go Print A Line Of Dots
      TAD      =1200      Set Pointer
      TAD      I1              For BATT
      DCA      10              P.E.T.
      JMS      D1         Get 1st Word
      TAD      0020
      CALL     0,BNBCD    Convert To BCD
      CALL     0,\PTP     Load First Print Call
      JMS      D1         Get 2nd Word
      TAD      0020
      CALL     0,BNBCD    Convert To BCD
      RTL                 Rotate Into Position
      RTL
      TAD      =0012      Add Trailing Zero
      CALL     0,\PTP     Load Second Print Call
      TAD      C1         Get BATT Flags
      AND      =0040      Mask All But Day Flag
      SZA+CLA             Night?
      TAD      =-1        Yes, Add 1
      TAD      =D12       Set Day Code
```

```
      TAD       =5240       Add Leading Periods
      CALL      0,\PTP      Load Third Print Call
      JMS       D1          Get 3rd Word
      TAD       0020
      CALL      0,BNBCD     Convert To BCD
      TAD       =5000       Add Leading Zero
      CALL      0,\PTP      Load Fourth Print Call
      JMS       D1          Get 4th Word
      TAD       0020
      CALL      0,BNBCD     Convert To BCD
      TAD       =5000       Add Leading Period
      CALL      0,\PTP      Load Fifth Print Call
      TAD       =5000       Add Period
      CALL      0,\PTP      Load Sixth Print Call. & Print line
      JMS       LF          Go Print A Spacing Line
      JMS       WA          Go Wait
      JMP*      HD          Return
*SUBROUTINE TO PRINT A LINE OF PERIODS (LINE FEED)
LF:   BSS       1           Return Address
      TAD       =-6         Set Counter To -6
      DCA       DC
LG:   TAD       =5252       Load 3 Periods
      CALL      0,\PTP      Load Print Call
      ISZ       DC          Last Char?
      JMP       LG          No, Do Again
      JMP*      LF          Yes, Return
* SUBROUTINE TO TEST FOR ICMR REQUEST
IQ:   1003
IS:   BSS       1           Return Address
      TAD       SR          Get "SR"
      AND       =0003       Mask All But ICMR Requests
      AND       C2          Mask For BATT No.
      SZA+CLA               Flag Set?
      JMS       IR          Yes, Go ICMR Record
      JMP*      IS          Return
IR:   BSS       1           Return Address
      CALL      0,\CL       Clear FPAC
      CALL      2,ICFOUT    Record Data On ICMR
      PAR       H2
      PAR       IQ
      JMP*      IR          Return
```

```
*WA (WAIT)
*SUBROUTINE TO WAIT ON SW. CLOSURE
      ENTRY    WA
WA:   BSS      1          Return Address
      CLA
      DCA      DC         Set Counter To Zero
W1:   ISZ      DC         Incrmnt Counter, Is It Zero
      JMP      W1         No, Do Again
      JMP*     WA         Yes, Return
```

```
*TD (TEMPERATURE DATA SCAN)
*ROUTINE TO SCAN TEMPERATURE DATA
TD:   BSS     1          Return Address
      TAD     17         Get Starting Chan No.
      TAD     =D141      Add 141
      DCA     CH         Store In Chan No.
      TAD     16         Store Compliment
      CIA                Of No. Of
      DCA     C4           Modules In "C4"
      TAD     =2
      DCA     FU         Set Function For OHMS
      TAD     =5
      DCA     RA         Set Range To 100K OHMS
      CALL    1,VIDAR    Initiate Acquisition
      PAR     CH
T6:   TAD     =-5        Store -5
      DCA     C          In "C"
T3:   ISZ     CH         Increment Chan. No.
      JMS     TV         Go Get Data And Convert
      ISZ     C          Increment Meas. No.
      JMP     T3         Do Again
      ISZ     C4         Last Measurement
      JMP     T6         No, Do Again
      CALL    0,VRSLT    Clear VRSLT Routine
      CLA                Clear Accumalator
      TAD     17         Get Starting Address
      TAD     =D166      Set Scanner To First Chamber
                           Temperature
      DCA     CH         Store In "CH"
      TAD     =-4        Set Counter "C4" To -4
      DCA     C4
      CALL    1,VIDAR    Initialize Acquisition
      PAR     CH
T2:   ISZ     CH         Increment Chan. No.
      JMS     TV
      ISZ     C4         No, Last Chamber Temperature?
      JMP     T2         No, Do Again
      CALL    0,VRSLT    Yes, Clear VRSLT Routine
      CALL    0,\CL      Clear FPAC
      CLA
      JMP*    TD         Return
TV:   BSS     1
      CALL    0,VRSLT    Get Results
      DCA     H1         Store Channel No.
      CALL    1,VIDAR    Initiate Acquisition
      PAR     CH
      TAD     0020       Change Sign Of Data
      AND     =3777
      DCA     0020
      JMS     TX         Go Verify Data Within Limits
      CALL    1,INTL1    Convert Data To
```

```
        AND     THERMO          Degrees
        CALL    1,\STO          Store results In "H2-H4"
        PAR     H2
        TAD     SR              Get Switch Register
        SPA+CLA                 In Hold?
        JMP     TW              Yes, Skip Limit Check
        TAD     =1400           Set Pointer To Temp
        JMS     IB              Limit And Get It
        CALL    1,\FSB          Subtract Results
        PAR     H2
        TAD     0020            Get Sign Of Results
        SPA+CLA                 Out Of Limit?
        JMS     ER              Yes, Go Error Routine
TW:     TAD     C1              Get flags
        AND     =0100           Mask All But Temperature
                                     Print Request
        SZA+CLA                 Print Requested
        JMS     PR              Yes, Go Print A Line
        JMS     IS              Go ICMR Recording Check
        JMP*    TV
```

```
*AC (CALCULATE DATA)
*ROUTINE TO CALCULATE ORBIT SUMMARY DATA
AC:   BSS     1          Return Address
      TAD     =1204
      JMS     IB
      TAD     =1105
      JMS     IA         Move SUNSET TIME Data
      TAD     =1207      To Print Storage
      DCA     10
      JMS     D1
      TAD     =1110
      DCA     10
      JMS     U1
      TAD     =1200      Set Pointer For BATT. P.E.T.
      JMS     R1         Get It And Store "H2-H4"
      TAD     =1103      Set Pointer To
      TAD     I1              Store Orbit No.
      DCA     10
      TAD     H2         Get First Word
      DCA     0020
      JMS     U1         Store It
      TAD     H3         Get Second Word
      DCA     0020
      JMS     U1         Store It
      TAD     =1102      Set Pointer To Get
      TAD     I1              Discharge Counter
      DCA     10
      JMS     D1         Get It
      TAD     =1111      Set Pointer To Store
      TAD     I1              Discharge Counter
      DCA     10
      JMS     U1         Store It
      TAD     =0325      Set Pointer To Get 60
      DCA     10
      JMS     D3         Get It
      CALL    1,\STO     Store 60 In "A"
      PAR     A
      TAD     =1036      Set Pointer To Get Summ. "A"
      JMS     R2         Get And Div. By 60
      TAD     =1112      Set Pointer To PPG WHO
      JMS     IA         Store Results As PPG WHO
      TAD     =1041      Set Pointer For Summ. "B"
      JMS     R2         Get It And Div. By 60
      TAD.    =1123      Set Pointer To BPRC WH
      JMS     IA         Store Results As BPRC WH
      TAD     =1047      Set Pointer For Summ. "D"
      JMS     R2         Get It And Div. By 60
      CALL    0,\T
      TAD     =1126      Set Pointer To BATT AHO
      JMS     IA         Store Results As BATT AHO
      TAD     =1052      Set Pointer For Summ. "E"
```

```
JMS       R2        Get It And Div. By 60
CALL      0,\T      Change Sign Of Results
TAD       =1134     Set Pointer For BATT WHO
JMS       IA        Store Results As BATT WHO
TAD       =1063     Set Pointer For Summ. "H"
JMS       R1        Get It And Store In "H2-H4"
JMS       NZ        Test Results For Zero
TAD       =1036     Set Pointer For Summ. "A"
JMS       R3        Get It and Div. Summ. "H"
TAD       =1115     Set Pointer To PPG EFF
JMS       IA        Store Results as PPG EFF
TAD       =1047     Set Pointer For Summ. "D"
JMS       R1        Get It And Store "H2-H4"
JMS       NZ        Go Test Results For Zero
TAD       =1055     Set Pointer For Summ. "F"
JMS       R3        Get It And Div. By Summ. "D"
CALL      0,\T      Change Sign Of Data
TAD       =1131     Set Pointer To RF
JMS       IA        Store Results As RF
TAD       =1060     Set Pointer For Summ. "G"
JMS       R1        Get It And Store In "H2-H4
JMS       NZ        Test Results For Zero
TAD       =1052     Set Pointer For Summ. "E"
JMS       R3        Get Data And Div. By Summ.  "G"
CALL      0,\T      Change Sign Of Results
TAD       =1137     Set Pointer To BATT EFF.
JMS       IA        Store Results As BATT EFF.
TAD       =1063     Set Pointer For Summ. "H"
JMS       R1        Get It And Store "H2-H4"
JMS       NZ        Go Test Results For Zero
TAD       =1066     Set Pointer For Summ. I
JMS       R3        Get It And Div. By Summ. "H"
TAD       =1160     Set Pointer To CHRG. EFF.
JMS       IA        Store Results AS CHRG. EFF.
TAD       =1044     Set Pointer For Summ. "C"
JMS       R1        Store Results
JMS       NZ        Go Test results For Zero
TAD       =1036     Set Pointer For Summ. "A"
JMS       R3        Get It And Div. By Summ. "C"
TAD       =1166     Set Pointer To REG. EFF.
JMS       IA        Store Results As REG. EFF.
TAD       =1077     Set Pointer For BATT TEMP.
                        Temporary Storage
JMS       IB        Get It
TAD       =1120     Set Pointer To BATT TEMP.
                        Print Storage
JMS       IA        Store Data As BATT TEMP.
TAD       =1071     Set Pointer For CHRGR. TEMP.
                        Temporary Storage
JMS       IB        Get It
TAD       =1163     Set Pointer To CHRGR. TEMP.
```

```
                                Print Storage
JMS       IA          Store Data As CHRGR. TEMP.
TAD       =1074       Set Pointer For REG. TEMP.
                          Temporary Storage
JMS       IB          Get It
TAD       =1171       Set Pointer To REG. TEMP.
                          Print Storage
JMS       IA          Store Data As REG. TEMP.
TAD       =0041       Set Pointer For HI CELL VOLT.
                          Temporary Storage
JMS       IB          Get It
TAD       =1142       Set Pointer For HI CELL
                                  VOLT. Print Storage
JMS       IA          Store It
TAD       =0103       Set Pointer For HI CELL CHAN.
TAD       I1               No. Temporary Storage
DCA       10
JMS       D1          Get It
TAD       =1145       Set Pointer To HI CELL CHAN.
TAD       I1               No. Print Storage
DCA       10
JMS       U1          Store It
TAD       =0063       Set Pointer For BATT Volt At
                                  HI CELL VOLT.
JMS       IB          Get It
CALL      1,\STO      Store In "H2-H4"
PAR       H2
CALL      1,FLOAT     Convert No. Of Cells To
PAR       C3               Flt. Point
CALL      1,\STO      Store In "A"
PAR       A
CALL      1,\FAD      Load BATT V Into FPAC
PAR       H2
CALL      1,\FDV      Divide By No. Of Cells
PAR       A
TAD       =1146       Set Pointer To AVE HI CELL VOLT.
JMS       IA          Store Results In AVE. HI
                          CELL VOLT.
TAD       =0241       Set Pointer For LO. CELL
                          VOLT. Temporary Storage
JMS       IB          Get It
TAD       =1151       Set Pointer To LO CELL VOLT
                                  Print Storage
JMS       IA          Store It
TAD       =0303       Set Pointer For LO. CELL NO.
TAD       I1            No. Temporary Storage
DCA       10
JMS       D1          Get It
TAD       =1154       Set Pointer To LO CELL
TAD       I1               NO.Print Storage
DCA       10
```

```
        JMS     U1          Store It
        TAD     =0263       Set Pointer For LO BATT
                                    VOLT. Temporary Storage
        JMS     R2          Get It And Div. By No. Of Cells
        TAD     =1155       Set Pointer To AVE. LO CELL
                                    VOLT. Print Storage
        JMS     IA          Store It
        JMP*    AC          Return
R1:     BSS     1
        JMS     IB          Get Data From Bank 2
        CALL    1,\STO      Store It In "H2-H4"
        PAR     H2
        JMP*    R1          Return
R2:     BSS     1
        JMS     IB          Get Data From Bank 2
        CALL    1,\FDV      Divide It By "A"
        PAR     A
        JMP*    R2          Return
R3:     BSS     1
        JMS     IB          Get Data From Bank 2
        CALL    1,\FDV      DividIt By "H2-H4" Data
        PAR     H2
        JMP*    R3          Return
R4:     BSS     1
        JMS     IB          Get Data From Bank 2
        CALL    1,\FSB      Subtract "H2-H4" Data From It
        PAR     H2
        JMP*    R4          Return
R5:     BSS     1           Return Address
        DCA     10          Set Pointer
        JMS     D3          Get Data
        CALL    1,\FMP      Divide By "H2-H4"
        PAR     H2
        CALL    1,\STO      Store Results In "H2-H4"
        PAR     H2
        CALL    1,\FAD      Restore Results In FPAC
        PAR     H2
        JMP*    R5          Return
* TEST FOR ZERO DATA
NZ:     BSS     1           Return Address
        TAD     H2          Get MSB
        SNA                 Is It Zero?
        TAD     =2014       Yes, Add 1
        DCA     H2          Redeposit In H2
        JMP*    NZ          Return
```

```
* VD (SCAN VOLTAGE DATA)
* ROUTINE TO SCAN VOLTAGE DATA ON CELLS AND MODULES
VD:   BSS      1          Return Address
      TAD      17         Set Up
      TAD      =1         Starting
      DCA      CH         Channel No.
      TAD      =4         Set Up IDVM
      DCA      RA
      TAD      =1
      DCA      FU
      TAD      C3
      CIA                 Set "C3" To Neg. No. Of Cells
      DCA      C3
      TAD      16
      CIA                 Set "C4" To Neg. No. Of Modules
      DCA      C4
      TAD      C1         Get BATT Flags
      AND      =0004      Mask Out All But "CAPTEST" Flag
      SZA+CLA             Captest?
      JMP      VC         Yes, Go "CAPTEST" Test Branch
      TAD      C1         Get BATT Flags
      AND      =0040      Mask Out All But "DAY" Flag
      SNA+CLA             Day?
      JMP      VN         No, Go NIGHT Test Branch
* DAY LIMIT CHECK
      TAD      =1414      Set Pointer To Cell Hi Limit
      JMS      IB         Get It
      CALL     1,\STO     Store In A
      PAR      A
      CALL     1,VIDAR    Initialize Acquisition
      PAR      CH
V1:   ISZ      CH         Increment Chan. No.
      CALL     0,VRSLT
      DCA      H1         Store Chan No. In "H1"
      CALL     1,VIDAR    Initialize Acquisition
      PAR      CH
      CALL     1,\STO     Store Data In "H2-H4"
      PAR      H2
      TAD      SR         Get Switch Reg. Storage
      SPA+CLA             "HOLD" On?
      JMP      V2         Yes, Go Print Check Branch
      CALL     1,\FAD     Put Limit Value In FPAC
      PAR      A
      CALL     1,\FSB     Subtract Data
      PAR      H2
      TAD      0020       Get Sign Of Result
      SPA+CLA             Out Of Limit?
      JMS      ER         Yes, Go Error Check Branch
      TAD      =0041      Set Pointer For HI CELL VOLT.
                                  Temporary Storage
      JMS      IB         Get Current Hi
```

```
        CALL    1,\FSB      Subtract Current Cell Volt.
        PAR     H2
        TAD     0020        Get Sign Of Result
        SPA+CLA             New Higher
        JMS     RV          Yes, Go Replace Hi Cell Volt.
V2:     TAD     C1          Get Flags
        AND     =0200       Mask All But "VOLT. PRINT"
                                Request
        SZA+CLA             "PRINT" Requested?
        JMS     PR          Yes, Go Print Data
        JMS     IS          Go Test For ICMR
        ISZ     C3          Last Cell
        JMP     V1          No, Do Again
        TAD     =D135       Yes, Set Chan. No To
        TAD     17              First Mod. Volt.
        DCA     CH
        CALL    0,VRSLT     Clr. VRSLT Routine
        TAD     =5          Set Range For Module Volt
        DCA     RA
VH:     CALL    1,VIDAR     Initialize Acquisition
        PAR     CH
V3:     ISZ     CH          Increment Chan No.
        CALL    0,VRSLT
        DCA     H1
        CALL    1,VIDAR     Initialize Acquisition
        PAR     CH
        CALL    1,\STO      Store Data In "H2-H4"
        PAR     H2
        TAD     C1          Get BATT Flags
        AND     =0200       Mask All But "PRINT" Request
        SZA+CLA             Print Requested?
        JMS     PR          Yes, Go Print Data
        JMS     IS          Go Test For ICMR
        ISZ     C4          Last Module?
        JMP     V3          No, Do Again
        CALL    0,VRSLT     Clr. VRSLT Routine
        CLA                 Clear accum.
        CALL    0,\CL       Clear FPAC
        JMP*    VD          Return
*PROGRAM BRANCH FOR CAPTST
VC:     TAD     C1          Get Flags
        AND     =2000       Mask All But "BPRC
                                ACKLDG"
        SZA+CLA             "BPRC ACKLDG"?
        JMP     V4          Yes, Go Check "RECONDITIONING"
        TAD     C1          Get Flags
        AND     =0010       Mask All But "BPRC LIMIT"
        SZA+CLA             "BPRC LIMIT"?
        JMP     V5          Yes, Go Set "CAPTEST OVER"
                                Flag
        TAD     C1          Get BATT Flags
```

```
        SPA+CLA                 1.0V Limit Reached?
        JMP     VN              Yes, Go Set low Limit
        TAD     ="1444             No, Set Pointer For 1.0V Limit"
        TAD     I1
        DCA     10
VG:     JMS     D3              Get It
        CALL    1,\STO          Store Limit In A
        PAR     A
        CALL    1,VIDAR         Initialize Acquisition
        PAR     CH
V8:     ISZ     CH              Increment Chan. No.
        CALL    0,VRSLT
        DCA     H1
        CALL    1,VIDAR         Initialize Acquisition
        PAR     CH
        CALL    1,\STO          Store Data In "H2-H4"
        PAR     H2
        TAD     SR              Get Switch Reg. Storage
        SPA+CLA                 In "HOLD"?
        JMP     V9              Yes, Go Print Check
        CALL    1,\FAD          Put Data In FPAC
        PAR     H2
        CALL    1,\FSB          Subtract Limit
        PAR     A
        TAD     0020            Get Sign Of Results
        SPA+CLA                 Under Limit
        JMS     CE              Yes, Go "CAPTEST" Error
        TAD     =0241           Set Pointer For LOWEST CELL
                                        VOLT. Storage
        JMS     IB              Get It
        CALL    1,\FSB          Subtract Data
        PAR     H2
        TAD     0020            Get Result Sign
        SMA+CLA                 New Data Lower?
        JMS     RV              Yes, Go Replace
V9:     TAD     C1              Get BATT Flags
        AND     =0200           Mask All But "PRINT" Flag
        SZA+CLA                 Print Requested
        JMS     PR              Yes, Go Print
        JMS     IS              Go Test For ICMR
        ISZ     C3              Last Chan?
        JMP     V8              No, Do Again
        TAD     =D135           Set Starting Chan. To First
        TAD     17                   Module Voltage
        DCA     CH
        CALL    0,VRSLT         Clr. VRSLT Routine
        TAD     =5
        DCA     RA              Set Range
        TAD     C1
        AND     =0004           Get BATT Flags
        SPA+CLA                 Is "CAPTEST" On
```

```
        JMP     VA          Yes, Go "CAPTEST" Mod Volt Check
        JMP     VH          Go Mod. Volt. Branch
VB:     TAD     I1
        DCA     10
        JMS     D3          Get It
        CALL    1,\STO      Store Limit In A
        PAR     A
        CALL    1,VIDAR     Initialize Acquisition
        PAR     CH
VE:     ISZ     CH          Increment Chan. No.
        CALL    0,VRSLT
        DCA     H1
        CALL    1,VIDAR     Initialize Acquisition
        PAR     CH
        CALL    1,\STO      Store Data In "H2-H4"
        PAR     H2
        TAD     SR          Get Switch Reg. Storage
        SZA+CLA             In Hold?
        JMP     VF          Yes, Go Check Print Request
        CALL    1,\FAD      Load Data Into FPAC
        PAR     H2
        CALL    1,\FSB      Subtract Limit
        PAR     A
        TAD     0020        Get Sign Of Results
        SMA+CLA             Below Limit
        JMP     VF          No, Go Test Print Branch
        JMS     HD          Yes, Go Print Header
        JMS     PR          Go Print Error Data
VF:     CLA
        TAD     C1          Get Flags
        AND     =0200       Mask All But Print Request
        SZA+CLA             Print Requested?
        JMS     PR          Yes, Go Print
        JMS     IS          Go Test For ICMR
        ISZ     C4          Last Module?
        JMP     VE          No, Do Again
        CALL    0,VRSLT     Clear VRSLT Routine
        CLA
        CALL    0,\CL
        JMP*    VD          Return
*CAPTST ON, IS CAPTST OVER ?
VA:     TAD     C1          Get BATT, Flags
        AND     =2000       Mask Out All But "BPRC
                                Acknowledged" Flag
        SZA+CLA             BPRC Acknowledged?
        JMP     VH          Yes, Go Mod. Volt. Branch
                                High Limit
        TAD     =1411       Adjust Pointer For Low Limit
        JMP     VB          Return
*NIGHT LIM CHECK
VN:     TAD     =1417       Set Pointer For 0.05 V Limit
```

```
      TAD       I1
      DCA       10
      JMP       VG          Go Test Branch
*RECOND CHECK
V4:   TAD       C1          Get BATT Flags
      AND       =0020       Mask All But Recond.
      SNA+CLA               Recond. On?
      JMP       VN          No, Go Night Limit Branch
      TAD       =1425       Yes, Set Pointer For
      TAD       I1                Recond. Limit
      DCA       10
      JMP       VG          Go Test Branch
V5:   TAD       =1
      DCA       TO          Set "Captest Over" Flag
      JMP       V4          Go Night Check Branch
*CAPTST OR NIGHT VOLT OUT OF LIMIT
CE:   BSS       1           Return Address
      TAD       C1          Get BATT Flags
      AND       =0004       Mask All But "CAPTEST"
      SNA+CLA               On?
      JMP       CY          No, Go Normal Error Branch
      TAD       C1          Get Flags
      SPA+CLA               "1.0V RCHD" Flag Set?
      JMP       CY          Yes, Go Normal Error Branch
*USING 1.0 V LIM. BUT NOT RCHD BEFORE
      TAD       C2          No, Get BATT No.
      TAD       =-1         Adjust
      CALL      2,\MPY      Multiply By 5
      PAR       =5
      TAD       FP          Add Faulty Chan Pointer
      DCA       DC          Deposit In "DC"
      TAD       =-5         Set "TE" To -5
      DCA       TE
CZ:   TAD*      DC          Get Faulty Chan. No.
      CIA                   Compliment
      TAD       H1          Add Current Chan. No.
      SNA+CLA               Agree
      JMP*      CE          Yes, Return
      ISZ       DC          No, Increment Faulty Chan Addr.
      ISZ       TE          Last Faulty Chan.
      JMP       CZ          No, Do Again
      TAD       C1          Get Flags
      AND       =3777       Mask Out "1.0V REACHED" Flag
      TAD       =4000       Set "1.0V REACHED" Flag
      DCA       C1          Redeposit Flags
      JMS       HD          Go Type Header
      JMS       PR          Go Print Data
      CALL      0,\CL       Clear FPAC
      CALL      1,\FAD      Load Data Into FPAC
      PAR       H2
      CALL      1,\STO      Store In "A"
```

```
        PAR     A
        TAD     =0325       Set Pointer To Get Flt. Pt. 60
        DCA     10
        JMS     D3          Get It
        CALL    1,\STO      Store In "H2-H4"
        PAR     H2
        TAD     H1          Store Chan No. In "DC"
        DCA     DC
        TAD     =D888       Put 888 In H1
        DCA     H1
        TAD     =1047       Set Pointer For Summ. "D"
        JMS     R3          Get It And Div. By 60
        CALL    1,\STO      Store Results In "H2-H4"
        PAR     H2
        JMS     PR          Go Print Data
        TAD     =D999       Put 999 In H1
        DCA     H1
        TAD     =0325       Set Pointer For Flt. Pt. 60
        DCA     10
        JMS     D3          Get It
        CALL    1,\STO      Store In "H2-H4"
        PAR     H2
        TAD     =1052       Set Pointer For Summ. "E"
        JMS     R3          Get It And Div. By 60
        TAD     0020        Change Sign Of Result
        TAD     =4000
        DCA     0020
        CALL    1,\STO      Store Results In "H2-H4"
        PAR     H2
        JMS     PR          Go Print
        CALL    1,\FAD      Put Data In "A" In FPAC
        PAR     A
        CALL    1,\STO      Put Data Back In "H2-H4"
        PAR     H2
        TAD     DC          Set "H1" To Chan No.
        DCA     H1
        TAD     =1422       Set Pointer For Lo Lim.
        JMS     IB
        CALL    1,\STO      Store It In "A"
        PAR     A
        JMP*    CE          Return
* 1.0 V LIMIT NOT IN USE
CY:     JMS     ER          Go Error Routine
        JMP*    CE          Return
```

```
*BANK SET UP AND TRANSFER ROUTINE
EB:   BSS      1          Temporary Storage
ED:   BSS      1          Temporary Storage
*TRANSFER 3 WORDS FROM BANK 1 TO BANK 2 STO
U3:   BSS      1          Return Address
      CLA
      TAD      =0020      Set "ED" To Loc 0020
      DCA      ED
      TAD      =-3        Set "EB" To -3
      DCA      EB
N3:   TAD*     ED         Load Indirect Through Loc. 0020
      6221
      DCA*     10         Store
      6211
      ISZ      ED         Increment Data Location
      ISZ      EB         Last Word
      JMP      N3         No, Do Again
      JMP*     U3         Return
*TRANSFER 3 WORDS FROM BNK 2 TO BANK 1
      ENTRY    D3
D3:   BSS      1          Return Address
      CLA
      TAD      =0020      Load "ED" With Loc 0020
      DCA      ED
      TAD      =-3        Load "FB" With -3
      DCA      EB
N4:   6221
      TAD*     10         Load Indirect Through 0010
      6211
      DCA*     ED         Store Indirect Through "ED"
      ISZ      ED         Increment Storage Location
      ISZ      EB         Last Word
      JMP      N4         No, Go Again
      JMP*     D3         Return
*TRANSFER 1 WORD FROM BANK 1 TO BANK 2 STO
      ENTRY    U1
U1:   BSS      1          Return Address
      CLA
      TAD      0020       Load From Loc 0020
      6221
      DCA*     10         Store Indirect Through 0010
      6211
      JMP*     U1         Return
*TRANSFER 1 WORD FROM BANK 2 TO BANK 1 FPAC
      ENTRY    D1
D1:   BSS      1          Return Address
      CLA
      6221
      TAD*     10         Load Indirect Through 0010
      6211
      DCA      0020       Store In Loc 0020
```

```
JMP*      D1          Return
```

```
* OD (SCAN AND CONVERT ORBIT DATA)
OD:   BSS      1          Return Address
      TAD      =6         Set IDVM Range
      DCA      RA
      TAD      =1         Set Function
      DCA      FU         To Volts
      TAD      17         Store Starting
      DCA      CH           Address In "C"
      CALL     1,VIDAR    Initiate Acquisition
      PAR      CH
      CALL     0,VRSLT    Get Results
      DCA      H1         Store Chan. No. In "H1"
      TAD      =1000      Set Pointer For "BATT VOLT"
                                  Storage
      JMS      IA         Store It In Bank 2
      CALL     1,\STO     Load Data Into FPAC
      PAR      H2
      TAD      C1         Get Flags
      AND      =1000      Mask All But "BATT DISCONNECT"
      SPA+CLA             Is It On?
      JMP      OF         Yes, Skip Calculations
      TAD      SR         Get "SR"
      SPA+CLA             "HOLD" Set?
      JMP      OF         Yes Skip Calculations
      TAD      C1         Get Flags
      AND      =0004      Mask All But Captst.
      SZA+CLA             In Captst.?
      JMP      OM         Yes Go Captst. Branch
      TAD      C1         Get Flags
      AND      =0040      Mask All But Day
      SNA+CLA             Night?
      JMP      OE         Yes Go Night Check
      TAD      =1403      Set Pointer For
                                  "BATT. VOLT> HI LIMIT
      JMS      R4         Get It And Sub. Curr. Value
      TAD      0020       Get Sign Of Results
      SPA+CLA             Over Limit?
      JMS      ER         Yes, Go Error
      CALL     0,\CL      Clear FPAC
      JMS      R4         Sub. Curr. Data
      TAD      0020       Get Sign Of Results
      SPA+CLA             Higher
      JMS      RP         Yes, Go Replace
OF:   TAD      17         Set Chan. To Next Data
      TAD      =D178
      DCA      CH
      TAD      =4         Set Range
      DCA      RA
      JMS      PC         Go Check For Print And
                               Get New Data
      TAD      =0341      Set Pointer For Conversion
```

```
                                    Factor (5.0)
JMS         R5          Go Multiply By Data
TAD         =1003       Set Pointer To Meas. 178 Storage
JMS         IA          Store It
ISZ         CH          Increment Chan. No.
JMS         PC          Go Check For Print And
                            Get New Data
TAD         =0300       Set Pointer For Conversion
                            Factor (15)
JMS         R5          Go Multiply By Data
TAD         =1006       Set Pointer To Meas. 179 Storage
JMS         IA          Store It
ISZ         CH          Increment Chan. No.
JMS         PC          Go Check For Print And
                            Get New Data
TAD         =0303       Set Pointer For Conversion
                            Factor (4)
JMS         R5          Go Multiply By Data
TAD         =1011       Set Pointer To Meas. 180 Storage
JMS         IA          Store It
ISZ         CH          Increment Chan. No.
TAD         =5
DCA         RA          Change IDVM Range

JMS         PC          Go Check For Print And
                            Get New Data
CALL        1,\FAD      Load Data Into FPAC
PAR         H2
TAD         =1014       Set Pointer For Meas. 181 Storage
JMS         IA          Store It
ISZ         CH          Increment Chan. No.
TAD         =4          Change IDVM Range
DCA         RA
JMS         PC          Go Check For Print And
                            Get New Data
CALL        1,\FAD      Restore Data In FPAC
PAR         H2
TAD         =1017       Set Pointer To Meas. 182 Storage
JMS         IA          Store It
ISZ         CH          Increment Chan No.
TAD         =2          Change
DCA         RA          Range
JMS         PC          Go Check For Print And
                            Get New Data
TAD         =0336       Set Pointer For Conversion
                            Factor (500)
JMS         R5          Multiply By Data
TAD         =1022       Set Pointer For Meas. 183 Storage
JMS         IA          Store It
ISZ         CH          Increment Chan. No.
TAD         =4          Change
```

```
DCA       RA          Range
JMS       PC          Go Check For Print And
                        Get New Data
TAD       =0341       Set Pointer For Conversion
                        Factor (5)
JMS       R5          Multiply By Data
TAD       =1025       Set Pointer To Meas. 184 Storage
JMS       IA          Get It
ISZ       CH          Increment Chan. No.
JMS       PC          Go Check For Print And
                        Get New Data
TAD       =0314       Set Pointer For Conversion
                        Factor (40)
JMS       R5          Multiply By Data
TAD       =1030       Set Pointer To Meas. 185 Storage
JMS       IA          Store It
ISZ       CH          Increment Chan. No.
JMS       PC          Go Check For Print And
                        Get New Data
TAD       =0300       Set Pointer For Conversion
                        Factor (15)
JMS       R5          Multiply By Data
TAD       =1033       Set Pointer To Meas. 186 Storage
JMS       IA          Store It
ISZ       CH          Increment Chan. No.
JMS       PC          Go Check For Print And
                        Get New Data
JMS       TC          Go Convert To Temperature
CALL      1,\STO      Store Result In "H2-H4"
PAR       H2
TAD       =1071       Set Pointer For Current Hi Temp.
JMS       R4          Get It
TAD       0020        Get Sign Of Results
SPA+CLA               New Hi
JMS       RP          Yes, Go Replace
ISZ       CH          Increment Chan. No.
JMS       PC          Go Check For Print And
                        Get New Data
JMS       TC          Go Convert To Temperature
CALL      1,\STO      Store Results In "H2-H4"
PAR       H2
TAD.      =1074       Set Pointer For Highest Reg. Temp.
                      Get It
                        Sub. Curr. Temperature
JMS       R4          Get It And Sub. Curr. Temp.
TAD       0020        Get Sign Of Results
SPA+CLA               New Hi?
JMS       RP          Yes, Go Replace
ISZ       CH          Increment Chan. No.
TAD       =2          Change IDVM Function
DCA       FU
```

```
TAD       =5          Change IDVM Range
DCA       RA
JMS       PC          Go Check For Print And
                        Get New Results
CALL      1,\FAD      Load FPAC With Data
PAR       H2
TAD       0020
AND       =3777       Change Sign Of Results
DCA       0020
JMS       TX            Go Verify Data Within Limits
CALL      1,INTL1     Convert To Degrees
AND       THERMO
CALL      1,\STO      Store In "H2-H4"
PAR       H2
TAD       =1077       Set Pointer To Highest BATT.
                        Temperature
JMS       R4          Get It And Sub. Curr. Results
TAD       0020        Get Sign Of Results
SPA+CLA               New Hi?
JMS       RP          Yes, Go Replace
JMS       PC
CALL      0,\CL
TAD       SR          Get Switch Reg. Storage
SPA+CLA               Hold On?
JMP*      OD          Yes, Return
TAD       =1006       Set Pointer For Meas. 179 Storage
JMS       R1          Get It And Store "H2-H4"
JMS       D3          Get Meas. 180 Data
CALL      1,\FMP      Multiply By Meas. 179
PAR       H2
CALL      1,\STO      Store Results In "H2-H4"
PAR       H2
TAD       =1036       Set Pointer For Summ. "A"
JMS       IB          Get It
CALL      1,\FAD      Add New Results To It
PAR       H2
JMS       RY          Reset Pointer And Store
TAD       =1014       Set Pointer For Meas. 181
JMS       R1          Get It And Store "H2-H4"
JMS       D3          Get Meas 182 Data
CALL      1,\FMP      Multiply By Meas. 181
PAR       H2
CALL      1,\STO      Store Results In "H2-H4"
PAR       H2
TAD       =1041       Set Pointer For Summ. BB"
JMS       IB          Get It
CALL      1,\FAD      Add New Results To It
PAR       H2
JMS       RY          Reset Pointer And Store
TAD       =1000       Set Pointer For Meas. 000
JMS       IB          Get It
```

```
CALL    1,\STO      Store In "A"
PAR     A
JMS     D3          Get Meas. 178 Data
CALL    1,\FMP      Multiply By Meas. 000
PAR     A
CALL    1,\STO      Store Results In "H2-H4"
PAR     H2
TAD     =1044       Set Pointer For Summ. "C"
JMS     IB          Get It
CALL    1,\FAD      Add New Results To It
PAR     H2
JMS     RY          Go Reset Pointer And Store
TAD     C1          Get BATT Flags
AND     =0040       Mask All But Day Flag
SNA+CLA             Night?
JMP     NI          Yes, Go Night Branch
TAD     C1          Get BATT Flags
AND     =0004       Mask All But "CAPTEST"
SZA+CLA             Captest?
JMP     NI          Yes, Go Night Branch
TAD     =1022       Set Pointer For Meas. 183
JMS     R1          Go Get It And Store In "H2-H4"
TAD     =1055       Set Pointer For Summ. "F"
TAD     I1
DCA     10
JMS     D3          Go Get It
CALL    1,\FAD      Add Current Data To It
PAR     H2
JMS     RY          Go Reset Pointer And Store
TAD     =1022       Set Pointer For Meas. 183
JMS     IB          Get It
CALL    1,\FMP      Multiply By Meas. 000
PAR     A
CALL    1,\STO      Store Results In "H2-H4"
PAR     H2
TAD     =1060       Set Pointer For Summ. "G"
JMS     IB          Get It
CALL    1,\FAD      Add Current Results To It
PAR     H2
JMS     RY          Go Reset Pointer And Store
TAD     =1025       Set Pointer For Meas. 184
JMS     R1
JMS     D3          Get Meas. 185
CALL    1,\FMP      Multiply By Meas. 184
PAR     H2
CALL    1,\STO      Store Results In "H2-H4"
PAR     H2
TAD     =1063       Set Pointer For Summ. "H"
JMS     IB          Go Get It
CALL    1,\FAD      Add Current Results To It
PAR     H2
```

```
        JMS     RY          Go Reset Pointer And Store
        TAD     =1063       Set Pointer For Meas. 183
        JMS     IB          Get It
        CALL    1,\FMP      Multiply By Meas. 000
        PAR     A
        CALL    1,\STO      Store Results In "H2-H4"
        PAR     H2
        TAD     =1066       Set Pointer For Summ. "I"
        JMS     IB          Get It
        CALL    1,\FAD      Add New Results To It
        PAR     H2
        JMS     RY          Go Reset Pointer And Store
        JMP*    OD          Return
*NIGHT SUMMATIONS
NI:     TAD     =1102       Set Pointer For Disc. Counter
        TAD     I1
        DCA     10
        JMS     D1          Get It
        TAD     0020
        TAD     =1          Increment Disc. Counter
        DCA     0020
        TAD     10          And
        TAD     =-1
        DCA     10
        JMS     U1          Store It
        TAD     =1022       Set Pointer For Meas. 183
        JMS     R1          Get It And Store "H2-H4"
        TAD     =1047       Set Pointer For Summ. "D"
        JMS     IB          Get It
        CALL    1,\FAD      Add New Meas. 183 To It
        PAR     H2
        JMS     RY          Go Reset Pointer And Store
        CALL    0,\CL       Clear FPAC
        CALL    1,\FAD      Load FPAC With Meas. 183
        PAR     H2
        CALL    1,\FMP      Multiply By Meas. 000
        PAR     A
        CALL    1,\STO      Store Results In "H2-H4"
        PAR     H2
        TAD     =1052       Set Pointer For Summ. "E"
        JMS     IB          Get It
        CALL    1,\FAD      Add New Results to It
        PAR     H2
        JMS     RY          Go Reset Pointer And Store
        JMP*    OD
*SUBROUTINE TO REPLACE NEW HIGHEST
RP:     BSS     1           Return Address
        TAD     10          Reset Pointer
        TAD     =-3
        DCA     10
        CALL    0,\CL       Clear FPAC
```

```
      CALL     1,\FAD      Load Data Into FPAC
      PAR      H2
      JMS      U3          Store Data
      JMP*     RP          Return
*TEST FOR LOWEST BATTERY VOLT
OE:   TAD      =0200       Set Pointer For Lowest BATT. Volt.
      JMS      IB          Get It
      CALL     1,\FSB      Subtract Current Voltage
      PAR      H2
      TAD      0020        Get Sign Of Results
      SMA+CLA              New Lo?
      JMS      RP          Yes, Go Replace
      JMP      OF          Continue Program
*PRINT CHECK AND NEXT CHAN ACQUISITION
PC:   BSS      1           Return Address
      TAD      C1          Get BATT Flags
      AND      =0400       Mask All But Print Request
      SZA+CLA              Print Requested?
      JMS      PR          Yes, Go Print
      CALL     0,\CL       Clear FPAC
      CALL     1,VIDAP     Initiate Acquisition
      PAR      CH
      CALL     0,VRSLT     Get Data
      DCA      H1
      CALL     1,\STO      Store Data In "H2-H4"
      PAR      H2
      JMP*     PC          Return
*SUBROUTINE FOR TEMP CONVERSION FROM VOLTS
TC:   BSS      1           Return Address
      TAD      =0306       Set Pointer For Limit
                               Factor (0.5)
      DCA      10
      JMS      D3          Go Get It
      CALL     1,\STO      Store Results In "A"
      PAR      A
      CALL     1,\FAD      Reload limit
      PAR      A
      CALL     1,\FSB      Subtract Results
      PAR      H2
      TAD      0020        Get Sign Of Results
      SPA+CLA              Below Limit?
      JMP      TU          No, Continue test
      CALL     0,\CL       Yes, Clear FPAC
      CALL     1,\FAD
      PAR      A
      CALL     1,\STO      Store New Value
      PAR      H2
TU:   TAD      =0311       Set Pointer For Conversion
      DCA      10          Factor (10.0)
      JMS      D3          Go Get It
      CALL     1,\FSB      Subtract Data
```

```
        PAR     H2
        CALL    1,\STO          Store Results In "A"
        PAR     A
        TAD     =0322           Set Pointer For Conversion
                                    Factor (15)
        DCA     10
        JMS     D3              Go Get It
        CALL    1,\FMP          Multiply By Results
        PAR     A
        CALL    1,\FDV          Divide By Data
        PAR     H2
        JMS     TX
        CALL    1,INTL1         Convert To Degrees
        AND     THERMO
        JMP*    TC              Return
TX:     BSS     1               Reutrn Address
        CALL    1,\STO          Store resistance Equivalent
        PAR     H2              In "H2-H0"
        CLA
        TAD     =2436           Set Pointer To High
        DCA     10              Table Limit
        JMS     D3              Go Get It
        CALL    1,\FSB          Subtract Temp. Equiv.
        PAR     H2
        TAD     0020            Out Of Limit?
        SMA+CLA
        JMP     TZ              Yes, Go Replace
        TAD     =2441           Set Pointer To Lo Limit
        DCA     10
        JMS     D3              Go Get It
        CALL    1,\FSB          Subtract data
        PAR     H2
        TAD     20
        SPA+CLA                 Out Of Limit
        JMP     TZ              Yes, Go Adjust Branch
        TAD     H1              No, Test For Overrange
        SPA+CLA                 Overrange?
        JMP     TZ              Yes, Go Adjust Branch
        CALL    0,\CL           Clear FPAC
        CALL    1,\FAD          Restore Data In FPAC
        PAR     H2
        JMP*    TX
TZ:     CALL    0,\CL           Clear FPAC
        TAD     =2441           Get Low Table Limit
        DCA     10
        JMS     D3
        JMP*    TX
OM:     TAD     C1              Get Flags
        AND     =2000           Mask All But BPRC Acknldgd
        SNA+CLA                     Captst Over?
        JMP     OE              Yes, Go Low Replace Branch
```

```
        TAD     I1
        TAD     =1406       Set Pointer For Captst
        DCA     10          BATT. V. Limit
        JMS     D3          Get It
        CALL    1,\FSB      Subtract Current Value
        PAR     H2
        TAD     0020        Get Sign Of Results
        SMA+CLA                         Under Limit
        JMP     OE          No, Go Low Replace Branch
        JMS     HD          Go Print Header
        JMS     PR          Go Print Value
        JMP     OE          Go Replace Branch
RY:     BSS     1
        TAD     10          Replace Data As Is
        TAD     -3
        DCA     10
        JMS     U3
        JMP*    RY
```

```
* IT (ITERATE TAPE)
* SUROUTINE TO WRITE TIME AND ORBIT DATA ON ICMR
ML:  0200
MM:  0300
MN:  0502
IK:  BSS     1
IT:  BSS     1
     TAD     =0077
     CALL    0,\IMR      Write Record Start Char.
     TAD     C2
     CALL    0,\IMR      Write BATT No.
     TAD     =0200       Set Pointer For T.O.Y.
     JMS     IV          Go Write T.O.Y.
     TAD     I1
     TAD     =1200       Set Pointer For BATT P.E.T.
     JMS     IV          Go Write P.E.T.
     TAD     C1          Get BATT Flags
     RTR
     RTR                 Rotate Into Position
     RTR
     AND     =0077       Mask
     CALL    0,\IMR      Write Flag Bits 0-5

     TAD     C1          Get BATT Flags
     AND     =0077       Mask
     CALL    0,\IMR      Write Flag Bits 6-11
     TAD     SR          Get "SR"
     RTR
     RTR                 Rotate Into Position
     RTR
     AND     =0077       Mask
     CALL    0,\IMR      Write "SR" Bits 0-5
     TAD     I1          Set Pointer For Orbit Data
     TAD     =1000
     DCA     10
     TAD     =-D10       Set "IK" to -10
     DCA     IK
* WRITE ORBIT DATA
IW:  JMS     D3          Get Data Point
     CALL    2,ICFOUT    Output Data In Flt. Pt.
     PAR.    0020
     PAR     IQ
     ISZ     IK          Last Data?
     JMP     IW          No, Go Again
     TAD     =-3         Set "IK" To -3
     DCA     IK
     TAD     I1
     TAD     =1071       Set Pointer For Orbit Temps
     DCA     10
* WRITE ORBIT TEMPS
IX:  JMS     D3          Get Temp
```

```
        CALL    2,ICFOUT    Output In F.P. Pt.
        PAR     0020
        PAR     MN
        ISZ     IK          Last Temp?
        JMP     IX          No, Do Again
        JMP*    IT          Return
* SUBROUTINE TO WRITE TIME OR P.E.T.
IV:     BSS     1
        DCA     10
        JMS     D1          Go Get Data
        CALL    2,ICIOUT    Output First 3 Digits
        PAR     0020
        PAR     MM
        TAD     =-3         Set "IK" To -3
        DCA     IK
IU:     JMS     D1          Go Get Data
        CALL    2,ICIOUT    Output 2 Digits
        PAR     0020
        PAR     ML
        ISZ     IK          Last Digit?
        JMP     IU          No, Do Again
        JMP*    IV          Return
```

```
*TY (TYPE)
*ROUTINE TO TYPE ORBIT OR CAPTEST DATA ON TTY
DD:   BSS      1          Temporary Storage
TS:   BSS      1          Type Pointer Storage
I2:   BSS      1          Pointer Storage
M1:   0200                Format XX
M3:   0500                Format XXXXX
M4:   0503                Format XXX.X
M5:   0601                Format XXXX.X
M7:   0703                Format XXX.XXX
M8:   1003                Format XXXX.XXX
M9:   1100                Format XXXXXXXX.
MA:   1101                Format XXXXXXX.X
MB:   1103                Format XXXXX.XXX
MC:   1201                Format XXXXXXXX.X
      ENTRY    TY
TY:   BSS      1          Return Address
      CALL     2,CLOSE    Turn TTY On
      PAR      =3
      TAD      =-10
      DCA      DD
T5:   CALL     0,WA       Go Wait
      ISZ      DD
      JMP      T5
      TAD*     TY         Get Type Pointer
      DCA      TS         Store In TS
      ISZ      TY         Set Up Return Address
      TAD*     TS         Get Type Indicator
      AND      =0001      Mask All But BATT 1 Flag
      SZA+CLA             BATT 1?
      JMP      TV         Yes, Go Set Pointers
      TAD      =3000      BATT 2, Set Pointer To
                               BATT Storage
      DCA      I2
TA:   TAD*     TS         Get Type Indicator Again
      SPA                 Bit 0 Set
      JMP      TB         Yes, Go Type First Line
      AND      =2000      Mask All But Bit 1
      SZA+CLA             Second Line?
      JMP      TC         Yes, Go Type Second Line
*TYPE LINE 3
      TAD      =0614      Set Pointer To Get Third
                               Line Header
      DCA      10
      JMS      TD         Go Type Header Line
      CLA
      CALL     0,\TTO     Carr. Return/Line Feed
      TAD      =1160      Set Pointer For CHGR EFF
      TAD      I2
      DCA      10
      CALL     0,D3       Go Get It
```

```
        JMS     ZE          Go Test For Zero
        JMS     ZA          Go Test For Oversize
        CALL    2,FOUT      Convert And Type It
        PAR     0020
        PAR     M4
        CALL    0,D3        Get CHRG TEMP
        CALL    2,FOUT      Convert And Type It
        PAR     0020
        PAR     MC
        CALL    0,D3        Get REG EFF
        JMS     ZE          Go Test For Zero
        JMS     ZA          Go Test For Oversize
        CALL    2,FOUT      Convert And Type It
        PAR     0020
        PAR     MB
        CALL    0,D3        Get REG TEMP
        CALL    2,FOUT      Convert And Type It
        PAR     0020
        PAR     MC
        TAD     =-12        Set Counter "DD" To -12
        DCA     DD
TL:     TAD     =0240
        CALL    0,\TTO        Type A Space
        ISZ     DD          Last Space
        JMP     TL          No, Go Again
        JMS     TT          Go Type Time (E.O.C.)
        TAD     10          Reset Pointer
        TAD     =-4
        DCA     10
        DCA     0020        Load Zero
        CALL    0,U1        Store In Bank 2 E.O.C. Time
        CALL    0,U1
        CALL    0,U1
        CALL    0,U1
TR:     CLA
        CALL    0,\TTO      Carriage Return/Line Feed
        CALL    0,\CK       Go Wait For TTY To Finish
        TAD     TS          Get Type Pointer
        DCA     12          Deposit In 12
        TAD     TS          Get Type Pointer
        TAD     =-1         Subtract 1
        DCA     11          Deposit In 11
        TAD     =-D13         Set Counter "DD" To -8
        DCA     DD
TM:     TAD*    12          Get Type Indicator
        DCA*    11          Shift Down One Address
        ISZ     DD          Last Shift?
        JMP     TM          No, Do Again
        CALL    1,CLOSE     Turn TTY Off
        PAR     =4
        CALL    0,WA        Go Wait
```

```
      JMP*     TY          Return
* SET UP FOR BATTERY 1
TV:   TAD      =1000       Set BATT 1 Storage Pointer
      DCA      12
      JMP      TA          Continue Type Selection
* SUBROUTINE TO TYPE HEADER LINE
TD:   BSS      1           Return Address
      CALL     0,\TTO      Carriage Return/Line Feed
      TAD      =-106       Set Counter "DD" To -43
      DCA      DD
TW:   CALL     0,D1        Get Character Pair
      TAD      0020        Load Into Accum
      CALL     0,\TTO      Type 1st Part Of Pair
      ISZ      DD          Last Pair
      JMP      TW          No, Do Again
      CALL     0,\CK
      NOP
      JMP*     TD          Return
* TYPE LINE 1
TB:   CLA
      CALL     0,\TTO      Carriage Return/Line Feed
      CALL     0,\TTO      Carriage Return/Line Feed
      CALL     0,\TTO      Carriage Return/Line Feed
      TAD      =0400       Set Pointer To First Line Header
      DCA      10
      JMS      TD          Go Type Header Line
      CLA
      CALL     0,\TTO      Carriage Return/Line Feed
      TAD      =0240         Type Space
      CALL     0,\TTO
      TAD*     TS          Get Type Indicator And
      AND      =0003            Mask For BATT No.
      TAD      =0260       Adjust Code
      CALL     0,\TTO      Type BATT No.
      TAD      =1103       Set Pointer For Orbit Count
      TAD      I2                 1st Word
      DCA      10
      CALL     0,D1        Get It
      CALL     2,IOUT      Convert And Type
      PAR      0020
      PAR      M3
      CALL     0,D1        Get 2nd Word Of Orbit Count
      CALL     2,IOUT      Convert And Type
      PAR      0020
      PAR      M1
      JMS      TT          Go Type Time
      CALL     0,D1        Get DCH
      CALL     2,IOUT        Convert And Type
      PAR      0020
      PAR      M3
      CALL     0,D3        Go Get Data
```

```
        CALL    2,FOUT      Convert And Type
        PAR     0020
        PAR     M9
        CALL    0,D3        Get PPG EFF
        JMS     ZE          Go Test For Zero
        JMS     ZA          Go Test For Oversize
        CALL    2,FOUT      Convert And Type
        PAR     0020
        PAR     M8
        CALL    0,D3        Get BATTERY TEMP
        CALL    2,FOUT      Convert And Type
        PAR     0020
        PAR     MA
        CALL    0,D3        Get BPRC WH
        CALL    2,FOUT      Covert And Type
        PAR     0020
        PAR     MC
        JMP     TR          Go Shift Type Indicators
*TYPE LINE 2
TC:     CLA
        TAD     =0506         Set Pointer For Second
                                 Line Header
        DCA     10
        JMS     TD          Go Type Header
        CLA
        CALL    0,\TTO      Carriage Return/Line Feed
        TAD     =1126       Set Pointer For BATTERY AHO
        TAD     I2
        DCA     10
        CALL    0,D3        Go Get It
        CALL    2,FOUT      Convert And Type
        PAR     0020
        PAR     M5
        CALL    0,D3        Get R.F.
        JMS     ZE          Go Test For Zero
        JMS     ZA          Go Test For Oversize
        CALL    2,FOUT      Convert And Type
        PAR     0020
        PAR     M8
        CALL    0,D3        Get BATTERY WHO
        JMS     ZE          Go Test For Zero
        CALL    2,FOUT      Convert And Type
        PAR     0020
        PAR     M9
        CALL    0,D3        Get BATTERY EFF
        JMS     ZE          Go Test For Zero
        JMS     ZA          Go Test For Oversize
        CALL    2,FOUT      Convert And Type
        PAR     0020
        PAR     M7
        CALL    0,D3        Get HI CELL VOLT
```

```
        JMS     ZE          Go Test For Zero
        JMS     ZA          Go Test For Oversize
        CALL    2,FOUT      Convert And Type
        PAR     0020
        PAR     MB
        CALL    0,D1        Get HI CELL NO.
        CALL    2,IOUT      Convert And Type
        PAR     0020
        PAR     M3
        CALL    0,D3        Get AVE. CELL VOLT.
        JMS     ZE          Go Test For Zero
        CALL    2,FOUT      Convert And Type
        PAR     0020
        PAR     M7
        CALL    0,D3        Get LO CELL VOLT.
        JMS     ZE          Go Test For Zero
        JMS     ZA          Go Test For Oversize
        CALL    2,FOUT      Convert And Type
        PAR     0020
        PAR     M7
        CALL    0,D1        Get LO CELL NO.
        CALL    2,IOUT      Convert And Type
        PAR     0020
        PAR     M3
        CALL    0,D3        Get AVE. CELL VOLT.
        JMS     ZE          Go Test For Zero
        CALL    2,FOUT      Convert And Type
        PAR     0020
        PAR     M7
        JMP     TR          Go Shift Type Indicators
*SUBROUTINE TO TYPE TIME
TT:     BSS     1           Return Address
        CALL    0,D1        Get 1st Word (Days)
        CALL    2,IOUT      Convert And Type
        PAR     0020
        PAR     M3
        TAD     =272        Type (:)
        CALL    0,\TTO
        CALL    0,D1        Get 2nd Word (Hours)
        CALL    2,IOUT      Convert And Type
        PAR     0020
        PAR     M1
        TAD     =272        Type (:)
        CALL    0,\TTO
        CALL    0,D1        Get 3rd Word (Minutes)
        CALL    2,IOUT      Convert And Type
        PAR     0020
        PAR     M1
        TAD     =272        Type (:)
        CALL    0,\TTO
        CALL    0,D1        Get 4th Word (Seconds)
```

```
      CALL      2,IOUT      Convert And Type
      PAR       0020
      PAR       M1
      JMP*      TT          Return
* TEST FOR ZERO DATA
ZE:   BSS       1
      CLA
      TAD       0020
      SZA+CLA
      JMP*      ZE
      TAD       =2035
      DCA       0020
      JMP*      ZE
* TEST FOR DATA LIMIT

ZA:   BSS       1
      CLA
      TAD       0020
      AND       =3777
      CIA
      TAD       =2035
      SMA+CLA
      JMP*      ZA
      TAD       =2035
      DCA       0020
      JMP*      ZA
```

APPENDIX D
CHANNEL ASSIGNMENTS (DDAS)

TEST POSITION 1

CHANNEL	MEASUREMENT
000	Battery Voltage
001	Mod. 1 Cell 1 Volt.
002	Mod. 1 Cell 2 Volt.
003	Mod. 1 Cell 3 Volt.
004	Mod. 1 Cell 4 Volt.
005	Mod. 1 Cell 5 Volt.
006	Mod. 1 Cell 6 Volt.
007	Mod. 1 Cell 7 Volt.
008	Mod. 1 Cell 8 Volt
009	Mod. 1 Cell 9 Volt.
010	Mod. 1 Cell 10 Volt.
011	Mod. 1 Cell 11 Volt.
012	Mod. 1 Cell 12 Volt.
013	Mod. 1 Cell 13 Volt.
014	Mod. 1 Cell 14 Volt.
015	Mod. 1 Cell 15 Volt.
016	Mod. 1 Cell 16 Volt.
017	Mod. 1 Cell 17 Volt.
018	Mod. 1 Cell 18 Volt.
019	Mod. 1 Cell 19 Volt.
020	Mod. 1 Cell 20 Volt.
021	Mod. 1 Cell 21 Volt.
022	Mod. 1 Cell 22 Volt.
023	Mod. 1 Cell 23 Volt.
024	Mod. 1 Cell 24 Volt.
025	Mod. 1 Cell 25 Volt.
026	Mod. 1 Cell 26 Volt.
027	Mod. 1 Cell 27 Volt.
028	Mod. 1 Cell 28 Volt.
029	Mod. 2 Cell 1 Volt.
030	Mod. 2 Cell 2 Volt.
031	Mod. 2 Cell 3 Volt.
032	Mod. 2 Cell 4 Volt.
033	Mod. 2 Cell 5 Volt.
034	Mod. 2 Cell 6 Volt.
035	Mod. 2 Cell 7 Volt.
036	Mod. 2 Cell 8 Volt.
037	Mod. 2 Cell 9 Volt.
038	Mod. 2 Cell 10 Volt.
039	Mod. 2 Cell 11 Volt.
040	Mod. 2 Cell 12 Volt.
041	Mod. 2 Cell 13 Volt.
042	Mod. 2 Cell 14 Volt.
043	Mod. 2 Cell 15 Volt.
044	Mod. 2 Cell 16 Volt.

045 Mod. 2 Cell 17 Volt.
046 Mod. 2 Cell 18 Volt.
047 Mod. 2 Cell 19 Volt.
048 Mod. 2 Cell 20 Volt.
049 Mod. 2 Cell 21 Volt.
050 Mod. 2 Cell 22 Volt.
051 Mod. 2 Cell 23 Volt.
052 Mod. 2 Cell 24 Volt.
053 Mod. 2 Cell 25 Volt.
054 Mod. 2 Cell 26 Volt.
055 Mod. 2 Cell 27 Volt.
056 Mod. 2 Cell 28 Volt.
057 Mod. 3 Cell 1 Volt.
058 Mod. 3 Cell 2 Volt.
059 Mod. 3 Cell 3 Volt.
060 Mod. 3 Cell 4 Volt.
061 Mod. 3 Cell 5 Volt.
062 Mod. 3 Cell 6 Volt.
063 Mod. 3 Cell 7 Volt.
064 Mod. 3 Cell 8 Volt.
065 Mod. 3 Cell 9 Volt.
066 Mod. 3 Cell 10 Volt.
067 Mod. 3 Cell 11 Volt.
068 Mod. 3 Cell 12 Volt.
069 Mod. 3 Cell 13 Volt.
070 Mod. 3 Cell 14 Volt.
071 Mod. 3 cell 15 volt.
072 Mod. 3 Cell 16 Volt.
073 Mod. 3 Cell 17 Volt.
074 Mod. 3 Cell 18 Volt.
075 Mod. 3 Cell 19 Volt.
076 Mod. 3 Cell 20 Volt.
077 Mod. 3 Cell 21 Volt.
078 Mod. 3 Cell 22 Volt.
079 Mod. 3 Cell 23 Volt.
080 Mod. 3 Cell 24 Volt.
081 Mod. 3 Cell 25 Volt.
082 Mod. 3 Cell 26 Volt.
083 Mod. 3 Cell 27 Volt.
084 Mod. 3 Cell 28 Volt.
085 Mod. 4 Cell 1 Volt.
086 Mod. 4 Cell 2 Volt.
087 Mod. 4 Cell 3 Volt.
088 Mod. 4 Cell 4 Volt.
089 Mod. 4 Cell 5 Volt.
090 Mod. 4 Cell 6 Volt.
091 Mod. 4 Cell 7 Volt.
092 Mod. 4 Cell 8 Volt.
093 Mod. 4 Cell 9 Volt.
094 Mod. 4 Cell 10 Volt.
095 Mod. 4 Cell 11 Volt.

096	Mod. 4 Cell 12 Volt.
097	Mod. 4 Cell 13 Volt.
098	Mod. 4 Cell 14 Volt.
099	Mod. 4 Cell 15 Volt.
100	Mod. 4 Cell 16 Volt.
101	Mod. 4 Cell 17 Volt.
102	Mod. 4 Cell 18 Volt.
103	Mod. 4 Cell 19 Volt.
104	Mod. 4 Cell 20 Volt.
105	Mod. 4 Cell 21 Volt.
106	Mod. 4 Cell 22 Volt.
107	Mod. 4 Cell 23 Volt.
108	Mod. 4 Cell 24 Volt.
109	Mod. 4 Cell 25 Volt.
110	Mod. 4 Cell 26 Volt.
111	Mod. 4 Cell 27 Volt.
112	Mod. 4 Cell 28 Volt.
113	Not Used
114	Not Used
115	Not Used
116	Not Used
117	Not Used
118	Not Used
119	Not Used
120	Not Used
121	Not Used
122	Not Used
123	Not Used
124	Not Used
125	Not Used
126	Not Used
127	Not Used
128	Not Used
129	Not Used
130	Not Used
131	Not Used
132	Not Used
133	Not Used
134	Not Used
135	Mod. 1 Mod. Volt.
136	Mod. 2 Mod. Volt.
137	Mod. 3 Mod. Volt.
138	Mod. 3 Mod. Volt.
139	Mod. 5 Mod. Volt.
140	Not Used
141	Mod. 1 Temp. 1
142	Mod. 1 Temp. 2
143	Mod. 1 Temp. 3
144	Mod. 1 Temp. 4
145	Mod. 1 Temp. 5
146	Mod. 2 Temp. 1

147	Mod. 2 Temp. 2
148	Mod. 2 Temp. 3
149	Mod. 2 Temp. 4
150	Mod. 2 Temp. 5
151	Mod. 3 Temp. 1
152	Mod. 3 Temp. 2
153	Mod. 3 Temp. 3
154	Mod. 3 Temp. 4
155	Mod. 3 Temp. 5
156	Mod. 4 Temp. 1
157	Mod. 4 Temp. 2
158	Mod. 4 Temp. 3
159	Mod. 4 Temp. 4
160	Mod. 4 Temp. 5
161	Not Used
162	Not Used
163	Not Used
164	Not Used
165	Not Used
166	Chamber Temp. 1
167	Chamber Temp. 2
168	Chamber Temp. 3
169	Chamber Temp. 4
170	Room Temp
171	Battery 1 Fault Current
172	Not Used
173	Not Used
174	Not Used
175	Not Used
176	Not Used
177	Not Used
178	I Reg In
179	I Reg Out
180	V Reg Out
181	V Bus
182	I BPRC
183	I BATT.
184	I SAS
185	V SAS
186	I Chrg. Out
187	Chrgr. Temp.
188	Reg Temp.
189	Battery Temp.
190	Not Used
191	Not Used
192	BATT Disc.
193.	Night Comp.
194	Orbit Comp.
195	Cap Test
196	BPRC Lim.
197	Recond.

198 Day
199 1 PPM (Hold)

CHANNEL ASSIGNMENT (DDAS)

TEST POSITION 2

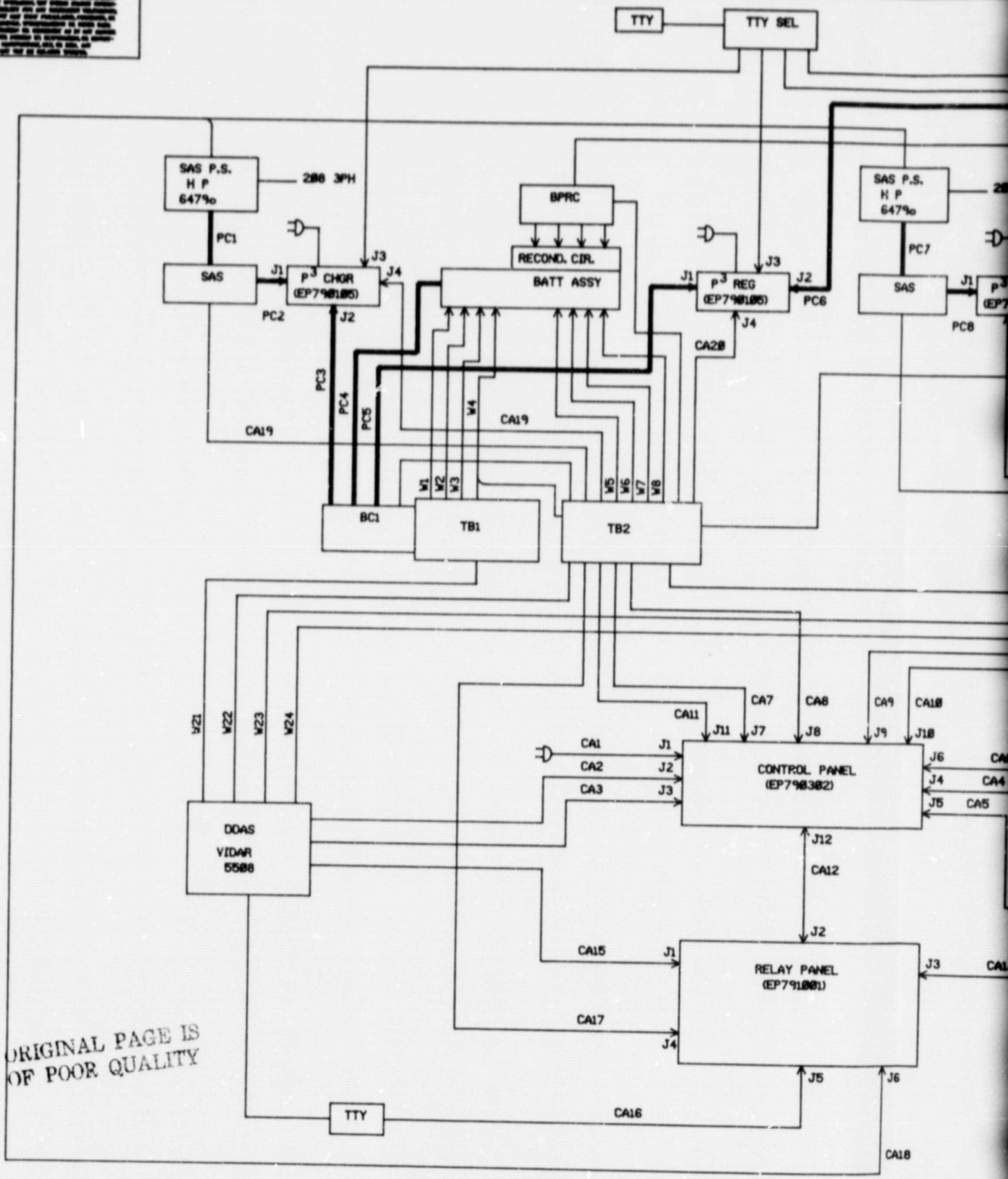
CHANNEL	MEASUREMENT
200	Battery Voltage
201	Mod. 1 Cell 1 Volt.
202	Mod. 1 Cell 2 Volt.
203	Mod. 1 Cell 3 Volt.
204	Mod. 1 Cell 4 Volt.
205	Mod. 1 Cell 5 Volt.
206	Mod. 1 Cell 6 Volt.
207	Mod. 1 Cell 7 Volt.
208	Mod. 1 Cell 8 Volt.
209	Mod. 1 Cell 9 Volt.
210	Mod. 1 Cell 10 Volt.
211	Mod. 1 Cell 11 Volt.
212	Mod. 1 Cell 12 Volt.
213	Mod. 1 Cell 13 Volt.
214	Mod. 1 Cell 14 Volt.
215	Mod. 1 Cell 15 Volt.
216	Mod. 1 Cell 16 Volt.
217	Mod. 1 Cell 17 Volt.
218	Mod. 1 Cell 18 Volt.
219	Mod. 1 Cell 19 Volt.
220	Mod. 1 Cell 20 Volt.
221	Mod. 1 Cell 21 Volt.
222	Mod. 1 Cell 22 Volt.
223	Mod. 2 Cell 1 Volt.
224	Mod. 2 Cell 2 Volt.
225	Mod. 2 Cell 3 Volt.
226	Mod. 2 Cell 4 Volt.
227	Mod. 2 Cell 5 Volt.
228	Mod. 2 Cell 6 Volt.
229	Mod. 2 Cell 6 Volt.
230	Mod. 2 Cell 8 Volt.
231	Mod. 2 Cell 9 Volt.
232	Mod. 2 Cell 10 Volt.
233	Mod. 2 Cell 11 Volt.
234	Mod. 2 Cell 12 Volt.
235	Mod. 2 Cell 13 Volt.
236	Mod. 2 Cell 14 Volt.
237	Mod. 2 Cell 15 Volt.
238	Mod. 2 Cell 16 Volt.
239	Mod. 2 Cell 17 Volt.
240	Mod. 2 Cell 18 Volt.
241	Mod. 2 Cell 19 Volt
242	Mod. 2 Cell 20 Volt.
243	Mod. 2 Cell 21 Volt.
244	Mod. 2 Cell 22 Volt.
245	Mod. 3 Cell 1 Volt.

246	Mod. 3 Cell 2 Volt.
247	Mod. 3 Cell 3 Volt.
248	Mod. 3 Cell 4 Volt.
249	Mod. 3 Cell 4 Volt.
250	Mod. 3 Cell 6 Volt.
251	Mod. 3 Cell 7 Volt.
252	Mod. 3 Cell 7 Volt.
253	Mod. 3 Cell 9 Volt.
254	Mod. 3 Cell 10 Volt.
255	Mod. 3 Cell 11 Volt.
256	Mod. 3 Cell 12 Volt.
257	Mod. 3 Cell 13 Volt.
258	Mod. 3 Cell 14 Volt.
259	Mod. 3 Cell 15 Volt.
260	Mod. 3 Cell 16 Volt.
261	Mod. 3 Cell 17 Volt.
262	Mod. 3 Cell 18 Volt.
263	Mod. 3 Cell 17 Volt.
264	Mod. 3 Cell 20 Volt.
265	Mod. 3 Cell 21 Volt.
266	Mod. 3 Cell 22 Volt.
267	Mod. 4 Cell 1 Volt.
268	Mod. 4 Cell 2 Volt.
269	Mod. 4 Cell 3 Volt.
270	Mod. 4 Cell 4 Volt.
271	Mod. 4 Cell 5 Volt.
272	Mod. 4 Cell 6 Volt.
273	Mod. 4 Cell 7 Volt.
274	Mod. 4 Cell 8 Volt.
275	Mod. 4 Cell 9 Volt.
276	Mod. 4 Cell 10 Volt.
277	Mod. 4 Cell 11 Volt.
278	Mod. 4 Cell 12 Volt.
279	Mod. 4 Cell 13 Volt.
280	Mod. 4 Cell 14 Volt.
281	Mod. 4 Cell 15 Volt.
282	Mod. 4 Cell 16 Volt.
283	Mod. 4 Cell 17 Volt.
284	Mod. 4 Cell 18 Volt.
285	Mod. 4 Cell 19 Volt.
286	Mod. 4 Cell 20 Volt.
287	Mod. 4 Cell 21 Volt.
288	Mod. 4 Cell 22 Volt.
289	Mod. 5 Cell 1 Volt.
290	Mod. 5 Cell 2 Volt.
291	Mod. 5 Cell 3 Volt.
292	Mod. 5 Cell 4 Volt.
293	Mod. 5 Cell 5 Volt.
294	Mod. 5 Cell 6 Volt.
295	Mod. 5 Cell 7 Volt.
296	Mod. 5 Cell 8 Volt.

297	Mod. 5 Cell 9 Volt.
298	Mod. 5 Cell 10 Volt.
299	Mod. 5 Cell 11 Volt.
300	Mod. 5 Cell 12 Volt.
301	Mod. 5 Cell 13 Volt.
302	Mod. 5 Cell 14 Volt.
303	Mod. 5 Cell 15 Volt.
304	Mod. 5 Cell 16 Volt.
305	Mod. 5 Cell 17 Volt.
306	Mod. 5 Cell 18 Volt.
307	Mod. 5 Cell 19 Volt.
308	Mod. 5 Cell 20 Volt.
309	Mod. 5 Cell 21 Volt.
310	Mod. 5 Cell 22 Volt.
311	Not Used
312	Not Used
313	Not Used
314	Not Used
315	Not Used
316	Not Used
317	Not Used
318	Not Used
319	Not Used
320	Not Used
321	Not Used
322	Not Used
323	Not Used
324	Not Used
325	Not Used
326	Not Used
327	Not Used
328	Not Used
329	Not Used
330	Not Used
331	Not Used
332	Not Used
333	Not Used
334	Not Used
335	Mod. 1 Mod. Volt.
336	Mod. 2 Mod. Volt.
337	Mod. 3 Mod. Volt.
338	Mod. 4 Mod. Volt.
339	Mod. 5 Mod. Volt.
340	Not Used
341	Mod. 1 Temp. 1
342	Mod. 1 Temp. 2
343	Mod. 1 Temp. 3
344	Mod. 1 Temp. 4
345	Mod. 1 Temp. 5
346	Mod. 2 Temp.
347	Mod. 2 Temp. 2

348	Mod. 2 Temp. 3
349	Mod. 2 Temp. 4
350	Mod. 2 Temp. 5
351	Mod. 3 Temp. 1
352	Mod. 3 Temp. 2
353	Mod. 3 Temp. 3
354	Mod. 3 Temp. 4
355	Mod. 3 Temp. 5
356	Mod. 4 Temp. 1
357	Mod. 4 Temp. 2
358	Mod. 4 Temp. 3
359	Mod. 4 Temp. 4
360	Mod. 4 Temp. 5
361	Mod. 5 Temp. 1
362	Mod. 5 Temp. 2
363	Mod. 5 Temp. 3
364	Mod. 5 Temp. 4
365	Mod. 5 Temp. 5
366	Chamber Temp. 1
367	Chamber Temp. 2
368	Chamber Temp. 3
369	Chamber Temp. 4
370	Not Used
371	Battery 2 Fault Current
372	Not Used
373	Not Used
374	Not Used
375	Not Used
376	Not Used
377	Not Used
378	I Reg In
379	I Reg Out
380	V Reg Out
381	V Bus
382	I BPRC
383	I BATT.
384	I SAS
385	V SAS
386	I Chrg. Out
387	Chrgr. Temp
388	Reg Temp.
389	Battery Temp.
390	Not Used
391	Not Used
392	BATT Disc.
393	Night Comp.
394	Orbit Comp.
395	Cap Test
396	BPRC Lim.
397	Recond.
398	Day

399 I PPM (Hold)



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OF POOR QUALITY

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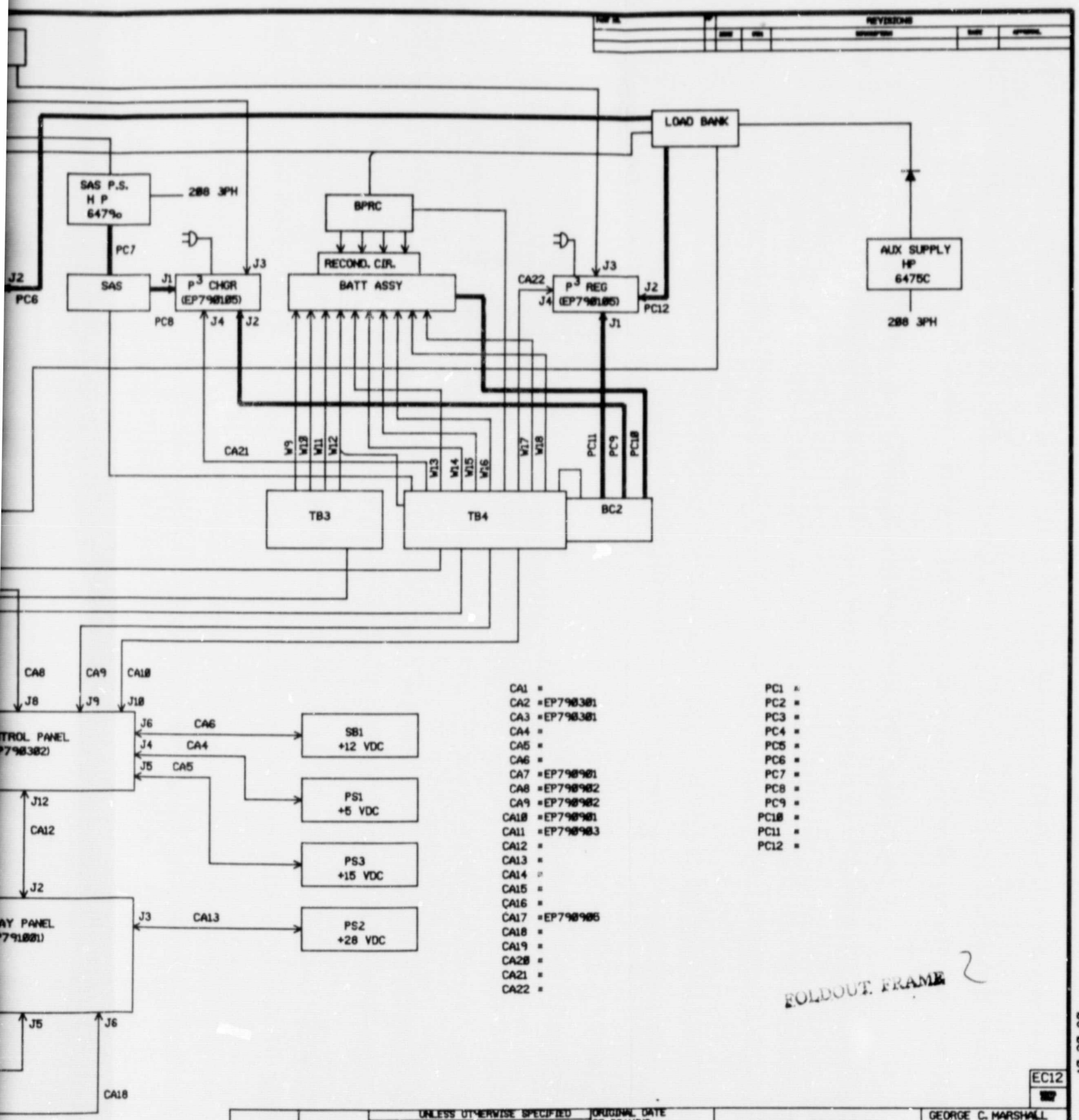


CA1 =
CA2 =EP790301
CA3 =EP790301
CA4 =
CA5 =
CA6 =
CA7 =EP790901
CA8 =EP790902
CA9 =EP790902
CA10 =EP790901
CA11 =EP790903
CA12 =
CA13 =
CA14 =
CA15 =
CA16 =
CA17 =EP790906
CA18 =
CA19 =
CA20 =
CA21 =
CA22 =

PC1 =
PC2 =
PC3 =
PC4 =
PC5 =
PC6 =
PC7 =
PC8 =
PC9 =
PC10 =
PC11 =
PC12 =

FOLDOUT FRAME 2

10-30-80

EC12

SEE ENGINEERING RECORDS	UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING	WIRING DIAGRAM HI VOLTAGE BATTERY TEST SYSTEM
NEXT ASSY / USED ON APPLICATION	FINISH PROTECTIVE FINISH	APPROVED / DIRECTOR	DRAWN CHECKED / DATE / CODE 14981 / SCALE / UNIT WEIGHT

GEORGE C. MARSHALL SPACE FLIGHT CENTER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
HUNTSVILLE, ALABAMA

SIZE D | FIG. 1 | SHEET 1 OF 1

BAT	ORBIT	SUNSET	DCH	PPG WHO	PPG EFF	BAT TEMP	BP/RC WH
1	5110	51:10:29:36	35	2632.	0.258	30.3	4.8

BAT AHO	RF	BAT WHO	BAT EFF	HI CV	CNO	AV CV	LO CV	CNO	AV CP
0.0	1.038	1.	1.162	1.541	59	.477	1.170	0	1.218

CHG EFF	CHG TEMP	REG EFF	REG TEMP	E O C TIME
0.306	52.4	0.292	75.7	0: 0: 0: 0

FIGURE 2

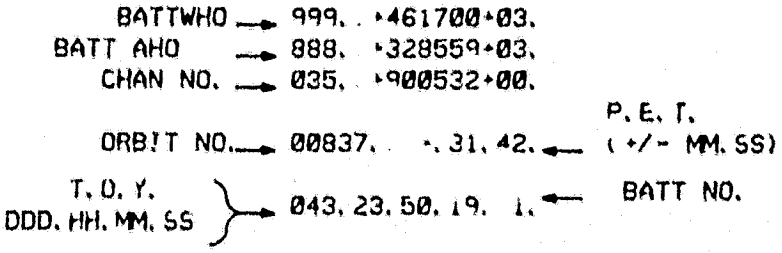


FIGURE 3

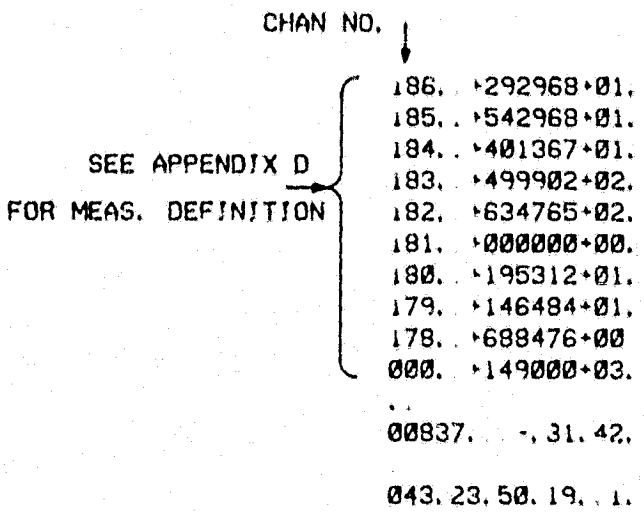
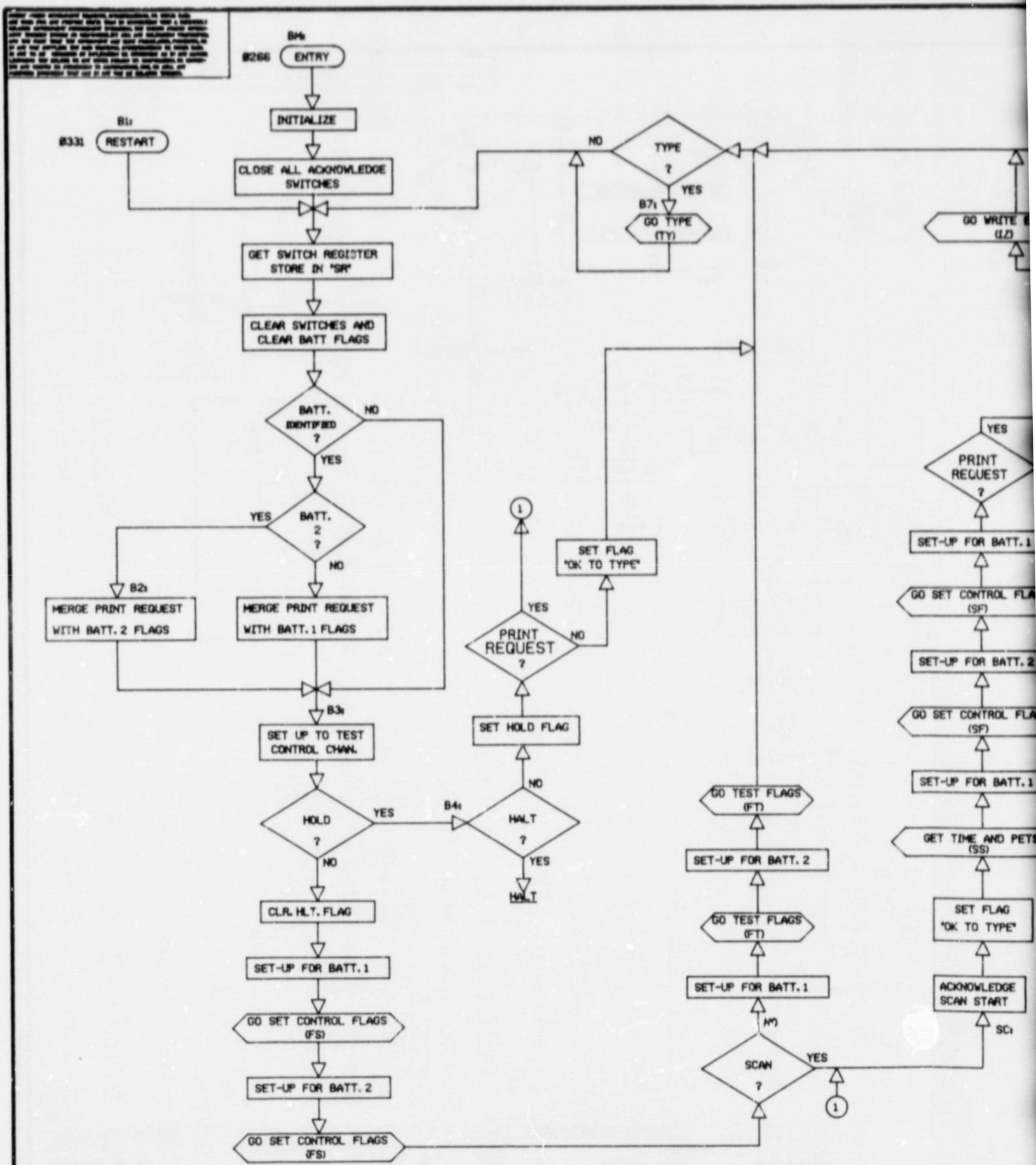


FIGURE 4



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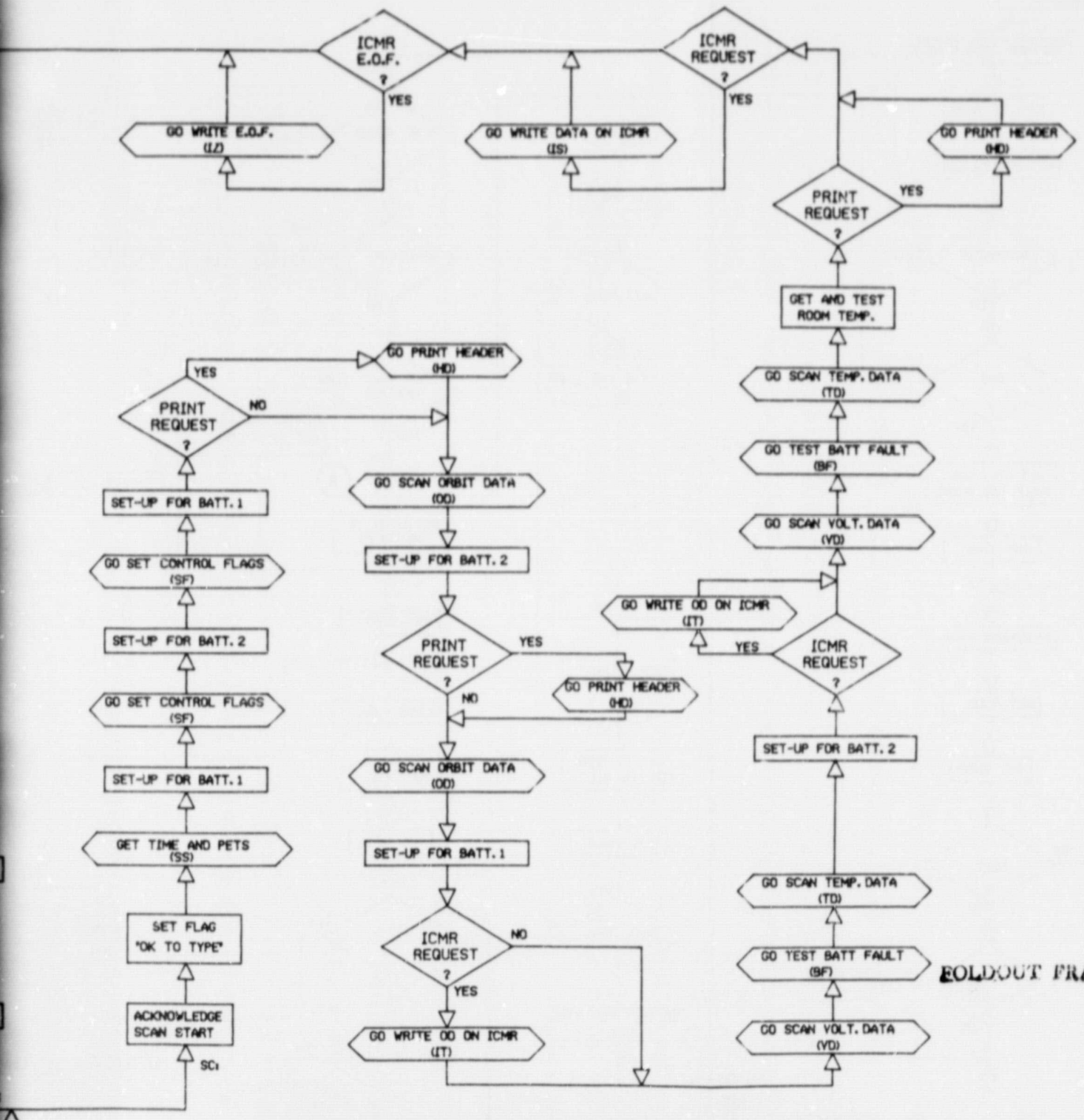
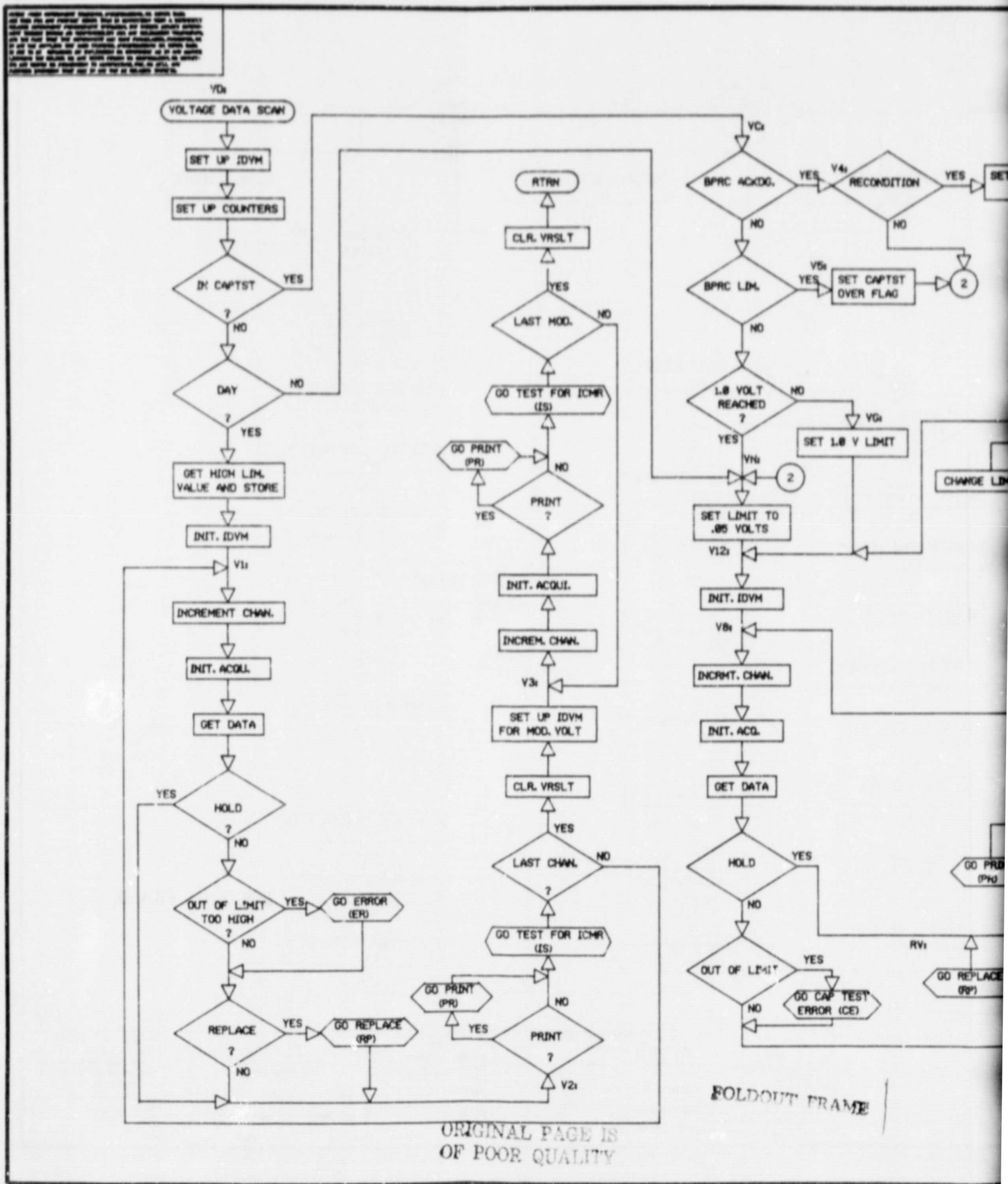
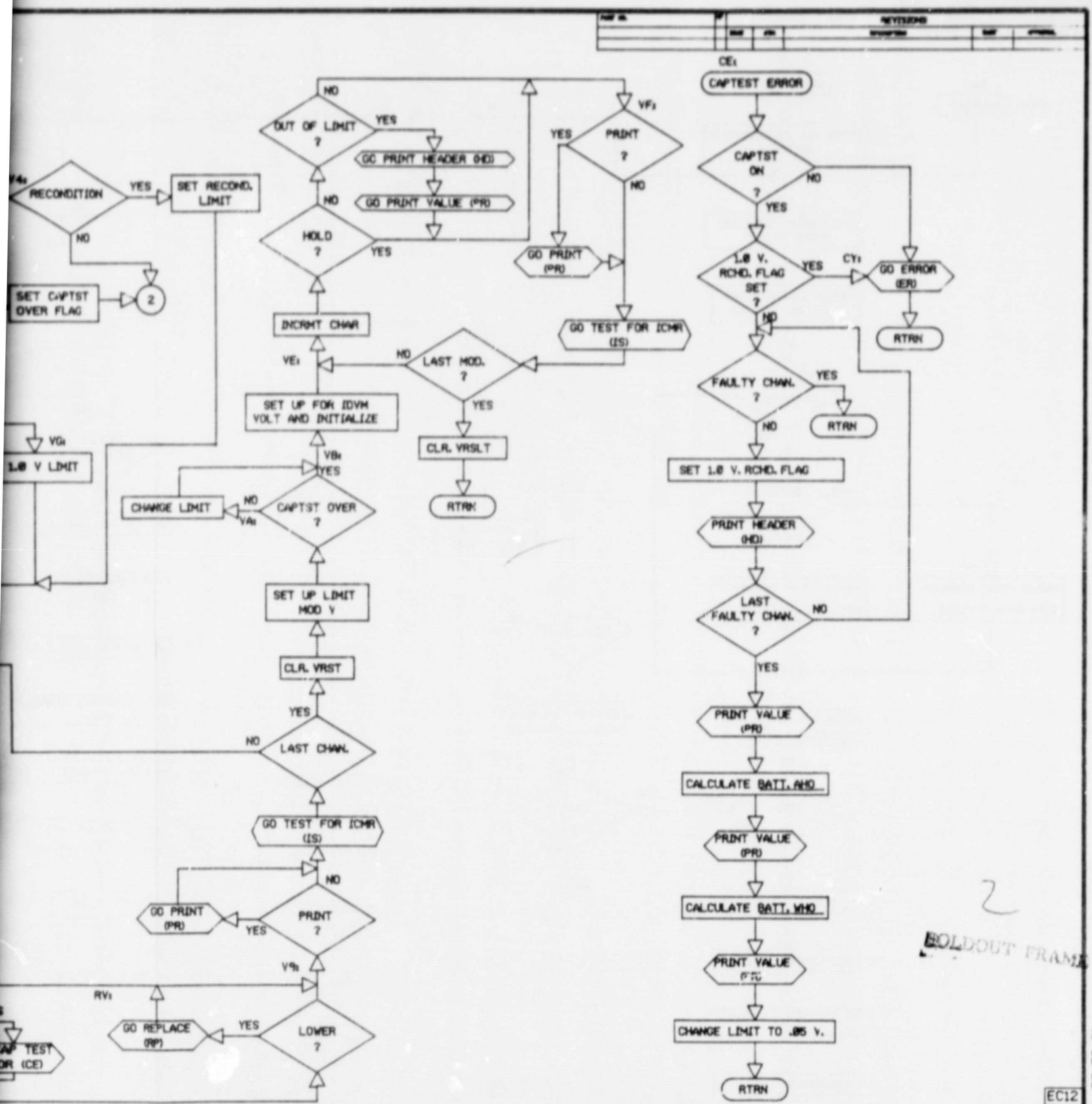


SEE ENGINEERING RECORDS	UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING	HIGH VOLTAGE POWER SUBSYSTEM DDAS FLOW DIAGRAM
NEXT ASSY / USED ON: APPLICATION	MATERIAL / HEAT TREATMENT / FINAL PROTECTIVE FINISH	APPROVED / DIRECTOR	CODE 14981 / SIZE D / FIG. 5

EC12

07-08-81



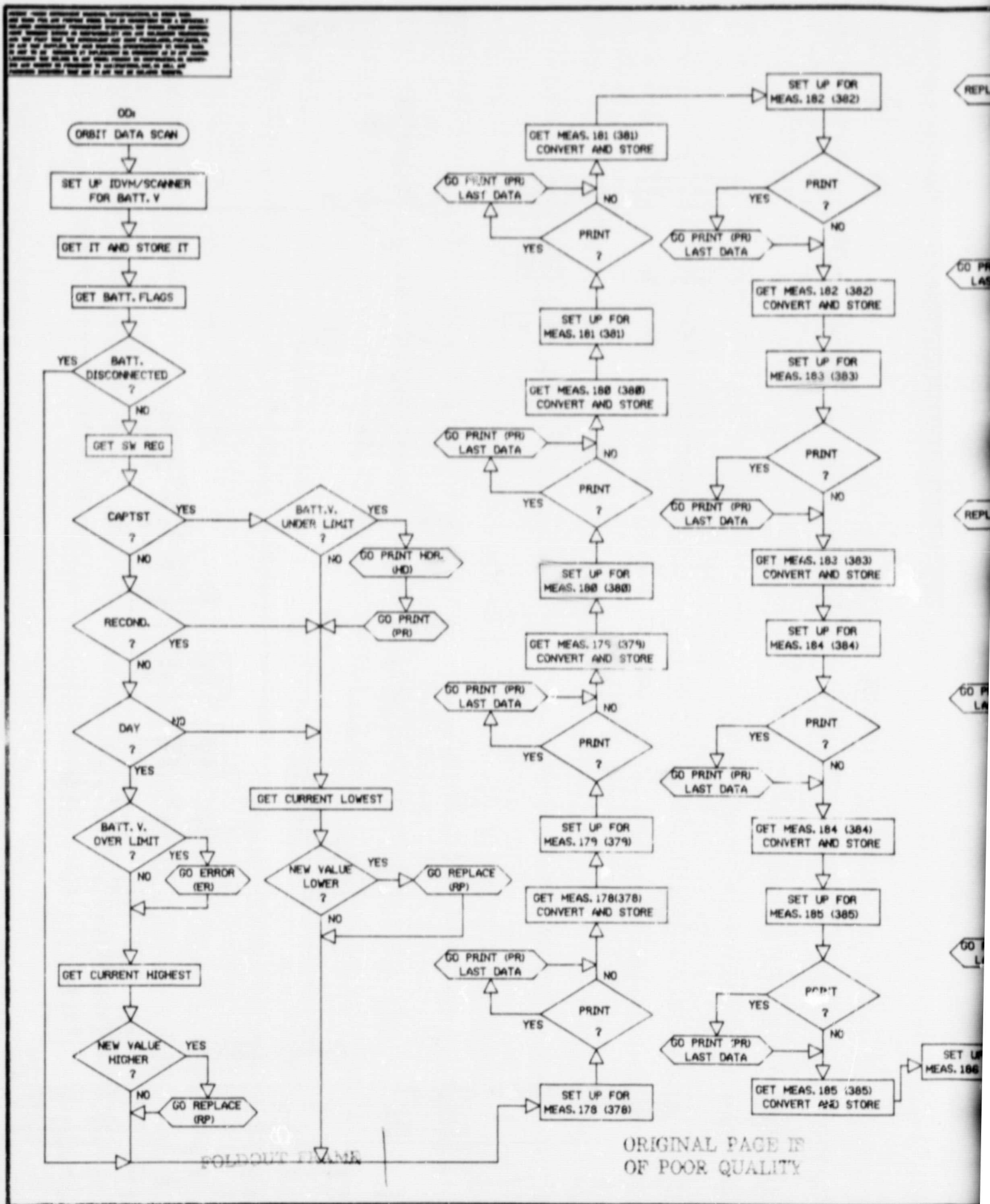


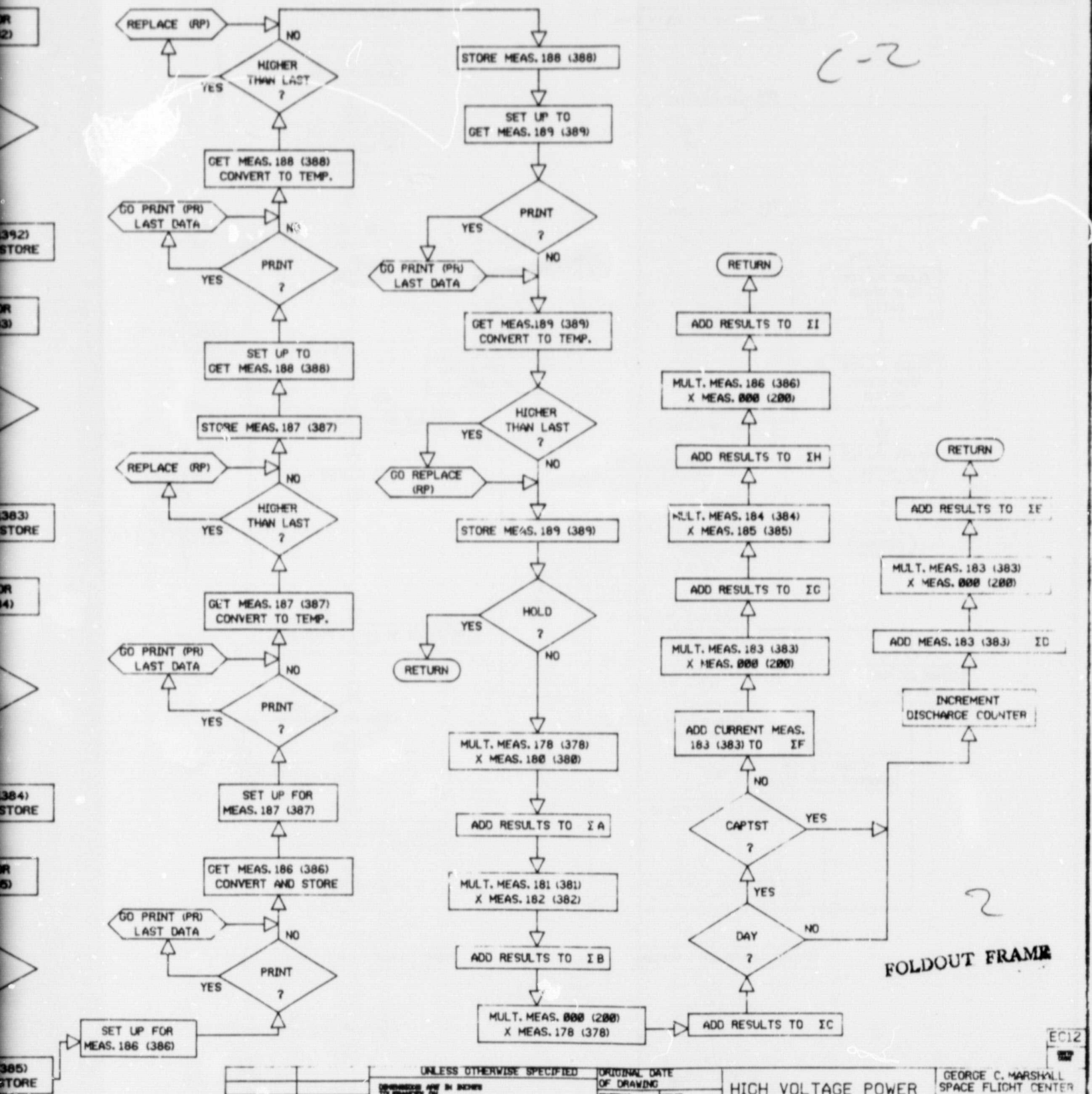
2

BOLDOUT FRAME

SEE ENGINEERING RECORDS	UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING	HIGH VOLTAGE POWER SUBSYSTEM DDAS FLOW DIAGRAM	GEORGE C. MARSHALL SPACE FLIGHT CENTER NATIONAL AERONAUTICS AND SPACE ADMINISTRATION HUNTSVILLE, ALABAMA	EC12
NEXT ASSY / USED ON APPLICATION	MATERIAL / HEAT TREATMENT / FINAL PROTECTIVE FINISH	APPROVED / DIRECTOR	WEIGHT CHECKED / SCALE	SIZE D / CODE 14981 / DATE / SHEET OF	FIG. 6

07-08-81





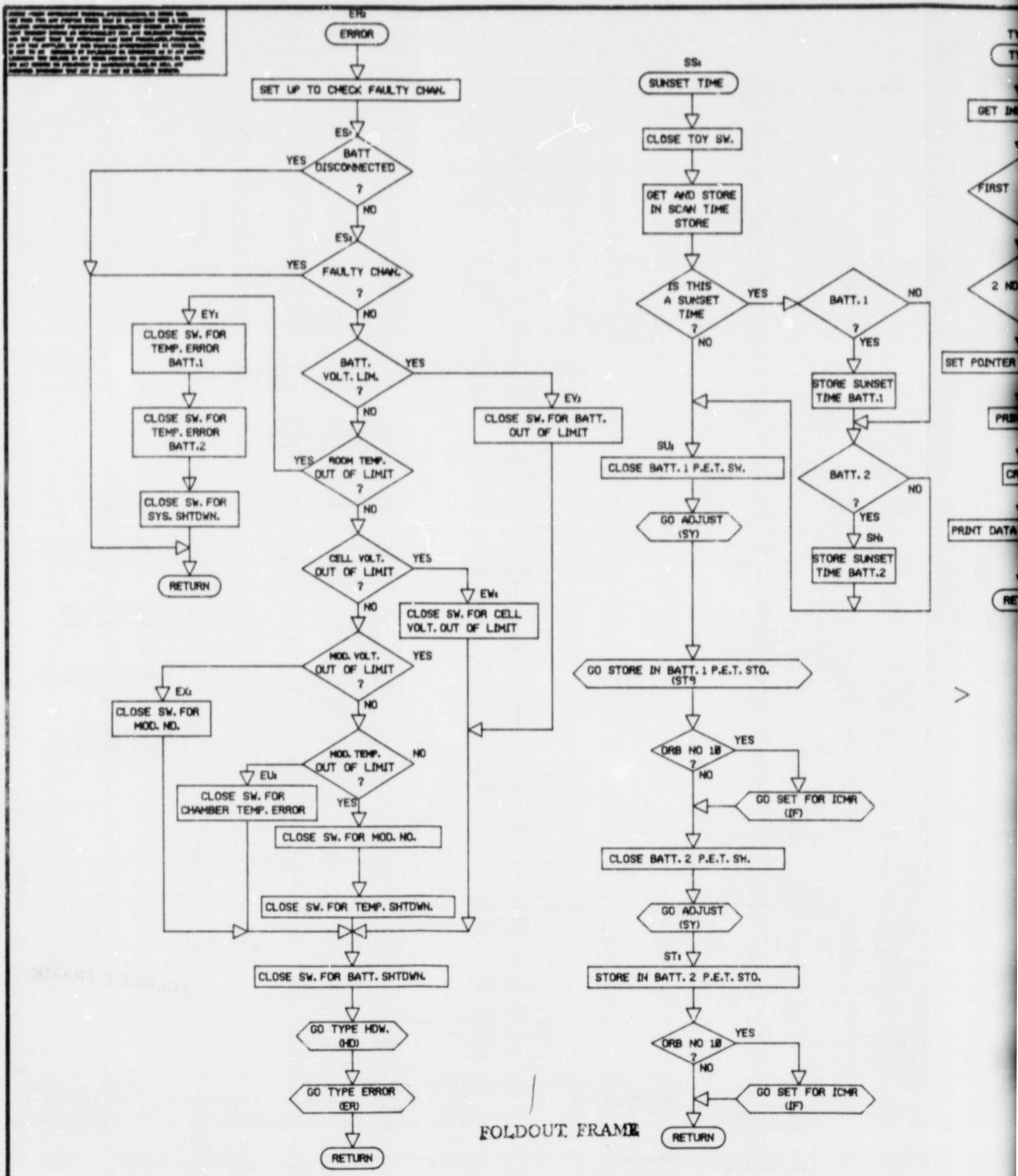
SEE ENGINEERING RECORDS	UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING	HIGH VOLTAGE POWER SUBSYSTEM DDAS FLOW DIAGRAM
NEXT ASSY / USED ON APPLICATION	MATERIAL / HEAT TREATMENT / FINISH PROTECTIVE FINISH	APPROVED / DIRECTOR	WEIGHT CHECKED / DATE / CODE 14981 / SCALE / UNIT WEIGHT

GEORGE C. MARSHALL SPACE FLIGHT CENTER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
HUNTSVILLE, ALABAMA

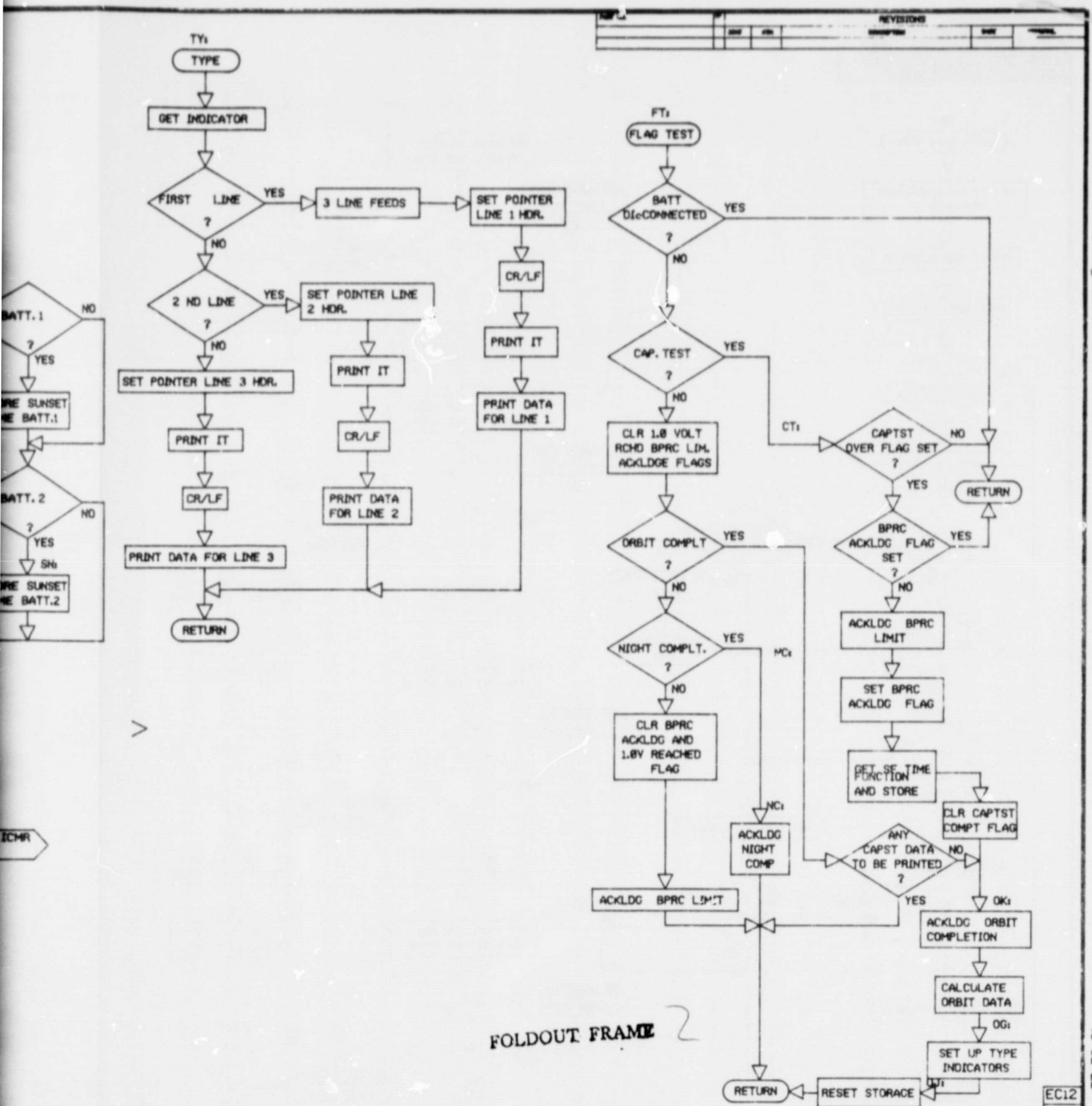
SIZE D | FIG. 7 | SHEET OF

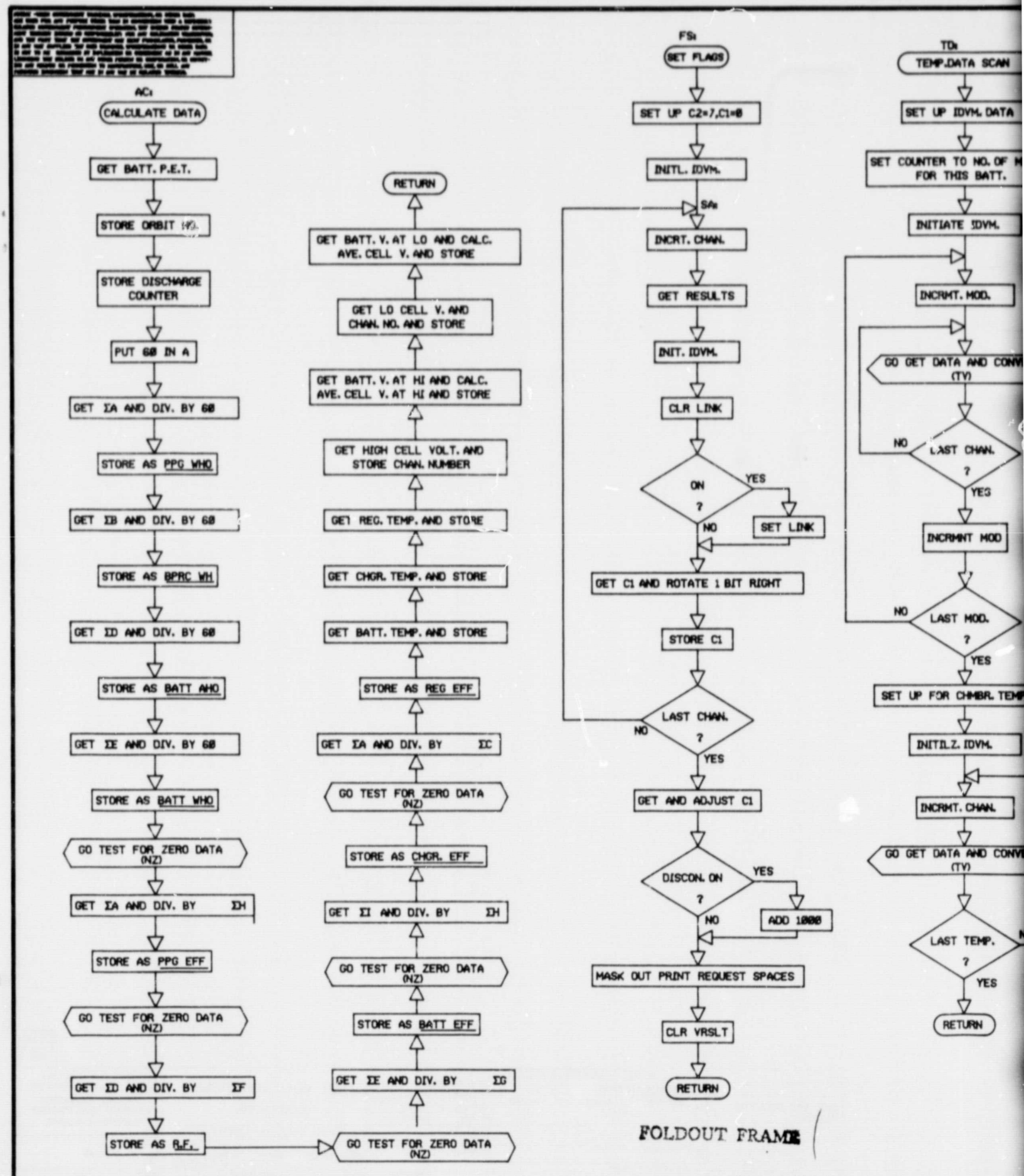
EC12

10-31-68



FOLDOUT FRAME


TY:
TYPE
GET INDICATOR
FIRST LINE ?
YES
3 LINE FEEDS
SET POINTER LINE 1 HDR.
NO
2 ND LINE ?
YES
SET POINTER LINE 2 HDR.
NO
SET POINTER LINE 3 HDR.
CR/LF
PRINT IT
PRINT DATA FOR LINE 1
PRINT IT
CR/LF
PRINT DATA FOR LINE 2
PRINT IT
CR/LF
PRINT DATA FOR LINE 3
RETURN
BATT. 1 ?
NO
YES
RE SUNSET
E BATT.1
BATT. 2 ?
NO
YES
SN:
RE SUNSET
E BATT.2
FT:
FLAG TEST
BATT DisCONNECTED ?
YES
NO
CAP. TEST ?
YES
NO
CT:
CLR 1.0 VOLT RCHD BPRC LIM. ACKLDGE FLAGS
CAPTST OVER FLAG SET ?
NO
YES
RETURN
ORBIT COMPLT ?
YES
NO
BPRC ACKLDG FLAG SET ?
YES
NO
NIGHT COMPLT. ?
YES
NO
MC:
ACKLDG BPRC LIMIT
SET BPRC ACKLDG FLAG
CLR BPRC ACKLDG AND 1.0V REACHED FLAG
GET SE TIME FUNCTION AND STORE
CLR CAPTST COMPT FLAG
NC:
ACKLDG NIGHT COMP
ANY CAPST DATA TO BE PRINTED ?
NO
YES
OK:
ACKLDG BPRC LIMIT
ACKLDG ORBIT COMPLETION
CALCULATE ORBIT DATA
OG:
SET UP TYPE INDICATORS
TJ:
RETURN
RESET STORAGE
REVISIONS
ICMR
ICMR
EC12
07-08-81
FOLDOUT FRAME 2
UNLESS OTHERWISE SPECIFIED
ORIGINAL DATE OF DRAWING
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
APPLICATION
MATERIAL
HEAT TREATMENT
FINAL PROTECTIVE FINISH
DIRECTOR
HIGH VOLTAGE POWER SUBSYSTEM
DDAS FLOW DIAGRAM
WEIGHT DRAWING
DATE
CODE 14981
SCALE
UNIT WEIGHT
GEORGE C. MARSHALL SPACE FLIGHT CENTER
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
HUNTSVILLE, ALABAMA
SIZE D
FIG. 8
SHEET OF



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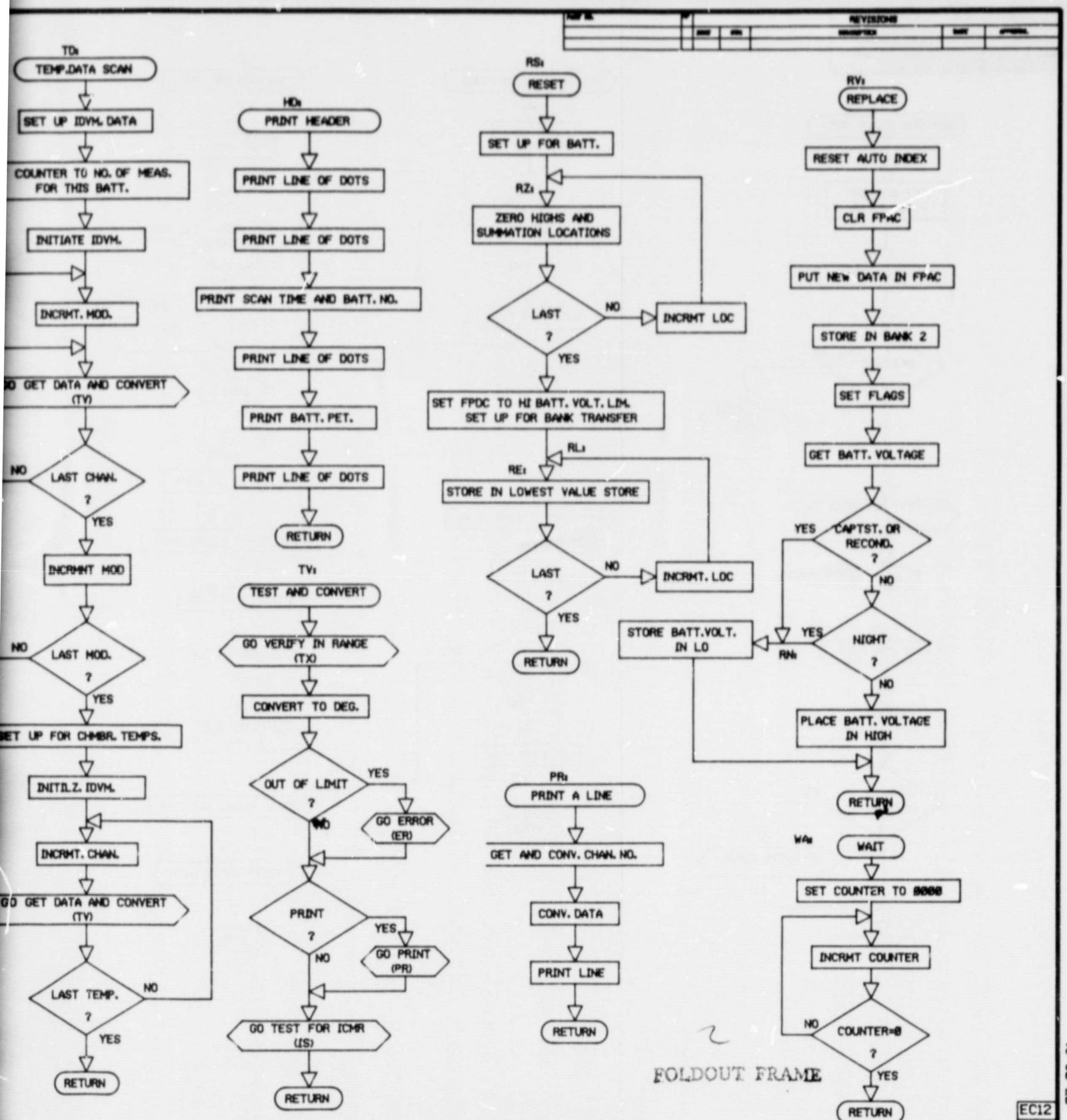
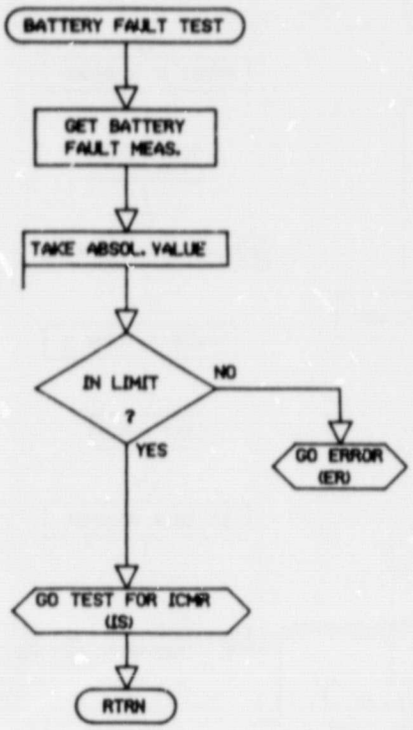


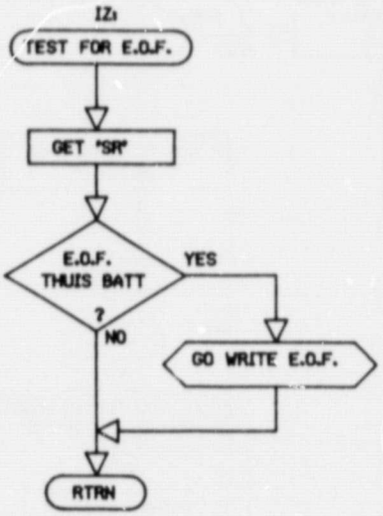
FOLDOUT FRAME

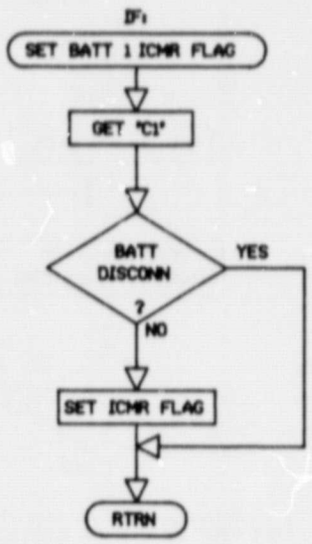
07-08-81

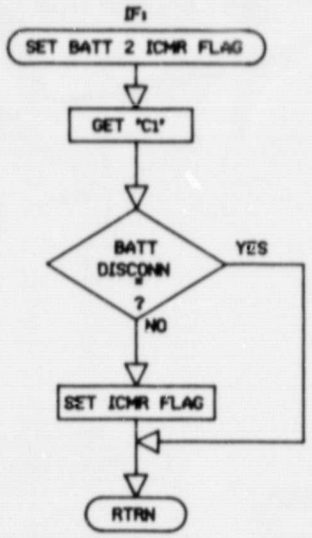
EC12

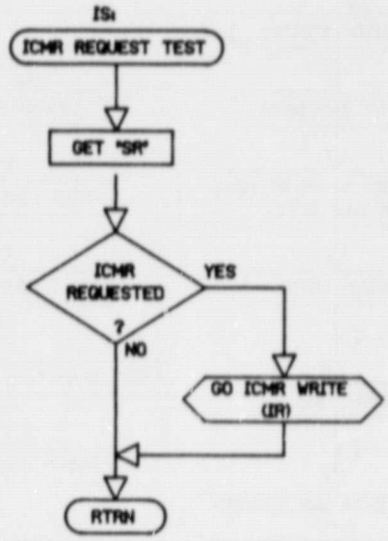
SEE ENGINEERING RECORDS	UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING	HIGH VOLTAGE POWER SUBSYSTEM DDAS FLOW DIAGRAM	GEORGE C. MARSHALL SPACE FLIGHT CENTER NATIONAL AERONAUTICS AND SPACE ADMINISTRATION HUNTSVILLE, ALABAMA	
NEXT ASSY USED ON APPLICATION	MATERIAL HEAT TREATMENT FINAL PROTECTIVE FINISH	APPROVED DIRECTOR	WEIGHT CHECKED DATE CODE 14981 SCALE UNIT WEIGHT	SIZE D	FIG. 9

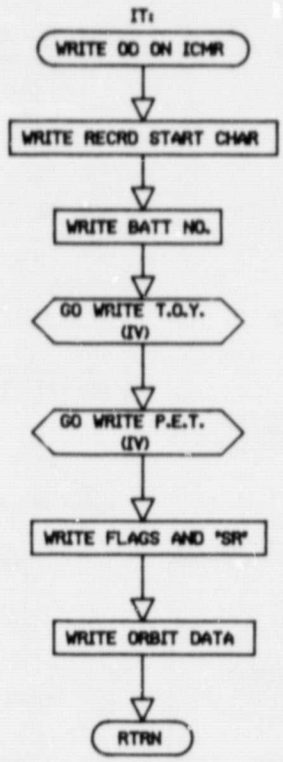












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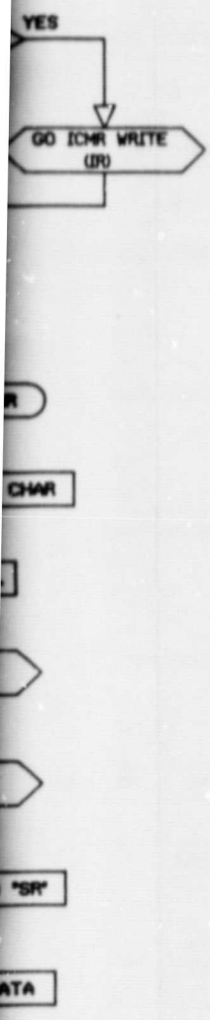
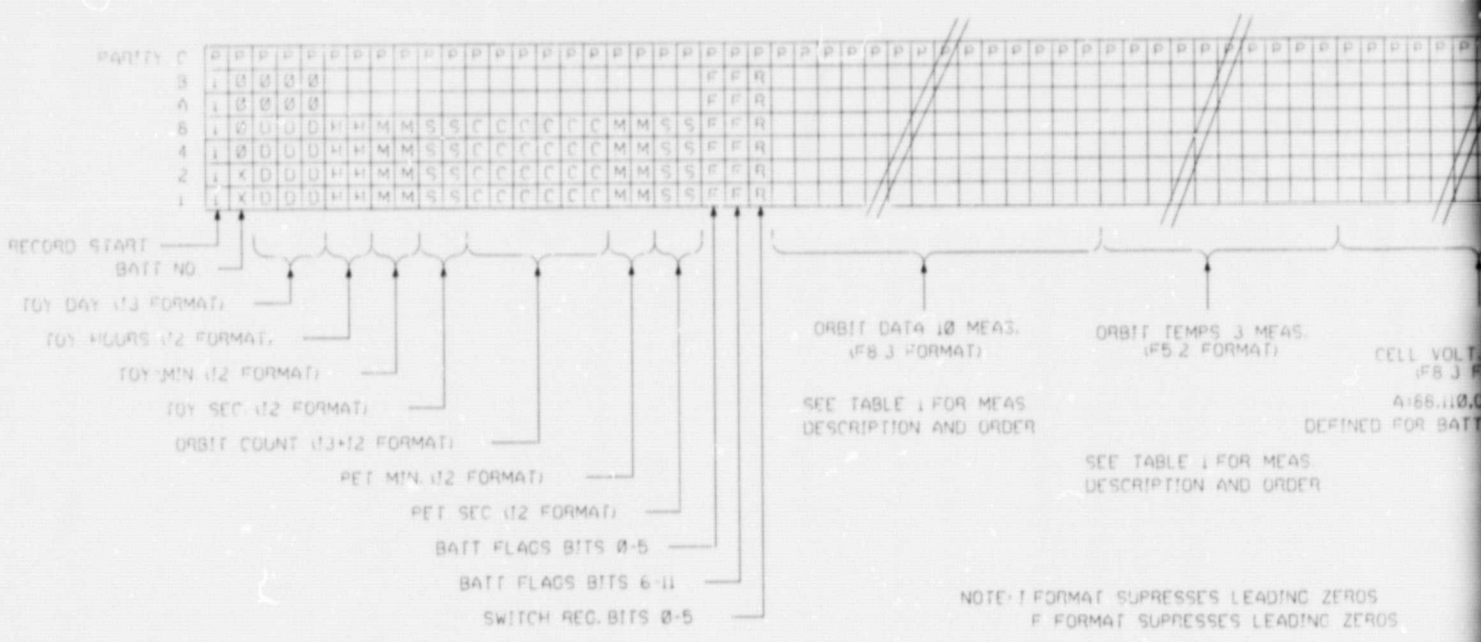


FOLDOUT FRAME 2

07-08-81

EC12

SEE ENGINEERING RECORDS		UNLESS OTHERWISE SPECIFIED	ORIGINAL DATE OF DRAWING	HIGH VOLTAGE POWER SUBSYSTEM DDAS FLOW DIAGRAM	GEORGE C. MARSHALL SPACE FLIGHT CENTER NATIONAL AERONAUTICS AND SPACE ADMINISTRATION HUNTSVILLE, ALABAMA
NEXT ASSY	USED ON				SIZE D — FIG. 18
APPLICATION			DIRECT A	CODE 14981	



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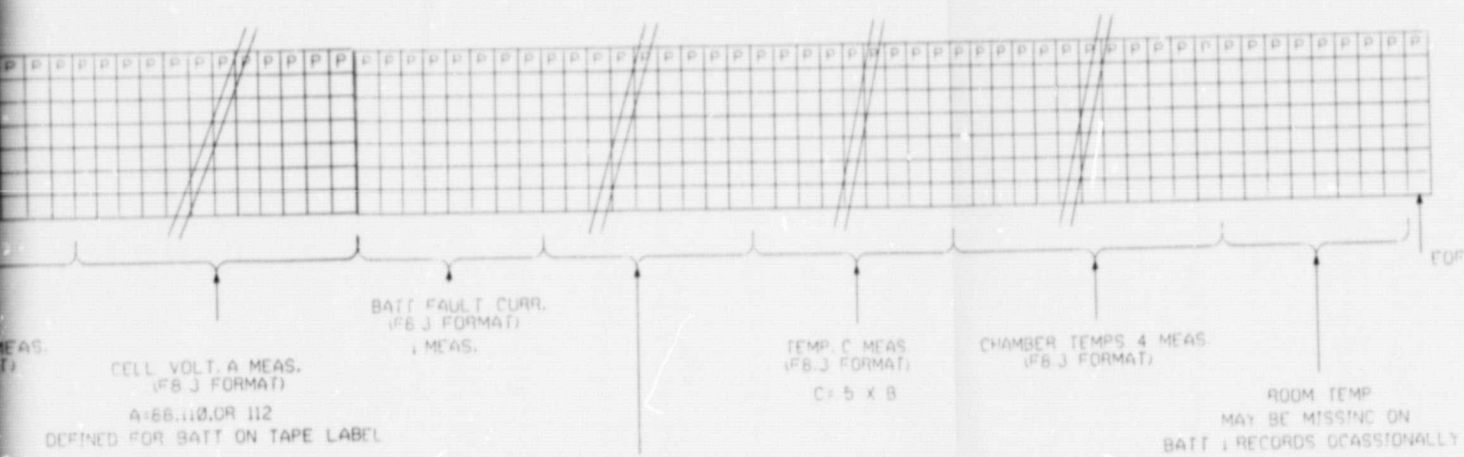

MAGNETIC TAPE FORMAT

FIG II

APPROVAL

SOFTWARE CONTROL PROGRAM
FOR
25 kW BREADBOARD TESTING

by

J. A. PAJAK

The information in this report has been reviewed for technical content. Review of any information concerning Department of Defense or nuclear energy activities or programs has been made by the MSFC Security Classification Officer. This report, in its entirety, has been determined to be unclassifed.

J. Brooks Moore JRL JLM

F. Brooks Moore
Director, Electronics
and Control Laboratory