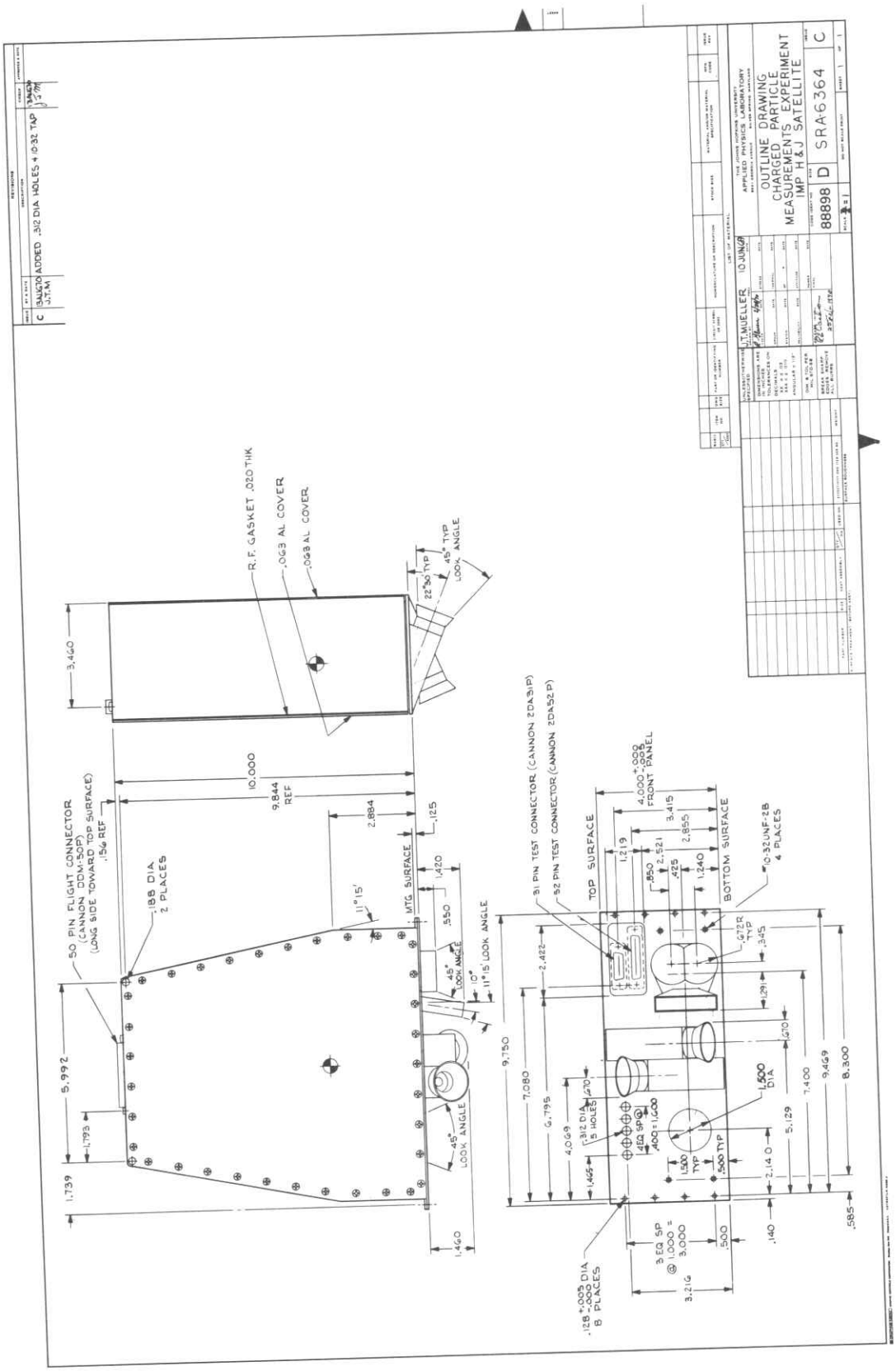
VI. MECHANICAL INTERFACE

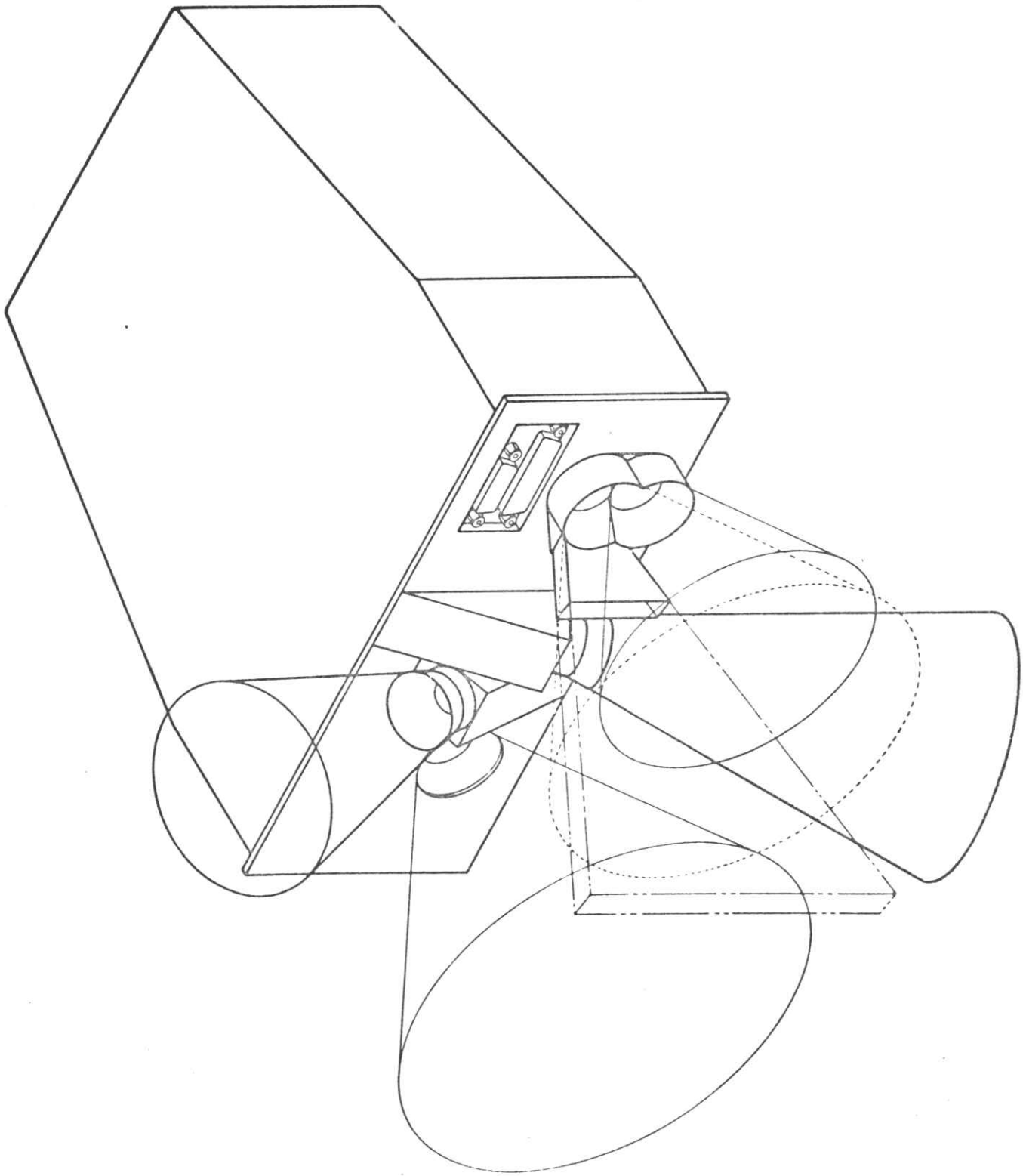
A. OUTLINE DRAWING



Approved A.E. Cashion Date August 6, 1970

VI. MECHANICAL INTERFACE

B. LOOK ANGLES



Approved Roy E Cashion Date Sept. 4, 1970

VI. MECHANICAL INTERFACE

C. MAGNETIC DESIGN

Magnetic materials used in the APP are as follows:

1. Tantalum Capacitors, 350D - Invar glass to metal seal.
2. Teledyne latching relays - Iron switching cores.
3. GM Tubes - Stainless stell 442 case.
4. Magnetic shield around power supplies.
5. Transistor cans and lead material.
6. Photomultiplier tube leads.

Solid tantalum capacitors are used as filters on power supply lines. These units have been used successfully in previous IMP experiments with similar magnetic specifications. The latching relays will be assembled in a staggered array in an attempt to have the magnetic fields cancel out each other. The GM tubes have been tested at the GSFC magnetic test facility, and shown to be within test limits. The photomultiplier tube pins are clipped as short as possible to minimize magnetic material. The magnetic shield for the power supply and transistor cans are not expected to exceed IMP H & J test limits.

Approved R. E. Cashion Date July 7, 1970

VI. MECHANICAL INTERFACE

D. POTTING METHODS

Materials to be used for potting and conformal coating are as follows:

1. RTV 11
2. RTV 102
3. RTV 108
4. NARMCO epoxy
5. Stycast 1090 SI
6. Uralene
7. Dow-Corning 93-500

Foam type encapsulation is not required for structural protection. All circuits will be surface protected with a conformal coating of uralene or silicon varnish. The application method will be dip-coat or brush coat as applicable. High voltage bleeder strings for the photomultipliers and voltage multipliers in the power supplies will be vacuum potted in RTV 11, cured at "pressure of 1 atm". The mold for bleeder strings is fiberglass which remains in place. Power supply transformers will be vacuum potted in Stycast 1090 SI.

In general, all potting will be accomplished in accordance with "Potting and Spray Solder Information" - Memorandum of 13 March 1969, File No. 15823.

Approved R. E. Cashion Date June 18, 1970

VI. MECHANICAL INTERFACE

E. HANDLING AND MECHANICAL RESTRAINTS

The sensors employed in the APP are silicon surface barrier and silicon lithium-drifted solid state detectors, GM tubes, and plastic scintillator-photomultiplier tube combinations. All of these sensors could be affected by extreme environment or handling. Precautions in handling other spaceflight equipment will apply to the APP. A list of chemical agents to be used in the vicinity of the spacecraft should be sent to APL for sensitivity tests of the sensors.

A thin (0.000012 inches) light tight foil on the PET can be damaged by sudden changes in pressure. A protective cover will be in place for normal test operations. When the protective cover is removed, precaution should be taken to prevent sudden drafts such as from air-conditioning ducts in shrouds and fairings.

Approved R. E. Cashion Date June 18, 1970

VI. MECHANICAL INTERFACE

F. HAZARDOUS MATERIAL

No hazardous material is used in the APP package as permanent parts.

Radioactive materials to be used in checkout of the APP are as follows:

1. Am^{241} + Sr^{90} - 10 microcuries each per unit, manufacturer is Isotope Products Laboratories.
2. Co^{60} - 10 microcuries, 5 required per unit, manufacturer is Nuclear Chicago.
3. Po^{210} - 100 millicuries, unprocured.
4. Sr^{90} - 100 millicuries, unprocured.

Ordnance: none
Pressurizations: none
Other: none

Approved R E Cashion Date June 18, 1970

VII. GROUND SUPPORT EQUIPMENT

A. BLOCK DIAGRAM AND DESCRIPTION - Preliminary

1. Experiment GSE

The Experiment GSE for APP will be used for both bench checkout of the experiment when APP is not installed in the spacecraft, and also for control of operational modes and verification of proper operation when APP is installed in the spacecraft. The GSE will connect to the experiment through both the flight connector, J1 and the test connector J2 for bench checkout, but will only require connection to J2 when the experiment is operated in the spacecraft.

This GSE contains the following systems:

1. Clock generator - simulates spacecraft address lines a_3, a_4, a_5, a_6, and C_{35}.
2. Command generator - simulates spacecraft commands.
3. Power supply - powers the experiment.
4. Voltmeter - monitors power supply and analog performance parameters.
5. Override controls - stops experiment in a given operational mode.
6. Counter - simulates spacecraft accumulators.

2. Calibration GSE

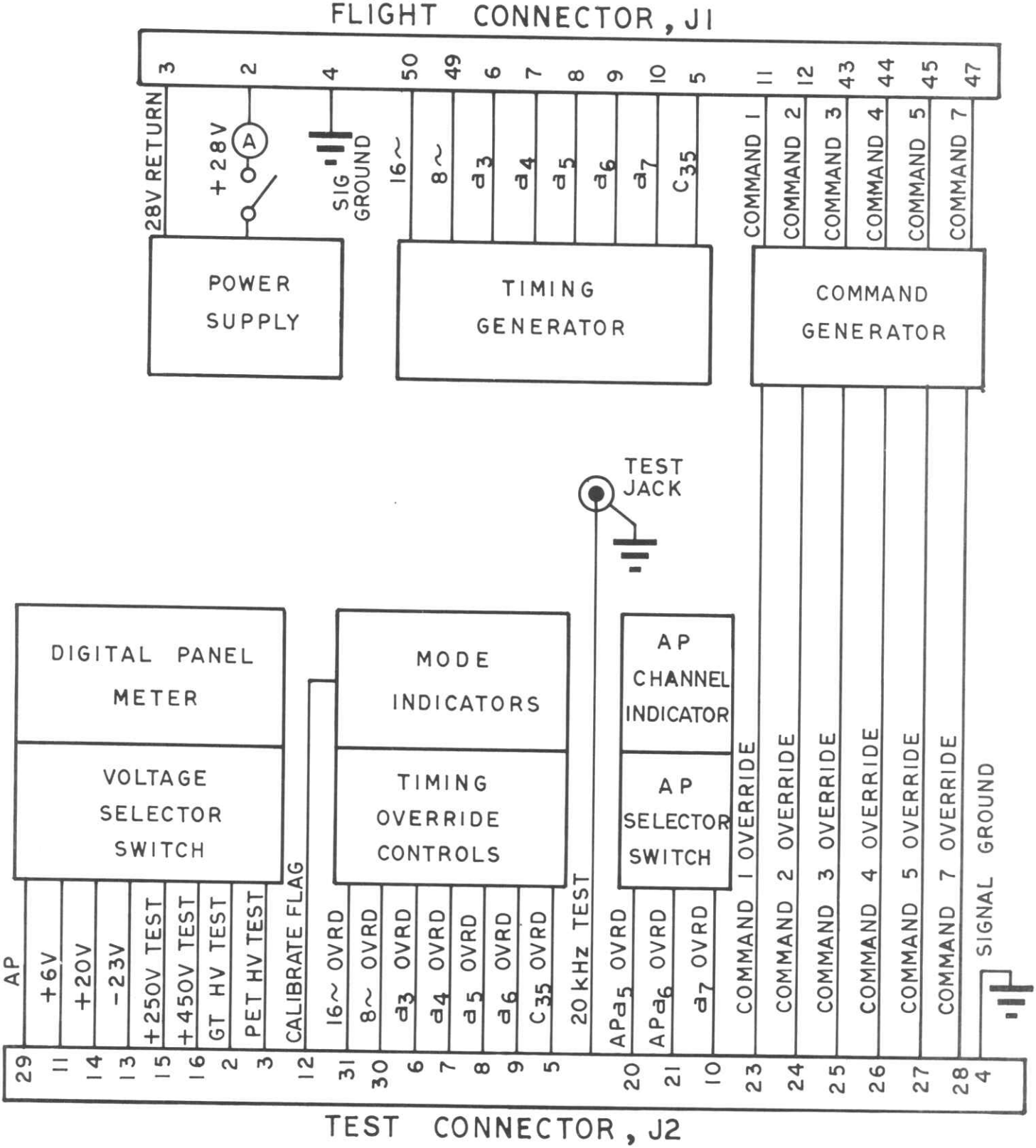
The calibration GSE will be used to perform Encoder Check described in Section IX. This equipment connects to the experiment through test connector J3 and is used to verify the proper operation of encoder circuits that process APP data. The Calibration GSE contains, (1) accumulators for counting APP output signals, (2) a digital printer for logging the accumulator data, and (3) a paper tape punch for logging data in a computer compatible format.

This GSE will be required only a few times in the life of spacecraft integration (following installation of APP into the spacecraft and after completion of all standard tests) and therefore, this equipment should not be installed in the spacecraft test rack. It is expected that this equipment will be qualified with the spacecraft and then delivered to GSFC from APL whenever the Encoder Check is scheduled. APL operators will be available for operation of the Calibration GSE for all Encoder Checks.

Approved R. E. Cashion Date June 18, 1970

VII. GROUND SUPPORT EQUIPMENT

A. BLOCK DIAGRAM



Approved R E Cashion Date July 7, 1970

VII. GROUND SUPPORT EQUIPMENT

B. SUMMARY TECHNICAL DATA

1. Experiment GSE

Size: $7\frac{1}{2}$ inches high, 19 inch rack mount drawer.
Controls: All located on front panel.
Power: 117 Vac, 50-60 Hz, single phase.
Temperature limits: 0 to +50°C operational.
Ground system: GSE common - DC isolated from chassis, bypassed to chassis for noise suppression.
GSE chassis - should connect to building ground.

2. Calibration GSE

Size: One portable 19 inch rack, 40 inches high.
Controls: Manual controls - front panel
Mode controls - from Experiment GSE
Power: 117 Vac, 50-60 Hz, single phase.
Temperature limits: 0 to +50°C
Ground system: GSE common - DC isolated
GSE chassis - connect to building ground.

Approved R E Cashion Date June 18, 1970

VIII. TEST DATA REQUIREMENTS

A. NORMAL DATA - GENERAL DESCRIPTION

In order to provide the capability both for exhaustive examination of the rates in each data channel on a high time resolution basis and for long term monitoring of performance, the CPME test data output takes four forms: one, called FULLIST I produces 8 print lines per snapshot and is a comprehensive tabulation of all data outputs at maximum time resolution. This option will be used sparingly because it produces ~ 120 pages of listed output for each hour of experiment operation at high bit rate. A minor modification of FULLIST I, called FULLIST II, produces one-half the output volume by listing only one-half of the sectored data registers for each snapshot, e.g., first snapshot lists sectors 1, 3, 5, 7, second lists 2, 4, 6, 8, third 1, 3, 5, 7 again, etc.

The third option SHORTLIST retains only representative outputs and is limited to one line of printed output per snapshot. SHORTLIST will be used most frequently.

The fourth option which provides the maximum compression of the output data is SUMOUT. SUMOUT accumulates 11 album sums of counts in each data channel beginning with the first 11 complete albums of data. An interruption of any kind in the data stream is treated by SUMOUT as a partial sum and is printed out as such. To be able to handle such interruptions, a running count must be kept of the number of frames (snapshots) accumulated for each channel.

Each output list option should have the usual header information printed at approximate intervals, e.g., year, month, day, test configuration, etc.

1. FULLIST I

   Tables VIII-A and B summarize the output from FULLIST I. Field lengths and spacing are flexible, providing the listed items and approximate ordering are maintained.

2. FULLIST II

   Substantially identical to FULLIST I except for sectored data, columns 91 to 130 in Table VIII-A. Only 4 sectors are retained in each snapshot, 1, 3, 5, 7 in one and 2, 4, 6, 8 in the next, etc. The output format is therefore 4 lines long instead of 8 as in FULLIST I.

3. SHORTLIST

   Provides an abbreviated synoptic output list consisting of:

   (a) Clock
   (b) P1, P4, P7, A2, E4, M, E1, E2A, E2B, E2C, E3, S rate channels
   (c) Analog performance parameters

   at snapshot time resolution. P1, E1, E2A are obtained from sector sums. The output format is not critical but should not exceed one printed line per snapshot.

Approved R E Cashion Date August 6, 1970

4. SUMOUT

Provides the maximum compression of data by forming 11 album sums of the rates in all output channels. When we have exactly 11 albums in a sum, we may specify a conversion to counting rate for each channel as follows (let T denote accumulation time for one snapshot in rate channels and T' denote that for a sector):

Descriptive Name	Signal Name	To form counting rate divide by*
P1 (sector sum)	S3(Alternate Snapshots)	88 * T
P2	R19	88 * T
P3	R20	88 * T
P4	R21	88 * T
P5	R22	88 * T
P6	R23	88 * T
P7	R4	176 * T
P8	R24	88 * T
P9	R3	176 * T
P10	R13	88 * T
P11	R12	88 * T
A1 (sector sum)	S4(every fourth snapshot)	44 * T
A2	R11	88 * T
A3	R10	88 * T
A4	R9	88 * T
A5	R8	88 * T
A6	R7	176 * T
A7	R6	176 * T
Z1	R5	176 * T
Z2	R25	88 * T
M	R1	176 * T
S ← E2B E2C	R2 ← R-17 R-18	176 * T ← 88 * T 88 * T
E1 Sector 1 to 8	S1	176 * T'
E2A Sectors 1 to 8	S2	88 * T'
E3 Sectors 1 to 8	S2	88 * T' → modify in sumout to give 3Z sectors subcom
E4 Sectors 1 to 8	S3	88 * T'

88 / 176 snaps = 1 abs

See next page

*The multiplying factor represents the number of snapshots in an uninterrupted stream of data. If an interruption occurs the actual number of accumulated snapshots must be used.

Approved R E Cashion Date August 6, 1970

4. SUMOUT

Provides the maximum compression of data by forming 11 album sums of the rates in all output channels. When we have exactly 11 albums in a sum, we may specify a conversion to counting rate for each channel as follows (let T denote accumulation time for one snapshot in rate channels and T' denote that for a sector):

Descriptive Name	Signal Name	To form counting rate divide by*
P1 (sector sum)	S3 (Alternate Snapshots)	88 * T
P2	R19	88 * T
P3	R20	88 * T
P4	R21	88 * T
P5	R22	88 * T
P6	R23	88 * T
P7	R4	176 * T
P8	R24	88 * T
P9	R3	176 * T
P10	R13	88 * T
P11	R12	88 * T
A1 (sector sum)	S4 (every 4th snapshot)	44 * T
A2	R11	88 * T
A3	R10	88 * T
A4	R9	88 * T
A5	R8	88 * T
A6	R7	176 * T
A7	R6	176 * T
Z1	R5	176 * T
Z2	R25	88 * T
M	R1	176 * T
S	R2	176 * T
E2B	R17	88 * T
E2C	R18	88 * T
E1 Sector 1 to 8	S1	176 * T'
E2A Sectors 1 to 8	S2	88 * T'
32 Sub Sector > E3 Sectors 1 to 8	S2	88 * T'
E4 Sectors 1 to 8	S3	88 * T'

*The multiplying factor represents the number of snapshots in an uninterrupted stream of data. If an interruption occurs, the actual number of accumulated snapshots must be used.

Approved [signature] Date Feb. 4, 71

Descriptive Name	Signal Name	To form counting rate divide by
P1 Sectors 1 to 8	S3	88 * T'
P10 Sectors 1 to 8	S4	44 * T'
P11 Sectors 1 to 8	S4	44 * T'
A1 Sectors 1 to 8	S4	44 * T'
A6 Sectors 1 to 8	S4	44 * T'

Command states are verified by means of analog performance parameters, 1, 2, and 3. If any of these three AP measurements change by more than 0.5 volt, stop the sum, print the count rates, and begin again. The nominal values for AP 1, 2, and 3 is given below with the command state.

See next page

AP	Command No.	Function	Value
1	5	RESET	1.5V
1	7	Calibrate Disable	0 V
2	5	RESET	0 V
2	1	GT HV ON	3.0V
2	2	PET HV ON	1.5V
2	1 + 2	GT + PET HV ON	4.5V
3	5	RESET	0 V
3	3	GAIN A DOWN	3.0V
3	4	GAIN B DOWN	1.5V
3	3 + 4	GAIN A + GAIN B DOWN	4.5V

Each of the 8 measurements subcommutated into the analog performance parameter, AP, appears 22 times if a command has not been received. Average values should be listed out.

The printing format for SUMOUT should be similar to that for FULLIST I with the following changes to add the additional sectored data:

1. There are 9 sectored averaged rates, E1, E2A, E3, E4, P1, P10, P11, A1, A6 to be listed in SUMOUT rather than 4 as in FULLIST I. The format may have to be lengthened by several lines and rearranged.

2. There are 8 average values for analog performance parameters in SUMOUT compared to 1 in the FULLIST option.

3. The actual number of accumulated snapshots for each channel must also be printed, if different than nominal number.

Approved R E Cashion Date August 6, 1970

Descriptive Name	Signal Name	To form counting rate divide by
P1 Sectors 1 to 8	S3	88 * T'
P10 Sectors 1 to 8	S4	44 * T'
P11 Sectors 1 to 8	S4	44 * T'
A1 Sectors 1 to 8	S4	44 * T'
A6 Sectors 1 to 8	S4	44 * T'

Command states are verified by means of analog performance parameters, 6, 7, and 8. If any of these three AP measurements change by more than 0.5 volt, stop the sum, print the count rates, and begin again. The nominal values for AP 6, 7, and 8 are given below with the command state.

AP	Command No.	Function	Value
8	5	RESET	1.5V
8	7	Calibrate Disable	4.5V
7	5	RESET	0 V
7	1	GT HV ON	3.0V
7	2	PET HV ON	1.5V
7	1 + 2	GT + PET HV ON	4.5V
6	5	RESET	4.5V
6	3	GAIN A DOWN	1.5V
6	4	GAIN B DOWN	3.0V
6	3 + 4	GAIN A + GAIN B DOWN	0 V

Each of the 8 measurements subcommutated into the analog performance parameter AP, appears 22 times if a command has not been received. Average values should be listed out.

The printing format for SUMOUT should be similar to that for FULLIST I with the following changes to add the additional sectored data:

1. There are 9 sectored averaged rates, E1, E2A, E3, E4, P1, P10, P11, A1, A6 to be listed in SUMOUT rather than 4 as in FULLIST I. The format may have to be lengthened by several lines and rearranged.

2. There are 8 average values for analog performance parameters in SUMOUT compared to 1 in the FULLIST option.

3. The actual number of accumulated snapshots for each channel must also be printed, if different than nominal number.

Approved Roy E Clarke Date Jan. 27, 1971

B. CALIBRATE DATA

The CPME package is equipped with an in-flight calibrator which exercises all of the PET channels. By means of simple arithmetic calculations, the output rates during the calibration sequence (which lasts for one full album) can be converted into internal discriminator thresholds. The calibrate sequence is initiated with the spacecraft line C35=1. Whenever a calibrate sequence is sensed, the data option FULLIST I must be assumed and sixteen snapshots of complete data will be listed. At the end of the calibrate album, a summary of the calculated results for discrimination levels will be printed. The following items explain this procedure in more detail:

1. Sensing the start of a calibrate album when C35=1.

2. Calculating discrimination levels. The following table outlines the procedure to be followed:

DP-3-21 APP Calibrate on/off.
1 = calibrate on

even SS , Seq 0, Fr. 12, Ch. 4, Bit 1

C35 ↑ sso, PGO, album 0

a6 ↑

Approved R E Cashion Date August 6, 1970

Discriminator Name	Register #	Label	Location Page	Location Snapshot	Expression*
A1	R4	YA1	4(3)	2 1	A1 = 400 - 0.2 * YA1 + DA1
A2	R4	YA2	3 2	2 1	A2 = 400 - 0.2 * YA1 + 0.6 * YA2 + DA2
A3	R19	YA3	3 2	2 1	A3 = 400 - 0.2 * YA1 + 0.6 * (YA2 + YA3) + DA3
A4	R10	YA4	2 1	4 3	A4 = 4.0 - 0.002 * YA4 + DA4
A5	R7	YA5	2 1	4 3	A5 = 4.0 - 0.002 * (YA4 - YA5) + DA5
A6	R5	YA6	1 0	2 1	A6 = 40.0 - 0.02 * YA6 + DA6
A7	R25	YA7	1 0	2 1	A7 = 40.0 - 0.02 * YA7 + DA7
B1	R14	YB1	4 3	4 3	B1 = 400 - 0.2 * YB1 + DB1
B2	R15	YB2	3 2	4 3	B2 = 1200 - 0.6 * YB2 + DB2
B3	R16	YB3	3 2	4 3	B3 = 1200 - 0.6 * YB3 + DB3
B4	R22	YB4	2 1	4 3	B4 = 4.0 - 0.002 * YB4 + DB4
B5	R22	YB5	1 0	4 3	B5 = 4.0 - 0.002 * YB4 + 0.02 * YB5 + DB5
B6	R10	YB6	1 0	4 3	B6 = 4.0 - 0.002 * YA4 + 0.02 * YB6 + DB6
B7	R8	YB7	1 0	4 3	B7 = 40.0 - 0.02 * YB7 + DB7
C1	R12	YC1	2 1	2 1	C1 = (400 - 0.2 * YB1 + 2.0 * (YC2 - YC1)) * 0.001 + DC1
C2	R14	YC2	2 1	2 1	C2 = (400 - 0.2 * YB1 + 2.0 * YC2) * 0.001 + DC2
C3	R13	YC3	2 1	2 1	C3 = (400 - 0.2 * YB1 + 2.0 * (YC2 + YC3)) + 0.001 + DC3
C4	R3	YC4	1 0	2 1	C4 = (400 - 0.2 * YB1 + 2.0 * (YC2 + YC3 + YC4)) * 0.001 + DC4
C5	R6	YC5	1 0	2 1	C5 = 40.0 - 0.02 * YC5 - DC5

*DA1 to DA7, DB1 to DB7, and DC1 to DC5 are constants to be supplied for each package.

Multiply each expression by $f(T) = \frac{\text{Attenuation at } 25^{\circ}C}{\text{Attenuation at T}}$ supplied for each package.

Approved J. E Cashion Date August 6, 1970

Discriminator Name	Register #	Label	Location Page	Location Snapshot	Expression*
A1	R4	YA1	4	2	A1 = 400 - 0.2 * YA1 + DA1
A2	R4	YA2	3	2	A2 = 400 - 0.2 * YA1 + 0.6 * YA2 + DA2
A3	R19	YA3	3	2	A3 = 400 - 0.2 * YA1 + 0.6 * (YA2 + YA3) + DA3
A4	R10	YA4	2	4	A4 = 6.0 - 0.003 * YA4 + DA4
A5	R7	YA5	2	4	A5 = 6.0 - 0.003 * YA4 + 0.02 * YA5 + DA5
A6	R5	YA6	1	2	A6 = 40.0 - 0.02 * YA6 + DA6
A7	R25	YA7	1	2	A7 = 40.0 - 0.02 * YA7 + DA7
B1	R14	YB1	4	4	B1 = 400 - 0.2 * YB1 + DB1
B2	R15	YB2	3	4	B2 = 1200 - 0.6 * YB2 + DB2
B3	R16	YB3	3	4	B3 = 1200 - 0.6 * YB3 + DB3
B4	R22	YB4	2	4	B4 = 6.0 - 0.003 * YB4 + DB4
B5	R22	YB5	1	4	B5 = 6.0 - 0.003 * YB4 + 0.02 * YB5 + DB5
B6	R10	YB6	1	4	B6 = 6.0 - 0.003 * YA4 + 0.02 * YB6 + DB6
B7	R8	YB7	1	4	B7 = 40.0 - 0.02 * YB7 + DB7
C1	R12	YC1	2	2	C1 = [400 - 0.2 YB1 + 6.0 YC2 - 20 YC1] * 0.001 + DC1
C2	R14	YC2	2	2	C2 = [400 - 0.2 * YB1 + 2.0 * YC2] * 0.001 + DC2
C3	R13	YC3	2	2	C3 = [400 - 0.2 * YB1 + 2.0 * (YC2 + YC3)] + 0.001 + DC3
C4	R3	YC4	1	2	C4 = [400 - 0.2 * YB1 + 2.0 * (YC2 + YC3 + YC4)] * 0.001 + DC4

*DA1 to DA7, DB1 to DB7, and DC1 to DC4 are constants to be supplied for each package.

Multiply each expression by $f(T) = \frac{\text{Attenuation at } 25^{\circ}C}{\text{Attenuation at T}}$ supplied for each package.

Approved Roy E Carlson Date January 19, 1971

SAMPLE OUTPUT FORMAT FOR FULLIST I OPTION

Line Number	Column Number 1	1_0	2_0	3_0	4_0	5_0	6_0	7_0	8_0	9_0	10_0	11_0	12_0	13_0
1	(CLOCK)	(P1XXXXXX)	(P2XXXXXX)	(P3XXXXXX)	(P4XXXXXX)	(P5XXXXXX)	(P6XXXXXX)	(P7XXXXXX)	(P8XXXXXX)	(E11XXXXX)	(NN1XXXXX)	(NN1XXXXX)	(NN1XXXXX)
2	(AP)	(P9XXXXXX)	(P10XXXXX)	(P11XXXXX)	(A1XXXXXX)	(A2XXXXXX)	(A3XXXXXX)	(A4XXXXXX)	(A5XXXXXX)	(E12XXXXX)	(NN2XXXXX)	(NN2XXXXX)	(NN2XXXXX)
3	(GMT)	(A6XXXXXX)	(A7XXXXXX)	(Z1XXXXXX)	(Z2XXXXXX)	(MXXXXXXX)	(E4XXXXXX)	(E5XXXXXX)	(E6XXXXXX)	(E13XXXXX)	(NN3XXXXX)	(NN3XXXXX)	(NN3XXXXX)
4		(E1XXXXXX)	(E2AXXXXX)	(E2BXXXXX)	(E2CXXXXX)	(E3XXXXXX)	(SXXXXXXX)			(E14XXXXX)	(NN4XXXXX)	(NN4XXXXX)	(NN4XXXXX)
5										(E15XXXXX)	(NN5XXXXX)	(NN5XXXXX)	(NN5XXXXX)
6										(E16XXXXX)	(NN6XXXXX)	(NN6XXXXX)	(NN6XXXXX)
7										(E17XXXXX)	(NN7XXXXX)	(NN7XXXXX)	(NN7XXXXX)
8										(E18XXXXX)	(NN8XXXXX)	(NN8XXXXX)	(NN8XXXXX)

Explanatory Notes:

1.) Field Descriptions - All digital data fields are 10 characters long, 3 leading characters contain descriptive lable, next 6 characters contain accumulated counts in integer format, last character is a blank. Clock field is snapshot counter, 9 digits and blank.

AP contains an analog performance parameter in the form LL = -XX.Xb where LL is a label obtained using Table VIII-B and X is the analog voltage.

2.) Spare space on line ~~X~~ 3 should be used for ~~optical aspect and data quality flags~~. GMT.

Line	Col. Nos.	Desc. Name	Signal Name	Rep.* Rate	Comments
1	1-10	Clock	-	A	~~Spacecraft clock, increments once per snapshot.~~ PAGE & SNAPSHOT COUNTER PGXXX SNXX
1	11-20	P1	S3	B	Sum of all sectors, S3, each second snapshot (see Table VIII-B).
1	21-30	P2	R19	B	
1	31-40	P3	R20	B	
1	41-50	P4	R21	B	
1	51-60	P5	R22	B	
1	61-70	P6	R23	B	
1	71-80	P7	R4	A	
1	81-90	P8	R24	B	
2	2-10	AP	-	A	See Explanatory Note 1.
2	11-20	P9	R3	A	
2	21-30	P10	R13,S4	C	See Table VIII-B.
2	31-40	P11	R12,S4	C	See Table VIII-B.
2	41-50	A1	S4	D	See Table VIII-B.
2	51-60	A2	R11	B	
2	61-70	A3	R10	B	
2	71-80	A4	R9	B	
2	81-90	A5	R8	B	
3	2-10		-	A	See Explanatory Note 2.
3	11-20	A6	R7	A	
3	21-30	A7	R6	A	
3	31-40	Z1	R5	A	
3	41-50	Z2	R25	B	
3	51-60	M	R1	A	
3	61-70	E4	R14,S3	E	Sum of Sectors S3 or R14 on alternate snapshots
3	71-80	E5	R15	B	
3	81-90	E6	R16	B	
1-8	91-100	E1	S1	A	
1-8	101-110	E2A,E3	S2	A	Contains E2A & E3 on alternate snapshots. See Table VIII-B.
1-8	111-120	E4,P1	S3	A	Contains E4 & P1 on alternate snapshots. See Table VIII-B.
1-8	121-130	P10,P11,A1,A6	S4	A	Contains P10, P11, A1, A6 on successive snapshots. See Table VIII-B.

*Rep. Rate A = Every Snapshot
B = Every Other Snapshot
C = Every second snapshot from rate registers & every fourth snapshot from sector sums
D = Every Fourth Snapshot.

LINE	Col. Nos.	DESC. NAME	SIGNAL NAME	REP. RATE	COMMENTS
4	11-20	E1	S1	A	SECTOR SUM
4	21-30	E2A	S2	B	SECTOR SUM ALTERNATE SNAPSHOTS SEE TABLE VIII-B
4	31-40	E2B	R-17	B	
4	41-50	E2C	R-18	B	
4	51-60	E3	S2	B	
4	61-70	S	R2	A	

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Sector sum, alternate snapshots, see table VIII-B

Table VIII-A

SAMPLE OUTPUT FORMAT FOR FULLIST I OPTION

Line Number	Column Number 1	1_0	2_0	3_0	4_0	5_0	6_0	7_0	8_0	9_0	10_0	11_0	12_0	13_0
1	(CLOCK)	(P1XXXXXX)	(P2XXXXXX)	(P3XXXXXX)	(P4XXXXXX)	(P5XXXXXX)	(P6XXXXXX)	(P7XXXXXX)	(P8XXXXXX)	(E11XXXXX)	(NN1XXXXX)	(NN1XXXXX)	(NN1XXXXX)
2	(AP)	(P9XXXXXX)	(P10XXXXX)	(P11XXXXX)	(A1XXXXXX)	(A2XXXXXX)	(A3XXXXXX)	(A4XXXXXX)	(A5XXXXXX)	(E12XXXXXX)	(NN2XXXXX)	(NN2XXXXX)	(NN2XXXXX)
3	(GMT)	(A6XXXXXX)	(A7XXXXXX)	(Z1XXXXXX)	(Z2XXXXXX)	(MXXXXXXX)	(E4XXXXXX)	(E5XXXXXX)	(E6XXXXXX)	(E13XXXXX)	(NN3XXXXX)	(NN3XXXXX)	(NN3XXXXX)
4		(E1XXXXXX)	(E2AXXXXX)	(E2BXXXXX)	(E2CXXXXX)	(E3XXXXXX)	(SXXXXXXX)			(E14XXXXX)	(NN4XXXXX)	(NN4XXXXX)	(NN4XXXXX)
5										(E15XXXXX)	(NN5XXXXX)	(NN5XXXXX)	(NN5XXXXX)
6										(E16XXXXX)	(NN6XXXXX)	(NN6XXXXX)	(NN6XXXXX)
7										(E17XXXXX)	(NN7XXXXX)	(NN7XXXXX)	(NN7XXXXX)
8										(E18XXXXX)	(NN8XXXXX)	(NN8XXXXX)	(NN8XXXXX)

Explanatory Notes:

1.) Field Descriptions - All digital data fields are 10 characters long, 3 leading characters contain descriptive label, next 6 characters contain accumulated counts in integer format, last character is a blank. Clock field is snapshot counter, 9 digits and blank.

AP contains an analog performance parameter in the form LL = -XX.Xb where LL is a label obtained using Table VIII-B and X is the analog voltage.

2.) Spare space on line 3 should be used for GMT.

*Rep. Rate A = Every Snapshot
B = Every Other Snapshot
C = Every second snapshot from rate registers and every fourth snapshot from sector sum.
D = Every Fourth Snapshot

Line	Col. Nos.	Desc. Name	Signal Name	Rep.* Rate	Comments
1	1-10	Clock	-	A	Page and snapshot counter PGXXXSNXX
1	11-20	P1	S3	B	Sum of all sectors, S3, each second snapshot (see Table VIII-B).
1	21-30	P2	R19	B	
1	31-40	P3	R20	B	
1	41-50	P4	R21	B	
1	51-60	P5	R22	B	
1	61-70	P6	R23	B	
1	71-80	P7	R4	A	
1	81-90	P8	R24	B	
2	2-10	AP	-	A	See Explanatory Note 1.
2	11-20	P9	R3	A	
2	21-30	P10	R13,S4	C	See Table VIII-B.
2	31-40	P11	R12,S4	C	See Table VIII-B.
2	41-50	A1	S4	D	See Table VIII-B.
2	51-60	A2	R11	B	
2	61-70	A3	R10	B	
2	71-80	A4	R9	B	
2	81-90	A5	R8	B	
3	2-10	-	-	A	See Explanatory Note 2.
3	11-20	A6	R7	A	
3	21-30	A7	R6	A	
3	31-40	Z1	R5	A	
3	41-50	Z2	R25	B	
3	51-60	M	R1	A	
3	61-70	E4	R14,S3	E	Sum of Sectors S3 or R14 on alternate snapshots
3	71-80	E5	R15	B	
3	81-90	E6	R16	B	
4	11-20	E1	S1	A	Sector Sum
4	21-30	E2A	S2	B	Sector Sum. Alternate snapshots, See Table VIII-B.
4	31-40	E2B	R17	B	
4	41-50	E2C	R18	B	
4	51-60	E3	S3	B	Sector Sum. Alternate snapshots, see Table VIII-B.
4	61-70	S	R2	A	
1-8	91-100	E1	S1	A	
1-8	101-110	E2A,E3	S2	A	Contains E2A and E3 on alternate snapshots. See Table VIII-B.
1-8	111-120	E4,P1	S3	A	Contains E4 and P1 on alternate snapshots. See Table VIII-B.
1-8	121-130	P10,P11,A1, A6	S4	A	Contains P10, P11, A1, A , on successive snapshots. See Table VIII-B.

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Table VIII-B

DESCRIPTION OF APL SUBCOMMUTATED SIGNALS

Signal Name	Descriptive Name	Clock Logic a_3	a_4	a_5	8N	16N	Comments
	E3	+	+	+	+	+	E3 is subsectored by dividing each sector by 4 to give a circle of 32 sectors. Subsectors are defined by the given logic.
		+	-	+	-	+	
S2		+	+	-	+	-	
		+	-	-	-	-	
	E2A	-					
S3	P1	+					
	E4	-					
	A1	+	+				
S4	P11	-	+				
	P10	+	-				
	A6	-	-				

		a_5	a_6	a_7	LL	
	1	+	+	+	CD	Calibrator Disable ID (Command 7)
	2	-	+	+	PM	PMT Power Supplies ID (Commands 1 & 2)
	3	+	-	+	GA	Gain Identification (Commands 3 & 4)
	4	-	-	+	HV	HIGH VOLTAGE SUPPLY
APP	5	+	+	-	TP	PET TEMPERATURE
	6	-	+	-	D1	D1 RMS NOISE
	7	+	-	-	D2	D2 RMS NOISE
	8	-	-	-	D3	D3 RMS NOISE

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Table VIII-B

DESCRIPTION OF APL SUBCOMMUTATED SIGNALS

Signal Name	Descriptive Name	Clock Logic a_3	a_4	a_5	8N	16N	Comments
	E3	+	+	+	+	+	E3 is subsectored by dividing each
		+	-	+	-	+	sector by 4 to give a circle of 32
S2		+	+	-	+	-	sectors. Subsectors are defined by
		+	-	-	-	-	the given logic.
	E2A	-					
S3	P1	+					
	E4	-					
	A1	+	+				
S4	P11	-	+				
	P10	+	-				
	A6	-	-				

	a_5	a_6	a_7	LL	
1	+	+	+	D1	D1 RMS NOISE
2	-	+	+	D2	D2 RMS NOISE
3	+	-	+	D3	D3 RMS NOISE
4	-	-	+	TP	PET TEMPERATURE
5	+	+	-	HV	HIGH VOLTAGE SUPPLY
6	-	+	-	GA	Gain Identification (Commands 3 & 4)
7	+	-	-	PM	PMT Power Supplies ID (Commands 1 & 2)
8	-	-	-	CD	Calibrator Disable ID (Command 7)

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IX. TEST PROCEDURES

This section contains the functional test procedures necessary to verify the performance of the APP experiment on the spacecraft and to provide a continuous time history of the unit prior to launch. Four different tests are described. Each test is designed to fit the environmental and physical conditions of the test, to yield the maximum amount of test information, and to be expeditious in disclosing test anomalies.

Type 1 - Laboratory Checkout

The following package test procedure should be performed at each level in the spacecraft integration program. This is considered to be the standard electrical performance checkout, using the APP GSE and the spacecraft encoder for data logging.

A. Test Setup

1. Connect the APP EXPERIMENT GSE to an AC outlet.
2. Set all clock control selector switches (a_3, a_4, a_5, a_6, C_{35}, ÷8, ÷16) to RUN position.
3. Set the Calibrate Trigger switch to NORM.
4. Set the Command Selector to OFF.
5. Set the AP Selector switch to RUN.
6. Set the Voltage Selector to -23 position
7. Connect the Test Cable to J2 of APP Experiment.
8. Turn-on the GSE power.

B. Initial Checks

The following checks should be performed to verify the system to be in the normal operating mode.

1. Set the Command Selector switch to test override position.
2. Set the Command switch to Command 5 and depress the Execute button. (This is the reset command)
3. Set the Command switch to Command 1 and depress the Execute button. (This is PMT 1 "on")
4. Set the Command switch to Command 2 and depress the Execute button. (This is PMT 2 "on")
5. Read and record the DVM value for the Voltage Selector switch positions at -23, +6, +20, +250, +450, HV1, and HV2.
6. Compare the above values with the nominal values given in Table 1 of this procedure.

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7. Set the Voltage Selector switch to the AP position.

8. Read and record the DVM value for the AP selector positions 1 through 8.

9. Compare the above values with the nominal value given in Table 2 of this procedure.

C. In-Flight Calibrator

The In-Flight-Calibrator is normally controlled by the C35 clock line (once each 46.6 hour). The calibrator can be initiated by the GSE by overriding C35 in synchronism with A6. The outputs are available through the spacecraft encoder, and can be decoded using the test data requirements given in Section VIII of the ERD. The outputs during the calibrate sequence should be compared with values given in Table 3 of this procedure.

1. Set the Calibrate Trigger switch to the CAL position. Do not touch any other control on the GSE for at least 4 minutes. (16 minutes if in the 400 BPS encoder rate)

2. At the end of 4 (or 16) minutes, set the calibrate trigger switch back to NORM position.

3. Obtain outputs from the encoder data.

D. Performance Parameter Checks

The performance parameters should be checked through the spacecraft telemetry system and found to be in the range of values given in Table 2 of this procedure.

1. Digital performance parameter DP3-21 must be recognized as a calibrator-on flag.

2. Analog performance parameters 6,7, and 8 are used to identify command logic.

The commands should be exercised through all states and proper operation verified by comparing the values obtained with those given in Table 4 of this procedure.

E. Source Check

Detector operation should be checked by installing radioactive sources into the source holder. The source holder and sources are marked so that they will always be placed in the same relative positions for this test.

With the sources installed and the experiment in the normal operating mode, the experiment data should be collected over one complete album. This data can be readout by use of the "Shortlist" program given in Section VIII-1 of the ERD.

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The observed counting rates should be compared with the standard counting rates given in Table 5 of this procedure.

TABLE 1

Voltage Selector Nominal Values

Position	Nominal Value	Comments
-23V	247 ± 50	
+6V	595 ± 10	Discriminator Bias
+20V	204 ± 5	Detector A Bias
+250 MON	214 ± 20	Bleeder String I (nominal 20μamp)
+450 MON	268 ± 25	Bleeder String I (nominal 25μamp)
HV 1	327 ± 60	VR Current (30μamp)
HV 2	288 ± 60	VR Current (30μamp)

TABLE 2

AP Selector Nominal Values

Position	Nominal Value	Comments
1	250 ± 20	D1 RMS Noise
2	65 ± 10	D2 RMS Noise
3	6 ± 2	D3 RMS Noise
4	115 @ + 25°C	PET Temperature (see Figure IX-1)
5	200 ± 15	HI Voltage Supply Monitor
6	425	Gain ID (both high gain position)
7	440	PMT Power Supply ID (both on)
8	145	Calibrator ID (enabled)

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TABLE 3

In-Flight-Calibrator Nominal Values

DISCRIMINATOR	VALUE	LABEL	VALUE	LOCATION	ALBUM	PAGE	SNAPSHOT
A1	210K	YA1	950	#LR12a_2-18	0	3	2
A2	430K	YA2	367	#LR12a_2-18	0	2	2
A3	900K	YA3	778	#LR10a_3-14	0	2	2
A4	2.50M	YA4	1163	#LR12a_3-14	0	2	0
A5	4.50M	YA5	100	#LR12a_2-26	0	0	2
A6	9.51M	YA6	1525	#LR12a_2-20	0	0	2
A7	38.0M	YA7	----	#LR10a_3-26	0	0	3
B1	250K	YB1	750	#LR10a_3-5	1	0	0
B2	461K	YB2	1232	#LR10a_3-6	0	3	0
B3	846K	YB3	590	#LR10a_3-7	0	3	1
B4	3.58M	YB4	807	#LR10a_3-21	0	2	0
B5	7.66M	YB5	204	#LR10a_3-21	0	1	0
B6	14.0M	YB6	575	#LR12a_3-14	0	1	0
B7	31.9M	YB7	----	#LR12a_3-6	0	1	0
C1	1.52M	YC1	74	#LR10a_3-1	0	0	2
C2	2.99M	YC2	913	#LR10a_3-5	0	1	2
C3	4.78M	YC3	596	#LR10a_3-2	0	1	2
C4	7.65M	YC4	144	#LR12a_2-14	0	0	2

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TABLE 4

Performance Parameter Nominal Values

Encode No. 1, Fast RO Speed.

AP	Function	Command	Tone	Value
1	D1 RMS Noise			2.5 ± 0.2V
2	D2 RMS Noise			0.65 ± 0.1V
3	D3 RMS Noise			0.06 ± 0.02V
4	PET Temperature			0.775 X Standard Calibrate
5	HI Voltage Supply			2.0 ± 0.15 V
6	RESET	5	66T	4.5V
6	Gain A Down	3	70T	3.0V
6	Gain B Down	4	71T	1.5V
6	Gain A + Gain B Down	3 + 4		0V
7	RESET	5	66T	0V
7	GT HV ON	1	68T	3.0V
7	PET HV ON	2	69T	1.5V
7	GT + PET HV ON	1 + 2		4.5V
8	RESET	5	66T	1.5V
8	Calibrate Disable	7	123T	4.5

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TABLE 5

Standard Source Counting Rates

Measurement	Nominal Value Counts/Second
P1	400 ± 50
P4	220 ± 40
P7	0
A2	150 ± 100
E4	24,000 ± 2000
M	50,000 ± 8000
E1	400 ± 50
E2A	320 ± 50
E2B	700 ± 50
E2C	600 ± 50
E3	1500 ± 100
S	70,000 ± 10,000

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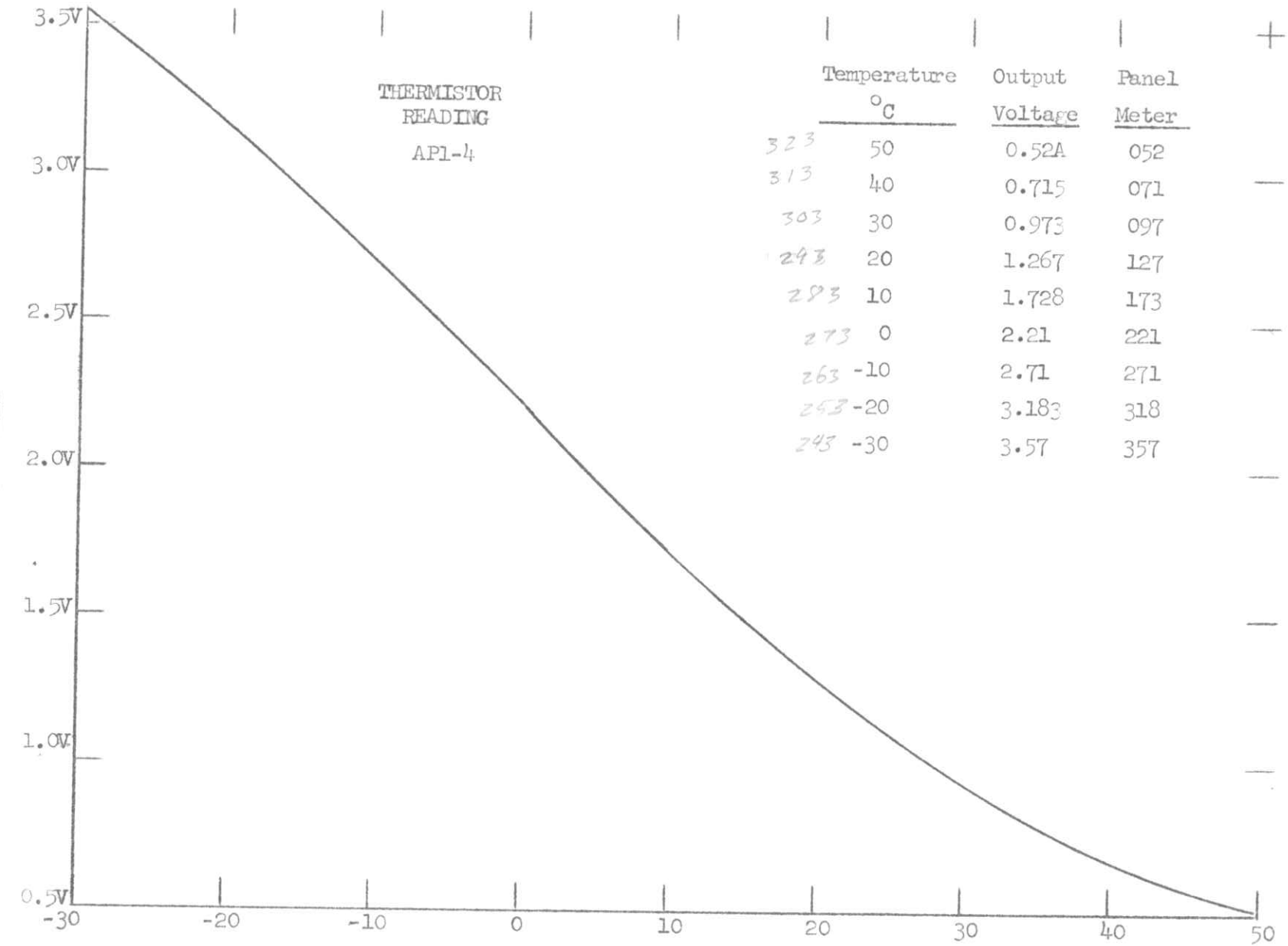

	Temperature °C	Output Voltage	Panel Meter
323	50	0.52A	052
313	40	0.715	071
303	30	0.973	097
293	20	1.267	127
283	10	1.728	173
273	0	2.21	221
263	-10	2.71	271
253	-20	3.183	318
243	-30	3.57	357

FIGURE IX-1

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F. Special Tests

The following test will be performed on the APP Experiment at each major level in the spacecraft integration and test program. APL experimenters will perform these tests and will furnish the test equipment for these tests.

1. Encoder Check - This test is designed to check the proper operation of the spacecraft encoder where it interfaces with APP experiment. Special items of interest are dynamic register capacity and sectoring control.

   (a) Equipments required for this test are the experiment GSE, an APL Triple HF Pulser, an APP Data Buffer Box, and a Scaler-Timer, HP Model #5201L.

   (b) For the Encoder check, each data channel will be stimulated so that a known data rate is on the channel output. Data obtained through the spacecraft encoder (printed by the spacecraft GSE) will be compared to simultaneous data obtained directly from the experiment through its GSE.

2. Sun-Gun Test - APL experimenters will use a sun-gun (Sylvania S.G. VIII) to test the light tightness of the foil on the PET and light leaks on the GT. The Sun-Gun must be flashed on for only brief periods (three to four seconds) so that the temperature of the foil and the detectors does not increase. During the test, APl-1 analog performance parameter will be monitored so that any increase in the noise level of the detectors can be observed. The output from the S and M Scintillators will be monitored for increases in count rates.

3. Maximum Rate Test - APL personnel will stimulate the PET Detector by using a 100 millicurie PO-210 alpha source, and the GM tubes by using a 100 millicurie Strontium-90 source. These tests will insure that the maximum counting rate of all channels is the same on the spacecraft and in the individual unit.

Type 2 - Environmental Checkout

A. Operating Temperature

During this test, the experiment should be placed in the normal operating mode with radioactive sources installed on the source bracket. Standard Tests C (Calibrate), D (Performance Parameter Checks), and E (Source Check) should be performed at both temperature extremes.

B. Thermal Vacuum

Throughout the Thermal Vacuum Test, Standard Tests C (Calibrate) and D (Performance Parameter) should be performed at each temperature. All Standard Tests should be performed before and after each thermal vacuum test.

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C. Vibration Tests

All Standard Tests should be performed before and after each vibration test.

Type 3 - Pre-Launch Checkout

All Standard and all Special Tests will be performed during pre-launch checkout.

Type 4 - Gantry Checkout

A Source Test (Standard Test E) and the Sun-Gun Special Test should be performed during gantry checkout. In addition, the in-flight calibrator should be exercised during gantry checkout and the data printed out each time the in-flight calibrator sequences.

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