Permanent File

SSEC No.75.08.01

OPR-64

Issued: 10 August 1975

OSO-8 SOFT X-RAY EXPERIMENT (WISCONSIN)

FINAL REPORT

OSO-8 Soft X-Ray Wheel Experiment

Contract No: NAS5-11361

U. W. Account No.: 144-B554

Prepared by

Space Science and Engineering Center

The University of Wisconsin

for

Goddard Space Flight Center

Greenbelt, Maryland

TABLE OF CONTENTS

1. SCOPE

This is the Final Report required by Article III of Contract NAS5-11361 and is intended to provide information for those involved in operating and reducing data from the OSO Wisconsin Soft X-Ray Experiment. Much of the material for this report was drawn from the technical manual and GSFC experiment descriptions document. New material has been added which would be useful for orbit operations or data reduction. Sections applicable only to prelaunch operations have not been included.

This report is intended to be self contained and is written with the assumption that the reader is generally familiar with the overall configuration of the OSO-I Spacecraft and its command and telemetry nomenclature.

Section two contains a description of the experiment beginning with a brief statement of the scientific objectives followed by a physical description and finally a discussion of the operation of the experiment. Detailed descriptions of the various subsystems are contained in Section three. The level of detail is deeper than in the overall description of the preceding section but only to the level required for operational understanding of the experiment. Section four is a command list with a description of the resultant telemetry response and preconditions necessary for execution. Section five contains the detailed telemetry description and Section six is devoted to operating precautions. Section seven contains a discussion of experiment operations and control center software descriptions. Section eight is a flight unit configuration list.

2. INTRODUCTION

2.1 Mission Objectives

NOTE: This statement of mission objectives is necessarily abbreviated and is only for the purpose of understanding experiment operation.

The Wisconsin Soft X-Ray Experiment is designed to map low energy x-ray background emissions from 130 ev (90 Å) to 35 Kev (0.25 Å) with special emphasis on the low energy portion below 1.0 Kev. Previous study of the background x-radiation above 1.0 Kev indicates generally it is diffuse and probably extragalactic in origin. The radiation below 1.0 Kev has a more complex spatial distribution which is the subject of interest of this experiment. The spatial distribution may be the result of one or more of the following: unresolved discrete sources, variation in the intervening absorbing galactic gas, or structure in extended emission features. All of these interpretations are clarified by mapping these features at a much higher sensitivity than has been done previously. The low background noise detectors in the Wisconsin experiment were designed specifically to map low energy x-ray emissions at high sensitivity.

2.2 Physical Description

The Wisconsin experiment occupies one 40° wheel section of the OSO-I spacecraft. An outline drawing is shown in Figure 1. The x-ray detectors are the six proportional counters located near the rim or outboard edge of the shelf, arranged in two sets of three, one set viewing forward and one aft. Each set of three consists of one aluminum window counter, one beryllium window counter, and one plastic window (gas flow) counter. The view of the forward set is parallel to the spin axis and is occulted fro from time to time by the sail and pointing instrument assembly (PIA). The aft set is tilted 5° from the spin axis and has a clear view at all times. The view ports in the forward and aft wheel enclosures are covered by thermal shields which are transparent to x-rays. The view of each proportional counter is collimated to 5° full-width half-maximum (FWHM) by a metal honeycomb collimator, bolted to the top of each counter over the window.

Each counter is mounted on feet which provide electrical isolation of the counter from the shelf. The front end electronics associated with each counter are mounted directly to the counter body (charge amplifiers, level discriminators, high voltage power supply, high voltage distribution box, and the gas regulation electronics on the gas flow counters). Each counter assembly also contains a movable radioactive calibration source and actuator. The entire assembly is designed to be readily removable for replacement of the counter during ground testing, if necessary. The data system is located on the forward side of the shelf just inboard of the three counter assemblies. The gas shelf is located just inboard of the counters on the aft side of the shelf. The gas shelf contains the solenoid valves, auxiliary pressure transducers, tubing, and pneumatic spacecraft interface for the gas system. Inboard from the gas shelf is the command and control system on which the electrical interface connectors are mounted. The outboard edge of the shelf has additional interface points as follows: two pneumatic fill ports (one each for the forward and aft gas flow counters), one exhaust port (with thrust nullifier), and an experiment monitor connector which provides buffered test points for the GSE. This connector allows operation of the monitor portion of the GSE while the experiment is fully interfaced to the spacecraft.

2.3 Functional Operation

This section is intended to provide a basic understanding of how the experiment works by discussing the operation of three key subsystems; the proportional counter and associated front end electronics, the data system, and the gas system. Other major subsystems are not discussed here (command and control, low voltage power supply) but are examined in detail in Section 4.

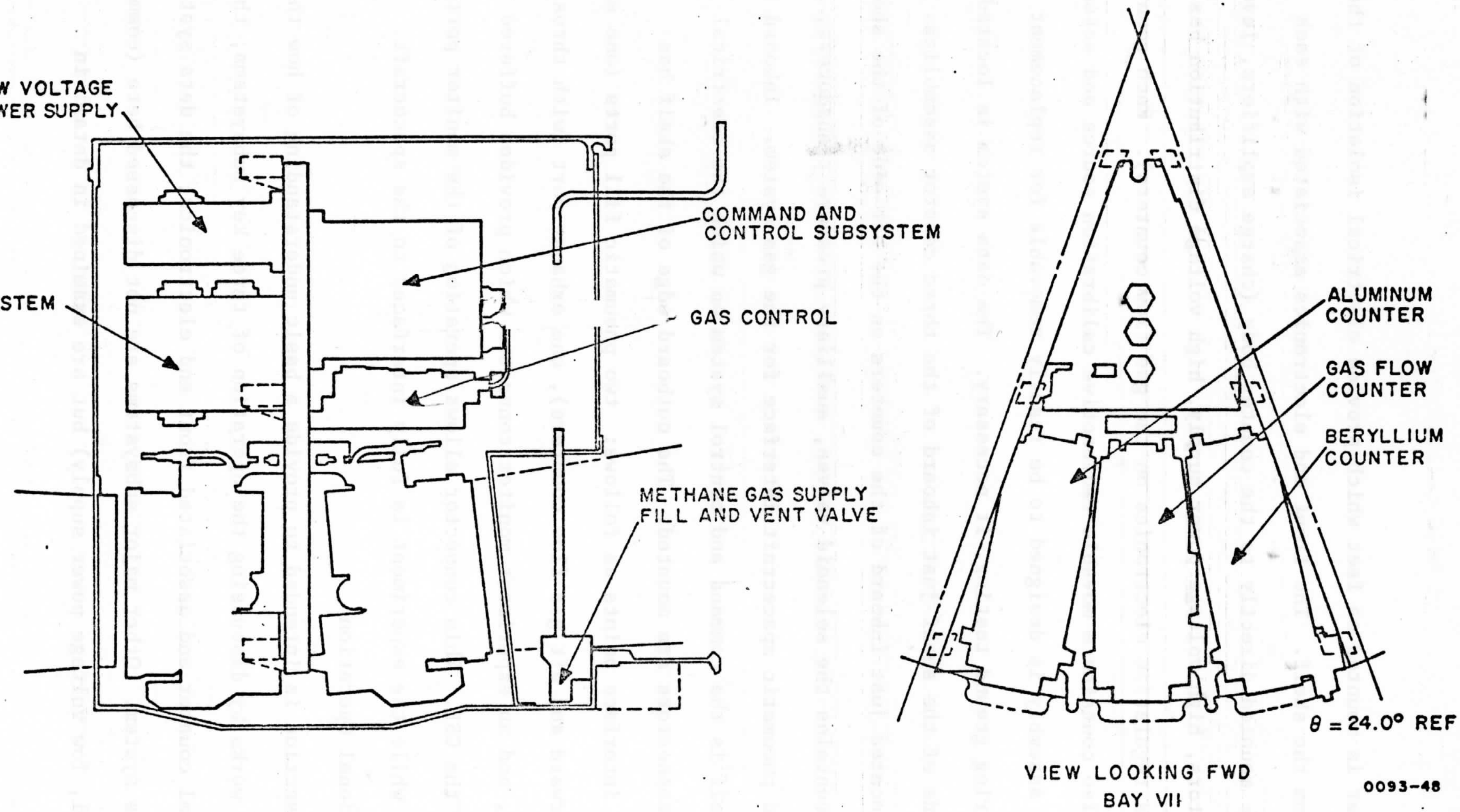


Figure 1 Wisconsin Experiment Physical Arrangement

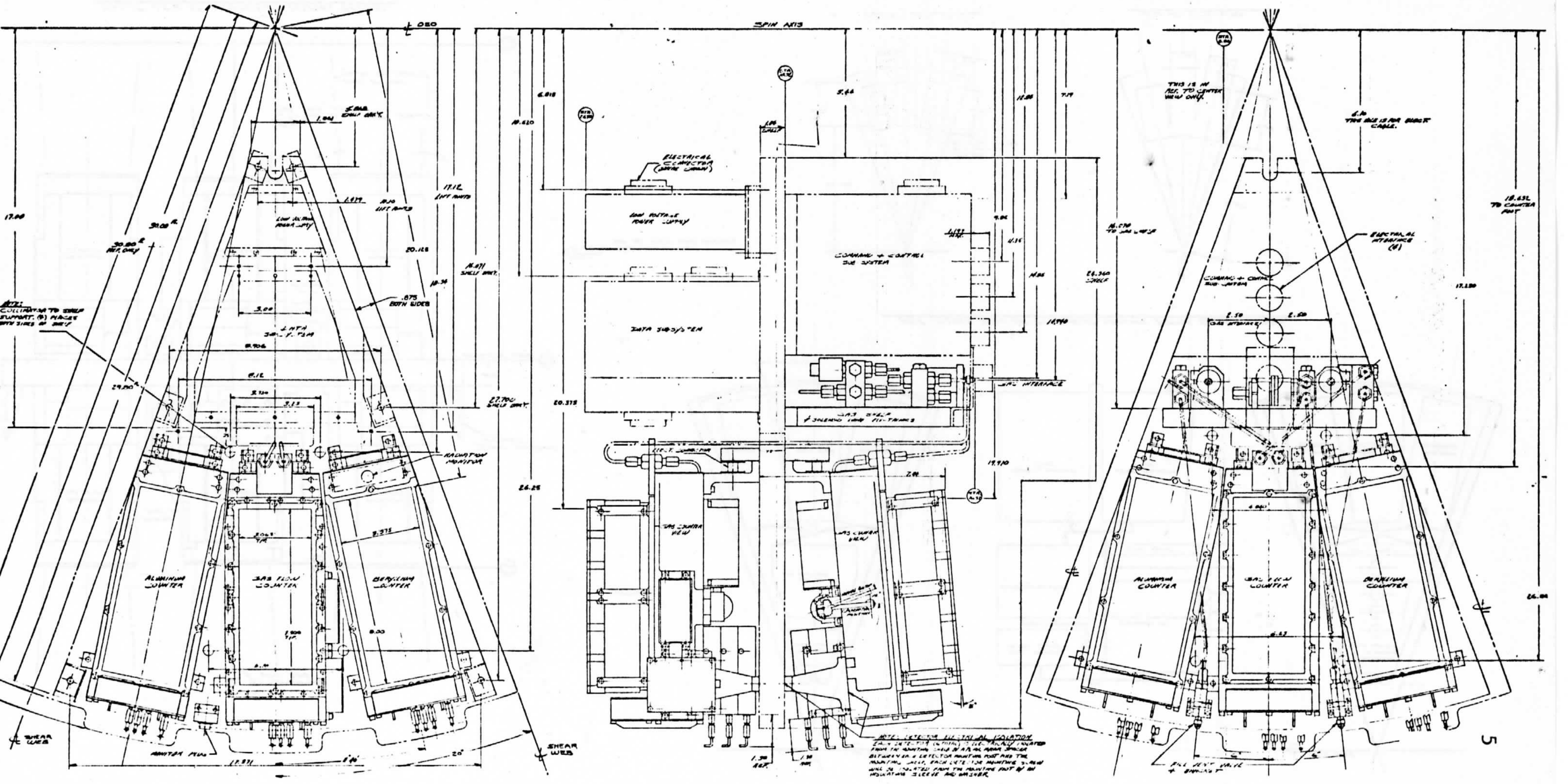


Figure 1 Experiment Outline

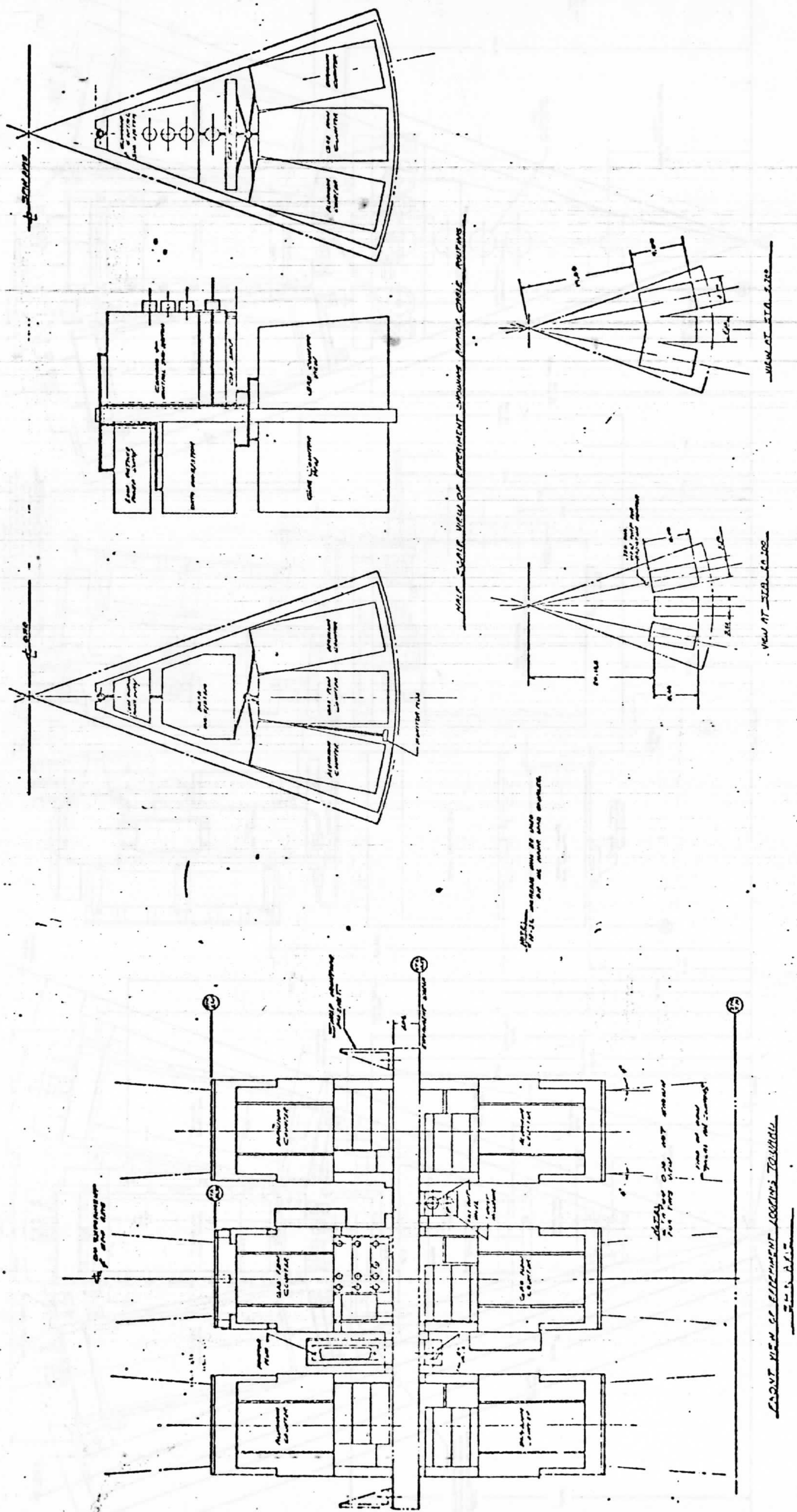


Figure 1 (cont.)

A simplified experiment block diagram is shown in Figure 2. The complete block diagram is shown in Figure 3.

2.3.1 Proportional Counter Operation

Each of the six proportional counters has its own set of electronics including the high voltage power supply, three charge amplifiers, a level discriminator, and a calibration source.

High voltage is supplied to the various anodes of the counter by a single high voltage power supply. The output voltage, which is programmable by command, is routed to the main anodes, bottom and side veto anodes, and end veto anodes via the high voltage distribution box. An incoming x-ray striking the main anode chamber causes an output pulse proportional in amplitude to the energy of the x-ray. The pulse is amplified and shaped by the charge amplifier. There are separate charge amplifiers for the main, bottom and side veto, and end veto anodes. The charge amplifier outputs are connected to the level discriminator which measured the amplitude of the pulse and generates a parallel digital output. A valid event is a pulse from the main anode in the range of the level discriminator which does not occur at the same time one occurs on the veto anodes. A valid event is signified by a pulse on the strobe output along with a pulse on the appropriate "level" line. (There is one level output line for each level in the discriminator.) The output of the level discriminator is connected to the data system where the information is stored for transmittal to the spacecraft during the following telemetry major frame.

2.3.2 Data System Operation

The data system output is serial digital data which appears in word 49 and 50 of the spacecraft telemetry major frame. Each 8 bit word is the sum of all valid events occuring in the previous major frame for a particular

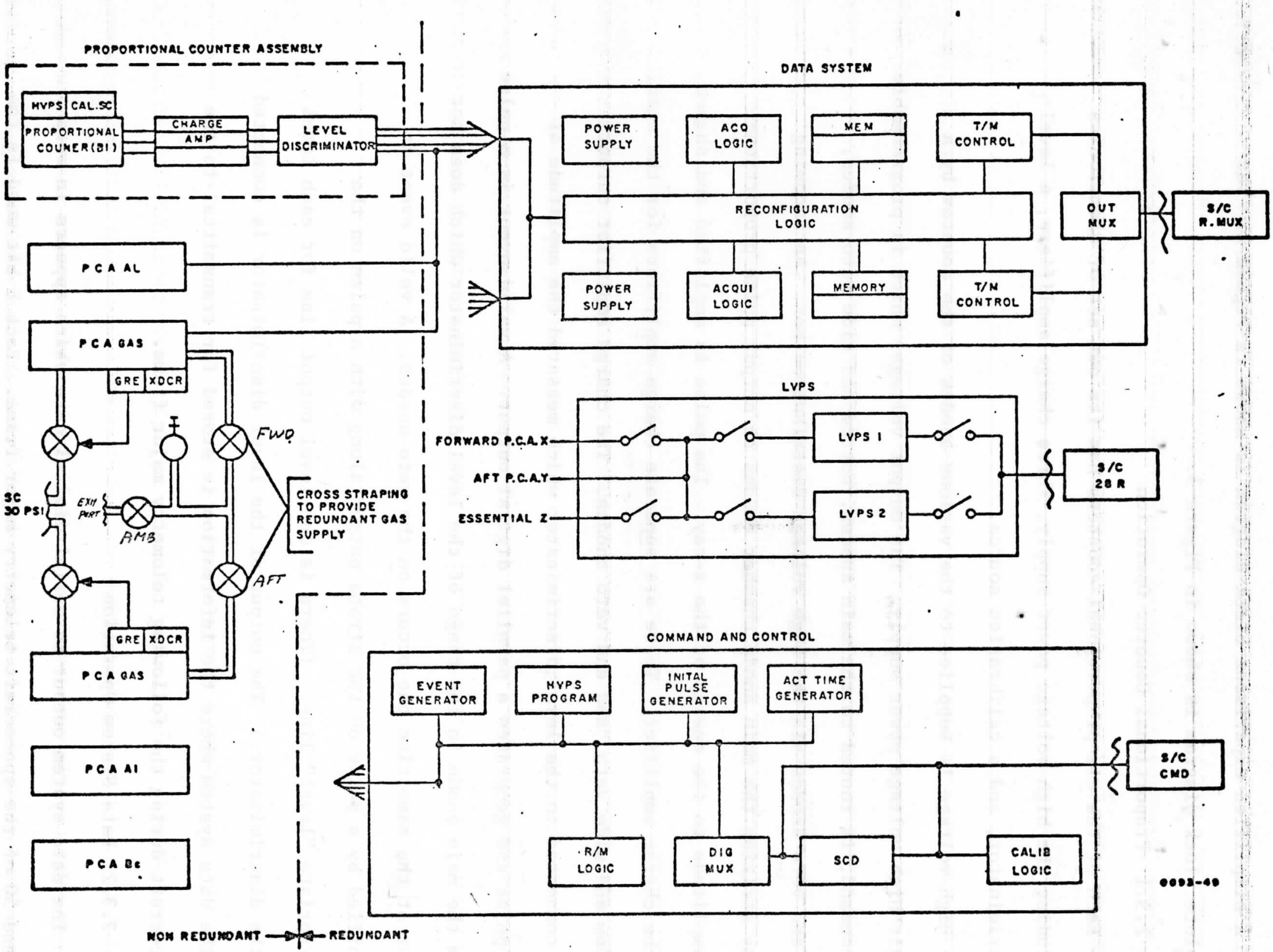
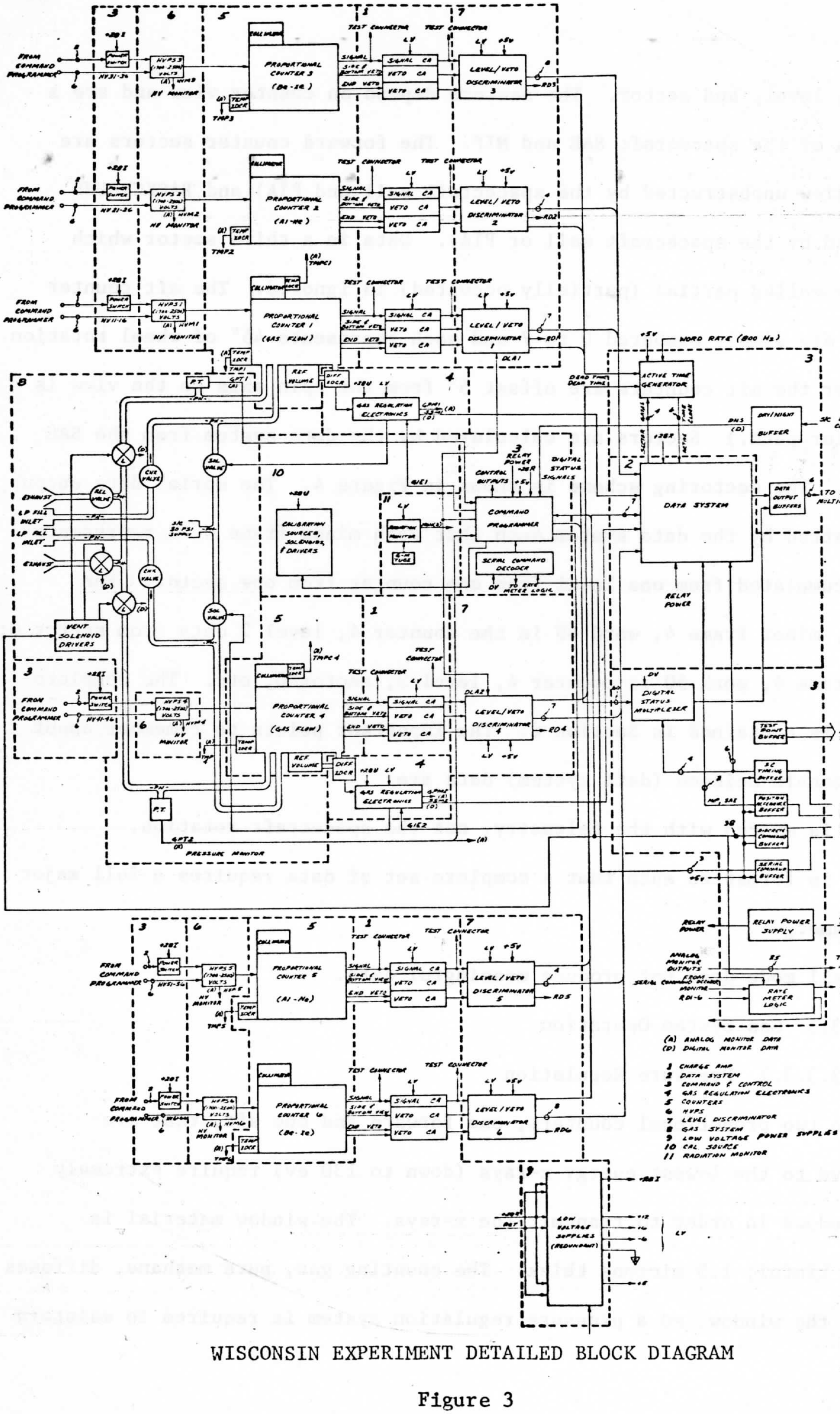


Figure 2. Wisconsin Experiment Simplified Block Diagram



WISCONSIN EXPERIMENT DETAILED BLOCK DIAGRAM

Figure 3

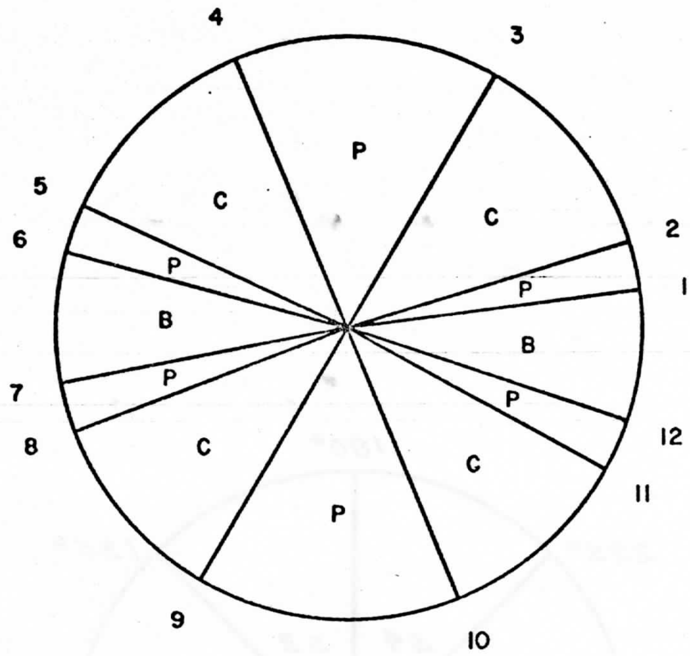
counter, level, and sector. The sectors depend on counter view and are a function of the spacecraft SAE and MIP. The forward counter sectors are CLEAR (view unobstructed by the spacecraft sail and PIA) and BACKGROUND (occulted by the spacecraft sail or PIA). Data in a third sector which might be called partial (partially occulted) is ignored. The aft counter sectors are simply numbered 0 to 7 and each represents 45° of wheel rotation. (Remember the aft counters are offset 5° from the spin axis so the view is a circular path.) Sectors are calculated by the data system from the SAE and MIP. The sectoring scheme is shown in Figure 4. The serial data output is formatted by the data system such that each minor frame word represents data accumulated from one level from one counter from one sector. For example, minor frame 4, word 49 is the counter 4, level 2 data from sector 0; minor frame 4, work 50 is counter 4, level 3, sector 0, etc. The complete listing is contained in Section 6. The important points to remember about the Wisconsin science (data system) data are:

1. It is synced with the telemetry, not the spacecraft rotation.
2. It is formatted such that a complete set of data requires a full major frame.
3. Dwell mode does not produce meaningful data.

2.3.3 Gas System Operation

2.3.3.1 Pressure Regulation

The two propotional counters, one forward and one aft, that are sensitive to the lowest energy x-rays (down to 130 ev) require extremely thin windows in order to transmit the x-rays. The window material is plastic kimfol, 1.5 microns thick. The counting gas, pure methane, diffuses through the window, so a pressure regulation system is required to maintain



Sector Boundary	SAE Count from MIP					
	PC 3		PC 1		PC 2	
	OCT	DEC	OCT	DEC	OCT	DEC
1	015	208	036	480	056	736
2	033	432	054	704	075	976
3	131	1424	151	1680	172	1952
4	243	2608	263	2864	304	3136
5	340	3584	360	3840	401	4112
6	356	3808	377	4080	417	4336
7	423	4400	444	4672	464	4928
8	441	4624	462	4896	502	5152
9	531	5520	551	5776	572	6048
10	643	6704	663	6960	704	7232
11	732	7584	753	7856	773	8112
12	750	7808	771	8080	011	144

NOTE: DEC = $(\text{SAE COUNT})_{10}$ OCT = $(\text{DEC} \div 2^4)_8$

Figure 4A Forward Sky Sector Boundaries

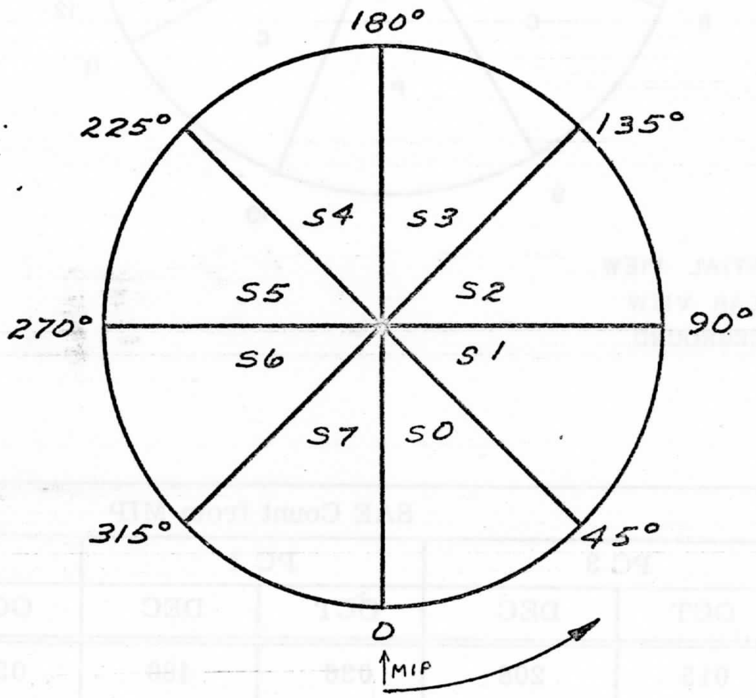


Figure 4B AFT SKY SECTOR BOUNDARIES

gas pressure in the counters within close limits. This is the function of the gas system, a block diagram of which is shown in Figure 5.

Pressure in the counters is sensed by a differential pressure transducer having one port open to the counter and the other connected to a sealed reference volume. The pressure in the reference volume is approximately 400 torr absolute at room temperature. The system attempts to regulate to a constant density equal to that of the gas within the sealed reference volume. The transducer is electrically connected to the gas regulation electronics (GRE) which controls the inlet solenoid valve. When pressure drops 1 torr below the reference volume pressure the valve is actuated briefly, allowing a short burst of gas to enter the counter. The system regulated pressure to ± 0.5 torr. The gas system also has three latching solenoid valves for controlling the exhaust lines. By arranging these valves the two counters may be operated independently, cross-strapped using either GRE as the control, or vented to ambient.

2.3.3.2 Window Support

Besides regulating pressure in the counters for actual operation, the gas system serves another vital maintenance function. The thin plastic windows are not mechanically supported on the inside of the counter. Support is provided by the gas pressure which holds the window against the collimator. There is a thin mesh material between the window and collimator to keep the plastic from contacting the sharp edges of the collimator. Mechanical support is provided by the collimator. Window life and low window leak rate depend on having gas pressure sufficient to hold the window against the collimator at all times. The two auxiliary pressure transducers provide an input to the GRE such that the GRE regulates pressure either to 400 torr absolute (as sensed by the differential transducer) ± 1 torr or 200 torr above ambient, whichever is

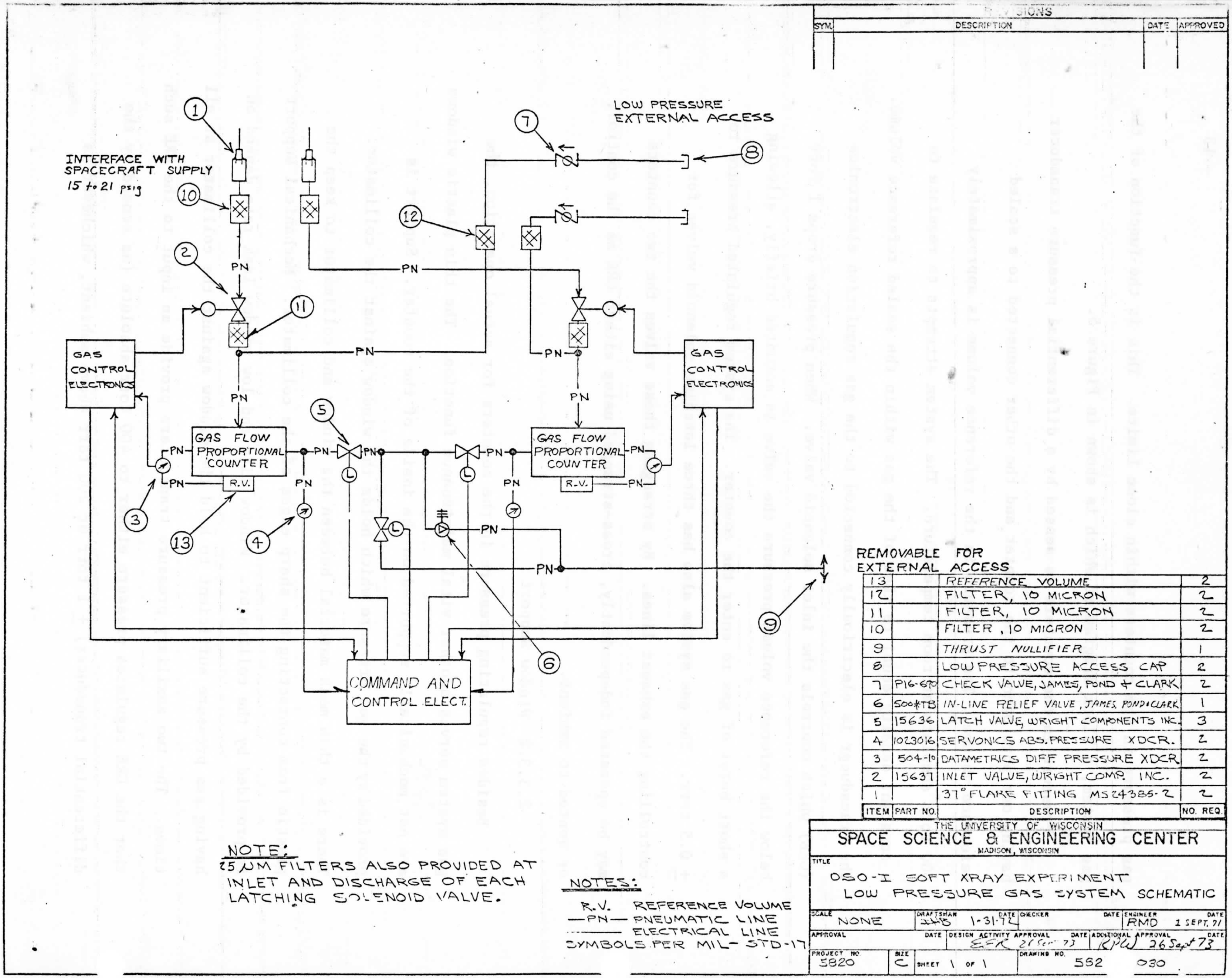

REVISIONS
SYM. DESCRIPTION DATE APPROVED
INTERFACE WITH SPACECRAFT SUPPLY 15 to 21 psig
LOW PRESSURE EXTERNAL ACCESS
GAS CONTROL ELECTRONICS
GAS FLOW PROPORTIONAL COUNTER
R.V.
PN
COMMAND AND CONTROL ELECT.
REMOVABLE FOR EXTERNAL ACCESS
13 REFERENCE VOLUME 2
12 FILTER, 10 MICRON 2
11 FILTER, 10 MICRON 2
10 FILTER, 10 MICRON 2
9 THRUST NULLIFIER 1
8 LOW PRESSURE ACCESS CAP 2
7 P16-670 CHECK VALVE, JAMES, POND + CLARK 2
6 500#TB IN-LINE RELIEF VALVE, JAMES, POND & CLARK 1
5 15636 LATCH VALVE, WRIGHT COMPONENTS INC. 3
4 1023016 SERVONICS ABS. PRESSURE XDCR. 2
3 504-10 DATAMETRICS DIFF. PRESSURE XDCR 2
2 15637 INLET VALVE, WRIGHT COMP. INC. 2
1 37° FLARE FITTING MS24385-2 2
ITEM PART NO. DESCRIPTION NO. REQ.
NOTE:
25 µM FILTERS ALSO PROVIDED AT INLET AND DISCHARGE OF EACH LATCHING SOLENOID VALVE.
NOTES:
R.V. REFERENCE VOLUME
—PN— PNEUMATIC LINE
——— ELECTRICAL LINE
SYMBOLS PER MIL-STD-17
THE UNIVERSITY OF WISCONSIN
SPACE SCIENCE & ENGINEERING CENTER
MADISON, WISCONSIN
TITLE OSO-I SOFT XRAY EXPERIMENT LOW PRESSURE GAS SYSTEM SCHEMATIC
SCALE NONE
DRAFTSMAN 1-31-72
ENGINEER RMD 1 SEPT. 71
DESIGN ACTIVITY APPROVAL 26 Sept 73
ADDITIONAL APPROVAL 26 Sept 73
PROJECT NO. 5820
SIZE C
SHEET 1 OF 1
DRAWING NO. 552 030

Figure 5

greater. This feature provides for window support while the experiment is at atmospheric pressure during tests and provides support in vacuum tests including the vacuum to atmospheric pressure transition. The relief valve is provided for relief of counter pressure during launch (or vacuum test pump-down) to prevent excessive window pressure. The relief valve cracks at 11 psig or 560 torr. The two fill valves provide a means to maintain window pressure when the experiment GRE is not operating, such as when power is off or gas at the spacecraft pneumatic interface is not available.

2.4 Modes of Operation

The normal mission operating mode is: all high voltage power supplies on and at proper output level, both forward and aft gas pressure regulation systems enabled, and all latch valves closed. The two gas flow counters high voltage supplies automatically turn off during spacecraft day and on again during spacecraft night. The major portion of the mission is planned to be spent in the normal operating mode. There are other modes of operation that are used from time to time as follows:

1. Calibrate mode.

Each proportional counter has a radioactive source mounted to an arm connected to a rotary solenoid. On command, all six sources are moved to a position over the calibrate windows of the counters for 25 seconds. The calibrate sequence is as follows: a) command 1,18 is sent (during major frame #1), (command 1,27 is sent first if any latch valve operations have been performed since the last calibration)

b) the sources are actuated 15 seconds into the following major frame (frame #2)

c) the sources remain over the calibrate windows for the entire next major frame (#3) or about 20 seconds

d) the sources drop back to the rest position at the start of the next frame (#4).

This operation will be performed several times per orbit.

2. Self-test mode.

The data system contains an internal self-test capability. On command (1,11) the data system performs the following sequence:

a) Command 1,11 is sent (frame #1).

b) Beginning with the next major frame (#2) the normal data inputs are replaced by internally generated pulses. This fills all memory words with a recognizable number of counts. This process continues for two major frames (#2 and #3).

c) At the start of major frame #4, the process is terminated and normal data is again received. The process can be terminated at any time by command 1,12.

The self-test mode is intended to be used occasionally for error detection and for troubleshooting in the event that data is anomalous.

3. Fill, vent mode.

During initial experiment turn-on in orbit it is necessary to establish operating pressure in the gas flow counters prior to turning on high voltage. From time to time it may also be necessary to purge the gas in the counters by venting and refilling. These operations would be done infrequently. All high voltage must be off during fill or vent operations. Venting must always be done carefully to maintain at least 50 torr in the counters for window support. To vent a gas flow counter a) turn off high voltage, b) be sure gas inlet is enabled, c) open the appropriate (forward or aft) exhaust valve, d) open the ambient exhaust valve briefly, then close when pressure drops to near 50 torr. To fill the gas flow counters a) close all latch valves, b) enable both gas inlets (1,17,192 and 1,71,12), c) inlet valve stops when counter is full.

4. Reconfigure redundant subsystem.

Several experiment subsystems are dual standby redundant and can be reconfigured on command. The following subsystems are redundant: a) data system power supply, b) data system acquisition logic, c) data system memory, d) data system telemetry output, e) low voltage power supply, f) command decoder, g) vent solenoid driver. In the event of a failure, the redundant unit can be switched in by command. All reconfiguration commands (except for the vent solenoid driver) must be sent with experiment +28 V off.

5. Emergency modes.

The experiment is divided into two loads, X and Y, either of which can be switched off by command in the event of a load fault on one of the low voltage power busses. There is also a "non-essential" 5 volt load bus which can be switched off. This operation is not planned except in the event of an otherwise total experiment failure due to a load fault.

As previously mentioned in the description of the gas system operation, the gas flow counters can be operated in the cross-strap mode in the event of a failure of one of the gas regulation systems.

3. SUBSYSTEM DETAILS

This section contains information about the major subsystems which could be useful to operations personnel. This section is not intended to provide design information or internal experiment interface details. Some information of that nature is required for operational understanding and is therefore included.

3.1 Proportional Counter

The experiment contains six proportional counters, three forward and three aft. Each set of three consists of a thin (1.5 micron) kimfol plastic window methane gas counter, an aluminum window neon gas counter, and a beryllium window xenon/argon/methane counter. The beryllium and aluminum window counters are sealed, the thin plastic window counter is a flow counter. The three counters cover the energy range from 130 ev to 35 Kev (see Fig. 6A).

The overall envelope dimensions of one proportional counter are approximately 2" x 4" x 11". Inside each counter are two main anodes, four end veto anodes (physically located on the same wires as the main anode but electrically isolated, two on each main anode wire, one at each end, and eight bottom and side veto anodes (see Fig. 6B). The two main anodes are electrically connected outside the counting volume as are the four end veto and eight bottom and side veto anodes. This gives three outputs, main, bottom and side, and end veto. The anode chambers are separated by ground plan wires. A high voltage distribution box attached to the counter divides the single high voltage power supply output into the two voltages needed, main, and bottom/side (end veto anode voltage is the same as the main). Networks for anode breakdown protection and signal/high voltage isolation are located in the end cavities of the counter. All high voltage circuitry is potted.

The window material is supported in all three cases on the outside of the counter. In the case of the gas flow counter, the window is supported by the collimator. (There is a thin mesh between the window and the collimator to protect the window from sharp edges.) The sealed counter windows are epoxied to the inside surface of a plate with many small holes called the "window frame" or sometimes "strongback". ("Strongback" is misleading since the window is unsupported on the inside.) A small window

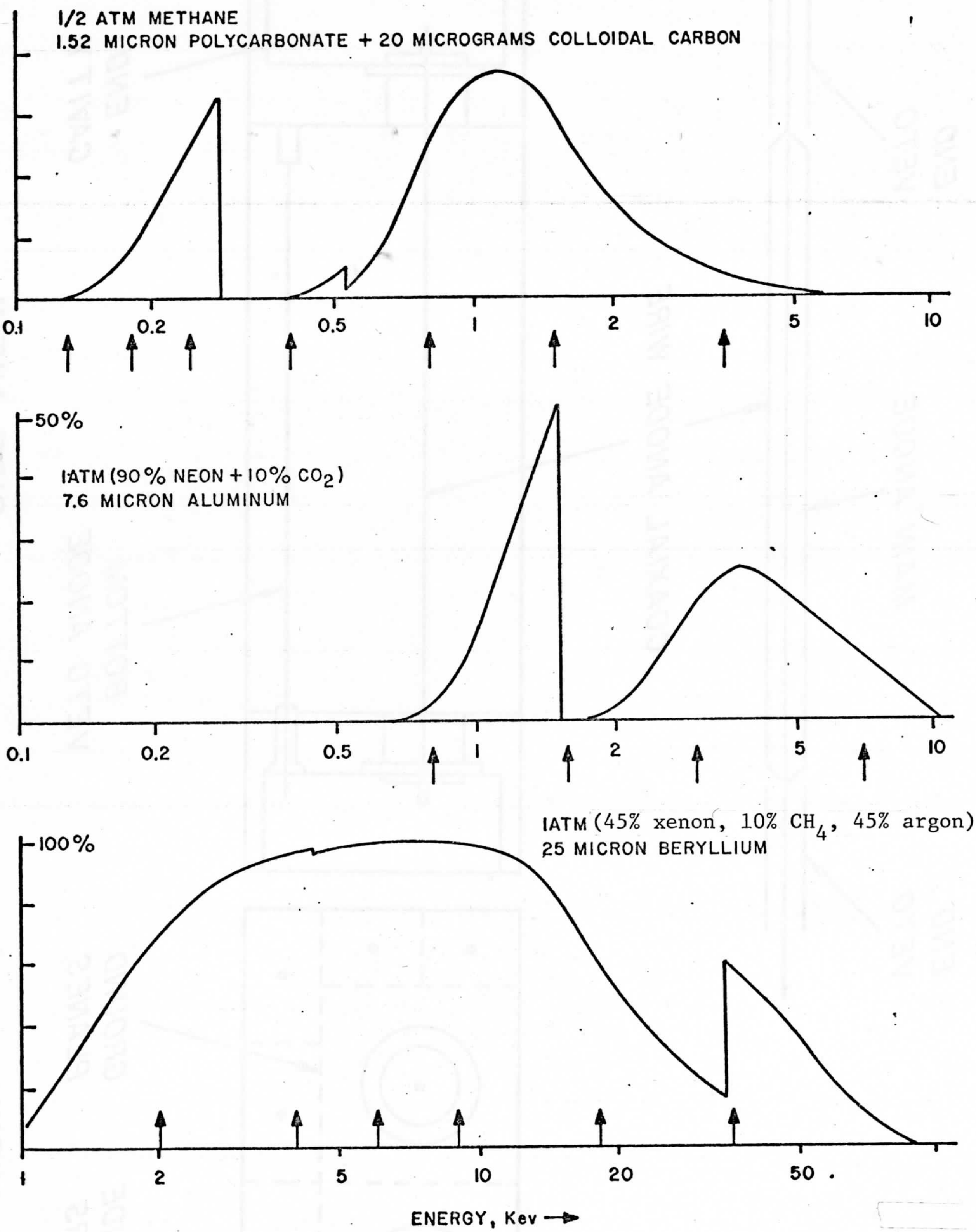


Figure 6A . Proportional Counter Response Curves

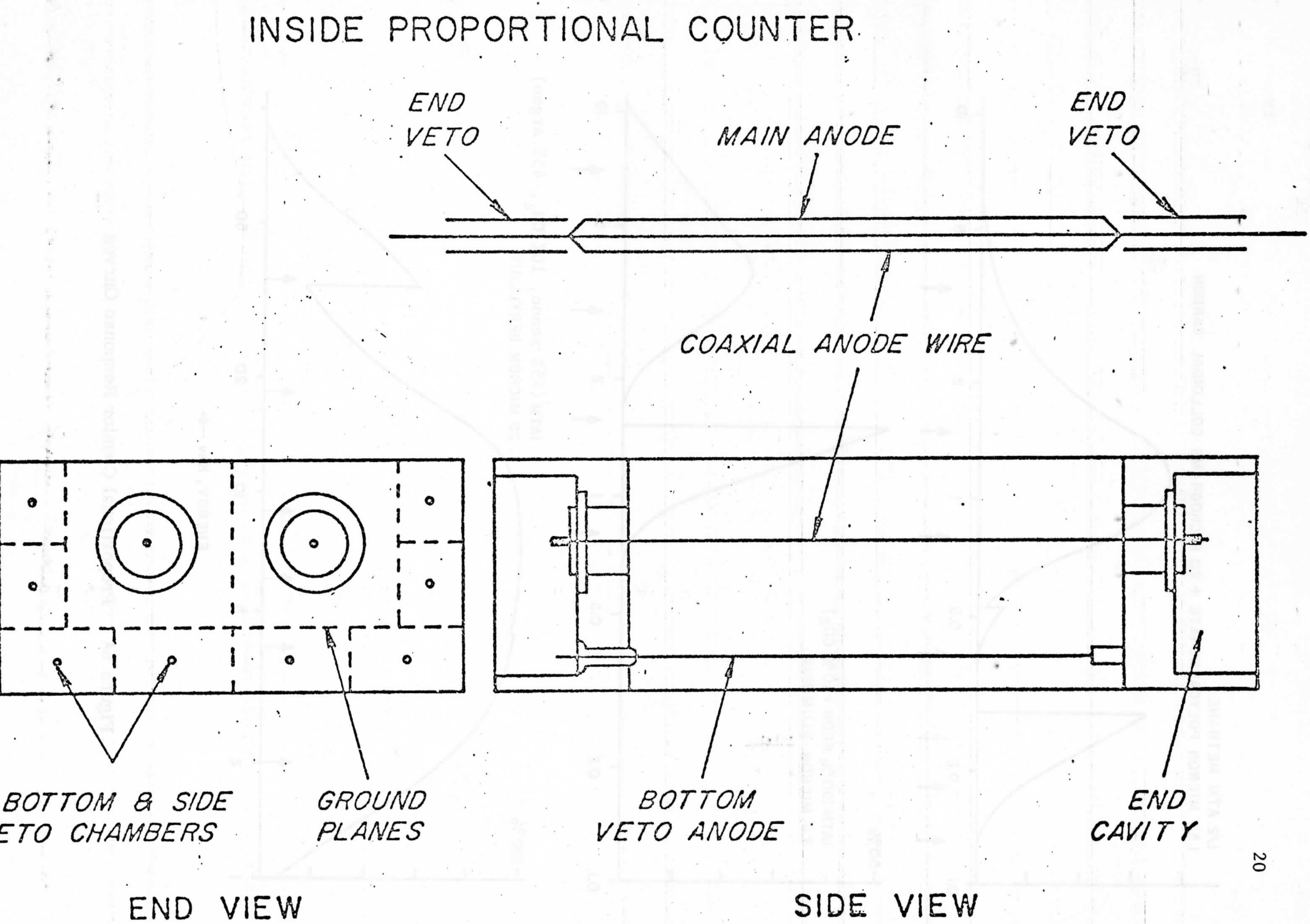

INSIDE PROPORTIONAL COUNTER
END VETO
MAIN ANODE
END VETO
COAXIAL ANODE WIRE
BOTTOM & SIDE
ETO CHAMBERS
GROUND PLANES
BOTTOM VETO ANODE
END CAVITY
END VIEW
SIDE VIEW

Figure 6B

is mounted on the side for the calibration source. All of the anode wires and the wires defining the ground potential planes between counter chambers are held in place by welded connections to fine springs which provide a nearly constant tension of about 18 grams force on the main anodes and about 75 grams force on the 2-mil tungsten veto anodes and ground plane wires. The tension is almost independent of thermal expansion or contraction of the counter body.

Polycarbonate-methane Counter. The polycarbonate-methane counter uses a 1.5-micron thick Kimfol polycarbonate window and a pure methane filling gas at a pressure of about 400 torr. The x-ray events are sorted according to pulse height into six energy channels; 0.13 to 0.18 Kev, 0.18 to 0.24 Kev, 0.24 to 0.40 Kev, 0.40 to 0.80 Kev, 0.80 to 1.5 Kev, and 1.5 to 3.5 Kev. This counter is kept at a constant gas density by an electronics pressure regulator in spite of diffuse leakage of the counting gas through the thin window. The window is supported by the internal gas pressure against an aluminum honeycomb collimator which forms the top half of the counter module.

Aluminum-neon Counter. The two aluminum-neon counters have 7.6-micron aluminum windows and a counting gas of neon-carbon dioxide at a pressure of 1.2 atmospheres and provide sensitivity into two energy windows between 1 and 7 Kev. Pulse-height discriminators divide data from this detector into three differential energy channels: 0.80 to 1.6 Kev, 1.6 to 3.0 Kev, and 3.0 to 7.0 Kev. The aluminum window is epoxied to a cover plate perforated with about 3000, 0.85-inch diameter holes. This perforated cover does not significantly disturb the response pattern of the honeycomb collimator.

Beryllium-xenon Counter. This counter has a 25-micron thick beryllium window which is sensitive to x-rays between 1.5 Kev and 35 Kev. The gas mixture in this counter is 45% xenon, 45% argon and 10% CH_4 at a pressure of 1.2 atmospheres. The x-rays in the beryllium-xenon detector are counted in six differential channels (1.5 to 2.0 Kev, 2.0 to 4.0 Kev, 4.0 to 6.0 Kev, 6.0 to 9.0 Kev, 9.0 to 18.0 Kev, and 18.0 to 35.0 Kev) and 1 integral energy channel (35.0 Kev).

3.2 High Voltage Power Supply (HVPS)

The experiment contains six high voltage power supplies, one for each proportional counter. The output voltage is programmable by command via a six line control input in 64 steps over the range from 1750 to 2500 VDC. Each step is 0.6% or approximately 12 v. There is a monitor output, compatible with the spacecraft analog subcom, which indicates the high voltage output.

The entire HVPS is potted except for the transformer which is vented to ambient. A cover is placed over the transformer vent hole which must be removed before flight or vacuum tests.

Table 3.2 contains a summary of HVPS parameters.

Table 3.2

High Voltage Power Supply

Specification 5800-0201
Overall Dimensions: 3.60" x 1.75" x .90"

Output voltage: 1750 to 2500 VDC in 64 discrete steps
Program control: 6 line TTL compatible control input
Input power: 175 mw max, 150 mw normal load, 100 mw no load
Output load current: 3 to 15 μA, limited between 25 and 50 μA
Ripple and noise: 2 mv p-p max.
Subcontractor: ELDEC, Lynnwood, Washington (formerly EDC)

3.3 Charge Amplifier

There are 18 charge amplifiers in the experiment, a set of three for each proportional counter. The set of three consists of one main, one side and bottom veto, and one end veto amplifier. There are two gain ranges: 10 volts per pico coulomb and 50 v/pc. The exact gain is determined by test select gain components installed during manufacturing. In addition to the signal input and output there are test input and output connectors. The test input connectors are used connecting a pulse generator for calibration and the test output connectors are used for noise measurements and pulse height analysis of the proportional counters. The end veto amplifiers have a transient cancellation input which is connected to an output on the main amplifiers. The transient cancellation is required because of crosstalk between the end veto and main anodes which otherwise result in self-vetoing of main anode events.

Table 3.3 contains a summary of charge amplifier parameters.

Table 3.3

Charge Amplifier

Specification 5830-0176
Overall Dimensions: 3.75" x 2.25 " x 0.74"

Part number	Version
5830-0414-001	Main - 10 v/pc
5830-0414-002	Main - 50 v/pc
5830-0414-003	End veto - 50 v/pc
5830-0414-004	Side/bottom veto - 50 v/pc
5830-0414-005	End veto - 10 v/pc
5830-0414-006	Side/bottom veto - 10 v/pc

Input power: 35 milliwatts max
Dynamic range (input): 2×10^{-15} to 2×10^{-10} coulombs
Dynamic range (output): 0, +3.0 volts
Maximum voltage swing (output): $\pm$ 3.6 volts
Noise: less than one event per second at 2.5×10^{-15} coulomb level with 150 pf stray input capacitance
Recovery time: 120 μs
Output pulse shape: 2 to 4 μs time constant
Load impedance: 3900 Ω

3.4 Level Discriminator

There are six level discriminators in the experiment, one for each proportional counter. The level discriminator processes the output of the three charge amplifiers and generates the following outputs:

1. For valid events: (a valid event is an x-ray detected by the main anode which is not vetoed and is within the range of the level discriminator) A pulse is generated on one of several output level lines depending on the amplitude of the input pulse. A pulse is also generated on the strobe output line to indicate a valid event.

2. For non valid events: The strobe pulse is inhibited by end and side/bottom veto amplifier pulses.

3. Deadtime Pulse. A deadtime pulse of 120 μ second duration is generated for each input pulse. The deadtime pulse inhibits processing of additional events during the 120 μ second charge amplifier recovery time. The deadtime pulse appears on a separate output line which is the input for the active time generator in the command and control systems.

4. High Event Rate Flag. An output pulse is generated whenever the input event rate reaches 1000 events/second. The high event rate pulse is the input to the ratemeter logic in the command and control system.

There are three versions of the level discriminator, one for each type of counter. The major parameters of the level discriminator are summarized below in Table 3.4.

The relationship between the counter, HVPS, amplifier gain, and level discriminator thresholds is shown in Table 3.5.

Table 3.4

Level Discriminator

Specification 5830-0180
Overall Dimensions: 3.688" x 3.75" x 1.50"

Part Number	For Counter Type	Number of Output Levels
5830-0151	Gas Flow	6 lowest threshold adjustable by command
5830-0152	Aluminum	3
5830-0153	Beryllium	7 highest "bin" is unbounded

Power Consumption: 100 mw max
Threshold Stability: ±2%

3.5 Calibration Source and Actuator

Attached to each counter is a radioactive calibration source on an arm actuated by a rotary solenoid. On command, all six rotary solenoids are actuated simultaneously and swing the sources in front of the respective counter calibration windows. The sources move into place five seconds before the end of the major frame following receipt of the command, and remain in position over the calibration windows for the entire following major frame. At the start of the next major frame, power is removed from the solenoids which allows solenoid return springs to return the sources to the off position. The sequence is summarized below:

Major Frame #	Event
	Command 1,27 is sent if latch valves have been operated.
1	Calibration command is sent (command 1,18).
2	Sources activated 15 seconds after major frame start.
3	Sources remain in position.
4	Sources drop back to rest position at start of major frame.

The sequence can be terminated at any time by sending command 1,19.

The calibration sources can be kept activated for longer periods by sending

VOLT, AMPLIFICATION AND DISCRIMINATOR VALUES

rating HV	Gas Gain	pC/KeV	Counter	Volts per KeV at Amplifier Output (nominal case)	Minimum choice of Amplifier Gain v/pC	Nominal Present Amplifier Gain v/pC	Maximum choice of Ampl Gain v/pC	Disc Level	Disc Level (eV)	Disc Level volts
2300 VDC	10,000	.0535	Gas Flow Main	0.750	12.2	14.0	20	D1	130	.0975
								D2	180	.135
								D3	240	.180
								D4	400	.300
								D5	800	.600
								D6	1500	1.125 (AlK_α)
								D7	3500	2.625
								Alt. D1	150	.1125
2300	10,000	.0535	Gas Flow End Veto	0.50	8	9.35	11	EVD1	180	.090
2200	15,000	.080	Gas Flow B&S Veto	0.60	6	7.5	11	VD1	150	.090
1675	5,000	.0267	Aluminum Main	0.125	4.3	4.68	22	D1	800	.100
								D2	1600	.200
								D3	3000	.375
								D4	6000	.750 (Fe^{55})
1675	5,000	.0267	Aluminum End Veto	0.668	12.2	25	30	EVD1	225	.150
1650	10,000	.0535	Aluminum B&S Veto	0.94	8	17.5	22	VD1	160	.150
2050	2,900	.0156	Beryllium Main	0.075	4.3	4.8	10	D1	1.5 KeV	.1125
								D2	2.0	.150
								D3	4.0	.300
								D4	6.0	.450
								D5	10.0	.750
								D6	22.0	1.650 (Cd^{109})
								D7	35.0 (unbounded)	2.625
2050	2.900	.0156	Beryllium End Veto	0.126	4.5	8.08	10	EVD1	1200 eV	.150
2020	4,800	.026	Beryllium B&S Veto	0.95	15	36.6	40	VD1	320 eV	.300

Table 3.5

repeated 1,18 commands in the first half of each major frame for as long as the sources are required.

Table 3.6 contains a summary of calibration source and actuator parameters.

Table 3.6

Calibration Source and Actuator

Specification 5810-0125

Counter	Source	Strength
Gas Flow	Fe55	500 μc
Aluminum	Fe55	0.1 μc
Beryllium	Cd109	0.19 μc

Actuator: Rotary Solenoid, manufactured by Cliftronics, Clifton Springs, N.Y.
Rotation: 15° with 23 VDC applied
Coil Resistance: 226 $\pm$ 20 ohms
Holding Current: 15 ma

3.6 Gas System - Gas Regulation Electronics (GRE)

The gas system maintains pressure in the gas flow counters according to the following rule:

> Pressure is maintained at 400 torr absolute or 210 torr above ambient pressure, whichever is greater.

The differential pressure, differential capacitance high resolution transducer (CGS Datametrics) provides the input to the GRE for regulation at 400 torr absolute. A potentiometer transducer (Servonics) provides the input for regulation at 210 torr guage. Whenever the pressure difference between ambient and the inside of the gas flow counters is less than 210 torr, the GRE actuates the inlet valve. This provides positive pressure for window support when the experiment is in atmospheric pressure and during vacuum chamber venting. This feature may be disabled for special tests of the 400 torr regulation loop by connecting certain pins on the monitor connector.

The GRE drives the inlet solenoid valve in short bursts. The GRE includes a duty cycle limit such that the maximum rate of each inlet valve is two operations per second.

There is one GRE with associated transducers and inlet valve for each of the two gas flow counters. The GRE is redundant in the sense that if one fails, the counters can be cross-strapped by means of the latch valves and pressure maintained in both counters by one GRE.

The gas system has a relief valve which ensures* pressure will not exceed 11 psig in the counters during launch or vacuum chamber pump down. There are also two fill valves for connecting an external gas system to keep windows supported with positive pressure.

3.7 Command and Control System

The command and control system performs the following function:

1. Serial Command Decoder

The serial command decoder (SCD) receives spacecraft commands via one serial command input from remote decoder number one (series 1, 71, XXX) commands. The output of the SCD is a command pulse on one of 28 command output lines to various experiment subsystems. Serial commands are decoded only if the input command word is valid. A valid command contains two data "ones" and is followed by a spacecraft generated verification pulse. The SCD also generates a command execute pulse (CEX) for each valid command received. If a non valid command is received, the command execute pulse is inhibited which causes a non-execute (NEX) output to switch to the one state until the next valid command is received. The NEX output appears as a digital subcom output to the spacecraft.

---

* If latch valves are in proper configuration: forward and aft open, ambient closed.

The SCD is redundant and switchable by command. (commands 1,21 and 1,22)

2. High Voltage Power Supply (HVPS) Programmer/Control Enable

The HVPS programmer consists of six units, one for each high voltage power supply, that control the power input and program control of each HVPS. Power is applied to each HVPS through a relay actuated by command from the HVPS programmer. A HVPS enable command will result in a HVPS turn-on only if all of the necessary conditions are met. Power turn on is inhibited by radiation monitor, ratemeter, and for HVPS 1 and 4 only gas pressure low and day/night signals if present.

The program state of the HVPS is set by a six line control interface controlled by a six stage binary counter. The program state may be incremented by command, one command per step, or reset by command, power turn on, initialization command, or HVPS off/reset command. There is no decrement (step-down) command. For step down,the programmer must be reset to zero and stepped up to the desired state. The program counter is modulo 64, i.e. a step up command from the all one's state will reset the counter to zero.

3. SAA Event Flag Generator

The SAA event flag generator provides the two outputs to the spacecraft in response to transitions in the state of the experiment radiation monitor. A flag is generated when the radiation monitor output changes from low to high and the other flag is generated for the high to low transition. The flag generator may be enabled or disabled by command.

4. Initialize Pulse Generator/Serial Command Memory Buffers

An initialize pulse is generated every time power is applied to the experiment and in response to a command initialize (1, 23) pulse command.

The initialize pulse is used to set various logic circuits in the experiment to known and safe start-up state. The serial command memory buffers provide bi-level control outputs which are set by the initialize pulse or a pair of serial command decoder outputs.

5. Ratemeter Logic

The ratemeter logic provides an output which is turned on by the level discriminator ratemeter output and which remains on for at least one major frame period after the level discriminator ratemeter turn off.

6. Gas Pressure Transducer Electronics

The gas pressure transducer electronics provide two unconditioned analog outputs to the spacecraft remote multiplexer indicating the pressure in each of two proportional counters. There is also a digital control signal output to indicate when counter pressure has fallen below a safe level. Another output is provided to the GRE as an input drive when the pressure is below 4 psig.

7. Active Time Generator

The active time generator gates an 800 Hz clock with the deadtime pulses from the six level discriminators and prescales the output using the data system sector boundary signals. The result is the active time which appears in the serial data output of the experiment. The purpose of the 800 Hz clock and the prescaling is to insure that when overflow occurs in the 8 bit accumulator of the data system it can be detected and the data adjusted to account for the overflow.

8. Digital Status Multiplexer

The digital status multiplexer accepts 80 parallel bilevel status data inputs and generates serial data on five output lines. All five lines are active simultaneously and selection is made by the spacecraft. The 80 bits are divided into two groups of 40, one group is available for output during the first half of the major frame and the other during the last half. It therefore takes a full major frame to obtain all experiment digital subcom data. (5 words x 8 bits/word x 2 per major frame = 80 bits per major frame). The significance of each bit of digital subcom data is described in section 6, Data Format.

9. Calibration Logic and Drivers

The calibration logic and drivers provide actuating and holding currents for the six rotary solenoid calibration source actuators. Power for the rotary solenoids is supplied from the spacecraft +28 unregulated bus through vent solenoid relay contacts. This provides a means to remove power from the rotary solenoids in case of shorted drive transistor or logic failure. (Resetting vent select relays 1 and 2 by sending commands 1, 29 and 1, 30 will remove rotary solenoid power, setting vent relays 1 and 2 by sending command 1, 27 restores power.) Upon receiving the calibrate command (1, 18) the calibrate sequence is started. There are two digital subcom status bits which indicate the major frames when the rotary solenoids are on and the frame during which the solenoids are on for the entire frame. The sequence is as follows:

MAJOR FRAME	EVENT	STATUS BITS - STATE	
		RAF (cal frame)	RAS(cal source)
1	Command 1, 18 sent	1 (invalid)	0 (off)
2	Solenoids actuated 15 seconds after major frame start	1	1 (on)
3	Solenoids remain on	0 (valid)	1 (on)
4	Solenoids deactivated at start of frame	1	0

Actuating current for each solenoid is 164 mA max for 80 ms. Holding current is 22.5 mA minimum for the duration of the calibrate cycle, approximately 25 seconds.

10. Vent Solenoid Selector/Drive

The vent solenoid selector/driver provides drive current to actuate the three solenoid latch valves. (forward, aft, and ambient exhaust) Each valve has two coils, open and close. The vent solenoid selector circuitry employs three vent select relays which switch the driver output to the appropriate valve coil as follows:

Relay 1	Relay 2	Relay 3	Coil Selected
Set	Set	Set	3 Close (ambient)
Set	Set	Reset	1 Close (forward)
Set	Reset	Set	2 Open (aft)
Set	Reset	Reset	3 Open (ambient)
Reset	Set	Set	NONE - no connection
Reset	Set	Reset	NONE - no connection
Reset	Reset	Set	2 Close (aft)
Reset	Reset	Reset	1 Open (forward)

Table 4.7.10.1

Note there are two relay states which result in no valve coil being selected. This provides the capability to disconnect all valve coils from the +28 unregulated bus in case of a shorted drive transistor or other failure. Also if both vent select relays 1 and 2 are reset, power is removed from the calibration source drivers.

The commands used to actuate the relays are as follows:

Command	Action
1, 27	set relays 1 and 2
1, 28	set relay 3
1, 29	reset relay 1
1, 30	reset relays 2 and 3

This results in the following command sequence to actuate a particular exhaust valve.

To operate the latch valves, send the command sequence shown, verify the bits of digital subcom word 98-95 is as shown, and execute by sending command 1,31.

Operation	Command Sequence	Word 98, Minor Frame 95 Bits 6, 7, and 8
Fwd Open	1,29 , 1,30	7
Fwd Close	1,30 , 1,27	1
Aft Open	1,27 , 1,30 , 1,28	2
Aft Close	1,29 , 1,30 , 1,28	6
Ambient Open	1,27 , 1,30	3
Ambient Close	1,27 , 1,28	0

To actuate: send command 1,31. (after each sequence)

Table 4.7.10.2

Latch Valve Operation Procedure

There are two redundant output drivers selectable by command. There are status bits in the digital subcom to indicate which output driver has been selected and the state of each vent select relay.

11. Relay Power Supply

The relay power supply is a redundant pair of capacitor storage units each of which is capable of driving the various relays in the experiment. The relay power supply is intended to reduce the di/dt on the preregulated bus at the experiment interface. The maximum repetition rate of the supplies is 0.2 Hz. Command sequences which include several relay actuation commands must include adequate time between relay operations to allow the supplies to recharge. If this is not considered, the relay could fail to operate.

12. Reconfiguration Logic

The reconfiguration logic responds to the various reconfiguration commands by applying drive to the appropriate reconfiguration relay.

13. Input/Output Interface

The interface for all input and output signals (except data system output) is provided by the command and control system. The interface for the eight thermistor networks, the high voltage switching networks, and the low voltage monitors is included. The buffered signals which appear on the monitor connector are also part of the command and control system.

3.8 Low Voltage Power Supply (LVPS)

The low voltage power supply provides the various low voltages required by all other experiment subsystems except the data system which has its own low voltage supply. The low voltage outputs are +28 (isolated) for the high voltage power supplies, +12, +6, -6, and +5 VDC. There are two complete redundant supplies, switchable by command. Each output voltage is further divided into X, Y, and Z bus outputs. The X and Y outputs may be switched off by command. This provision is intended to remove any load fault which would otherwise completely disable the experiment. With the X or Y bus off there is approximately half of the experiment remaining in operation.

Table 3.8 contains a summary of LVPS parameters.

Table 3.8

Low Voltage Power Supply

Specification 5830-0142
Overall Dimensions: 7.4" x 3.0" x 4.9"
Power Consumption: 4.5 Watts 0 to 100% load
Subcontractor: Collins Radio Company, Cedar Rapids, Iowa

3.9 Radiation Monitor

There is a GM tube radiation monitor attached to counter number three (forward beryllium) viewing forward parallel to the spin axis. The radiation monitor is designed to detect high energy radiation which would degrade the proportional counters. The radiation monitor output is used to disable the high voltage supplies and provides the input for the SAA flag generator.

3.10 Data System

The function of the data system is to accumulate the data from the six proportional counters during a major frame and read it out to the spacecraft as a single serial digital data interface during the following major frame. The data system memory is divided into halves, each of which alternately accumulates and reads out, to provide continuous data collection. The data output format is (detailed in section 5) such that each word of the major frame is assigned to a specific level, counter, and sector. For example, minor frame 3, word 50 is counter #4, level 1, sector 0. Minor frame 68, word 49 is counter #1, level 2, sector clear.

To do this, the data system is divided into four major blocks, each of which is redundant and switchable by the fifth block, the reconfiguration logic. The four blocks are: acquisition logic, memory, telemetry control, and power supply. Each memory is further divided into two halves which switch every major frame for alternate accumulation and readout. The configuration status of the data system is shown in minor frame 1, words 49 and 50. The significance of each bit is as follows:

Bit # (MSB=1)	Parameter	1=	0=
1	Self Test	ON	OFF
2	Memory Half	A	B
3	Memory #1	ON	OFF
4	Memory #2	ON	OFF
5	TM Control #1	ON	OFF
6	TM Control #2	ON	OFF
7	Acquisition #1	ON	OFF
8	Acquisition #2	ON	OFF

Note there is no status bit for the power supply.

There is a self test routine which is initiated by command which places counts in all data word locations. The self test runs for two major frames to test both memory halves but can be terminated early by command.

The acquisition block responds to inputs from the six level discriminators and generates the proper memory address for the input event. Data is accumulated in 8 bit words during a major frame. Overflows reset each word (i.e. modulo 256 arithmetic). At the start of the next major frame the memory halves are switched so the accumulated data can be read out while new data is collected in the other half. The telemetry control block then reads out the data to the spacecraft and clears the memory.

In addition to the X-ray data and status words, the data system output also contains counter active times, spacecraft sail position (most significant 8 bits of the SAE count at the start of the major frame), and solenoid count for the forward and aft inlet valves. These two words indicate the number of inlet valve operations which occured in the last major frame.

It is important to understand the following points concerning the data system output.

1. The data is time synchronized to the telemetry major frame, not to the spacecraft rotation.

2. Since each word signifies a particular counter, level, and sector, a full major frame of telemetry is required to obtain a complete set of data, thus dwell mode produces meaningless output.

Table 3.10 contains a summary of data system parameters.

Table 3.10

Data System

Specification 5830-0060
Overall Dimensions: 7.4" x 6.75" x 6.54"
Input Power: 2.5 Watts
Memory: 2 512 x 8 core memories
Logic: TI 54L
Subcontractor: Time Zero Labs, division BBRC

4. COMMAND LIST AND DESCRIPTION

The following four pages contain the experiment command list. Table 4-1, command response chart, on the succeeding pages details the preconditions and resulting telemetry response for each command. In addition to the experiment commands, the following spacecraft commands are required for operation of the experiment:

NAME	CMD DEC	CHAN (DEC)
Methane valve A pulse	9	42
Methane valve B pulse	9	43
Unreg power on/overload reset	8	54
Unreg power off	8	55
Regulated power on	7	7
Regulated power off	7	8
Wisconsin regulator A select	7	22
Wisconsin regulator B select	7	23

COMMAND LIST

NO.	COMMAND NAME	ABBREVIATION	COMMAND TYPE (Note 1)	COMMAND # Octal	COMMAND # Decimal
101	HV Power Supply 1 On	HVN1	D	1	1
102	HV Power Supply 2 On	HVN2	D	2	2
103	HV Power Supply 3 On	HVN3	D	3	3
104	HV Power Supply 4 On	HVN4	D	4	4
105	HV Power Supply 5 On	HVN5	D	5	5
106	HV Power Supply 6 On	HVN6	D	6	6
107	LVPS Bus X On	LVXN	DP	7	7
108	LVPS Bus Y On	LVYN	DP	10	8
109	HV Power Supplies Off/ Reset	HVFR	D	11	9
110	Data System Normal	DSNORM	DP	12	10
111	Data System Test On	DSTN	D	13	11
112	Data System Test Off/ Ratemeter Normal	DSTF/RTN	D	14	12
113	Data System Power Supply 1	DSPS1	DP	15	13
114	Data System Power Supply 2	DSPS2	DP	16	14
115	Data System Acquisition 2	DSAQ2	DP	17	15
116	Data System Memory 2	DSMEM2	DP	20	16
117	Data System Telemetry 2	DSTM2	DP	21	17
118	Calibrate On	CLN	D	22	18
119	Calibrate Terminate	CLT	D	23	19
120	Configuration Normal	CFN	DP	24	20
121	Command Decoder Reconfigure/LVPS Bus X Off	CDR/XF	DP	25	21
122	Non-essential +5 Off/ LVPS Bus Y Off	N5F/YF	DP	26	22
123	Command Initialize	CNT	D	27	23
124	HVPS Off	HVF	DP	66	54
125	LVPS 1	LPS1	DP	31	25
126	LVPS 2	LPS2	DP	32	26
127	Vent Select Relay Set 12	VRS12	D	33	27
128	Vent Select Relay Set 3	VRS3	D	34	28
129	Vent Select Relay Reset 1	VRR1	D	35	29
130	Vent Select Relay Reset 23	VRR23	D	36	30

NO.	COMMAND NAME	ABBREVIATION	COMMAND TYPE	COMMAND # Octal	COMMAND # Decimal
131	Vent Solenoid Actuate	VSA	D	37	31
132	Vent Solenoid Driver Select 1	VDS1	D	74	60
133	Vent Solenoid Driver Select 2	VDS2	D	30	24
134	Ratemeter Enable	RTE	D	67	55
135	SAA Flag Enable	SAAE	D	70	56
136	SAA Flag Diable	SAAD	D	71	57
137	HVPS 1 Off	GHVF1	D	72	58
138	HVPS 4 Off	GHVF4	D	73	59

NO.	COMMAND NAME	ABBREVIATION	COMMAND TYPE	Last 8 Bits Octal	Last 8 Bits Decimal
201	Gas Pressure Low/ Aft Ratemeter Disable	GPL/RMAD	SY	12	10
202	Gas Pressure Low/ Aft Ratemeter Enable	GPL/RMAE	SY	11	9
203	Step HV 4 Up	HVSU4	SY	6	6
204	Step HV 5 Up	HVSU5	SY	5	5
205	Step HV 6 Up	HVSU6	SY	42	34
206	HV Program Reset 4	HVPR4	SY	41	33
207	HV Program Reset 5	HVPR5	SY	22	18
208	HV Program Reset 6	HVPR6	SY	21	17
209	Day/Night Signal Disable	DNSD	SZ	202	130
210	Day/Night Signal Enable	DNSE	SZ	201	129
211	Level Discriminator 4 Threshold High	LD4H	SY	102	66
212	Level Discriminator 4 Threshold Low	LD4L	SY	101	65
213	Radiation Monitor Disable	MOND	SX	50	40
214	Radiation Monitor Enable	MONE	SX	44	36
215	Step HV 1 Up	HVSU1	SX	30	24
216	Step HV 2 Up	HVSU2	SX	24	20
217	Step HV 3 Up	HVSU3	SX	210	136
218	HV Program Reset 1	HVPR1	SX	204	132
219	HV Program Reset 2	HVPR2	SX	110	72
220	HV Program Reset 3	HVPR3	SX	104	68

NO.	COMMAND NAME	ABBREVIATION	COMMAND TYPE	Last 8 Bits Octal	Decimal
221	Level Discriminator 1 Threshold High	LD1H	SX	240	160
222	Level Discriminator 1 Threshold Low	LD1L	SX	220	144
223	Gas Pressure Low/Forward Ratemeter 1 Disable	GPL/RMFD	SX	140	96
224	Gas Pressure Low/Forward Ratemeter 1 Enable	GPL/RMFE	SX	120	80
225	Gas Flow Control 1 On	GFCN1	SX	300	192
226	Gas Flow Control 1 Off	GFCF1	SX	60	48
227	Gas Flow Control 2 On	GFCN2	SY	14	12
228	Gas Flow Control 2 Off	GFCF2	SY	3	3

Epxeriment Unregulated Power On/Overload Reset	Spacecraft
Experiment Unregulated Power Off	Spacecraft
Experiment Regulated Power On/Overload Reset	Spacecraft
Experiment Regulated Power Off	Spacecraft

Note 1 -- Command Type Explanation

Spacecraft - Command actuates spacecraft systems only, does not interface directly with Soft X-Ray Experiment

D - Pulse Command

P - Operates from Relay Supply Bus

S - Serial magnitude command. All required serial commands are applied through a single serial command interface. Serial command codes are shown in Figure 1.

X, Y, Z, - Designates load bus which must be active for response to command input.

Command Summary

Command Type	Number Required
Pulse	38
Serial	1

All blank bits are zero.

SERIAL MAGNITUDE COMMAND CODES

CMD. NO.	1 - 8 BIT	9	10	11	12	13	14	15	16
201		0	0	0	0	1	0	1	0
202		0	0	0	0	1	0	0	1
203		0	0	0	0	0	1	1	0
204		0	0	0	0	0	1	0	1
205		0	0	1	0	0	0	1	0
206		0	0	1	0	0	0	0	1
207		0	0	0	1	0	0	1	0
208		0	0	0	1	0	0	0	1
209		1	0	0	0	0	0	1	0
210		1	0	0	0	0	0	0	1
211		0	1	0	0	0	0	1	0
212		0	1	0	0	0	0	0	1
213		0	0	1	0	1	0	0	0
214		0	0	1	0	0	1	0	0
215		0	0	0	1	1	0	0	0
216		0	0	0	1	0	1	0	0
217		1	0	0	0	1	0	0	0
218		1	0	0	0	0	1	0	0
219		0	1	0	0	1	0	0	0
220		0	1	0	0	0	1	0	0
221		1	0	1	0	0	0	0	0
222		1	0	0	1	0	0	0	0
223		0	1	1	0	0	0	0	0
224		0	1	0	1	0	0	0	0
225		1	1	0	0	0	0	0	0
226		0	0	1	1	0	0	0	0
227		0	0	0	0	1	1	0	0
228		0	0	0	0	0	0	1	1

Table 4-1
Wisconsin Experiment Commands and Verifications

CMD	Description	Mnemonic	Type	Function	Initial Condition or Result	Verification: Minor Frame Word	Channel	Bits	Bit Meaning: Bit On	Bit Off
1-01	HVPS 1 on	HVN1	P	Enables HVPS 1 turn-on	GPO1 = 0	98	30	4	Gas pressure 1 override on	Gas pressure 1 override off
					GIE1 = 0	98	30	3	Gas inlet 1 disabled	Gas inlet 1 enabled
					HV11 through 16 OK	98	27	3-8	Binary weighted program bit on	Binary weighted program bit off
					Result	98	27	2	HVPS 1 enabled	HVPS 1 disabled
1-02	HVPS 2 on	HVN2	P	Enable HVPS 2 turn-on	GPO1 = 0	98	30	4	Gas pressure 1 override on	Gas pressure 1 override off
					HV 21 through 26 OK	98	28	3-8	Binary weighted program bit on	Binary weighted program bit off
					Result	98	28	2	HVPS 2 enabled	HVPS 2 disabled
1-03	HVPS 3 on	HVN3	P	Enable HVPS 3 turn-on	GPO1 = 0	98	30	4	Gas pressure 1 override on	Gas pressure 1 override off
					HV 31 through 36 OK	98	29	3-8	Binary weighted program bit on	Binary weighted program bit off
					Result	98	29	2	HVPS 3 enabled	HVPS 3 disabled
1-04	HVPS 4 on	HVN4	P	Enable HVPS 4 turn-on	GPO2 = 0	98	30	7	Gas pressure 2 override on	Gas pressure 2 override off
					GIE2 = 0	98	30	6	Gas inlet 2 disabled	Gas inlet 2 enabled
					HV 41 through 46 OK	98	91	3-8	Binary weighted program bit on	Binary weighted program bit off
					Result	98	91	2	HVPS 4 enabled	HVPS 4 disabled
1-05	HVPS 5 on	HVN5	P	Enable HVPS 5 turn-on	GPO2 = 0, RTC = 1	98	30	7	Gas pressure 2 override on	Gas pressure 2 override off
					HV51 through 56 OK	98	92	3-8	Binary weighted program bit on	Binary weighted program bit off
					Result	98	92	2	HVPS 5 enabled	HVPS 5 disabled
1-06	HVPS 6 on	HVN6	P	Enable HVPS 6 turn-on	GPO2 = 0, RTC = 1	98	30	7	Gas pressure 2 override on	Gas pressure 2 override off
					HV 61 through 66 OK	98	93	3-8	Binary weighted program bit on	Binary weighted program bit off
					Result	98	93	2	HVPS 6 enabled	HVPS 6 disabled

P = pulse S = serial

Table 4-1
Wisconsin Experiment Commands and Verifications (Cont)

CMD	Description	Mnemonic	Type	Function	Initial Condition or Result	Verification: Minor Frame Word	Channel	Bits	Bit Meaning: Bit On	Bit Off
1-07	LVPS Bus X on	LVXN	P	Closes LVPS X bus output circuits	+28 v reg off +28 v unreg off				No direct verification, X bus load circuits are operative after experiment turn on	
1-08	LVPS bus Y on	LVYN	P	Closes LVPS Y bus output circuits	+28 v reg off +28 v unreg off				No direct verification. Y bus load circuits operative after experiment turn-on	
1-09	HVPS off/ reset	HVFR	P	Turns off all HVPS, resets all HV program counters, disables all HV switch logic		98	27	1	HVPS 1 on	HVPS 1 off
						98	27	2	HV1 switch control logic enabled	HV1 switch control logic disabled
						98	27	3-8	Program bit on	Program bit off
						98	28	1	HVPS 2 on	HVPS 2 off
						98	28	2	HV2 switch control logic enabled	HV2 switch control logic disabled
						98	28	3-8	Program bit on	Program bit off
						98	29	1	HVPS 3 on	HVPS 3 off
						98	29	2	HV3 switch control logic enabled	HV3 switch control logic disabled
						98	29	3-8	Program bit on	Program bit off
						98	91	1	HVPS 4 on	HVPS 4 off
						98	91	2	HV4 switch control logic enabled	HV4 switch control logic disabled
						98	91	3-8	Program bit on	Program bit off
						98	92	1	HVPS 5 on	HVPS 5 off
						98	92	2	HV5 switch control logic enabled	HV5 switch control logic disabled
						98	92	3-8	Program bit on	Program bit off
						98	93	1	HVPS 6 on	HVPS 6 off
						98	93	2	HV6 switch control logic enabled	HV6 switch control logic disabled
						98	93	3-8	Program bit on	Program bit off
						98	58-63		All data ≥ 0	
						98	64-66		All data $\geq 115_{10}$	

Table 4-1
Wisconsin Experiment Commands and Verifications (Cont)

CMD	Description	Mnemonic	Type	Function	Initial Condition or Result	Verification: Minor Frame Word	Channel	Bits	Bit Meaning: Bit On	Bit Off
1-10	Data system normal	DSNORM	P	Selects acquisition logic 1, memory 1, telemetry control 1	+28 v reg off	1	49-50	8	Acquisition block 2 on	Acquisition block 2 off
						1	49-50	7	Acquisition block 1 on	Acquisition block 1 off
						1	49-50	6	TM control 2 on	TM control 2 off
						1	49-50	5	TM control 1 on	TM control 1 off
						1	49-50	4	Memory 2 on	Memory 2 off
						1	49-50	3	Memory 1 on	Memory 1 off
1-11	Data system test on	DSTN	P	Starts data system self-test sequence		1	49-50	1	Self-test on	Self-test off
1-12	Data system test off/ ratemeter normal	DSTF/ RTN	P	Terminates data system self-test sequence. Ratemeter logic function may be inhibited by status commands 2-01 and 2-23		1	49-50	1	Self-test on	Self-test off
						98	95	3	Ratemeter system normal	Ratemeter system enabled
1-13	Data system power supply 1	DSPS1	P	Selects data system power supply 1	+28 v reg off				No direct verification	
1-14	Data system power supply 2	DSPS2	P	Selects data system power supply 2	+28 v reg off				No direct verification	
1-15	Data system acquisition 2	DSAQ2	P	Selects acquisition logic 2	+28 v reg off	1	49-50	8	Acquisition block 2 on	Acquisition block 2 off
						2	49-50	7	Acquisition block 1 on	Acquisition block 1 off
1-16	Data system memory 2	DSMFM2	P	Selects memory 2	+28 v reg off	1	49-50	4	Memory 2 on	Memory 2 off
						1	49-50	3	Memory 1 on	Memory 1 off
1-17	Data system telemetry 2	DSYM2	P	Selects telemetry control 2	+28 v reg off	1	49-50	6	TM control 2 on	TM control 2 off
						1	49-50	5	TM control 1 on	TM control 1 off
1-18	Calibrate on	CLN	P	Starts calibration sequence		98	95	2	Calibration source on (For two major frames following command)	Calibration source off

Table 4-1
Wisconsin Experiment Commands and Verifications (Cont)

CMD	Description	Mnemonic	Type	Function	Initial Condition or Result	Verification				
						Minor Frame Word	Channel	Bits	Bit Meaning	
									Bit On	Bit Off
1-18 (Cont)						98	95	1	Invalid frame for calibration data	Valid frame for calibration data (During second major frame after command)
1-19	Calibrate terminate	CLT	P	Terminates calibration sequence		98	95	2	Calibration source on	Calibration source off
						98	95	1	Invalid frame for calibrate data	Valid frame for calibrate data
1-20	Configuration normal	CFN	P	Turns on nonessential +5 v and serial command decoder 1	+28 v reg off +28 v unreg off	98	94	6	Serial command decoder 2 operating	Serial command decoder 1 operating
1-21	Command decoder reconfigure/ LVPS bus X off	CDR/XF	P	Turns on serial command decoder 2, turns off LVPS X bus	+28 v reg off +28 v unreg off	98	94	6	Serial command decoder 2 operating (this response indicates that the X bus load circuits are inoperative after turn-on)	Serial command decoder 1 operating (this response indicates that the X bus load circuits are inoperative after turn-on)
1-22	Non-essential +5 v off/ LVPS bus Y on	N5F/YF	P	Turns off nonessential +5 v loads, turns off LVPS Y bus	+28 v reg off +28 v unreg off				Subcommand Y bus load circuits are inoperative after turn-on	
1-23	Command Initialize	CNT	P	Initializes control logic turns off all HVPS		98	58-63		All data ≡ 0	
						98	64-66		All data ≡ 115_{10}	
						98	30	2	SAA event flag disabled	SAA event flag enabled
						98	94	1	Level disc. 4, high threshold	Level disc. 4, low threshold
						98	94	2	Level disc. 1, high threshold	Level disc. 1, low threshold
						98	30	3	Gas flow 1 off	Gas flow 1 on
						98	30	6	Gas flow 2 off	Gas flow 2 on
						98	30	4	Gas pressure low 1 override on	Gas pressure low 1 override off
						98	30	7	Gas pressure low 2 override on	Gas pressure low 2 override off

Table 4-1
Wisconsin Experiment Commands and Verifications (Cont)

CMD	Description	Mnemonic	Type	Function	Initial Condition or Result	Verification: Minor Frame Word	Verification: Channel	Verification: Bits	Bit Meaning: Bit On	Bit Meaning: Bit Off
1-23 (Cont)						98	31	1	Radiation monitor override on	Radiation monitor override off
						98	94	4	Day/night override on	Day/night override off
						98	95	2	Calibration source on	Calibration source off
						98	95	1	Invalid frame for calibration data	Valid frame for calibration data
						98 98	27-29 91-93	1-8 1-5	All bits off, all programmers to minimum, all HV switch control logic disabled, all HVPS off	
						98	95	3	Ratemeters normal	Ratemeters enabled
1-24	Vent solenoid actuate	VSA	P	Applies drive to selected latching gas valve coil	GIE1 and/or GIE2 = 1 for venting operation	98 98	126 127		Data values decrease to ≈0 after venting operations	
1-25	LVPS 1	LPS1	P	Selects LVPS 1 redundant unit	+28 v reg off +28 v unreg off	98	94	8	LVPS 2 operating (after experiment turn-on)	LVPS 1 operating (after experiment turn-on)
1-26	LVPS 2	LPS2	P	Selects LVPS 2 redundant unit	+28 v reg off +28 unreg off	98	94	8	LVPS 2 operating (after experiment turn-on)	LVPS 1 operating (after experiment turn-on)
1-27	Vent select, relay set 12	VRS12	P	Sets vent solenoid, selects relays 1 and 2		98 98	95 95	6 7	Vent relay 1 reset Vent relay 2 reset	Vent relay 1 set Vent relay 2 set
1-28	Vent select, relay set 3	VRS3	P	Sets vent solenoid, selects relay 3		98	95	8	Vent relay 3 reset	Vent relay 3 set
1-29	Vent select, relay reset 1	VRR1	P	Resets vent solenoid, selects relay 1		98	95	6	Vent relay 1 reset	Vent relay 1 set
1-30	Vent select, relay reset 23	VRR23	P	Resets vent solenoid, selects relays 2 and 3		98 98	95 95	7 8	Vent relay 2 reset Vent relay 3 reset	Vent relay 2 set Vent relay 3 set

Table 4-1
Wisconsin Experiment Commands and Verifications (Cont)

CMD	Description	Mnemonic	Type	Function	Initial Condition or Result	Verification: Minor Frame Word	Verification: Channel	Verification: Bits	Bit Meaning: Bit On	Bit Meaning: Bit Off
1-31	Vent solenoid actuate	VSA	P	Applies drive to selected latching gas valve coil	GIE1 and/or GIE2 = 1 for venting operations	98 98	126 127		Data values ≡ 0 after venting operations	Same as bit on Same as bit on
1-54	HVPS off	HVF	P	Turns off all HVPS	(See next entry)	98		58-63	All data ≡ 0 (after experiment turn-on)	Same as bit on
						98		64-66	All data ≡ 0 (after experiment turn-on)	Same as bit on
1-54	Supplementary Data	HVF	P	Turns off all HVPS, disables all HV switch logic	If command is applied with +28 v reg on, the adjacent results are also obtained	98	27	1	HVPS 1 on	HVPS 1 off
						98	27	2	HV1 switch control logic enabled	HV1 switch control logic disabled
						98	28	1	HVPS 2 on	HVPS 2 off
						98	28	2	HV2 switch control logic enabled	HV2 switch control logic disabled
						98	29	1	HVPS 3 on	HVPS 3 off
						98	29	2	HV3 switch control logic enabled	HV switch control logic disabled
						98	91	1	HVPS 4 on	HVPS 4 off
						98	91	2	HV4 switch control logic enabled	HV4 switch control logic disabled
						98	92	1	HVPS 5 on	HVPS 5 off
						98	92	2	HV5 switch control logic enabled	HV5 switch control logic disabled
						98	93	1	HVPS 6 on	HVPS 6 off
						98	93	2	HV6 switch control logic enabled	HV6 switch control logic disabled
						98	58-63		All data ≈ 0	
						98	64-66		All data ≡ 115_{10}	
1-55	Ratemeter Enable	RTE	P	Disables all ratemeter logic inputs		98	95	3	Ratemeter normal	Ratemeter enabled

Table 4-1
Wisconsin Experiment Commands and Verifications (Cont)

CMD	Description	Mnemonic	Type	Function	Initial Condition or Result	Verification				
						Minor Frame Word	Channel	Bits	Bit Meaning	
									Bit On	Bit Off
1-56	SAA flag enable	SAAE	P	Enables SAA event flag generators		98	30	2	Flag disabled	Flag enabled
1-57	SAA flag disable	SAAD		Disables SAA event flag generators		98	30	2	Flag disabled	Flag enabled
1-58	HVPS 1 off	GHVF1	P	Turns off HVPS 1 and disables HV1 switch control logic		98	27	1	HVPS 1 on	HVPS 1 off
						98	27	2	HV1 switch control logic enabled	HV1 switch control logic disabled
						98	58	1-8	Data = 0	
						98	64	1-8	Data ≈ 115_{10} or 141_{10}	
1-59	HVPS 4 off	GHVF4	P	Turns off HVPS 4 and disables HV4 switch control logic		98	91	1	HVPS 4 on	HVPS 4 off
						98	91	2	HV4 switch control logic enabled	HV4 switch control logic disabled
						98	61	1-8	Data ≈ 0	
						98	64	1-8	Data ≈ 115_{10} or 141_{10}	
1-60	Vent solenoid driver select 1	VDS1	P	Selects event solenoid driver 1		98	95	5	Vent driver 1 selected	Vent driver 2 selected
1-71 (12)	Gas pressure low/ratemeter disable	GPL/ RMAD	S	Overrides gas pressure low 2 control, disables aft ratemeter logic	HVPS 4, 5, and 6 off, or per special test procedures	98	30	7	Gas pressure 2 override on, aft ratemeters disabled	Gas pressure 2 override off, aft ratemeters enabled
1-71 (11)	Gas pressure low/ratemeter enable	GPL/ RMAE	S	Enables gas pressure low 2 control and aft ratemeter logic		98	30	7	Gas pressure 2 override on, aft ratemeters disabled	Gas pressure 2 override off, aft ratemeters enabled
1-71 (6)	Step HV4 up	HVSU4	S	Increments HV4 program	HVPS 4 off or per special test procedures	98	91	3-8	Binary value incremented by one	Binary value incremented by one

Table 4-1
Wisconsin Experiment Commands and Verifications (Cont)

CMD	Description	Mnemonic	Type	Function	Initial Condition or Result	Verification				
						Minor Frame Word	Channel	Bits	Bit Meaning	
									Bit On	Bit Off
1-71 (5)	Step HV5 up	HVSU5	S	Increments HV5 program	HVPS 5 off or per special test procedures	98	92	3-8	Binary value incremented by one	
1-71 (42)	Step HV6 up	HVSU6	S	Increments HV6 program	HVPS 6 off or per special test procedures	98	93	3-8	Binary value incremented by one	
1-71 (41)	HV program reset 4	HVPR4	S	HV4 program set to minimum		98	91	3-8	Binary value = 0	
1-71 (22)	HV program reset 5	HVPR5	S	HV5 program set to minimum		98	92	3-8	Binary value = 0	
1-71 (21)	HV program reset 6	HVPR6	S	HV6 program set to minimum		98	93	3-8	Binary value = 0	
1-71 (202)	Day/night signal DIS-able	DNSD	S	Turns on day/night control override	HVPS 1 and 4 off or per special test procedures	98	94	4	Day/night override on	Day/night override off
1-71 (201)	Day/night signal enable	DNSE	S	Enables day/night control signal		98	94	4	Day/night override on	Day/night override off
1-71 (102)	Level discriminator 4 threshold high	LD4H	S	Selects high LD4 threshold setting		98	94	1	LD4 high threshold	LD4 low threshold
1-71 (101)	Level discriminator 4 threshold low	LD4L	S	Selects low LD4 threshold setting		98	94	1	LD4 high threshold	LD4 low threshold
1-71 (50)	Radiation monitor disable	MOND	S	Turns on radiation monitor control override		98	31	1	Radiation monitor override on	Radiation monitor override off

Table 4-1

Wisconsin Experiment Commands and Verifications (Cont)

CMD	Description	Mnemonic	Type	Function	Initial Condition or Result	Verification				
						Minor Frame Word	Channel	Bits	Bit Meaning	
									Bit On	Bit Off
1-71 (44)	Radiation monitor enable	MONE	S	Enable radiation monitor control signal		98	31	1	Radiation monitor override on	Radiation monitor override off
1-71 (30)	Step HV1 up	HVSU1	S	Increments HV1 program	HVPS 1 off or per special test procedure	98	17	3-8	Binary value incremented by 1	
1-71 (24)	Step HV2 up	HVSU2	S	Increments HV2 program	HVPS 2 off or per special test procedure	98	28	3-8	Binary value incremented by 1	
1-71 (210)	Step HV3 up	HVSU3	S	Increments HV3 program	HVPS 3 off or per special test procedure	98	29	3-8	Binary value incremented by 1	
1-71 (204)	HV program reset 1	HVPR1	S	HV1 program set to minimum		98	27	3-8	Binary value = 0	
1-71 (110)	HV program reset 2	HVPR2	S	HV2 program set to minimum		98	28	3-8	Binary value = 0	
1-71 (104)	HV program reset 3	HVPR3	S	HV3 program set to minimum		98	29	3-8	Binary value = 0	
1-71 (240)	Level Discriminator 1 threshold high	LDIH	S	Selects high LD1 threshold setting		98	94	2	LD1 high threshold	LD1 low threshold
1-71 (220)	Level discriminator 1 threshold low	LDIL	S	Selects low LD1 threshold setting		98	94	2	LD1 high threshold	LD1 low threshold
1-71 (140)	Gas pressure low/forward ratemeter disable	GPL/RMFD	S	Overrides gas pressure low 1 control, disables forward ratemeter logic	HVPS 1, 2, and 3 off or per special test procedure	98	30	4	Gas pressure 1 override on, forward ratemeters disabled	Gas pressure 1 override off, forward ratemeters enabled

Table 4-1
Wisconsin Experiment Commands and Verifications (Cont)

CMD	Description	Mnemonic	Type	Function	Initial Condition or Result	Verification: Minor Frame Word	Verification: Channel	Verification: Bit	Bit Meaning: Bit On	Bit Meaning: Bit Off
1-71 (120)	Gas pressure low/ forward ratemeter enable	GPL/ RMFE	S	Enables gas pressure low 1 control and forward ratemeter logic	·	98	30	4	Gas pressure 1 override on, forward ratemeters disabled	Gas pressure 1 override off, forward ratemeters enabled
1-71 (300)	Gas flow control 1 on	GFCN1	S	Enables forward gas regulation system	Gas latching valve 1 closed or per special test procedures	98	30	3	Gas inlet 1 disabled	Gas inlet 1 enabled
1-71 (60)	Gas flow control 1 off	GFCF1	S	Disables forward gas regulation system	HVPS1 off or per special test procedures	98	30	3	Gas inlet 1 disabled	Gas inlet 1 enabled
1-71 (14)	Gas flow control 2 on	GFCN2	S	Enables aft gas regulation system	Gas latching valve 1 closed or per special test procedure	98	30	6	Gas inlet 2 disabled	Gas inlet 2 enabled
1-71 (3)	Gas flow control 2 off	GFCF2	S	Disables aft gas regulation system	HVPS4 off or per special test procedure	98	30	6	Gas inlet 2 disabled	Gas inlet 2 enabled

5. DATA FORMAT

The data format of the experiment is described in the following pages.

Table 5-1 is the digital subcom status and control table. The bit, name, meaning, and command and/or conditions required to set the bit to the indicated state are shown. The right hand column shows the initial state of each word in octal. The experiment is set in the initial state whenever power is turned on or when the 1,23 command is sent.

Tables 5-2, 5-3, 5-4, and 5-5 list all telemetry output, analog and digital both parallel and serial. Limits, conversion coefficients, ranges, and units are shown. In addition to the experiment telemetry, the following spacecraft telemetry parameters are required for operation of the experiment:

NAME	TM/WORD
Methane tank A temperature	97-39
Methane tank B temperature	97-40
Methane tank pressure	96-85
Buffer volume A pressure	96-86
Buffer volume B pressure	96-87
Wisconsin regulated power bus voltage	96-103
Wisconsin regulator A/B select	96-20(1)
Wheel unregulated bus voltage	27-2
Wisconsins unregulated bus on/off	96-19(3)
Shear web 7 temperature	97-74
Shear web 8 temperature	97-75
Wisconsin rim panel temperature	97-79
Wisconsin top closure temperature	97-81

WORD \ BIT	1 (MSB)	2	3	4	5	6	7	8 (LSB)	INITIALIZED STATE
0	ON: 02·31·94·34+($\overline{35 \cdot 43}$)	ENABLED: 101	ON: 215 *	ON: 215 *	ON: 215 *	ON: 215 *	ON: 215 *	ON: 215 *	
	HVP 1 HVPS1 POWER	HVE 1 HVPS1 ENABLE	HV 16 HV1 PROGRAM BIT 6	HV 15 HV1 PROGRAM BIT 5	HV 14 HV1 PROGRAM BIT 4	HV 13 HV1 PROGRAM BIT 3	HV 12 HV1 PROGRAM. BIT 2	HV 11 HV1 PROGRAM BIT 1	0 0 0
98-27	OFF: 137,124 109,123	DISABLED: 137,124 109,123	OFF: 218,109 123	OFF: 218,109 123	OFF: 218,109 123	OFF: 218,109 123	OFF: 218,109 123	OFF: 218,109 123	
1	ON: 12·31·$\overline{44}$	ENABLED: 102	ON: 216 *	ON: 216 *	ON: 216 *	ON: 216 *	ON: 216 *	ON: 216 *	
	HVP 2 HVPS2 POWER	HVE 2 HVPS2 ENABLE	HV 26 HV2 PROGRAM BIT 6	HV 25 HV2 PROGRAM BIT 5	HV 24 HV2 PROGRAM BIT 4	HV 23 HV2 PROGRAM BIT 3	HV 22 HV2 PROGRAM BIT 2	HV 21 HV2 PROGRAM BIT 1	0 0 0
98-28	OFF: 124 109,123	DISABLED: 124 109,123	OFF: 219,109 123	OFF: 219,109 123	OFF: 219,109 123	OFF: 219,109 123	OFF: 219,109 123	OFF: 219,109 123	
2	ON: 22·31·$\overline{44}$	ENABLED: 103	ON: 217 *	ON: 217 *	ON: 217 *	ON: 217 *	ON: 217 *	ON: 217 *	
	HVP 3 HVPS3 POWER	HVE 3 HVPS3 ENABLE	HV 36 HV3 PROGRAM BIT 6	HV 35 HV3 PROGRAM BIT 5	HV 34 HV3 PROGRAM BIT 4	HV 33 HV3 PROGRAM BIT 3	HV 32 HV3 PROGRAM BIT 2	HV 31 HV3 PROGRAM BIT 1	0 0 0
98-29	OFF: 124 109,123	DISABLED: 124 109,123	OFF: 220,109 123	OFF: 220,109 123	OFF: 220,109 123	OFF: 220,109 123	OFF: 220,109 123	OFF: 220,109 123	
3	ENABLE: (41+$\overline{42}$)	DISABLED: 136,123	DISABLE: 226,123	ON: 223	LOW: $\overline{Z}$	DISABLE: 228,123	ON: 201	LOW: $\overline{Z}$	3 4 4
	MN RAD MON CONTROL OUTPUT	FLO EVENT FLAG GENERATOR	GIE 1 GAS INLET 1 CONTROL	GPO 1 GAS PRESSURE LOW 1/FWD RATE METER DISABLE	GPL 1 GAS PRESSURE 1 INDICATOR	GIE 2 GAS INLET 2 ENABLE CONTROL	GPO 2 GAS PRESSURE LOW 2/AFT RATE METER DISABLE	GPL 2 GAS PRESSURE 2 INDICATOR	1 5 5
98-30	DISABLE: ($\overline{41}$ · 42)	ENABLED: 135	ENABLE: 225	OFF: 224,123	NORMAL: 224 · Z	ENABLE: 227	OFF: 202,123	NORMAL: 202 Z	
4	ON (RAD MON OFF): 213	HIGH RAD: Z	HIGH: ($\overline{93 \cdot 34} \cdot Z$)	HIGH: ($\overline{93 \cdot 34} \cdot Z$)	HIGH: ($\overline{93 \cdot 34} \cdot Z$)	HIGH: ($\overline{93 \cdot 37} \cdot Z$)	HIGH: ($\overline{93 \cdot 37} \cdot Z$)	HIGH: ($\overline{93 \cdot 37} \cdot Z$)	0
	MNO RAD MON OVERRIDE	MON RADIATION MONITOR	RA 1 RATE METER 1 ACTIVITY	RA2 RATE METER 2 ACTIVITY	RA3 RATE METER 3 ACTIVITY	RA4 RATE METER 4 ACTIVITY	RA5 RATE METER 5 ACTIVITY	RA6 RATE METER 6 ACTIVITY	X X
98-31	OFF: 214,123	NORM RAD: $\overline{Z}$	NORM: (93·34+$\overline{Z}$)	NORM: (93·34+$\overline{Z}$)	NORM: (93·34+$\overline{Z}$)	NORM: (93·37+$\overline{Z}$)	NORM: (93·37+$\overline{Z}$)	NORM: (93·37+$\overline{Z}$)	1

* BINARY COUNT SEQUENCE
Z EXTERNAL INPUT OR STIMULUS
1XX OR 2XX COMMAND NUMBERS

0093-62

Table 5-1 Digital Words 0 through 4 Subcommutation Chart

WORD \ BIT	1 (MSB)		2		3		4		5		6		7		8 (LSB)		INITIALIZED STATE
5	ON	52·31·94·37+($\overline{38·46}$)	ENABLED	104	ON	203 *	ON	203 *	ON	203 *	ON	203 *	ON	203 *	ON	203 *	
	HVP 4 HPS4 POWER		HVE 4 HPS4 ENABLE		HV 46 HV4 PROGRAM BIT 6		HV 45 HV4 PROGRAM BIT 5		HV 44 HV4 PROGRAM BIT 4		HV 43 HV4 PROGRAM BIT 3		HV 42 HV4 PROGRAM BIT 2		HV 41 HV4 PROGRAM BIT 1		0 0 0
98-91	OFF	138,124 109,123	DISABLED	138,124 109,123	OFF	206,109 123	OFF	206,109 123	OFF	206,109 123	OFF	206,109 123	OFF	206,109 123	OFF	206,109 123	
6	ON	62·31·$\overline{47}$	ENABLED	105	ON	204 *	ON	204 *	ON	204 *	ON	204 *	ON	204 *	ON	204 *	
	HVP 5 HVS5 POWER		HVE 5 HPS5 ENABLE		HV 56 HV5 PROGRAM BIT 6		HV 55 HV5 PROGRAM BIT 5		HV 54 HV5 PROGRAM BIT 4		HV 53 HV5 PROGRAM BIT 3		HV 52 HV5 PROGRAM BIT 2		HV 51 HV5 PROGRAM BIT 1		0 0 0
98-92	OFF	124,109 123	DISABLED	124,109 123	OFF	207,109 123	OFF	207,109 123	OFF	207,109 123	OFF	207,109 123	OFF	207,109 123	OFF	207,109 123	
7	ON	63·31·$\overline{48}$	ENABLED	106	ON	205 *	ON	205 *	ON	205 *	ON	205 *	ON	205 *	ON	205 *	
	HVP 6 HVPS6 POWER		HVE 6 HVPS6 ENABLE		HV 66 HV6 PROGRAM BIT 6		HV 65 HV6 PROGRAM BIT 5		HV 64 HV6 PROGRAM BIT 4		HV 63 HV6 PROGRAM BIT 3		HV 62 HV6 PROGRAM BIT 2		HV 61 HV6 PROGRAM BIT 1		0 0 0
98-93	OFF	124,109 123	DISABLED	124,109 123	OFF	208,109 123	OFF	203,109 123	OFF	208,109 123	OFF	208,109 123	OFF	208,109 123	OFF	208,109 123	
8	HIGH	211	HIGH	221	FLAG		ON	209	DAY	Ƶ	2	121			2	126	
	DLA 4 DISC 4 LEVEL ADJUST		DLA 1 DISC 1 LEVEL ADJUST		NEX NON-EXECUTE FLAG		DNO DAY/NITE SIGNAL OVERRIDE		DNS DAY/NITE SIGNAL STATUS		CMD RDT CMD DECODER SELECT		0		LVPS RDT LVPS SELECT		0 (0 1 4 5) X
98-94	LOW	212,123	LOW	222,123	NORM		OFF	210,123	NIGHT	$\overline{Ƶ}$	1	120			1	125	
9	INVLD	119,123	ON	118 (AT)	NORMAL	112,123	ENABLE	(84+$\overline{85}$)	1	132	RESET	129	RESET	130	RESET	130	
	RAF CAL FRAME		RAS CAL SOURCE		RTC RATE METER CONTROL		DN DAY/NITE CONTROL OUTPUT		VDR RDT VENT DRIVER SELECT		VR1 VENT SELECT RELAY 1		VR2 VENT SELECT RELAY 2		VR3 VENT SELECT RELAY 3		2 (4 5 6 7) X
98-95	VALID	118 (AT)	OFF	119,123	ENABLED	134	DISABLE	($\overline{84}$·85)	2	133	SET	127	SET	127	SET	128	

* BINARY COUNT SEQUENCE
Ƶ EXTERNAL INPUT OR STIMULUS
1XX OR 2XX COMMAND NUMBERS

0093-63

Table 5-1 cont. Digital Words 5 through 9 Subcommutation Chart

Table 5-2
Analog Monitor Points

Minor Frame Word	Channel	Description	Units	Range	Alarm Limit Lower	Alarm Limit Upper	Alarm Name
97	96	Temperature monitor 5	degrees celsius	-20 to +40			
97	97	Temperature monitor 6	degrees celsius	-20 to +40			
97	98	Temperature collimator 1	degrees celsius	-20 to +40			
97	99	Temperature collimator 4	degrees celsius	-20 to +40			
97	120	Temperature monitor 1	degrees celsius	-20 to +40			
97	121	Temperature monitor 2	degrees celsius	-20 to +40			
97	122	Temperature monitor 3	degrees celsius	-20 to +40			
97	123	Temperature monitor 4	degrees celsius	-20 to +40			
98	58	HVPS 1 monitor gas fwd	volts	1600 to 2605	none	225	Wisc HVPS 1
98	59	HVPS 2 monitor Al fwd	volts	1600 to 2605	none	225	Wisc HVPS 2
98	60	HVPS 3 monitor Be fwd	volts	1600 to 2605	none	225	Wisc HVPS 3
98	61	HVPS 4 monitor gas aft	volts	1600 to 2605	none	225	Wisc HVPS 4
98	62	HVPS 5 monitor Al aft	volts	1600 to 2605	none	225	Wisc HVPS 5
98	63	HVPS 6 monitor Be aft	volts	1600 to 2605	none	225	Wisc HVPS 6
98	64	HV relay 1 and 4 gas flow	volts	0 to 5.10			
98	65	HV relay 2 and 3 fwd	volts	0 to 5.10			
98	66	HV relay 5 and 6 aft	volts	0 to 5.10			
98	114	LV monitor -6 v	volts	-7.28 to +4.02			

Table 5–2
Analog Monitor Points (Cont)

Minor Frame Word	Channel	Description	Units	Range	Alarm Limit Lower	Alarm Limit Upper	Alarm Name
98	115	LV monitor 28 v	volts	0 to 31.2			
98	123	LV monitor 12 v	volts	0 to 13.3			
98	124	LV monitor 5 v	volts	0 to 5.55			
98	125	LV monitor +6 v	volts	0 to 6.64			
98	126	Forward gas pressure	torr	0 to 663	77	211	Wisc aft gas pressure
98	127	Aft gas pressure	torr	0 to 663	77	211	Wisc aft gas pressure

Table 5-3
Single Bit Digital Data Points

Minor Frame Word	Channel	Bit	Description	Verification
98	30	1	Radiation monitor control	1 = Enable, 0 = Disable
98	30	2	SAA flag generator	1 = Disable, 0 = Enable
98	30	3	Gas inlet 1 control	1 = Disable, 0 = Enable
98	30	4	Gas pressure 1/ratemeters disable	1 = On, 0 = Off
98	30	5	Gas pressure 1 low	1 = Yes, 0 = No
98	30	6	Gas inlet 2 control	1 = Disable, 0 = Enable
98	30	7	Gas pressure 2/ratemeters disable	1 = On, 0 = Off
98	30	8	Gas pressure 2 low	1 = Yes, 0 = No
98	31	1	Radiation monitor override	1 = On, 0 = Off
98	31	2	Radiation monitor output	1 = High, 0 = Low
98	31	3	Ratemeter 1 rate	1 = High, 0 = Low
98	31	4	Ratemeter 2 rate	1 = High, 0 = Low
98	31	5	Ratemeter 3 rate	1 = High, 0 = Low
98	31	6	Ratemeter 4 rate	1 = High, 0 = Low
98	31	7	Ratemeter 5 rate	1 = High, 0 = Low
98	31	8	Ratemeter 6 rate	1 = High, 0 = Low
98	94	1	Level discrim 4 threshold	0 = Low, 1 = High
98	94	2	Level discrim 1 threshold	0 = Low, 1 = High
98	94	3	Serial command verification	0 = Good, 1 = No good
98	94	4	Day/night override	1 = On, 0 = Off
98	94	5	Day/night switch	1 = Day, 0 = Night
98	94	6	Cmd decoder select	1 = 2, 0 = 1
98	94	7	0 always (not in LRV)	
98	94	8	LVPS select	1 = 2, 0 = 1
98	95	1	Calibration frame valid	1 = No, 0 = Yes
98	95	2	Calibration source	1 = On, 0 = Off
98	95	3	Ratemeter control	1 = Disable, 0 = Enable
98	95	4	Day/night control	1 = Enable, 0 = Disable
98	95	5	Vent driver select	1 = 1, 0 = 2

Table 5-3
Single Bit Digital Data Points (Cont)

Minor Frame Word	Channel	Bit	Description	Verification
98	95	6	Vent relay 1	0 = Set, 1 = Reset
98	95	7	Vent relay 2	0 = Set, 1 = Reset
98	95	8	Vent relay 3	0 = Set, 1 = Reset
98	27	1	HVPS 1 gas fwd power	1 = On, 0 = Off
98	27	2	HVPS 1 gas enab/dsab	1 = Enable, 0 = Disable
98	28	1	HVPS 2 Al fwd power	1 = On, 0 = Off
98	28	2	HVPS 2 Al fwd enab/dsab	1 = Enable, 0 = Disable
98	29	1	HVPS 3 Be fwd power	1 = On, 0 = Off
98	29	2	HVPS 3 Be fwd enab/dsab	1 = Enable, 0 = Disable
98	91	1	HVPS 4 gas aft power	1 = On, 0 = Off
98	91	2	HVPS 4 gas aft enab/dsab	1 = Enable, 0 = Disable
98	92	1	HVPS 5 Al aft power	1 = On, 0 = Off
98	92	2	HVPS 5 Al aft enab/dsab	1 = Enable, 0 = Disable
98	93	1	HVPS 6 Be aft power	1 = On, 0 = Off
98	93	2	HVPS 6 Be aft enab/dsab	1 = Enable, 0 = Disable
50	1	1	Self test	1 = On, 0 = Off
50	1	2	Memory half	1 = A, 2 = B
50	1	3	Memory 1	1 = On, 0 = Off
50	1	4	Memory 2	1 = On, 0 = Off
50	1	5	TM control 1	1 = On, 0 = Off
50	1	6	TM control 2	1 = On, 0 = Off
50	1	7	Acquisition block 1	1 = On, 0 = Off
50	1	8	Acquisition block 2	1 = On, 0 = Off

TABLE 5-4

DIGITAL DATA - 6 and 8 BIT COUNTS

Minor Frame Word	Channel	Description	Units	Range
50	0	Sail position	degrees	0 to 360
50	98	Solenoid counts Me fwd	counts	0 to 255
49	99	Solenoid counts Me aft	counts	0 to 255
98	27	HVPS 1 gas fwd cmded state	counts	0 to 63 (Bits 3-8)
98	28	HVPS 2 Al fwd cmded state	counts	0 to 63 (Bits 3-8)
98	29	HVPS 3 Be fwd cmded state	counts	0 to 63 (Bits 3-8)
98	91	HVPS 4 gas aft cmded state	counts	0 to 63 (Bits 3-8)
98	92	HVPS 5 Al aft cmded state	counts	0 to 63 (Bits 3-8)
98	93	HVPS 6 Be aft cmded state	counts	0 to 63 (Bits 3-8)

Table 5-5
Wisconsin Experiment Science Dump

Channel	Minor Frame Word 49	Minor Frame Word 50	Channel	Minor Frame Word 49	Minor Frame Word 50
0	Sync (all 1s)	Sail position	21	ME-E4-AFT-S2	ME-E5-AFT-S2
1	Status	Status	22	ME-E6-AFT-S2	AL-E7-AFT-S2
2	Sail position	0	23	AL-E8-AFT-S2	AL-E9-AFT-S2
3	0	ME-E1-AFT-S0	24	BE-E10-AFT-S2	BE-E11-AFT-S2
4	ME-E2-AFT-S0	ME-E3-AFT-S0	25	BE-E12-AFT-S2	BE-E13-AFT-S2
5	ME-E4-AFT-S0	ME-E5-AFT-S0	26	BE-E14-AFT-S2	BE-E15-AFT-S2
6	ME-E6-AFT-S0	AL-E7-AFT-S0	27	BE-E16-AFT-S2	ME-E1-AFT-S3
7	AL-E8-AFT-S0	AL-E9-AFT-S0	28	ME-E2-AFT-S3	ME-E3-AFT-S3
8	BE-E10-AFT-S0	BE-E11-AFT-S0	29	ME-E4-AFT-S3	ME-E5-AFT-S3
9	BE-E12-AFT-S0	BE-E13-AFT-S0	30	ME-E6-AFT-S3	AL-E7-AFT-S3
10	BE-E14-AFT-S0	BE-E15-AFT-S0	31	AL-E8-AFT-S3	AL-E9-AFT-S3
11	BE-E16-AFT-S0	ME-E1-AFT-S1	32	BE-E10-AFT-S3	BE-E11-AFT-S3
12	ME-E2-AFT-S1	ME-E3-AFT-S1	33	BE-E12-AFT-S3	BE-E13-AFT-S3
13	ME-E4-AFT-S1	ME-E5-AFT-S1	34	BE-E14-AFT-S3	BE-E15-AFT-S3
14	ME-E6-AFT-S1	AL-E7-AFT-S1	35	BE-E16-AFT-S3	ME-E1-AFT-S4
15	AL-E8-AFT-S1	AL-E9-AFT-S1	36	ME-E2-AFT-S4	ME-E3-AFT-S4
16	BE-E10-AFT-S1	BE-E11-AFT-S1	37	ME-E4-AFT-S4	ME-E5-AFT-S4
17	BE-E12-AFT-S1	BE-E13-AFT-S1	38	ME-E6-AFT-S4	AL-E7-AFT-S4
18	BE-E14-AFT-S1	BE-E15-AFT-S1	39	AL-E8-AFT-S4	AL-E9-AFT-S4
19	BE-E16-AFT-S1	ME-E1-AFT-S2	40	BE-E10-AFT-S4	BE-E11-AFT-S4
20	ME-E2-AFT-S2	ME-E3-AFT-S2	41	BE-E12-AFT-S4	BE-E13-AFT-S4

NOTE: ACTTIME = active time, AFT = aft, AL= aluminum, BE = beryllium, BKG = top sky occulted, CLR = top sky clear, E1 through E16 = energy level of X-ray from .13 to >35 kev, FWD = forward, S0 through S8 = bottom sky sector, SOL CTS = solenoid actuated for methane

Table 5-5
Wisconsin Experiment Science Dump (Cont)

Channel	Minor Frame Word 49	Minor Frame Word 50	Channel	Minor Frame Word 49	Minor Frame Word 50
42	BE-E14-AFT-S4	BE-E15-AFT-S4	65	BE-E12-AFT-S7	BE-E13-AFT-S7
43	BE-E16-AFT-S4	ME-E1-AFT-S5	66	BE-E14-AFT-S7	BE-E15-AFT-S7
44	ME-E2-AFT-S5	ME-E3-AFT-S5	67	BE-E16-AFT-S7	ME-E1-FWD-CLR
45	ME-E4-AFT-S5	ME-E5-AFT-S5	68	ME-E2-FWD-CLR	ME-E3-FWD-CLR
46	ME-E6-AFT-S5	AL-E7-AFT-S5	69	ME-E4-FWD-CLR	ME-E5-FWD-CLR
47	AL-E8-AFT-S5	AL-E9-AFT-S5	70	ME-E6-FWD-CLR	AL-E7-FWD-CLR
48	BE-E10-AFT-S5	BE-E11-AFT-S5	71	AL-E8-FWD-CLR	AL-E9-FWD-CLR
49	BE-E12-AFT-S5	BE-E13-AFT-S5	72	BE-E10-FWD-CLR	BE-E11-FWD-CLR
50	BE-E14-AFT-S5	BE-E15-AFT-S5	73	BE-E12-FWD-CLR	BE-E13-FWD-CLR
51	BE-E16-AFT-S5	ME-E1-AFT-S6	74	BE-E14-FWD-CLR	BE-E15-FWD-CLR
52	ME-E2-AFT-S6	ME-E3-AFT-S6	75	BE-E16-FWD-CLR	ME-E1-FWD-BKG
53	ME-E4-AFT-S6	ME-E5-AFT-S6	76	ME-E2-FWD-BKG	ME-E3-FWD-BKG
54	ME-E6-AFT-S6	AL-E7-AFT-S6	77	ME-E4-FWD-BKG	ME-E5-FWD-BKG
55	AL-E8-AFT-S6	AL-E9-AFT-S6	78	ME-E6-FWD-BKG	AL-E7-FWD-BKG
56	BE-E10-AFT-S6	BE-E11-AFT-S6	79	AL-E8-FWD-BKG	AL-E9-FWD-BKG
57	BE-E12-AFT-S6	BE-E13-AFT-S6	80	BE-E10-FWD-BKG	BE-E11-FWD-BKG
58	BE-E14-AFT-S6	BE-E15-AFT-S6	81	BE-E12-FWD-BKG	BE-E13-FWD-BKG
59	BE-E16-AFT-S6	ME-E1-AFT-S7	82	BE-E14-FWD-BKG	BE-E15-FWD-BKG
60	ME-E2-AFT-S7	ME-E3-AFT-S7	83	BE-E16-FWD-BKG	ACTTIME-ME-AFT-S0
61	ME-E4-AFT-S7	ME-E5-AFT-S7	84	ACTTIME-AL-AFT-S0	ACTTIME-BE-AFT-S0
62	ME-E6-AFT-S7	AL-E7-AFT-S7	85	ACTTIME-ME-AFT-S1	ACTTIME-AL-AFT-S1
63	AL-E8-AFT-S7	AL-E9-AFT-S7	86	ACTTIME-BE-AFT-S1	ACTTIME-ME-AFT-S2
64	BE-E10-AFT-S7	BE-E11-AFT-S7	87	ACTTIME-AL-AFT-S2	ACTTIME-BE-AFT-S2

Table 5-5
Wisconsin Experiment Science Dump (Cont)

Channel	Minor Frame Word 49	Minor Frame Word 50	Channel	Minor Frame Word 49	Minor Frame Word 50
88	ACTTIME-ME-AFT-S3	ACTTIME-AL-AFT-S3	95	ACTTIME-BE-AFT-S7	ACTTIME-ME-FWD-CLR
89	ACTTIME-BE-AFT-S3	ACTTIME-ME-AFT-S4	96	ACTTIME-AL-FWD-CLR	ACTTIME-BE-FWD-CLR
90	ACTTIME-AL-AFT-S4	ACTTIME-BE-AFT-S4	97	ACTTIME-ME-FWD-BKG	ACTTIME-AL-FWD-BKG
91	ACTTIME-ME-AFT-S5	ACTTIME-AL-AFT-S5	98	ACTTIME-BE-FWD-BKG	SOL CTS-ME-FWD
92	ACTTIME-BE-AFT-S5	ACTTIME-ME-AFT-S6	99	SOL CTS-ME-AFT	0
93	ACTTIME-AL-AFT-S6	ACTTIME-BE-AFT-S6	100-127	All 0's	All 0's
94	ACTTIME-ME-AFT-S7	ACTTIME-AL-AFT-S7			

6. OPERATING PRECAUTIONS

6.1 Prohibited Operations

There are three prohibited modes of operation which will damage the experiment and are described below:

A. High voltage power supplies for the gas flow counters must never be turned on without proper gas pressure or resulting corona or arcing could destroy the counter.

There are automatic interlocks to prevent high voltage from being turned on in the gas flow counters (#1 and #4) when gas pressure is too low but these can be overridden by command. To prevent high voltage turn on without proper gas pressure, observe the following rules:

1. Never enable high voltage power supplies 1 and 4 until pressure has been verified.
2. Always disable high voltage power supplies 1 and 4 before starting any venting or crossstrapping operation.
3. Be especially alert for proper gas pressure if the gas pressure low override is enabled.

B. There must always be gas pressure in counters 1 and 4. The windows in the gas flow counters must NEVER be allowed to be slack. Particle contamination on the window surface could be trapped between the window and the support and puncture the window upon repressurization. To prevent window damage, observe the following rules:

> 1. Enable gas inlets immediately after turn-on if the experiment is ever turned off.
>
> 2. Be sure gas inlets are enabled before starting any venting operations.
>
> 3. Never allow buffer volume pressure to drop below 100 psi.

C. Reconfiguration relays must never be operated with experiment power (regulated) on.

Capacitive loads on the relay contacts can cause excessive contact current if relays are switched with power on. Normal operating procedure is to turn off experiment power before actuating relays. To prevent relay damage, observe the following rule:

> 1. All commands of type DP (see command list) must not be sent unless experiment power is off. [Does not apply to command 1,54 HVPS off]

6.2 Recommended Operating Practices

In addition to the prohibited operations described above, there are other operating practices which if not observed could result in unintended experiment operations or apparently anomalous response which are described below:

1. High voltage program levels must never be allowed to exceed the desired value. Always verify starting program level before stepping up to a new level.

2. Power on sequence should be as follows: First enable regulated bus, then unregulated. Power off should be the reverse, first disable unreg bus, then reg.

3. Send command 1,27 subsequent to any latch valve series of operations to insure calibrate (1,18) will work.

4. Check gas pressure at least once per orbit. Fill buffer volume when buffer volume pressure drops below 100 psi.

5. If gas pressure low overrides are ever enabled, be sure ratemeters are enabled (1,34).

6. The first serial command sent after experiment power turn on is ignored by the experiment. Therefore, a "dummy" serial command should always be sent after each power turn on. A good one to use would be command 1,71,132, HV program reset 1. The extra command is required only once after each power turn-on.

7. EXPERIMENT OPERATIONS

Normal experiment operation requires four calibrate commands per orbit (after sunset, midnight, before sunrise, midday) and an occasional buffer volume fill. The critical parameters to be checked once per orbit are listed in Table 8-1 which is a copy of the message transmitted to the control center defining the alarm conditions.

To obtain greater useful observing time, the radiation monitor can be disabled for selected portions of the orbit providing great care is exercised to ensure it is re-enabled during transits of the SAA.

7.1 Control Center Software

The following paragraphs describe the OSO control center software applicable to the Wisconsin experiment:

7.1.1 Data Displays

1. Page 29 (P29.)

This CRT display is devoted to high and low voltage power supply status.

2. Page 30 (P30.)

Parameters on page 30 are those associated with the gas system and the gas flow counters.

****

OSO DE UW

UW MSG NBR 1 DTG 8/2030 JULY 75

TABLE 7-1

ATTENTION DICK WHITE OR BILL WORRALL:

THE FOLLOWING LIST PROVIDES ALARM LIMITS FOR A SELECTED SUBSET OF THE WISCONSIN EXPT DATA, WITH MINOR FRAME-WORD TELEMETRY ADDRESSES. THIS LIST IS WRITTEN SPECIFICALLY FOR MEASUREMENTS DESERVING CONSTANT WATCH FOR ALARM CONDITIONS, AS PER DICK WHITE'S REQUEST OF 7 JULY 75.

NAME	M.F.	WORD	BIT	CONDITION FOR ALARM
BV PRESS A	96	86		LESS THAN 100 PSI
BV PRESS B	96	87		LESS THAN 100 PSI
FWD SOL COUNTS	98	50		MORE THAN 1 COUNT
AFT SOL COUNTS	99	49		MORE THAN 1 COUNT
FWD GAS INLET CTRL	30	98	3	BIT HIGH=GAS INLET DISABLED
AFT GAS INLET CTRL	30	98	6	BIT HIGH=GAS INLET DISABLED
FWD GAS PRESS	126	98		LESS THAN 330 OR MORE THAN 415 TORR
AFT GAS PRESS	127	98		LESS THAN 330 OR MORE THAN 415 TORR
WIS UNREG VOLT	27	2		LESS THAN 24.0 OR MORE THAN 35.0 V *
REG VOLTS	96	103		LESS THAN 28.0 OR MORE THAN 29.0 VDC
LV MON 28V	115	98		LESS THAN 27.4 OR MORE THAN 28.4 VDC
LV MON 12V	123	98		LESS THAN 11.7 OR MORE THAN 12.2 VDC
LV MON +6V	125	98		LESS THAN 5.90 OR MORE THAN 6.07 VDC
LV MON -6V	114	98		LESS THAN 6.00 OR MORE THAN 6.07 VDC
LV MON 5V	124	98		LESS THAN 4.78 OR MORE THAN 5.00 VDC
RAD MON OVRD	31	98	1	BIT HIGH (OVERRIDE ON) IS ABNORMAL
RATEMETER 1 RATE	31	98	3	HIGH
RATEMETER 2 RATE	31	98	4	HIGH
RATEMETER 3 RATE	31	98	5	HIGH
RATEMETER 4 RATE	31	98	6	HIGH
RATEMETER 5 RATE	31	98	7	HIGH
RATEMETER 6 RATE	31	98	8	HIGH
HVPS 1 MON	58	98		1 TO 2300 OR MORE THAN 2516 VDC
HVPS 2 MON	59	98		1 TO 2050 OR MORE THAN 2225 VDC
HVPS 3 MON	60	98		1 TO 2070 OR MORE THAN 2290 VDC
HVPS 4 MON	61	98		1 TO 2300 OR MORE THAN 2516 VDC
HVPS 5 MON	62	98		1 TO 2050 OR MORE THAN 2225 VDC
HPVS 6 MON	63	98		1 TO 2070 OR MORE THAN 2290 VDC
ACTIVE TIME 1	83	50		LESS THAN 59 OR MORE THAN 82 COUNTS
ACTIVE TIME 2	84	49		LESS THAN 59 OR MORE THAN 82 COUNTS
ACTIVE TIME 3	84	50		LESS THAN 59 OR MORE THAN 82 COUNTS
ACTIVE TIME 4	97	49		LESS THAN 103 OR MORE THAN 149 CNTS
ACTIVE TIME 5	97	50		LESS THAN 103 OR MORE THAN 149 CNTS
ACTIVE TIME 6	98	49		LESS THAN 103 OR MORE THAN 149 CNTS

IN THE BIT COLUMN ABOVE . BIT 1 EQUALS MOST SIGNIF BIT.
FOR COMPRESSING SPACE REQUIRED ON A SNAPSHOT PAGE, RATEMETERS 1 THRU 6 RATES CAN BE MADE ONE WORD.

* WIS UNREG VOLTS MEASUREMENT DOES NOT APPEAR IN FORMAT C.

AS TIME PROGRESSES, IT IS POSSIBLE THAT CHANGES IN THE ABOVE ALARM LIMITS MAY NEED TO BE MADE.

****

IN CASE ANY OF THE ABOVE ALARM CONDITIONS ARE DISCOVERED, IMMEDIATLY CALL:

	WORK	HOME
ALAN BUNNER	608-262-6879	608 222 3298
RICK BORKEN	608-262-5916	608-836-3507
EVAN RICHARDS	608-262-5938	608-838-3655

3. Page 31 (P31.)

Temperatures and configuration of redundant subsystems are the major portion of page 31.

4. *SNAP, WISCSTAT.

This is a line printer output of all experiment status data and related spacecraft data such as buffer volume pressures, voltages, and temperatures.

5. *SNAP,WISCON,X.

This is the quick-look data line printer and TTY tape output. There are three options:

a. *SNAP,WISCON,n. where n is any number of major frames (up to 100). The line printer will print n frames of data in the format shown in Figure 8-1.

b. *SNAP,WISCON,A. The line printer will print (up to 100 frames) until the operator discontinues the snap by typing in *SNAP,CANCEL.

c. *SNAP,WISCON,Ø. (zero) The purpose of this option is to generate the quick-look TTY tape for transmission to Wisconsin. The processor waits for a valid calibrate frame then prints that frame, skips one, and prints two more.

7.1.2 Procedures

1. WISINIT - turns off the experiment then turns it back on.

2. WISOFF - turns off the experiment

3. WISHSU1 - Sets high voltage power supply number one to the desired program step. Local variable V1 is set by the operator to the desired step number (in decimal) which must be between 0 and 63. There are five similar procedures for the other five high voltage supplies.

4. FLUSH - This procedure enables both gas inlets, disables both gas flow counter high voltage power supplies, opens the ambient exhaust valve for 25 seconds, and finally closes the ambient exhaust valve.

5. FLUSHFWD - This procedure closes the aft valve, opens the forward valve, executes the procedure FLUSH, and closes the forward valve.

6. FLUSHAFT - This procedure closes the forward valve, opens the aft, executes FLUSH, and closes the aft.

UW SOFT X-RAY QUICK LOOK DATA

ORBIT 0000 DAY 001 TIME 00:23:53 UT

D/N = N CALIBATE = ON

SCTR	CHANNEL 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	050	049	050	049	050	049	050	049	050	049	050	049	050	049	050	049
1	050	049	050	049	050	049	050	049	050	049	050	049	050	049	050	049
2	050	049	050	049	050	049	050	049	050	049	050	049	050	049	050	049
3	050	049	050	049	050	049	050	049	050	049	050	049	050	049	050	049
4	050	049	050	049	050	049	050	049	050	049	050	049	050	049	050	049
5	050	049	050	049	050	049	050	049	050	049	050	049	050	049	050	049
6	050	049	050	049	050	049	050	049	050	049	050	049	050	049	050	049
7	050	049	050	049	050	049	050	049	050	049	050	049	050	049	050	049
CL	050	049	050	049	050	049	050	049	050	049	050	049	050	049	050	049
BK	050	049	050	049	050	049	050	049	050	049	050	049	050	049	050	049

ACTIVE TIMES

COUNTER	SECTOR 0	1	2	3	4	5	6	7	CL	BK
ME	050	049	050	049	050	049	050	049	050	049
NE	049	050	049	050	049	050	049	050	049	050
XE	050	049	050	049	050	049	050	049	050	049

SOL1 = 050 SOL2 = 049 SAIL POS = 030462

D/S STATUS = 061

DIGITAL SUBCOMM:

142 142 142 142 142 142 142 142

ANALOG UNCONDITIONED SUBCOMM:

098 098 098 098 098 098 098 098 098 098 098 098 098

ANALOG CONDITIONED SUBCOMM:

097 097 097 097 097 097 097 097 098 098 098

METH PRESS	******
METH TEMP A	******
METH TEMP B	******
B/V PRESS A	******
B/V PRESS B	******
REG V	******
UNREG V	******
REG A/B	A
UNREG ON/OFF	OFF

0093-64

Figure 7-1 Wisconsin Experiment Soft X-ray Quick-look Data

7. CLOSEALL - This procedure closes all three valves (forward, aft, and ambient).

7.1.3 Groups

1. 90 - Close forward exhaust valve
   91 - Close aft exhaust valve
   92 - Close ambient exhaust valve
   93 - Open forward exhaust valve
   94 - Open aft exhaust valve
   95 - Open ambient exhaust valve

All the above groups include no-op commands to provide one second spacing between relay commands and include a 1,27 command at the end of the sequence to insure calibrate actuator power is restored.

2. 765 - turns on the experiment regulated and unregulated bus in the proper order. Prereg bus must be on prior to executing this group.

3. 766 - turns off the experiment regulated and unregulated power busses in the proper sequence.

4. 768 - actuates the calibration sequence by sending 1,27 and 1,18 commands.

5. 515 - enables both gas inlets.

   520 - disables both gas inlets.

6. 530 - enables all high voltage power supplies.

7. 531 - disables all high voltage power supplies and resets all program states to zero (CMD 1,9).

7.2 Operating Procedures

7.2.1 Counter Flush Procedure

When a gas flow counter is to be flushed, the operation shall be scheduled early in a long ground station pass. Wisconsin personnel should be present at the control center to direct the operation. Group 92 should be ready on the control panel for transmission in case the procedure fails to complete. During a flush operations, the event display must be monitored to detect procedure failures. Page 30 shall also be monitored closely. Buffer volume pressure should also be checked prior to a flush.

> The experiment must never be allowed to approach LOS with all valves open.

7.2.2 Experiment Turn-on

In the event of an unplanned experiment power outage, the experiment must be turned on at the earliest possible opportunity. The procedure is as follows: (after prereg bus is restored)

1. Group 765
2. Group 414
3. *SNAP,WISCSTAT.
4. Check voltages, pressures, and gas inlet state.
5. Enable and step up high voltage under direction from Wisconsin personnel.

8. FLIGHT UNIT CONFIGURATION LIST

The part and serial numbers of the major subsystems and subassemblies of the flight experiment are shown in the following table.

ITEM	PART NO.	SERIAL NO.
Foward Gas Flow Counter	5810-0164	33752
Charge Amp Main	5810-0414-002	4
Charge Amp Side/Bottom	" " -006	3
Charge Amp End Veto	" " -005	8
Level Discriminator	5830-0151	3
HVPS	7-015-02	17
GRE	5830-0225	4
XDucer/Reference Volume Assembly		2436
Calibrate Source		Fe-55-401
Calibrate Source Sol.		315-11
Aft Gas Flow Counter	5810-0164	37134
Charge Amp Main	5810-0414-002	3
Charge Amp Side/Bottom	" " -006	4
Charge Amp End Veto	" " -005	9
Level Discriminator	5830-0151	4
GRE	5830-0225	3
HVPS	7-015-02	13
XDucer/Reference Volume Assembly		2713
Calibrate Source		Fe-55-410
Calibrate Source Sol.		315-10
Aft Al/Ne Counter	5810-0164	37136
Charge Amp Main	5830-0414-001	1
Charge Amp Side/Bottom	" " -004	6
Charge Amp End Veto	" " -003	3
Level Discriminator	5830-0152	3
HVPS	7-015-02	10
Calibrate Source		Fe-55-409
Calibrate Source Sol.		315-09

ITEM	PART NO.	SERIAL NO.
Forward Al/Ne Counter	5810-0164	37135
Charge Amp Main	5830-0414-001	6
Charge Amp Side/Bottom	" " -004	5
Charge Amp End Veto	" " -003	4
Level Discriminator	5830-0152	4
HVPS	7-015-02	18
Calibrate Source		Fe-55-414
Calibrate Source Sol.		315-07
Forward Be/Xe Counter	5810-0164	33860
Charge Amp Main	5830-0414-001	9
Charge Amp Side/Bottom	" " -004	9
Charge Amp End Veto	" " -005	6
Level Discriminator	5830-0153	4
HVPS	7-015-02	11
Calibrate Source		Cd-109-105
Calibrate Source Sol.		315-08
Aft Be/Xe Counter	5810-0164	37137
Charge Amp Main	5830-0414-001	8
Charge Amp Side/Bottom	" " -004	8
Charge Amp End Veto	" " -005	5
Level Discriminator	5830-0153	3
HVPS	7-015-02	
Calibrate Source		Cd-109-106
Calibrate Source Sol.		315-12
Low Voltage Power Supply	5830-0142	F1
Command and Control System	5830-0080	3
Data System	5830-0060	3