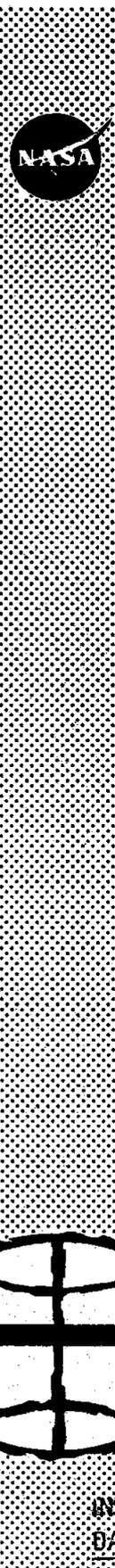


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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

***COMMAND/SERVICE
MODULE
SYSTEMS HANDBOOK
CSM 112-114**

MARCH 12, 1971

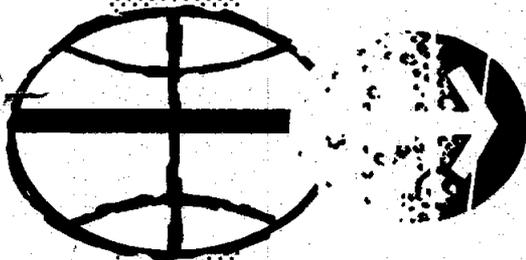
- 1 STANDARDS
- 2 SEQUENTIAL EVENTS SYSTEM
- 3 ELECTRICAL SYSTEM
- 4 ENVIRONMENTAL CONTROL SYS
- 5 FUEL CELL/CRYOGENICS SYSTEM
- 6 COMMUNICATIONS SYSTEM
- 7 INSTRUMENTATION
- 8 GUIDANCE AND CONTROL SYSTEM
- 9 SERVICE PROPULSION SYSTEM
- 10 REACTION CONTROL SYSTEM
- 11 MISCELLANEOUS
- 12 LUNAR ORBIT EXPERIMENTS

PREPARED BY

FLIGHT CONTROL DIVISION

MANNED SPACECRAFT CENTER

HOUSTON, TEXAS



INDEXING DATA

DATE	QPR	#	T	PGM	SUBJECT	SIGNATOR	LOC
3/12/71	MSC	00	R	APD	* Apollo 16 & Apollo 17	Aldrich	080-49A

CSM

SYSTEMS HANDBOOK

CSM 112 - 114

PCN - 2

MAY 14, 1971

Parker

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APOLLO

COMMAND/SERVICE MODULE SYSTEMS HANDBOOK

CSM 112-114

PCN-2

PREFACE

This page change notice (PCN) is a partial revision and should be incorporated into the basic document dated March 12, 1971 according to the page change instruction sheet which follows this page.

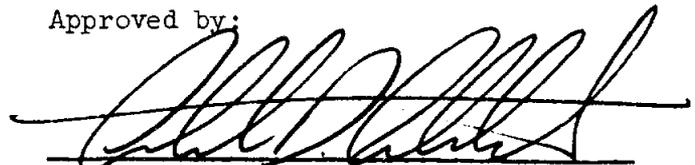
This PCN has been prepared by the Flight Control Division, Manned Spacecraft Center, Houston, Texas, with technical support by North American Rockwell (NR). The incorporation of this PCN will make the handbook current, reflecting the Command/Service Module Systems for CSM 112-114 as of May 14, 1971 and the Lunar Orbit Experiments Systems for CSM 112-113 as of April 1, 1971.

Major emphasis is on material for use by the flight crew and flight controllers during mission operations. Caution should be exercised in using the systems drawings or other information in the handbook for any other purposes.

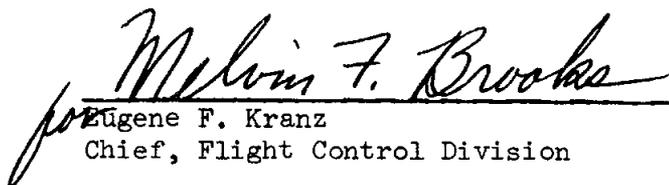
Comments concerning the general contents of this handbook should be directed to FC3/Mr. Hubert V. Gregan, NR, Flight Operations Support, 713-483-5104. Comments related to the Lunar Orbit Experiments (Section 12) should be directed to FC9/Mr. Harold M. Draughon, Lunar/Earth Experiments Branch, 713-483-4426.

This document is not to be reproduced without the written approval of the Chief, Flight Control Division, Manned Spacecraft Center, Houston, Texas.

Approved by:



Arnold D. Aldrich
Chief, CSM Systems Branch



for Eugene F. Kranz
Chief, Flight Control Division

*

APOLLO

COMMAND/SERVICE MODULE SYSTEMS HANDBOOK

CSM 112-114

PCN-2

PAGE CHANGE INSTRUCTION SHEET

Update this document in accordance with the following instructions:

Remove and replace the following changed pages:

CSM Title Page

ii

iiia

iii

iv

v

vi

vii

8-24 (Figure 8-1)

Add the following new pages:

11-1 (Figure 11-1, Sheet 1 of 3)

11-2 (Figure 11-1, Sheet 2 of 3)

11-3 (Figure 11-1, Sheet 3 of 3)

11-4 (Figure 11-2)

11-5 (NR Drawing 1.1 STR)

11-6 (NR Drawing 1.2 STR)

11-7 (NR Drawing 1.3 STR)

11-8 (NR Drawing 1.4 STR)

11-9 (NR Drawing 1.5 STR)

11-10 (NR Drawing 1.6 STR)

11-11 (NR Drawing 1.7 STR)

11-12 (NR Drawing 1.8 STR)

11-13 (NR Drawing 1.9 STR)

11-13A (NR Drawing 1.10 STR)

11-13B (NR Drawing 1.11 STR)

11-13C (NR Drawing 1.12 STR)

11-13D (NR Drawing 1.13 STR)

11-13E (NR Drawing 1.14 STR)

COMMAND/SERVICE MODULE SYSTEMS HANDBOOK

CSM 114

MAY 14, 1971

TABLE OF CONTENTS AND ITEM EFFECTIVITY

ITEM	TITLE	REV	PCN	SIGNOFF/ DATE	PAGE	REMARKS
<u>SECTION 1 STANDARDS</u>						
PAR. 1.1	GENERAL DRAWING INFORMATION, LEGENDS, AND SYMBOLS	BASIC		11/6/70	1-1	
<u>SECTION 2 SEQUENTIAL EVENTS SYSTEM</u>						
DWG 2.1	SEQUENTIAL OVERVIEW	BASIC		3/3/71	2-1	
DWG 2.2	SEQUENTIAL POWER DISTRIBUTION	BASIC		3/3/71	2-2	CSM 112 ONLY
DWG 2.3	SEQUENTIAL ABORT INITIATION	BASIC		3/3/71	2-3	
DWG 2.4	SEQUENTIAL LES AND SPS ABORT SUBSYSTEM	BASIC		3/3/71	2-4	
DWG 2.5	SEQUENTIAL EARTH LANDING SUBSYSTEM	BASIC		2/24/71	2-5	
DWG 2.6	SEQUENTIAL UPRIGHTING SYSTEM	BASIC		2/24/71	2-6	
DWG 2.7	SEQUENTIAL LM SEPARATION AND DOCKING	BASIC		3/3/71	2-7	
DWG 2.8	CSM-LM ELECTRICAL INTERFACE	BASIC		2/26/71	2-8	
DWG 2.9	CSM/EXPERIMENTS INTERFACE	BASIC		3/4/71	2-9	CSM 112 ONLY
<u>SECTION 3 ELECTRICAL SYSTEM</u>						
DWG 3.1	CSM ELECTRICAL BUS DISTRIBUTION	BASIC		2/23/71	3-1	
DWG 3.2	ELECTRICAL DC DISTRIBUTION AND CONTROL SYSTEM AND RHEB 229 POWER DISTRIBUTION NOTES	BASIC		2/23/71	3-2	NOTES ON DWG APRON
DWG 3.3	ELECTRICAL AC DISTRIBUTION AND CONTROL SYSTEM	BASIC		2/23/71	3-3	
DWG 3.4	SCIENTIFIC EXPERIMENTS AND UTILITY POWER DISTRIBUTION	BASIC		3/10/71	3-4	
FIG 3-1	POWER DISTRIBUTION MATRIX - MAIN BUSES	BASIC		2/23/71	3-5	
FIG 3-2	POWER DISTRIBUTION MATRIX - AC BUSES	BASIC		2/23/71	3-6	
FIG 3-3	POWER DISTRIBUTION MATRIX - MISCELLANEOUS BUSES	BASIC		2/23/71	3-7	
<u>SECTION 4 ENVIRONMENTAL CONTROL SYSTEM</u>						
DWG 4.1	ENVIRONMENTAL CONTROL SYSTEM OVERVIEW	BASIC		3/10/71	4-1	
DWG 4.2	SUIT AND CABIN PRESSURIZATION	BASIC		3/10/71	4-2	
DWG 4.3	PRIMARY GLYCOL LOOP	BASIC		3/12/71	4-3	
DWG 4.4	SECONDARY GLYCOL LOOP	BASIC		3/10/71	4-4	
DWG 4.5	WATER AND WASTE MANAGEMENT	BASIC		3/10/71	4-5	
<u>SECTION 5 FUEL CELL/CRYOGENICS SYSTEM</u>						
DWG 5.1	FUEL CELL/CRYOGENIC OVERVIEW	BASIC		3/3/71	5-1	
DWG 5.2	CRYOGENIC GAS STORAGE SYSTEM	BASIC		3/10/71	5-2	
DWG 5.3	FUEL CELL	BASIC		3/4/71	5-3	

TABLE OF CONTENTS AND ITEM EFFECTIVITY 5/14/71 (CONTINUED)

ITEM	TITLE	REV	PCN	SIGNOFF/ DATE	PAGE	REMARKS
<u>SECTION 6 COMMUNICATIONS SYSTEM</u>						
DWG 6.1	COMMUNICATION SYSTEM OVERVIEW WITH ANTENNA LOCATIONS DIAGRAM	BASIC		3/3/71	6-1	ANTENNA LOCATIONS ON DWG APRON
DWG 6.2	UNIFIED S-BAND SYSTEM RF EQUIPMENT	BASIC		2/23/71	6-2	
DWG 6.3	VHF AM TRANSCEIVERS AND AUDIO EQUIPMENT	BASIC		2/23/71	6-3	
DWG 6.4	PREMODULATION PROCESSOR	BASIC		2/23/71	6-4	
DWG 6.5	UPDATA LINK	BASIC		2/23/71	6-5	
DWG 6.6	RENDEZVOUS TRANSPONDER AND RECOVERY EQUIPMENT	BASIC		2/23/71	6-6	
TABLE 6-I	UNIFIED S-BAND TRANSPONDER AND FM TRANSMITTER	BASIC		3/3/71	6-7	
TABLE 6-II	S-BAND POWER AMPLIFIER	BASIC		11/6/70	6-10	
TABLE 6-III	S-BAND DOWNLINK MODES AND MODULATION PROCESS	BASIC		11/6/70	6-12	
TABLE 6-IV	S-BAND UPLINK MODES AND MODULATION PROCESS	BASIC		11/6/70	6-13	
TABLE 6-V	PREMODULATION PROCESSOR	BASIC		11/6/70	6-14	
TABLE 6-VI	VHF AM TRANSCEIVER EQUIPMENT	BASIC		11/6/70	6-17	
TABLE 6-VII	AUDIO CENTER EQUIPMENT	BASIC		11/6/70	6-19	
TABLE 6-VIII	UPDATA LINK EQUIPMENT	BASIC		11/6/70	6-21	
TABLE 6-IX	TELEVISION CAMERA, SLOW SCAN	BASIC		11/6/70	6-24	
TABLE 6-X	RENDEZVOUS RADAR TRANSPONDER	BASIC		11/6/70	6-25	
TABLE 6-XI	VHF RECOVERY BEACON	BASIC		11/6/70	6-27	
TABLE 6-XII	VHF SURVIVAL BEACON - TRANSCEIVER	BASIC		11/6/70	6-28	
TABLE 6-XIII	ANTENNA SWITCH, S-BAND	BASIC		11/6/70	6-29	
TABLE 6-XIV	ANTENNA SWITCH, VHF	BASIC		11/6/70	6-30	
TABLE 6-XV	ANTENNA, S-BAND OMNI	BASIC		11/6/70	6-31	
TABLE 6-XVI	ANTENNA, VHR SCIMITAR	BASIC		11/6/70	6-32	
TABLE 6-XVII	ANTENNA VHF RECOVERY	BASIC		11/6/70	6-33	
TABLE 6-XVIII	ANTENNA, RENDEZVOUS RADAR TRANSPONDER	BASIC		11/6/70	6-34	
TABLE 6-XIX	ANTENNA, HIGH-GAIN	BASIC		11/6/70	6-35	
TABLE 6-XX	VHF DIGITAL RANGING GENERATOR	BASIC		11/6/70	6-37	
TABLE 6-XXI	COLOR TELEVISION CAMERA	BASIC		11/6/70	6-39	
TABLE 6-XXII	DATA MODULATOR	BASIC		3/3/71	6-40	
TABLE 6-XXIII	BUFFER AMPLIFIER	BASIC		3/3/71	6-43	
TABLE 6-XXIV	DATA STORAGE EQUIPMENT (DSE)	BASIC		3/3/71	6-44	
<u>SECTION 7 INSTRUMENTATION</u>						
PAR 7.1	GENERAL	BASIC		2/25/71	7-1	
TABLE 7-I	SIGNAL CONDITIONING EQUIPMENT (SCE) PARAMETER LIST	BASIC		2/25/71	7-2	

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TABLE OF CONTENTS AND ITEM EFFECTIVITY 5/14/71 (CONCLUDED)

ITEM	TITLE	REV	PCN	SIGNOFF/ DATE	PAGE	REMARKS
<u>SECTION 10 REACTION CONTROL SYSTEM</u>						
DWG 10.1	SERVICE MODULE REACTION CONTROL SYSTEM	BASIC		3/11/71	10-1	
DWG 10.2	COMMAND MODULE REACTION CONTROL SYSTEM	BASIC		3/11/71	10-2	
<u>SECTION 11 MISCELLANEOUS</u>						
FIG 11-1 (SHEET 1 OF 3)	CONTROL-DISPLAY FIGURE	BASIC	PCN-2	----	11-1	NR FIGURE
FIG 11-1 (SHEET 2 OF 3)	CONTROL-DISPLAY FIGURE	BASIC	PCN-2	----	11-2	NR FIGURE
FIG 11-1 (SHEET 3 OF 3)	CONTROL-DISPLAY FIGURE	BASIC	PCN-2	----	11-3	NR FIGURE
FIG 11-2	CSM-LM EXTERNAL COMPONENT LOCATIONS	BASIC	PCN-2	5/14/71	11-4	
DWG 11.1.1 THROUGH DWG 11.1.14	NR INBOARD PROFILE DRAWINGS: 1.1 STR THROUGH 1.14 STR	BASIC	PCN-2	----	11-5	NR DRAWINGS
DWG 11.2	LIGHTING INTERIOR AND EXTERIOR	BASIC		2/23/71	11-14	
DWG 11.3	TIMER CONTROL	BASIC		3/3/71	11-15	
DWG 11.4	SYSTEMS TEST METER	BASIC		3/8/71	11-16	
<u>SECTION 12 LUNAR ORBIT EXPERIMENTS</u>						
DWG 12.1	PANORAMIC CAMERA	BASIC	PCN-1	4/1/71	12-1	} CSM 112-113
DWG 12.2	MAPPING CAMERA	BASIC	PCN-1	4/1/71	12-2	
DWG 12.3	LASER ALTIMETER LOGIC DIAGRAM	BASIC	PCN-1	4/1/71	12-3	
DWG 12.4	ALPHA PARTICLE SPECTROMETER	BASIC	PCN-1	4/1/71	12-4	
DWG 12.5	GAMMA RAY SPECTROMETER	BASIC	PCN-1	4/1/71	12-5	
DWG 12.6	MASS SPETROMETER	BASIC	PCN-1	4/1/71	12-6	
DWG 12.7	X-RAY SPECTROMETER	BASIC	PCN-1	4/1/71	12-7	

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TABLE OF CONTENTS AND ITEM EFFECTIVITY 5/14/71 (CONTINUED)

ITEM	TITLE	REV	PCN	SIGNOFF/ DATE	PAGE	REMARKS
<u>SECTION 7 INSTRUMENTATION (CONTINUED)</u>						
TABLE 7-II	INSTRUMENTATION - POWER DISTRIBUTION	BASIC		2/25/71	7-3	
DWG 7.1	INSTRUMENTATION POWER AND CONTROL	BASIC		2/25/71	7-9	
PAR 7.2	PCM EQUIPMENT (51.2 KBPS) SYSTEM NOTES	BASIC		2/25/71	7-10	
TABLE 7-III	PCM EQUIPMENT PARAMETER CAPABILITIES	BASIC		2/25/71	7-12	
TABLE 7-IV	PCM EQUIPMENT OPERATING CHARACTERISTICS	BASIC		2/25/71	7-13	
PAR 7.3	COLUMN DEFINITIONS FOR PCM EQUIPMENT PARAMETER LOADING TABLES 7-V THROUGH 7-XVIII	BASIC		2/25/71	7-15	
TABLE 7-V	PCM EQUIPMENT TELEMETRY (51.2 KBPS) - STRUCTURES	BASIC		2/25/71	7-20	
TABLE 7-VI	PCM EQUIPMENT TELEMETRY (51.2 KBPS) - ELECTRICAL POWER SYSTEM	BASIC		2/25/71	7-21	
TABLE 7-VII	PCM EQUIPMENT TELEMETRY (51.2 KBPS) - LAUNCH ESCAPE SYSTEM	BASIC		2/25/71	7-23	
TABLE 7-VIII	PCM EQUIPMENT TELEMETRY (51.2 KBPS) - EARTH LANDING SEQUENCE CONTROLLER	BASIC		2/25/71	7-24	
TABLE 7-IX	PCM EQUIPMENT TELEMETRY (51.2 KBPS) - ENVIRONMENTAL CONTROL SYSTEM	BASIC		2/25/71	7-25	
TABLE 7-X	PCM EQUIPMENT TELEMETRY (51.2 KBPS) - GUIDANCE AND NAVIGATION SYSTEM	BASIC		2/25/71	7-26	
TABLE 7-XI	PCM EQUIPMENT TELEMETRY (51.2 KBPS) - STABILIZATION AND CONTROL SYSTEM	BASIC		2/25/71	7-27	
TABLE 7-XII	PCM EQUIPMENT TELEMETRY (51.2 KBPS) - LIFE SYSTEM	BASIC		2/25/71	7-29	
TABLE 7-XIII	PCM EQUIPMENT TELEMETRY (51.2 KBPS) - FLIGHT TECHNOLOGY	BASIC		2/25/71	7-30	
TABLE 7-XIV	PCM EQUIPMENT TELEMETRY (51.2 KBPS) - SCIENTIFIC EQUIPMENT	BASIC		2/25/71	7-31	
TABLE 7-XV	PCM EQUIPMENT TELEMETRY (51.2 KBPS) - SERVICE PROPULSION SYSTEM	BASIC		2/25/71	7-33	
TABLE 7-XVI	PCM EQUIPMENT TELEMETRY (51.2 KBPS) - REACTION CONTROL SYSTEM	BASIC		2/25/71	7-34	
TABLE 7-XVII	PCM EQUIPMENT TELEMETRY (51.2 KBPS) - CREW SAFETY SYSTEM	BASIC		2/25/71	7-36	
TABLE 7-XVIII	PCM EQUIPMENT TELEMETRY (51.2 KBPS) - COMMUNICATION AND INSTRUMENTATION	BASIC		2/25/71	7-37	
DWG 7.2	INSTRUMENTATION PCM SIGNAL FLOW	BASIC		2/25/71	7-38	

TABLE OF CONTENTS AND ITEM EFFECTIVITY 5/14/71 (CONTINUED)

ITEM	TITLE	REV	PCN	SIGNOFF DATE	PAGE	REMARKS
<u>SECTION 7 INSTRUMENTATION (CONCLUDED)</u>						
DWG 7.3	CAUTION AND WARNING SYSTEM			2/25/71	7-39	
PAR 7.4	DATA PROCESSOR (64 KBPS) SYSTEM NOTES			2/25/71	7-40	
TABLE 7-XIX	DATA PROCESSOR PARAMETER CAPABILITIES			2/25/71	7-43	
TABLE 7-XX	DATA PROCESSOR OPERATING CHARACTERISTICS			2/25/71	7-44	
PAR 7.5	COLUMN DEFINITIONS FOR DATA PROCESSOR PARAMETER LOADING TABLES 7-XXI AND 7-XXII			2/25/71	7-47	
TABLE 7-XXI	DATA PROCESSOR PCM TELEMETRY (64 KBPS) - SCIENTIFIC EQUIPMENT			2/25/71	7-49	
TABLE 7-XXII	DATA PROCESSOR PCM TELEMETRY (64 KBPS) - COMMUNICATION AND INSTRUMENTATION			2/25/71	7-51	
TABLE 7-XXIII	DATA PROCESSOR PROGRAMED FORMATS			2/25/71	7-53	
DWG 7.4	DATA PROCESSOR			2/25/71	7-54	
<u>SECTION 8 GUIDANCE AND CONTROL SYSTEM</u>						
DWG 8.1	GUIDANCE AND NAVIGATION OVERVIEW WITH MISCELLANEOUS G & C INFORMATION			3/9/71	8-1	MISC. G & C INFORMATION ON DWG APRON
DWG 8.2	STABILIZATION CONTROL SYSTEM OVERVIEW (POWER) AND SCS SIGNAL AND POWER CODE			2/18/71	8-2	SCS SIG AND PWR CODE ON DWG APRON
DWG 8.3	STABILIZATION CONTROL SYSTEM OVERVIEW			3/12/71	8-3	
TABLE 8-I	CMC INPUT/OUTPUT CHANNELS ON TELEMETRY			3/12/71	8-4	
TABLE 8-11	CSM ALARM CODES			3/12/71	8-5	
TABLE 8-111	G & N/SCA ASSOCIATED POWER SUPPLY/ SWITCH			3/12/71	8-19	
DWG 8.4	G & N POWER DISTRIBUTION			3/9/71	8-20	
DWG 8.5	INERTIAL SUBSYSTEM			3/9/71	8-21	
DWG 8.6	OPTICS SUBSYSTEM			3/9/71	8-22	
DWG 8.7	SCS POWER DISTRIBUTION			3/12/71	8-23	
FIG 8-1	SCS LOGIC POWER DISTRIBUTION			5/14/71	8-24	
DWG 8.8A	ATTITUDE REFERENCE LOGIC			3/10/71	8-25	
DWG 8.8	ATTITUDE REFERENCE SUBSYSTEM			3/10/71	8-26	
DWG 8.9A	SCS TVC/RCS ELECTRONICS LOGIC			3/12/71	8-27	
DWG 8.9	CONTROL ELECTRONICS (ECA/TVC/GYROS)			3/10/71	8-28	
DWG 8.10	AUTO/MANUAL RCS			3/12/71	8-29	
DWG 8.11	ENTRY MONITORING SYSTEM			3/12/71	8-30	
<u>SECTION 9 SERVICE PROPULSION SYSTEM</u>						
DWG 9.1	SERVICE PROPULSION SYSTEM			3/11/71	9-1	
DWG 9.2	SPS PROPELLANT GAUGING SYSTEM			2/24/71	9-2	
DWG 9.3	SPS PROPELLANT UTILIZATION VALVE CONTROL			2/24/71	9-3	

1 STANDARDS

SECTION 1

CSM
S/C 112-114

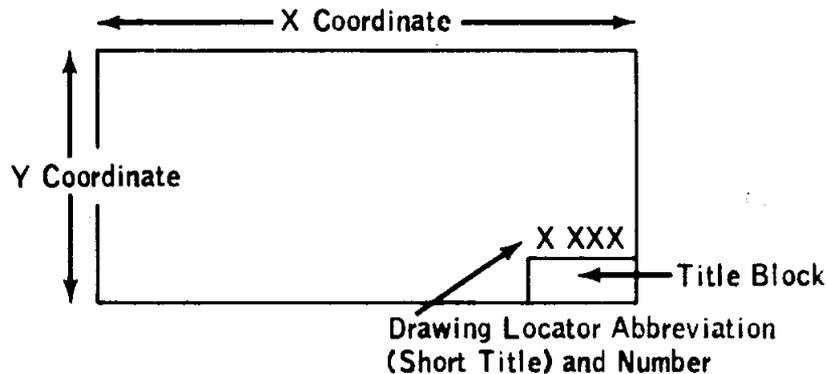
STANDARDS

1.1 GENERAL DRAWING INFORMATION

1.1.1 Cross-indexing

1.1.1.1 General drawing configuration

The X coordinate zones are marked alphabetically from the right-hand edge of the sheet (including the 1/2 inch margin). The Y coordinate zones are marked numerically from the bottom right-hand and left-hand corners of the sheet.



1.1.1.2 Component location code

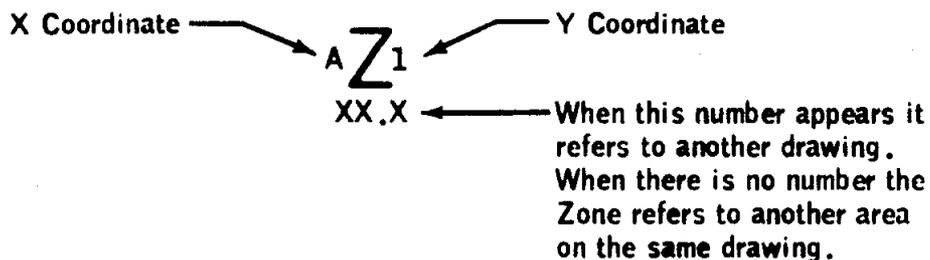
The component location code is used to reference controls (on the control-display figure) and components (on the overview drawing) into the detail system drawings.



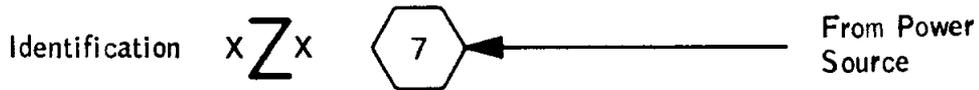
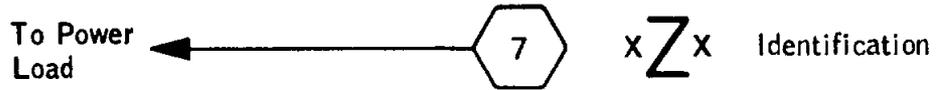
- 3 - Drawing Locator Number for the given detail subsystem drawing
- K - X Coordinate
- 4 - Y Coordinate

1.1.2 Technical Zone References

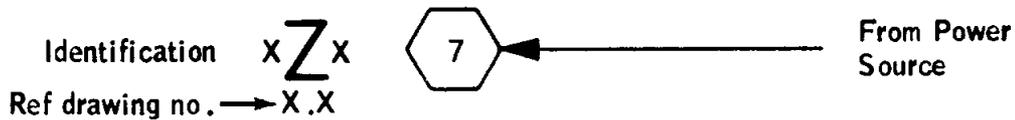
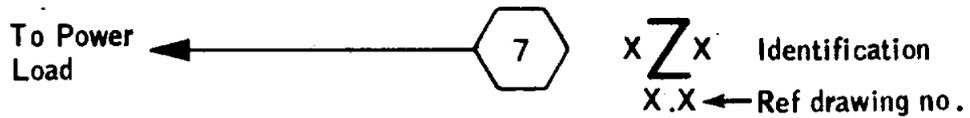
1.1.2.1 Zone reference



1.1.2.2 Power intra-drawing
(Section to section within the same drawing)

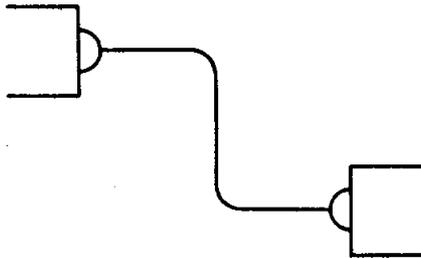


1.1.2.3 Power inter-drawings
(Drawing to drawing)



1.2 **LINE LEGEND**

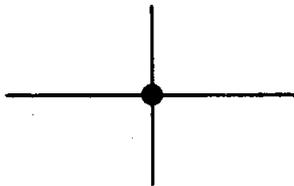
1.2.1 **RF Cable**



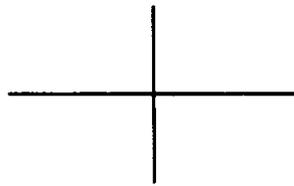
1.2.2 **Electrical Line, Power and control**



1.2.2.1 **Electrical connected**



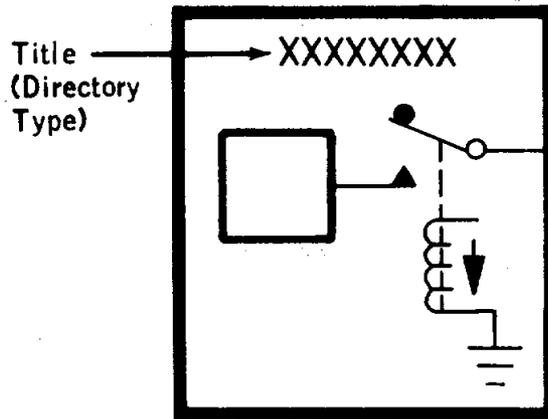
1.2.2.2 **Electrical crossover**



1.2.3 **Directional Flow Arrows**



1.2.4 **Component Enclosures**



1.2.4.1 **Main enclosure**
1/16-inch solid black line



1.2.4.2 **Sub enclosure**
1/32-inch solid black line



1.2.4.3 **Component enclosure with crew (manual control)**
1/16-inch dashed black line



1.2.4.4 **Module interface and systems assembly**
1/8-inch dashed black line

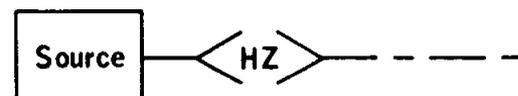


CM **SM**

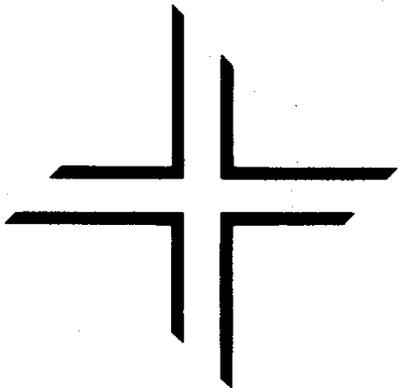
1.2.5 **Mechanical Linkage**



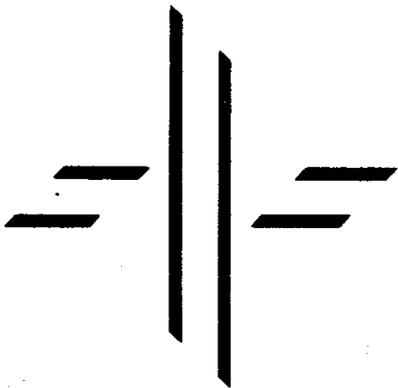
1.2.6 **Timing Pulses**



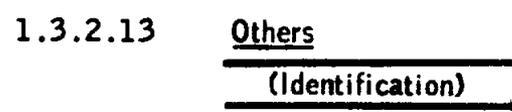
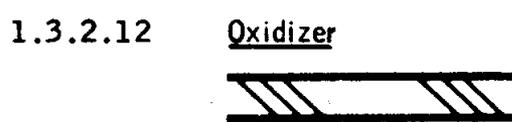
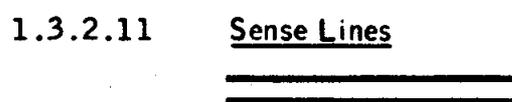
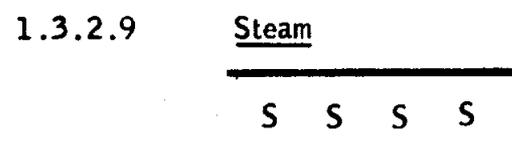
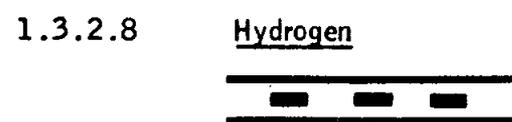
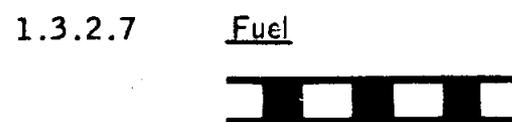
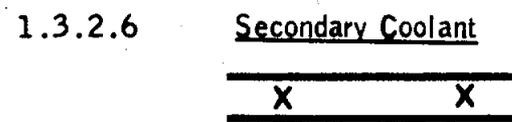
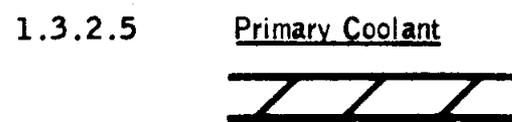
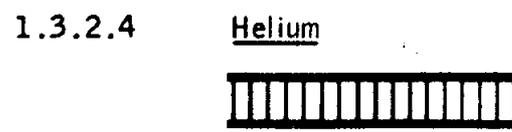
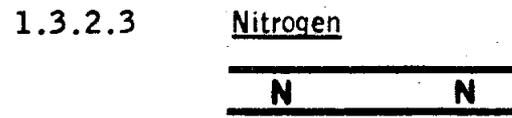
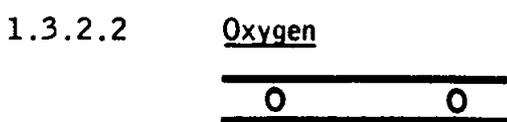
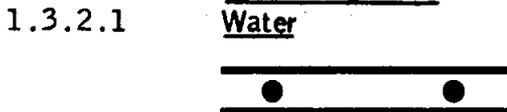
1.3 PIPE LEGEND
 1.3.1 General
 1.3.1.1 Plumbing connected



1.3.1.2 Plumbing crossover

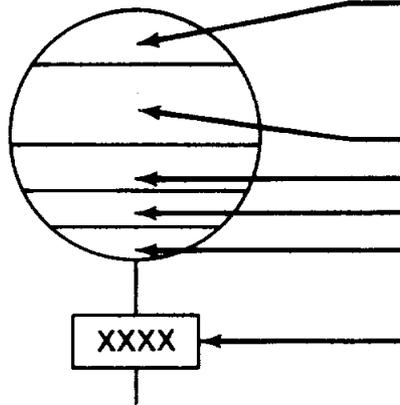


1.3.2 Line designation



1.4
1.4.1

TELEMETRY SYMBOLS
Measurements Telemetered



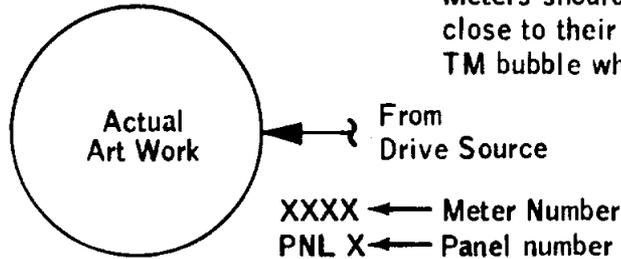
Measurement Number: Should include the letter associating it with the transducer type. Alternate system measurement numbers and PCM codes may appear near the TM bubble.

Measurement Name
Measurement Range
High Bit Sample Rate
Low Bit Sample Rate

TM Signal Conditioner: To be located on the input line next to TM bubble, positioned at 0°, 90°, 180° and 270° around bubble.

1.4.2

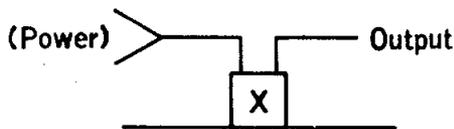
Onboard Meters



Meters should be placed close to their associated TM bubble wherever possible.

1.4.3
1.4.3.1

Sensors
Single source

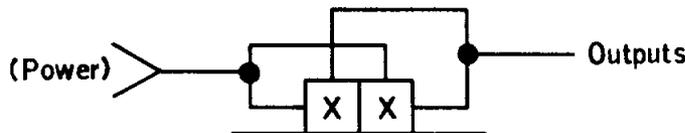


Example: Letter indicates the type:

- P - Pressure
- T - Temperature
- Q - Quantity
- W - Wetness
- R - Rate

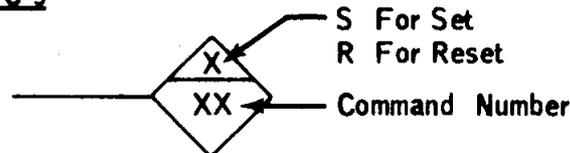
1.4.3.2

Double source



1.4.4
1.4.4.1

Ground Commands (Contents Optional by Vehicle)
RTC's



1.5 ELECTRICAL SYMBOLS

1.5.1 Switches

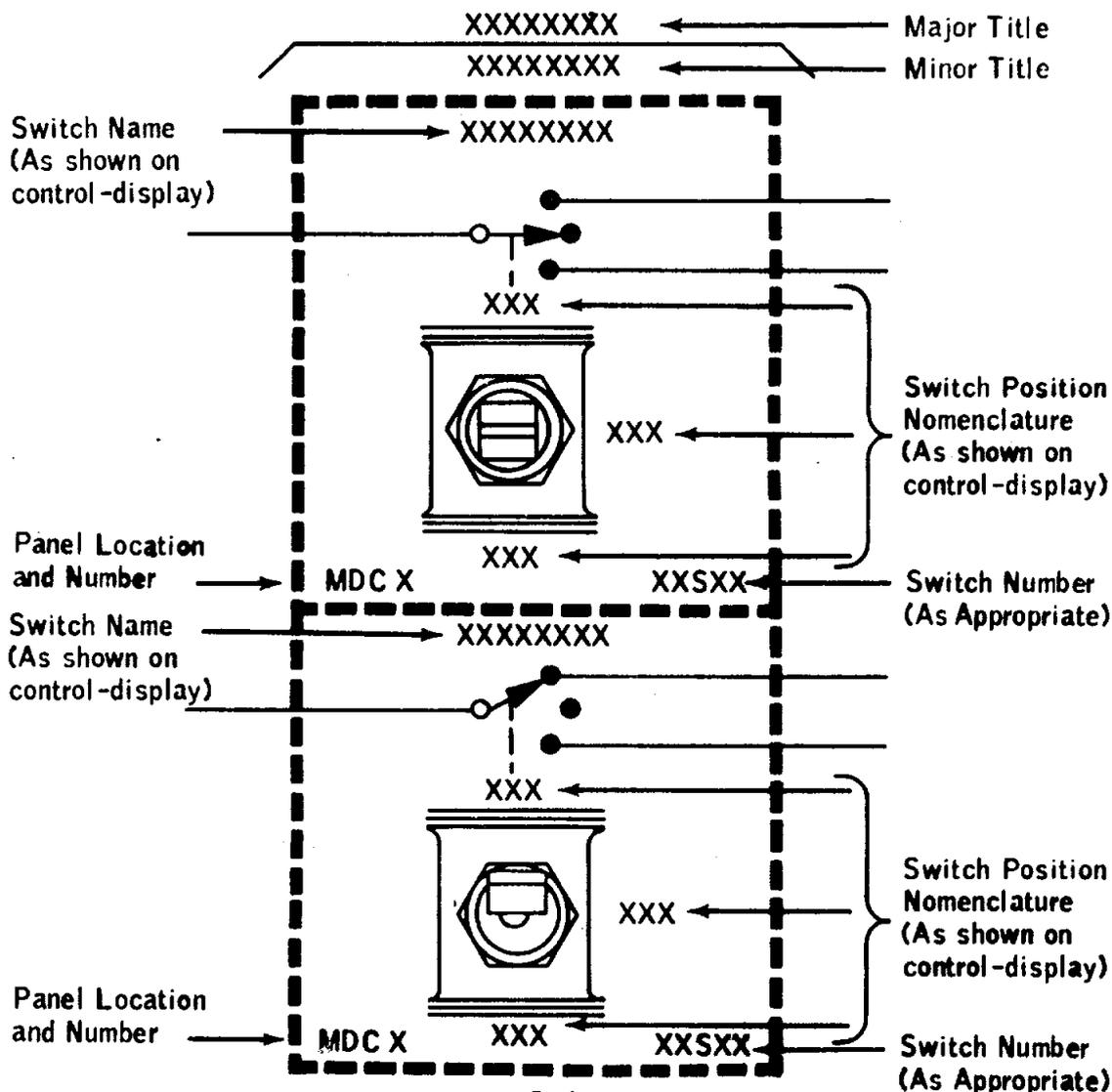
All switches will be shown in the de-energized position (if possible). When a switch has more than one set of contacts, only one set needs to have switch contact nomenclature.

1.5.1.1 Switch nomenclature

Major Title: The title given to a group of switches on the panel.

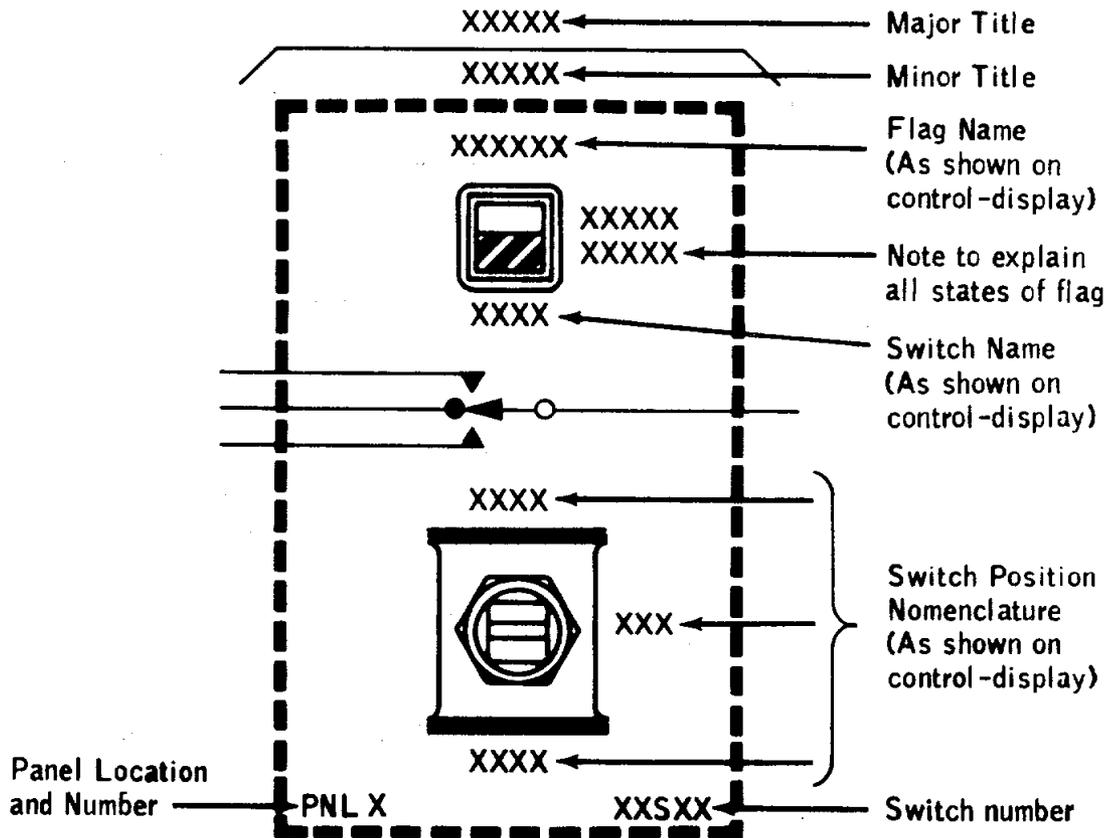
Minor Title: The title given to a sub-group of switches

Note: If more than one switch has identical major and minor titles, they may be stacked without repeating these titles.



1.5.1.2 Switch controlled flag

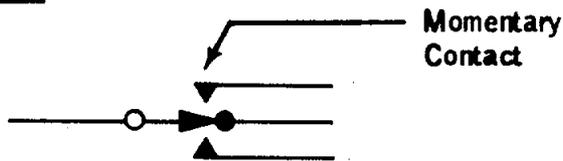
If a flag is directly controlled by a switch, it may be shown in the following manner:



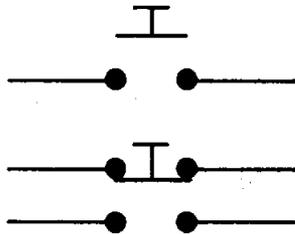
1.5.1.3 Two-position



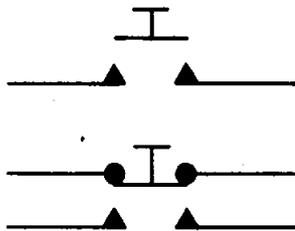
1.5.1.4 Three-position



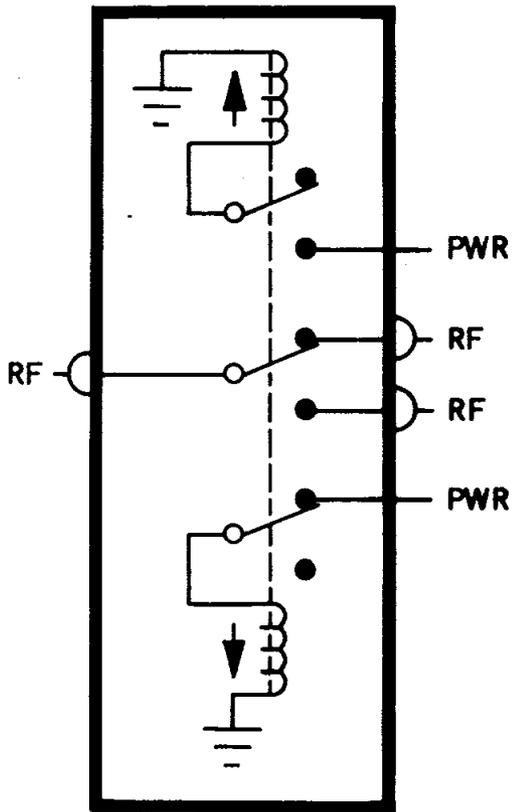
1.5.1.5 Pushbutton
1.5.1.5.1 Latching



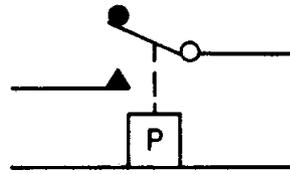
1.5.1.5.2 Momentary



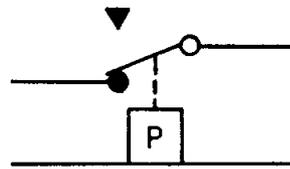
1.5.1.6 Coax



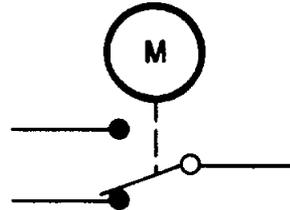
1.5.1.7 Pressure
1.5.1.7.1 Closed decreased pressure



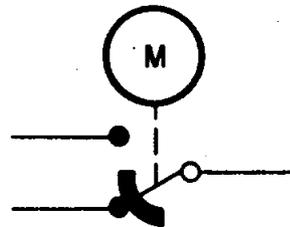
1.5.1.7.2 Closed increased pressure



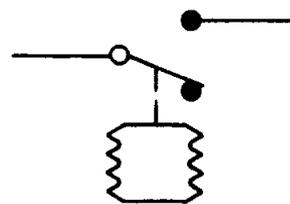
1.5.1.8 Motor
1.5.1.8.1 Break before make



1.5.1.8.2 Make before break



1.5.1.9 Baro

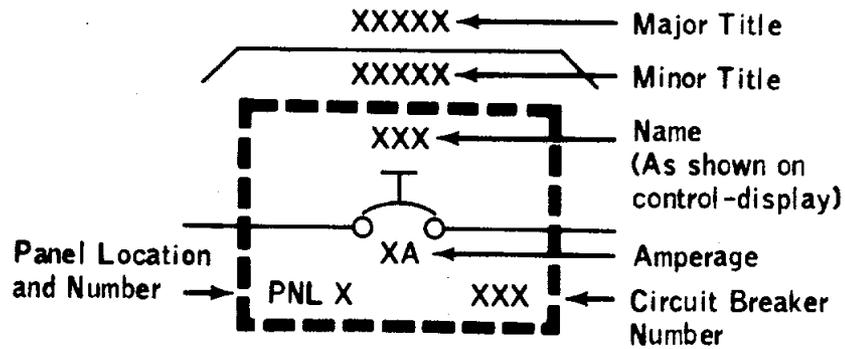


Close XXX psi or altitude
Open XXX psi or altitude

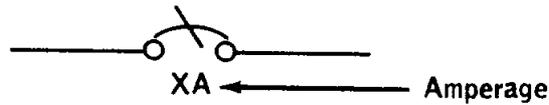
1.5.2 Circuit Breakers

The circuit breaker should be placed near the associated bus whenever possible. For the difference between major and minor titles see remark under switches (1.5.1.1).

1.5.2.1 Pushbutton

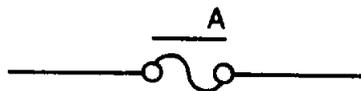


1.5.2.2 Automatic

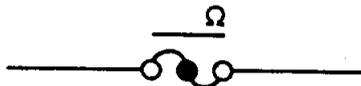


1.5.3 Fuses

1.5.3.1 General

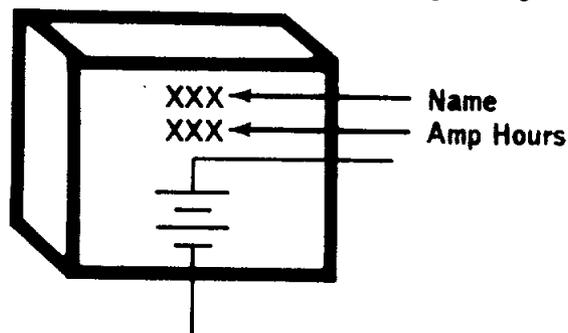


1.5.3.2 Fusistor



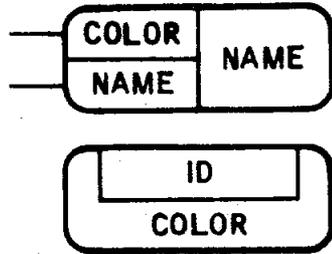
1.5.4 Battery

1/16-inch black tape
Size varies with number of cells and drawing arrangement.



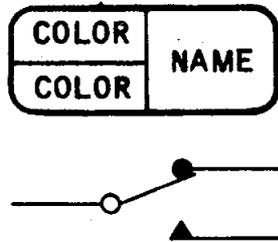
1.5.5
1.5.5.1

Lights
Teledights



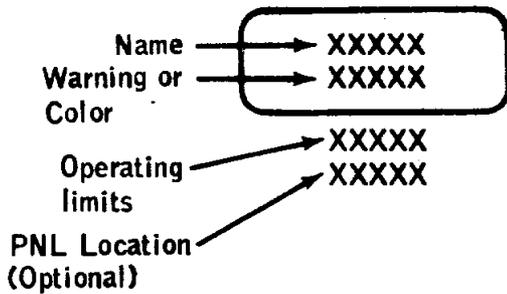
1.5.5.2

Switching



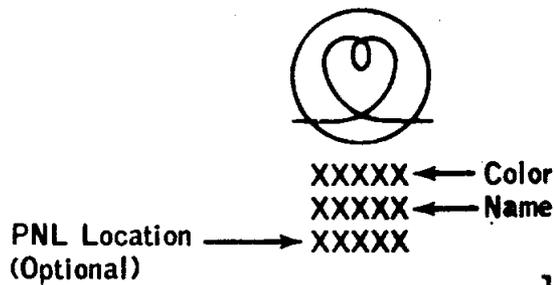
1.5.5.3

Caution and warning



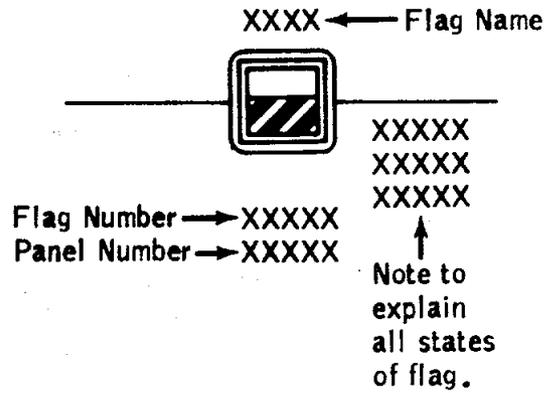
1.5.5.4

Component



1.5.6

Annunciator Flag
Flag symbol will not reflect switch position of the associated switch.



1.5.7

Relays

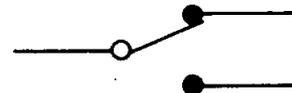
1.5.7.1

Momentary contact



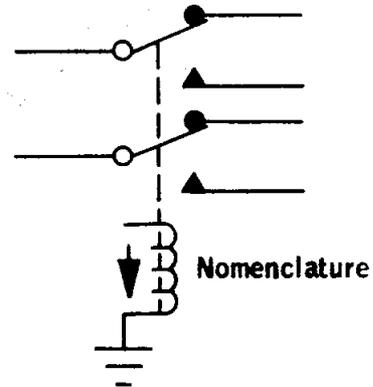
1.5.7.2

Latching contacts

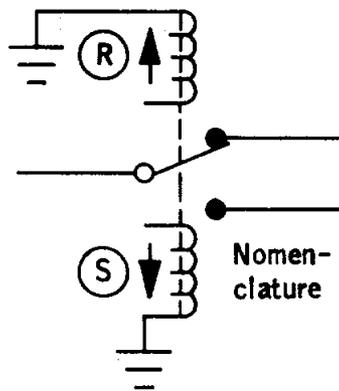


1.5.7.3

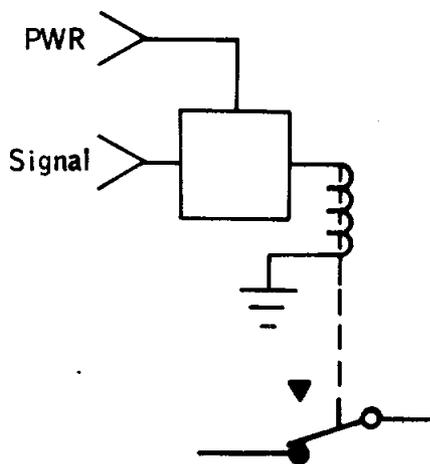
Non-Latching relay



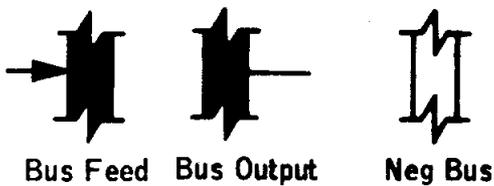
1.5.7.4 Latching relay



1.5.8 Relay or Solenoid Driver



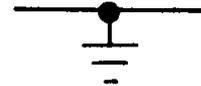
1.5.9
1.5.9.1 Buses
Symbol
Length can vary depending on the bus function on a given drawing.



1.5.9.2 Designation
See bus designation list.



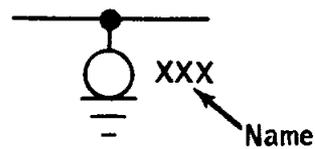
1.5.10
1.5.10.1 Grounds
System



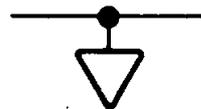
1.5.10.2 Frame



1.5.10.3 Floating or Controlled



1.5.10.4 Signal



1.5.11
1.5.11.1 Diodes
General



1.5.11.2 Zener



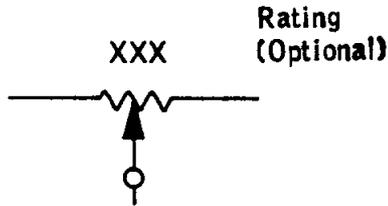
1.5.11.3 Tunnel



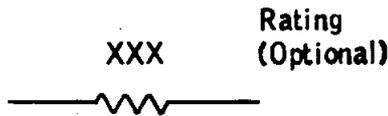
1.5.11.4 Control rectifier (SCR)



1.5.12 Potentiometer



1.5.13 Fixed Resistor



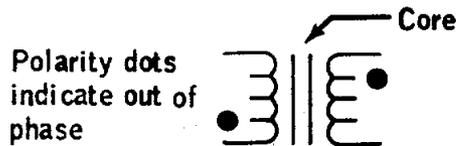
1.5.14 Heater



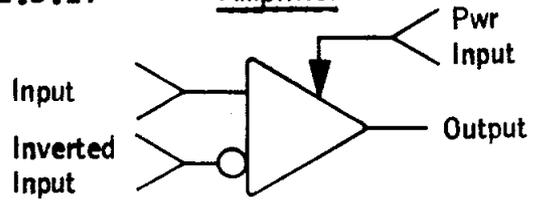
1.5.15 Thermostat



1.5.16 Transformers



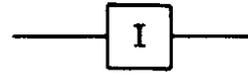
1.5.17 Amplifier



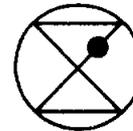
1.5.18 Capacitor



1.5.19 Digital Inverter

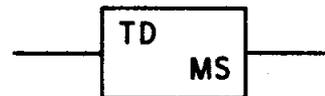


1.5.20 Wire Resolver



- × = Sine Winding
- = Minus Sine
- = Cosine Winding

1.5.21 Time Delay



1.5.22 Electrical Filter

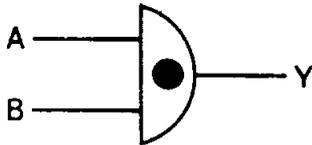


1.5.23 Modulator



1.5.24
1.5.24.1

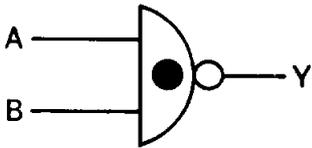
Gates
And



A	B	Y
1	1	1
1	0	0
0	1	0
0	0	0

1.5.24.2

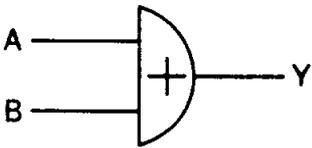
Nand



1	1	0
1	0	1
0	1	1
0	0	1

1.5.24.3

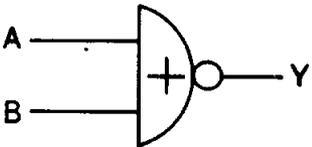
Or



1	1	1
1	0	1
0	1	1
0	0	0

1.5.24.4

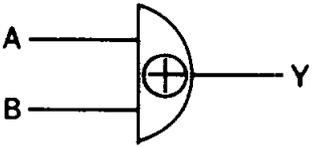
Nor



1	0	0
0	1	0
1	1	0
0	0	1

1.5.24.5

Exclusive Or

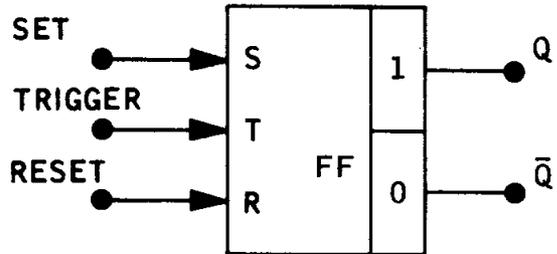


1	1	0
1	0	1
0	1	1
0	0	0

Open circle means it is an inverter and may appear on any of the lines on the gate.

1.5.24.6

SRT Flip-Flop



INPUT

S

OUTPUT

Sets Q to "1"
Sets \bar{Q} to "0"

T

Q and \bar{Q} Change States

R

Resets Q to "0"
Resets \bar{Q} to "1"

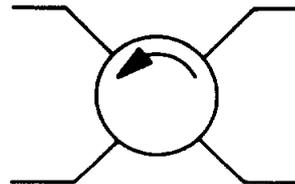
1.5.25

Demodulator

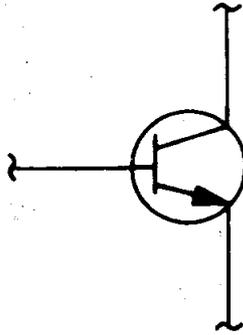


1.5.26

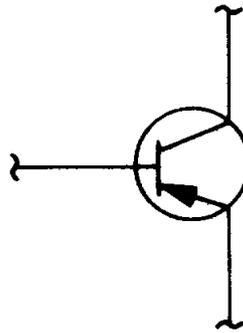
RF Circulator



1.5.27 Transistor
1.5.27.1 NPN

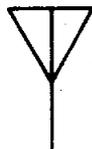


1.5.27.2 PNP



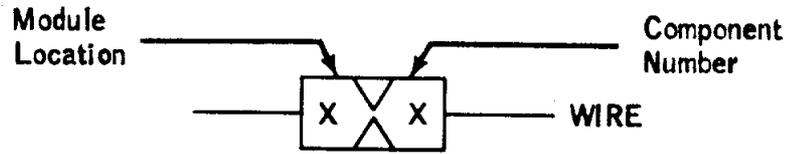
1.5.28 Antenna

Name
(Type or Function)

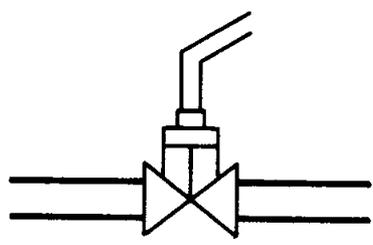


1.6 PYROTECHNIC SYMBOLS

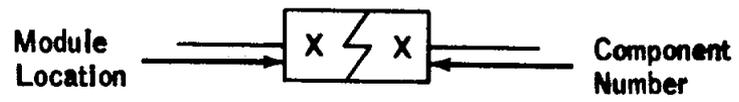
1.6.1 Pyro Guillotine



1.6.2 Pyro Valve with Single Initiator

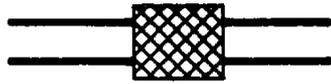


1.6.3 Electrical Circuit Interrupter

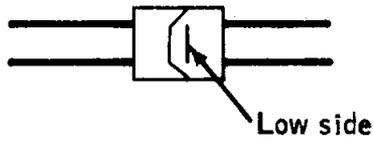


1.7 MECHANICAL SYMBOLS

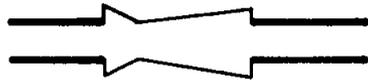
1.7.1 Mechanical Filter



1.7.2 Burst Diaphragm



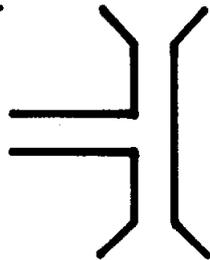
1.7.3 Venturi



1.7.4 Vent



1.7.5 Thrust Neutralized Vent

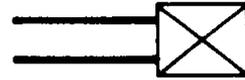


1.7.6 Disconnects

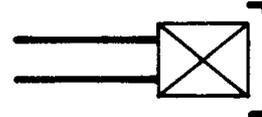
1.7.6.1 Self-sealing



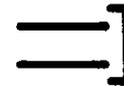
1.7.6.2 Quick



1.7.7 Quick Disconnect Fill and Drain

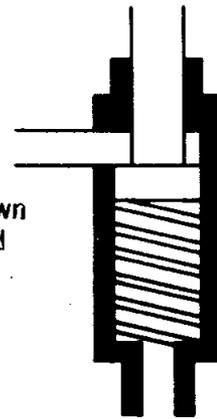


1.7.8 Fill and Drain

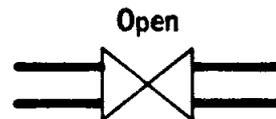


1.7.9 Ball Valve Actuator

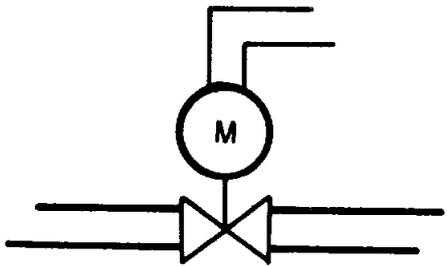
May be shown
in depressed
or partially
depressed
position



1.7.10 Valves



1.7.10.1 Motor Control



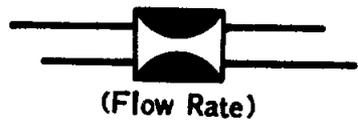
1.7.10.2 Manual Control



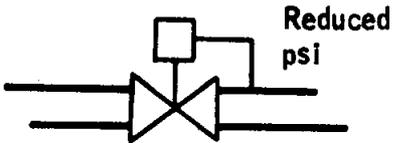
1.7.10.3 Check Valve



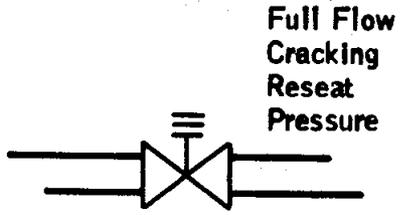
1.7.10.4 Orifice



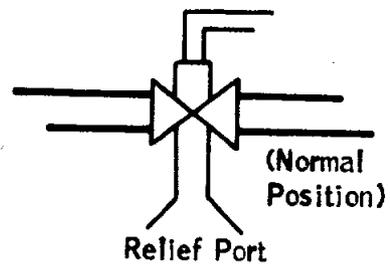
1.7.10.5 Pressure regulator



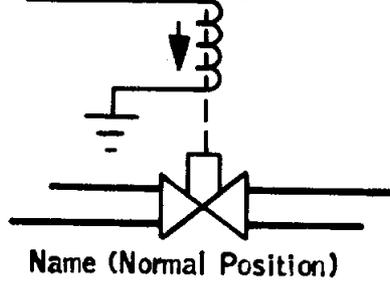
1.7.10.6 Relief Valve



1.7.10.7 Pneumatic controlled valve with line bleed

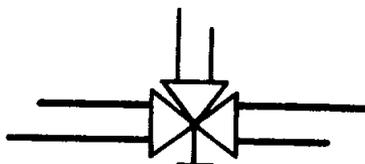


1.7.10.8 Solenoid valve

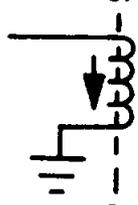


1.7.10.9 Three-way valve

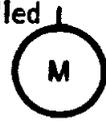
1.7.10.9.1 Manual



1.7.10.9.2 Solenoid



1.7.10.9.3 Motor controlled



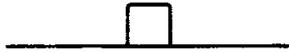
1.7.10.10 Ball valve



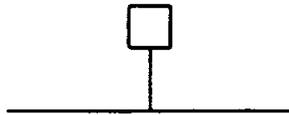
1.8 MISCELLANEOUS SYMBOLS
1.8.1 Drawing Note Reference



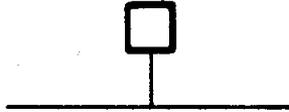
1.8.2 Overview Drawing Instrumentation Legend
1.8.2.1 Automatic control only



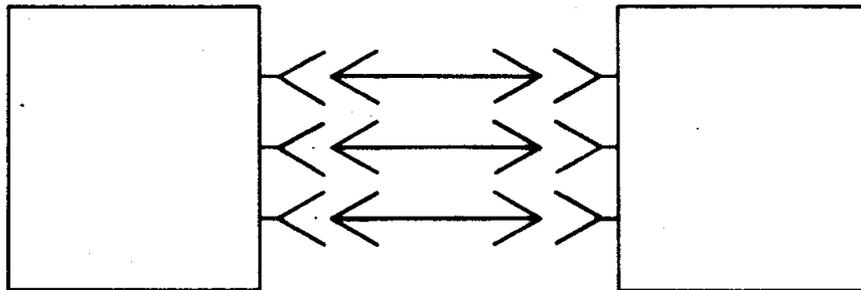
1.8.2.2 PCM only



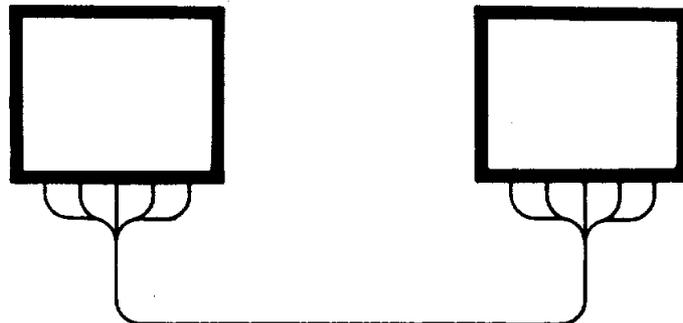
1.8.2.3 PCM and/or onboard display



1.8.3 Two-unit Interface



1.8.4 Two-unit Cable Connection



1.8.5 **BUSES**

1.8.5.1 **POWER BUSES**

- V_{MA} - MAIN BUS A
- V_{MB} - MAIN BUS B
- V_{BA} - BATTERY BUS A
- V_{BB} - BATTERY BUS B
- V_{BR} - BATTERY RELAY BUS
- V_{FP} - FLIGHT AND POSTLANDING BUS
- V_{NE1} - NON ESSENTIAL BUS 1
- V_{NE2} - NON-ESSENTIAL BUS 2
- V_{AC1} - AC BUS 1
- V_{AC2} - AC BUS 2
- V_F - FLIGHT BUS
- V_{SMA} - SERVICE MODULE BUS A
- V_{SMB} - SERVICE MODULE BUS B

1.8.5.2

SEQUENTIAL BUSES

- V_{SQA} - SEQUENTIAL PYRO BUS A
- V_{RQA} - RCS CONTROLLER PYRO BUS A
- V_{RLA} - RCS CONTROLLER LOGIC BUS A
- V_{LQA} - LM DOCKING BUS A
- V_{SLA} - SEQUENTIAL LOGIC BUS A
- V_{SAA} - SEQUENTIAL ARM BUS A
- V_{ELA} - EARTH LANDING BUS A
- V_{SQB} - SEQUENTIAL PYRO BUS B
- V_{RQB} - RCS CONTROLLER PYRO BUS B
- V_{RLB} - RCS CONTROLLER LOGIC BUS B
- V_{LQB} - LM DOCKING BUS B
- V_{SLB} - SEQUENTIAL LOGIC BUS B
- V_{SAB} - SEQUENTIAL ARM BUS B
- V_{ELB} - EARTH LANDING BUS B

SEQUENTIAL BUSES (cont'd)

- V_{ED 1} - EMERGENCY DETECTION SYSTEM BUS NO 1
- V_{ED 2} - EMERGENCY DETECTION SYSTEM BUS NO 2
- V_{ED 3} - EMERGENCY DETECTION SYSTEM BUS NO 3
- V_{6D95} - IU ABORT BUS

1.8.5.3

INSTRUMENTATION BUSES

- V₁ - CM ESS INST BUS PWR FROM RHEB PNL 276-CB1
- V₂ - CM ESS INST BUS PWR FROM RHEB PNL 276-CB2
- V_{3S} - SM ESS INST BUS PWR FROM RHEB PNL 276-CB3
- V_{4S} - SM ESS INST BUS PWR FROM RHEB PNL 276-CB4
- V_{SC} - SCE PWR REQ'D FOR SIGNAL CONDITIONING
(+20, -20, and/or +10Vdc)
- V_{SC5} - SCE CM +5Vdc PWR

1.8.5.4 SCS LOGIC BUSES

V_{LB1} - LOGIC BUS 1

V_{LB2} - LOGIC BUS 2

V_{LB3} - LOGIC BUS 3

V_{LB4} - LOGIC BUS 4

1.8.5.5 EXPERIMENT BUSES

V_{SIMJA} - SIM JETTISON BUS A

V_{SIMJB} - SIM JETTISON BUS B

V_{SIMLA} - SIM LOGIC BUS A

V_{SIMLB} - SIM LOGIC BUS B

V_{SIMQA} - SIM PYRO BUS A

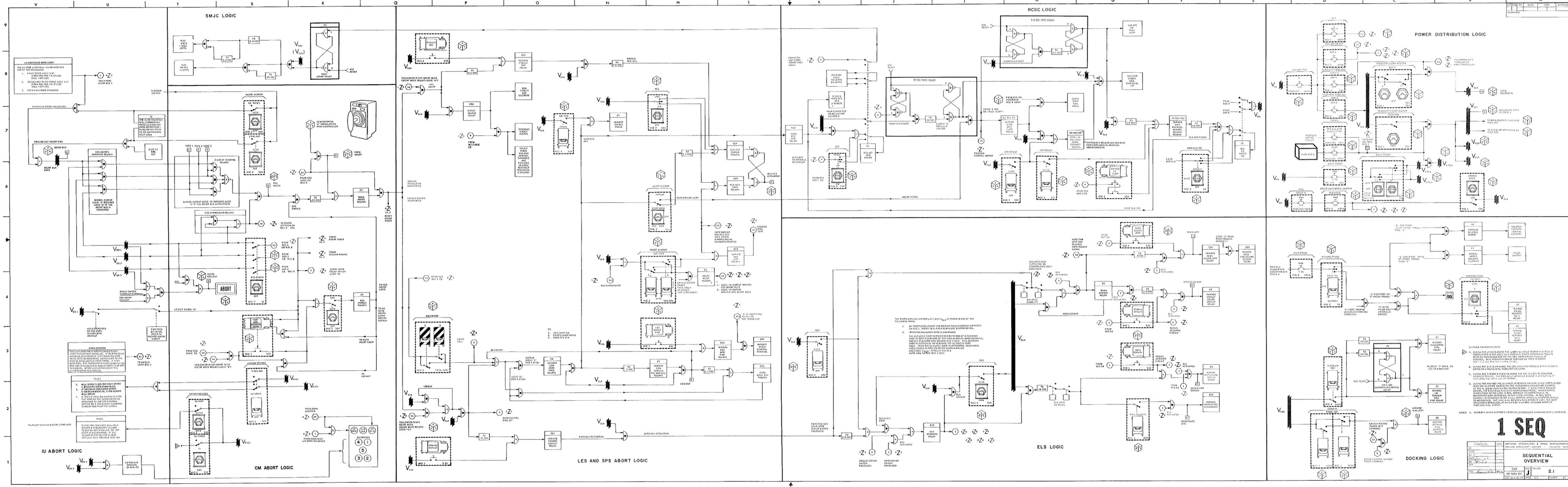
V_{SIMQB} - SIM PYRO BUS B

V_{E1} - EXPERIMENT BUS 1

V_{E2} - EXPERIMENT BUS 2

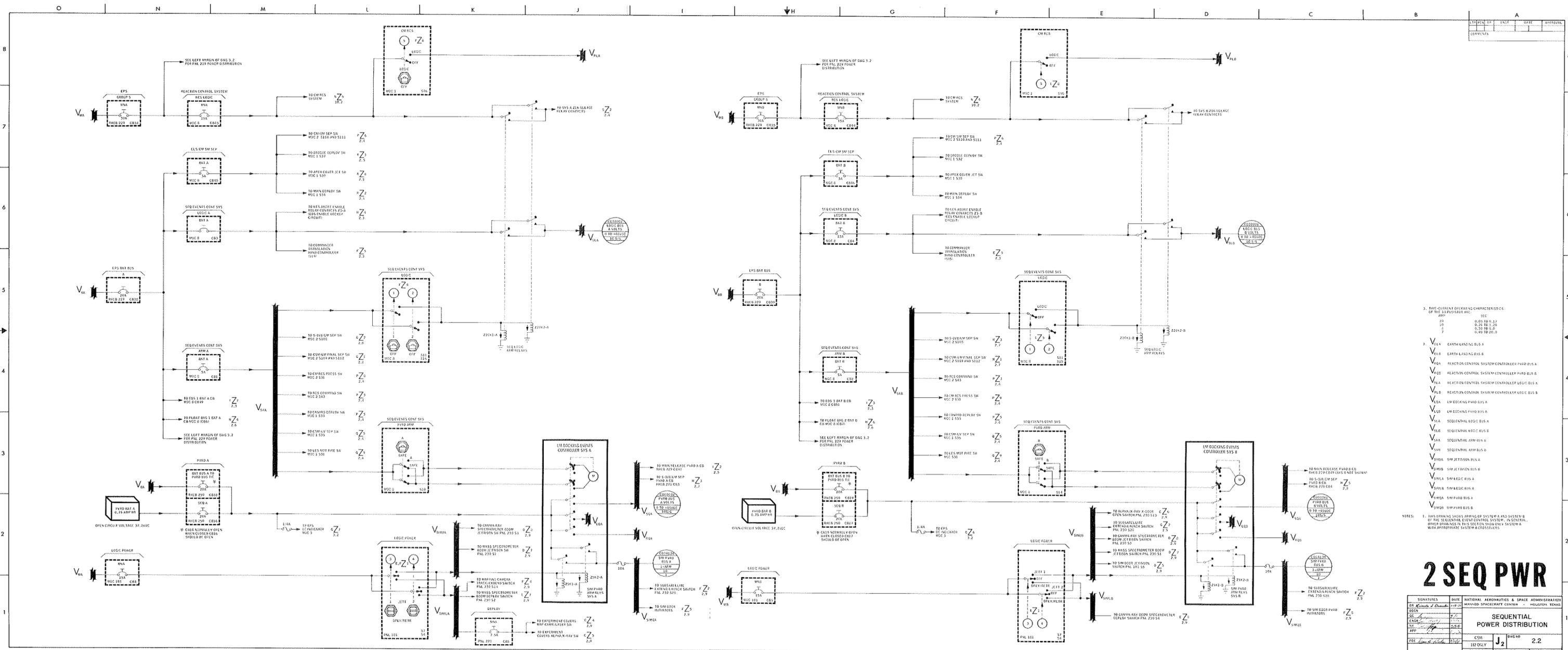
V_{E3} - EXPERIMENT BUS 3

2 SEQUENTIAL
EVENTS SYSTEM



1 SEQ

DATE	REVISION	BY	CHKD	APP'D
1972 03 28	1	J		
1972 03 28	2	J		
1972 03 28	3	J		
1972 03 28	4	J		
1972 03 28	5	J		
1972 03 28	6	J		
1972 03 28	7	J		
1972 03 28	8	J		
1972 03 28	9	J		
1972 03 28	10	J		



3. TIME-CURRENT OPERATING CHARACTERISTICS OF THE FUSES ARE:

AMP	SEC
20	0.03 TO 0.10
10	0.30 TO 0.50
5	0.70 TO 1.00
2.5	0.40 TO 20.0

4. V_{ELA} EARTH LANDING BUS A
V_{ELB} EARTH LANDING BUS B
V_{QA} REACTOR CONTROL SYSTEM CONTROLLER PHD BUS A
V_{QB} REACTOR CONTROL SYSTEM CONTROLLER PHD BUS B
V_{LA} REACTOR CONTROL SYSTEM CONTROLLER LOGIC BUS A
V_{LB} REACTOR CONTROL SYSTEM CONTROLLER LOGIC BUS B
V_{DA} EM LOCKING PHD BUS A
V_{DB} EM LOCKING PHD BUS B
V_{LA} SEQUENTIAL LOGIC BUS A
V_{LB} SEQUENTIAL LOGIC BUS B
V_{QA} SEQUENTIAL ARM BUS A
V_{QB} SEQUENTIAL ARM BUS B
V_{QA} SIM JET FUSION BUS A
V_{QB} SIM JET FUSION BUS B
V_{QA} SIM PWD BUS A
V_{QB} SIM PWD BUS B
V_{QA} SIM PWD BUS A
V_{QB} SIM PWD BUS B

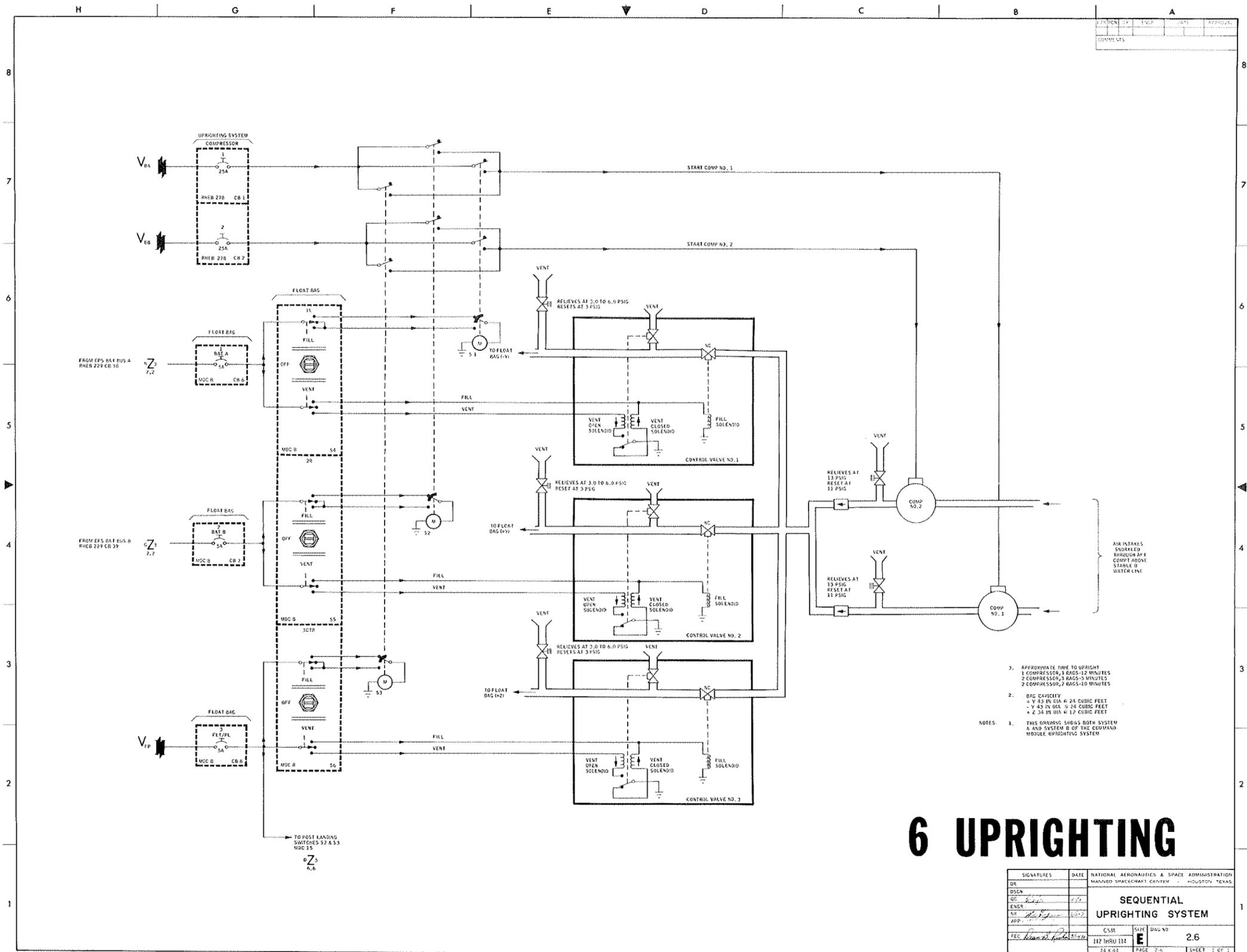
NOTES: 1. THIS DRAWING SHOWS ARMING OF SYSTEM A AND SYSTEM B OF THE SEQUENTIAL EVENT CONTROL SYSTEM. IN GENERAL, OTHER DRAWINGS IN THIS SECTION SHOW ONLY SYSTEM A WITH APPROPRIATE SYSTEM B CROSSOVERS.

2 SEQ PWR

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DESIGN	11/20/72	MANNED SPACECRAFT CENTER - HOUSTON, TEXAS
ENGINEER		
APP		

SEQUENTIAL POWER DISTRIBUTION

CSM PAGE NO. 2.2
1/2 ONLY
PAGE 2-2 SHEET 1 OF 1

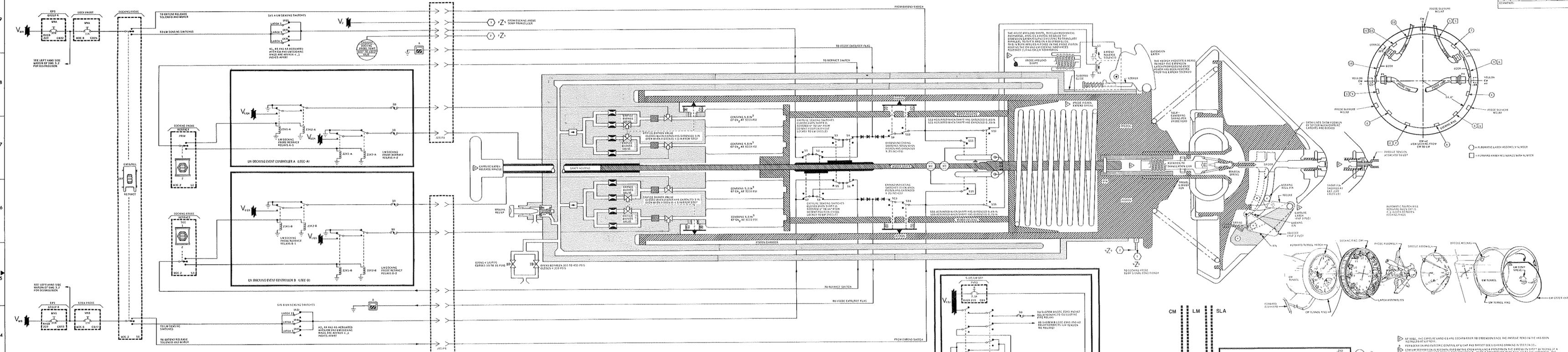


- NOTES:
1. THIS DRAWING SHOWS BOTH SYSTEM A AND SYSTEM B OF THE COMMAND MODULE UPRIGHTING SYSTEM
 2. BAG CAPACITY
 - 7.43 IN DIA @ 24 CUBIC FEET
 - 4.23 IN DIA @ 12 CUBIC FEET
 3. APPROXIMATE TIME TO UPRIGHT
 1 COMPRESSOR, 3 BAGS-12 MINUTES
 2 COMPRESSOR, 3 BAGS-9 MINUTES
 2 COMPRESSOR, 2 BAGS-10 MINUTES

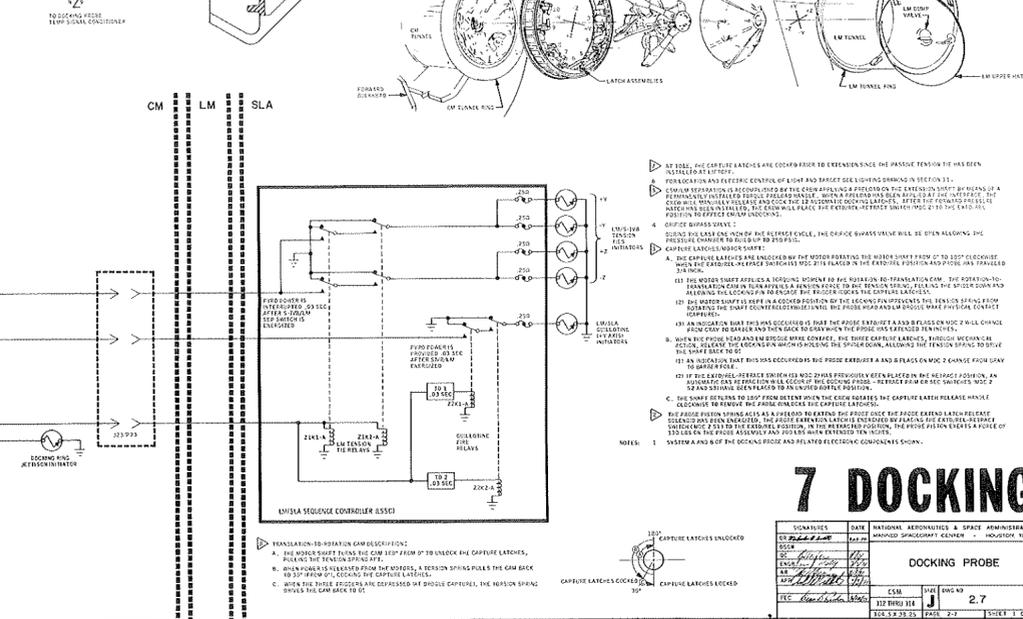
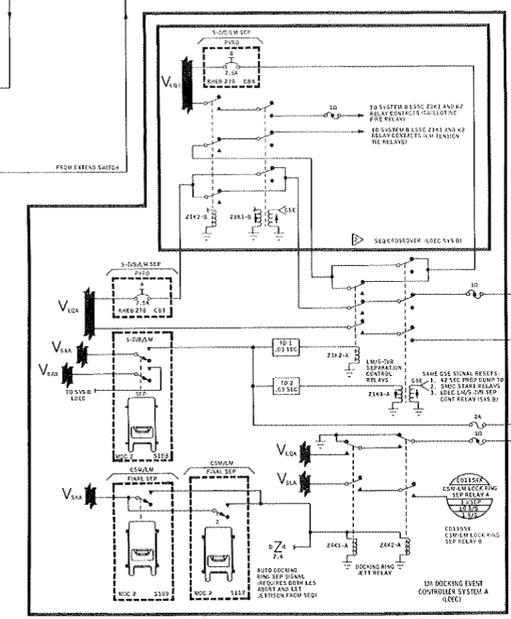
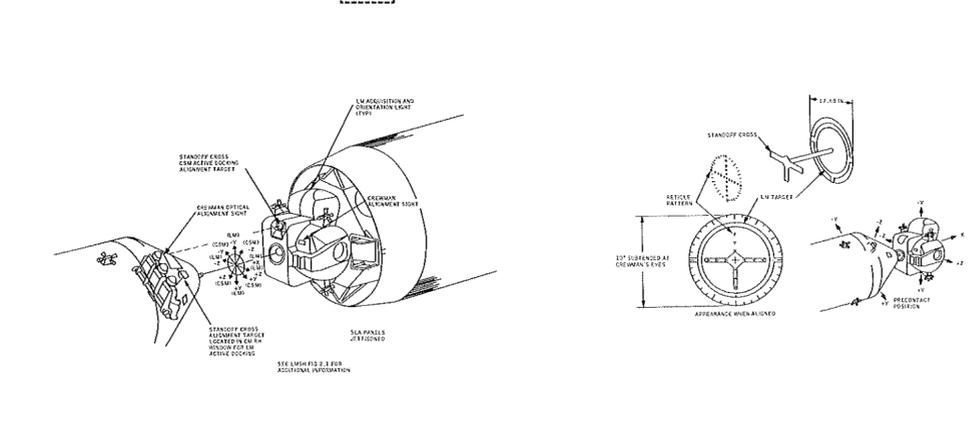
6 UPRIGHTING

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DR		MANNEED SPACECRAFT CENTER HOUSTON, TEXAS
DSGN		
CHKD		
ENGR		
APP		
REC		

SEQUENTIAL UPRIGHTING SYSTEM	
C5M	SIZE
112 INRU 114	DWG NO
	2.6
14 JUN 64	PAGE 24
	SHEET 1 OF 1



	DOCKING PROBE EXTENDED SWITCH POSITION	NORMAL EXTENSION PROBE > 10 INCHES	PROBE < 10 IN	PROBE > 10 IN < 10 IN	NO PROBE POWER	PROBE NOT WITH CAPTURE LATCHES NOT CLOSED
EXTENSION	EXT RET SHOCK	YES NO NO	NO NO NO	NO NO NO	NO NO NO	YES NO NO
CAPTURE	EXT RET SHOCK	NO NO NO	NO NO NO	NO NO NO	NO NO NO	NO NO NO
RETRACTION	EXT RET SHOCK	NO NO NO	NO NO NO	NO NO NO	NO NO NO	NO NO NO



- NOTES:
- SYSTEM A AND B OF THE DOCKING PROBE AND RELATED ELECTRO-MECHANICAL SYSTEMS SHOWN.
 - THE PROBE SPRING ASSEMBLY ASSEMBLY RELEASES THE PROBE FROM THE STATION AS THE PROBE EXTENDS AND HELD IN POSITION BY THE STATION SPRING ASSEMBLY. THE PROBE EXTENDS AND HELD IN POSITION BY THE STATION SPRING ASSEMBLY. THE PROBE EXTENDS AND HELD IN POSITION BY THE STATION SPRING ASSEMBLY.
 - THE PROBE SPRING ASSEMBLY RELEASES THE PROBE FROM THE STATION AS THE PROBE EXTENDS AND HELD IN POSITION BY THE STATION SPRING ASSEMBLY. THE PROBE EXTENDS AND HELD IN POSITION BY THE STATION SPRING ASSEMBLY.
 - THE PROBE SPRING ASSEMBLY RELEASES THE PROBE FROM THE STATION AS THE PROBE EXTENDS AND HELD IN POSITION BY THE STATION SPRING ASSEMBLY. THE PROBE EXTENDS AND HELD IN POSITION BY THE STATION SPRING ASSEMBLY.

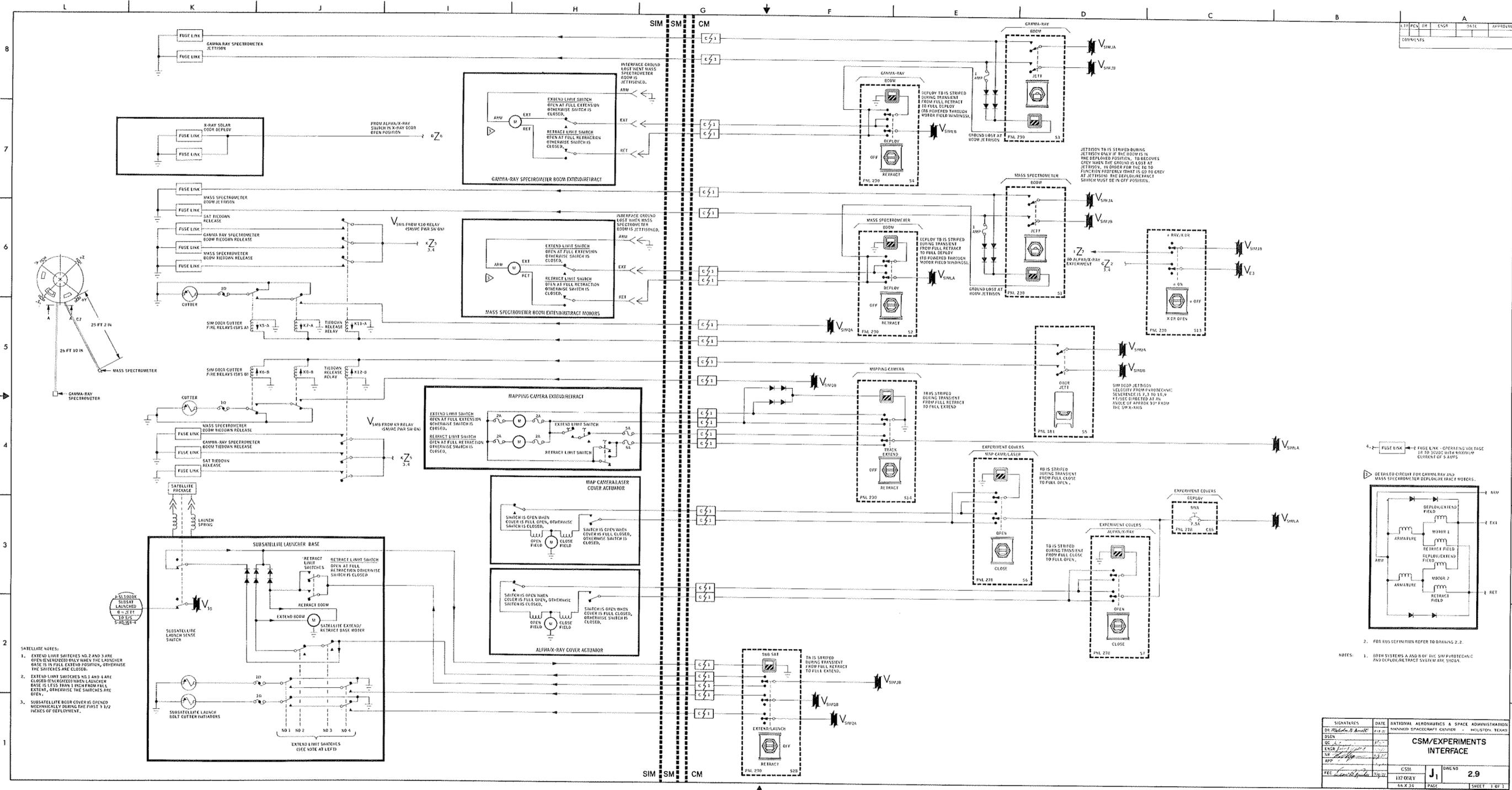
7 DOCKING

REVISION	DATE	REVISION	DATE
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2	10/1/68	2	10/1/68
3	10/1/68	3	10/1/68
4	10/1/68	4	10/1/68
5	10/1/68	5	10/1/68
6	10/1/68	6	10/1/68
7	10/1/68	7	10/1/68
8	10/1/68	8	10/1/68
9	10/1/68	9	10/1/68
10	10/1/68	10	10/1/68

ISSUED BY: [Signature]

DATE: 10/1/68

SCALE: 2.7



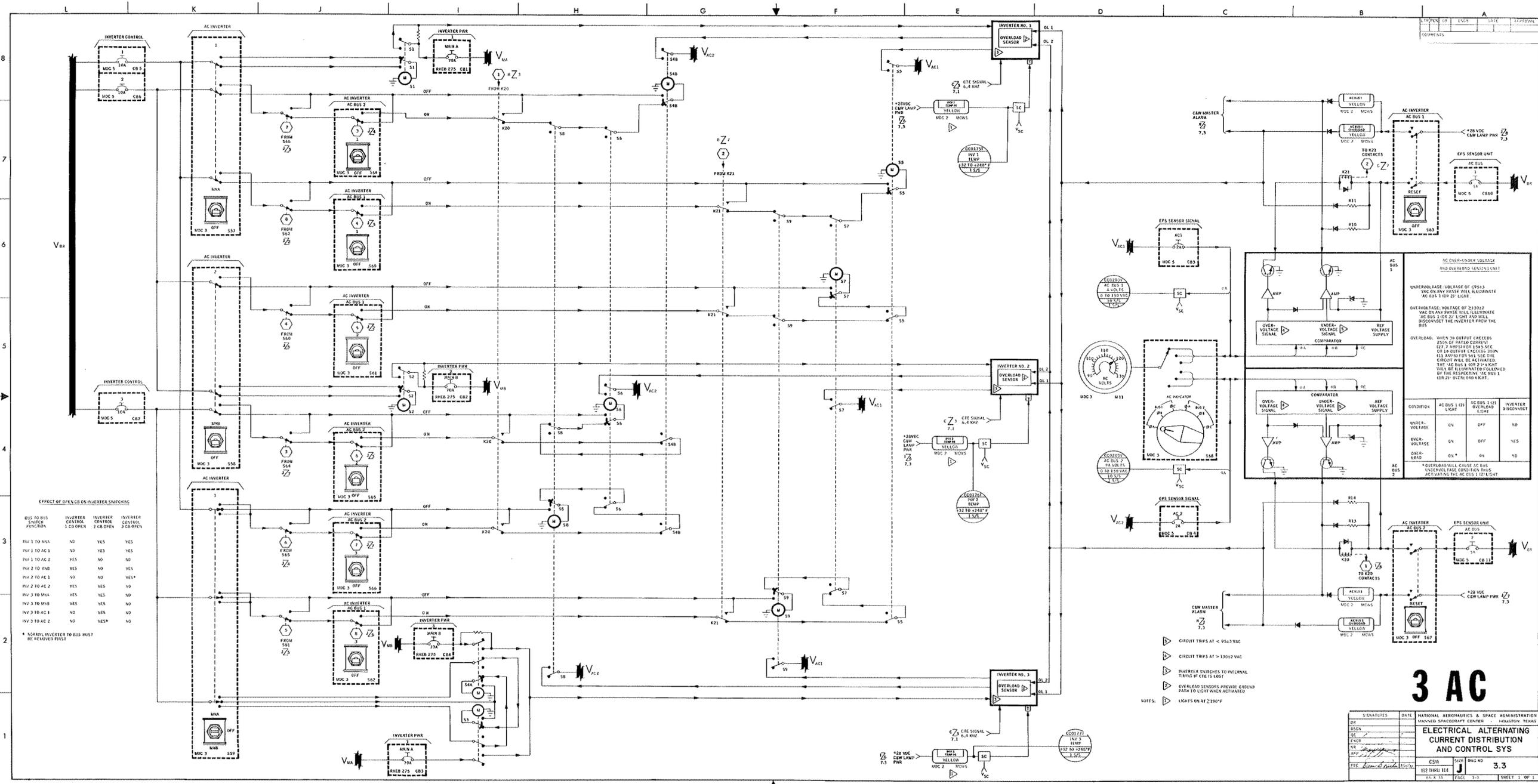
- SATELLITE NOTES:**
1. EXTEND LIMIT SWITCHES NO. 2 AND 3 ARE OPEN (GENERATED) ONLY WHEN THE LAUNCHER BASE IS IN FULL EXTEND POSITION, OTHERWISE THE SWITCHES ARE CLOSED.
 2. EXTEND LIMIT SWITCHES NO. 1 AND 4 ARE CLOSED (GENERATED) WHEN LAUNCHER BASE IS LESS THAN 1 INCH FROM FULL EXTENT, OTHERWISE THE SWITCHES ARE OPEN.
 3. SUBSATELLITE BOOR COVER IS OPENED MECHANICALLY DURING THE FIRST 3 1/2 INCHES OF DEPLOYMENT.

- NOTES:**
1. BOTH SYSTEMS A AND B OF THE SIM PARATECHNIC AND DEPLOY/RETRACT SYSTEM ARE SHOWN.
 2. FOR BUS DEFINITION REFER TO DRAWING 2.2.

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DR [Signature]	11/1/68	HOUSTON, TEXAS
DESIGN		
CHECKED		
APP		
REC		

CSM/EXPERIMENTS INTERFACE	
CSM	DWG NO. 2.9
112 ORLY	PAGE
6x 2 3/4	SHEET 1 OF 1

3 ELECTRICAL
SYSTEM



EFFECT OF OPEN CB ON INVERTER SWITCHING

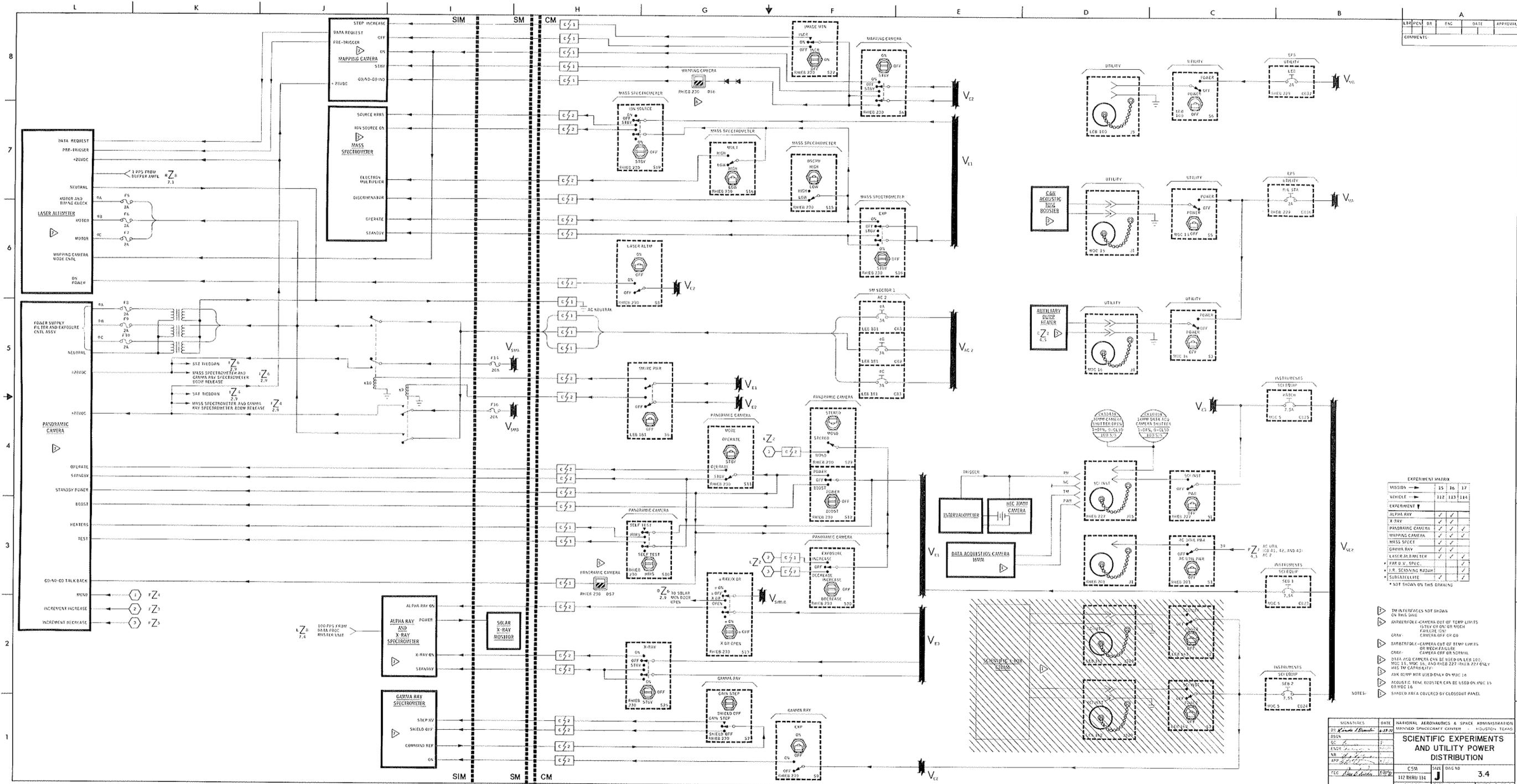
EPS TO BUS SWITCH FUNCTION	INVERTER CONTROL 1 CB OPEN	INVERTER CONTROL 2 CB OPEN	INVERTER CONTROL 3 CB OPEN
INV 1 TO MVA	NO	YES	YES
INV 1 TO AC 1	NO	YES	YES
INV 1 TO AC 2	YES	NO	NO
INV 2 TO MVA	NO	NO	YES*
INV 2 TO AC 1	YES	NO	NO
INV 2 TO AC 2	YES	NO	NO
INV 3 TO MVA	YES	YES	NO
INV 3 TO MVA	YES	YES	NO
INV 3 TO AC 1	NO	YES	NO
INV 3 TO AC 2	NO	YES*	NO

* DURING INVERTER TO BUS MUST BE REMOVED FIRST

- ▷ CIRCUIT TRIPS AT < 95% VAC
- ▷ CIRCUIT TRIPS AT > 130% VAC
- ▷ INVERTER SWITCHES TO INTERNAL TIMING IF CTE IS LOST
- ▷ OVERLOAD SENSORS PROVIDE SOUND PATH TO LIGHT WHEN ACTIVATED
- ▷ LIGHTS ON AT 2400P

3 AC

SIGNATURE	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DESIGN	11/82	MANNED SPACECRAFT CENTER HOUSTON TEXAS
ENGR		
CHK		
APP		
ELECTRICAL ALTERNATING CURRENT DISTRIBUTION AND CONTROL SYS		
CSM	51P	51P
112 THRU 114	J	3.3
REV. 2		PAGE 3-3

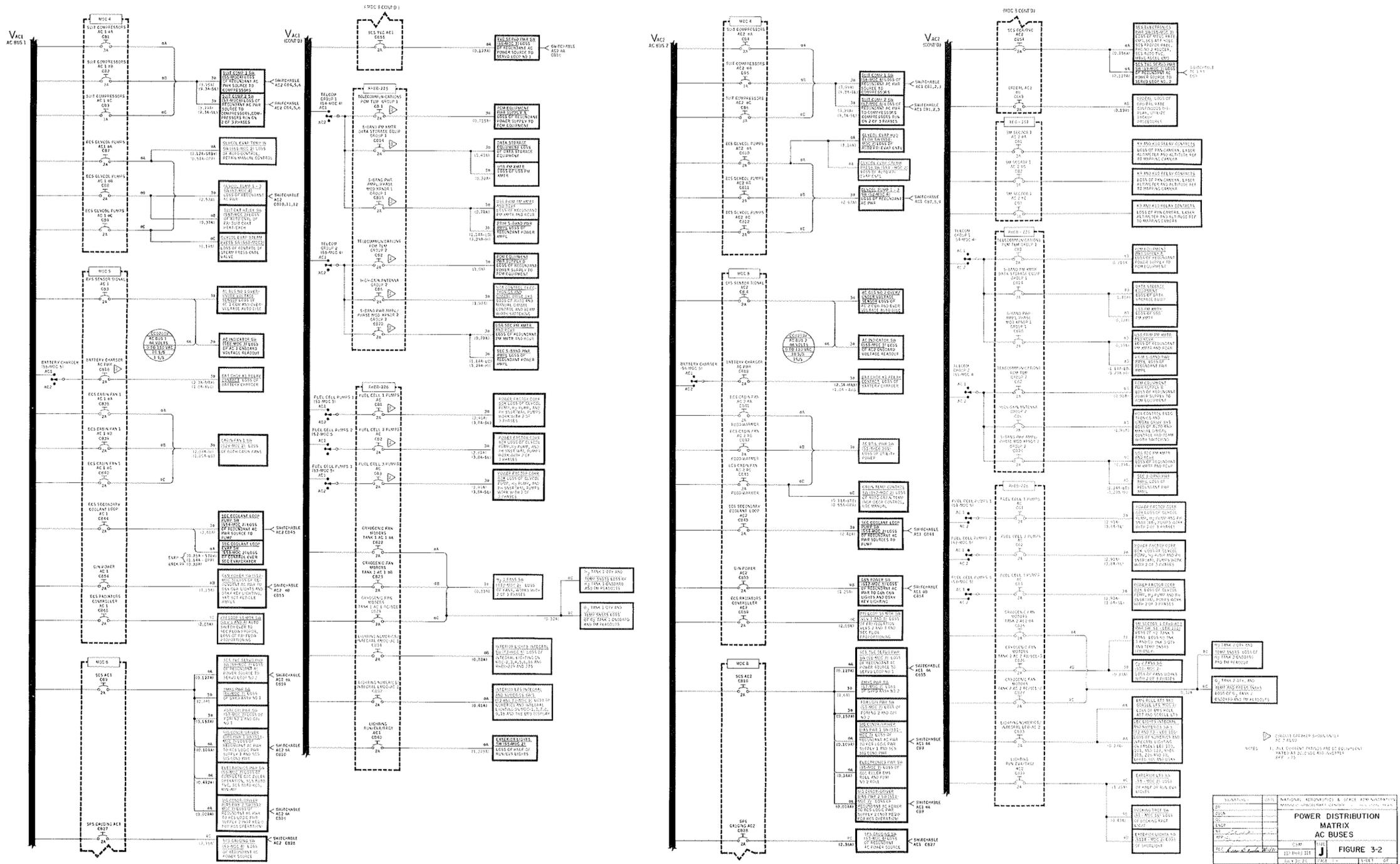


REV	BY	DATE	APPROVAL

EXPERIMENT MATRIX		15	16	17
MISSION				
VEHICLE		112	113	114
EXPERIMENT				
ALPHA RAY		✓	✓	✓
X-RAY		✓	✓	✓
PANORAMIC CAMERA		✓	✓	✓
MAPPING CAMERA		✓	✓	✓
MASS SPECT		✓	✓	✓
GAMMA RAY		✓	✓	✓
LASER ALTIMETER		✓	✓	✓
PAR. V. SPEC.		✓	✓	✓
I.R. SCANNING RADAR		✓	✓	✓
SUBSATELLITE		✓	✓	✓

- NOTES:
- △ INSTRUMENTS NOT SHOWN ON THIS DRAWING
 - ▽ SAFETY/POLE-CAMERA OUT OF TEMP LIMITS (STAY ON OR RECH) FAILURE USE CAMERA OFF OR ED
 - ◇ SAFETY/POLE-CAMERA OUT OF TEMP LIMITS OR RECH FAILURE CAMERA OFF OR NORMAL
 - ◇ DATA ACQ CAMERA CAN BE USED ON LEB 100, 100C, 101, 102, 103, 104, AND 105 (INSTR 227 INSTR 227 ONLY USE TO CAPABILITY)
 - ◇ AIR BUFP HTR USED ONLY ON MDC 16
 - ◇ REQUESTED TRNG BOOSTER CAN BE USED ON MDC 15 OR MDC 16
 - ◇ SHIMMED AREA COVERED BY CLOSEOUT PANEL

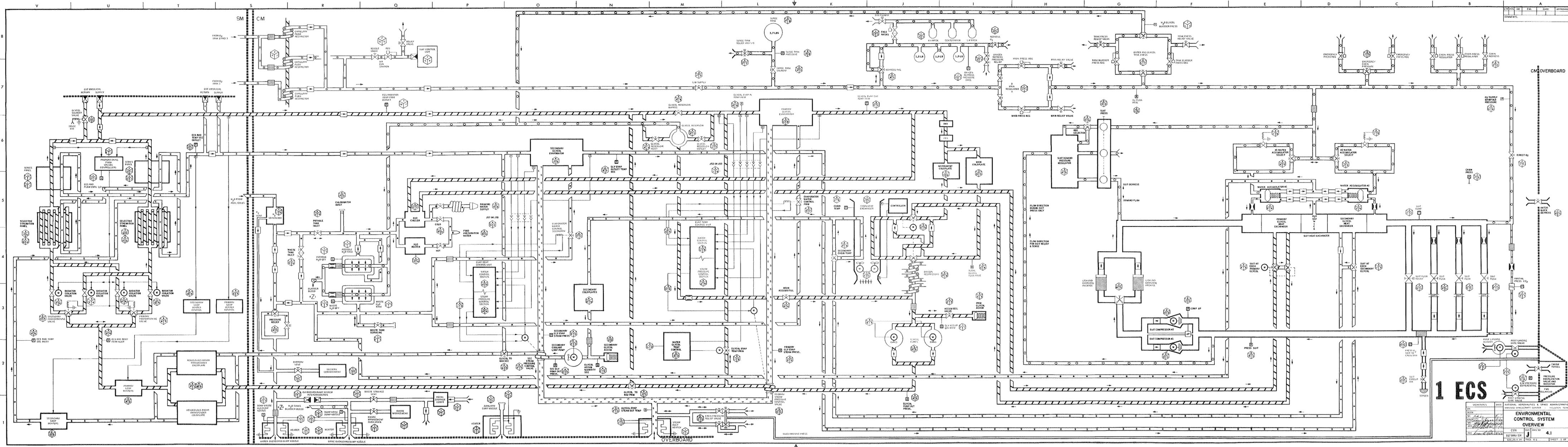
DATE	12/10/71	DATE	12/10/71
DR	W. B. ...	DR	W. B. ...
DC	...	DC	...
ENG	...	ENG	...
NS	...	NS	...
APP	...	APP	...
NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER - HOUSTON, TEXAS SCIENTIFIC EXPERIMENTS AND UTILITY POWER DISTRIBUTION CSN PAGE NO 3.4 112 THRU 114 3 OF 1			



POWER DISTRIBUTION MATRIX			
AC BUSES			
AC BUS 1	AC BUS 2	AC BUS 3	AC BUS 4
AC BUS 5	AC BUS 6	AC BUS 7	AC BUS 8
AC BUS 9	AC BUS 10	AC BUS 11	AC BUS 12
AC BUS 13	AC BUS 14	AC BUS 15	AC BUS 16
AC BUS 17	AC BUS 18	AC BUS 19	AC BUS 20
AC BUS 21	AC BUS 22	AC BUS 23	AC BUS 24
AC BUS 25	AC BUS 26	AC BUS 27	AC BUS 28
AC BUS 29	AC BUS 30	AC BUS 31	AC BUS 32
AC BUS 33	AC BUS 34	AC BUS 35	AC BUS 36
AC BUS 37	AC BUS 38	AC BUS 39	AC BUS 40
AC BUS 41	AC BUS 42	AC BUS 43	AC BUS 44
AC BUS 45	AC BUS 46	AC BUS 47	AC BUS 48
AC BUS 49	AC BUS 50	AC BUS 51	AC BUS 52
AC BUS 53	AC BUS 54	AC BUS 55	AC BUS 56
AC BUS 57	AC BUS 58	AC BUS 59	AC BUS 60
AC BUS 61	AC BUS 62	AC BUS 63	AC BUS 64
AC BUS 65	AC BUS 66	AC BUS 67	AC BUS 68
AC BUS 69	AC BUS 70	AC BUS 71	AC BUS 72
AC BUS 73	AC BUS 74	AC BUS 75	AC BUS 76
AC BUS 77	AC BUS 78	AC BUS 79	AC BUS 80
AC BUS 81	AC BUS 82	AC BUS 83	AC BUS 84
AC BUS 85	AC BUS 86	AC BUS 87	AC BUS 88
AC BUS 89	AC BUS 90	AC BUS 91	AC BUS 92
AC BUS 93	AC BUS 94	AC BUS 95	AC BUS 96
AC BUS 97	AC BUS 98	AC BUS 99	AC BUS 100

FIGURE 3-2

4 ENVIRONMENTAL
CONTROL SYS

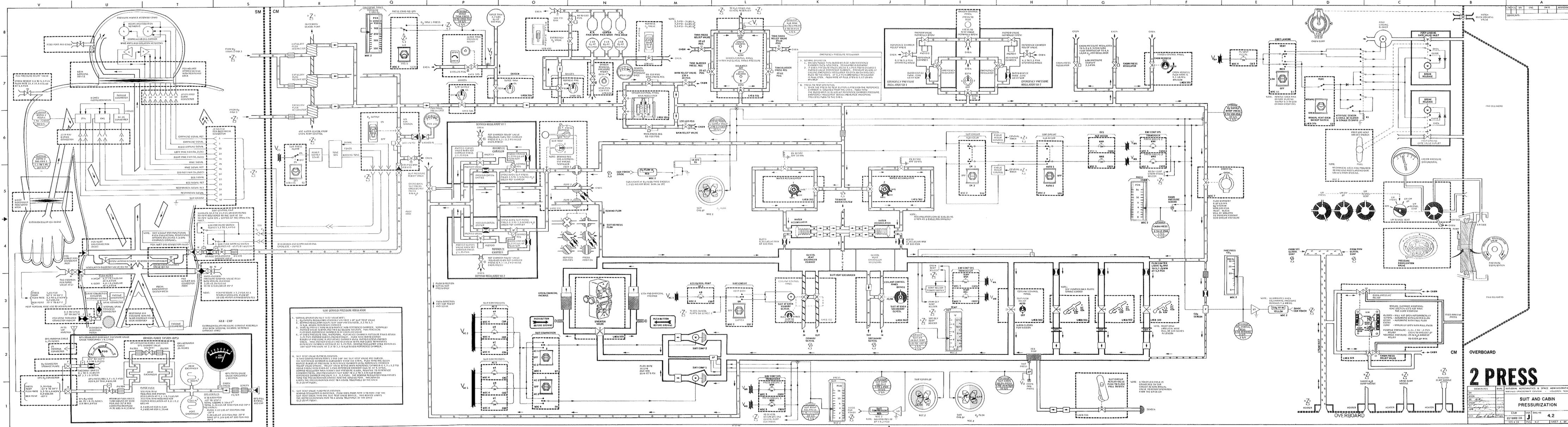


REV	DATE	APPROVAL
1		
2		
3		
4		
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6		
7		
8		

1 ECS

SIGNATURE	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DESIGN		MANHATTAN SPACECRAFT CENTER
ENGINEER		
TEST ENGINEER		
TEST TECHNICIAN		
TEST OPERATOR		
TEST SUPERVISOR		
TEST MANAGER		
TEST DIRECTOR		
TEST OFFICE		
TEST FACILITY		
TEST EQUIPMENT		
TEST PROCEDURES		
TEST RESULTS		
TEST REPORT		
TEST SUMMARY		
TEST CONCLUSIONS		
TEST RECOMMENDATIONS		
TEST NOTES		
TEST COMMENTS		
TEST OBSERVATIONS		
TEST ANOMALIES		
TEST CORRECTIVE ACTIONS		
TEST PREVENTIVE ACTIONS		
TEST FOLLOW-UP ACTIONS		
TEST CLOSURE		
TEST ARCHIVE		
TEST RETRIEVAL		
TEST DESTRUCTION		

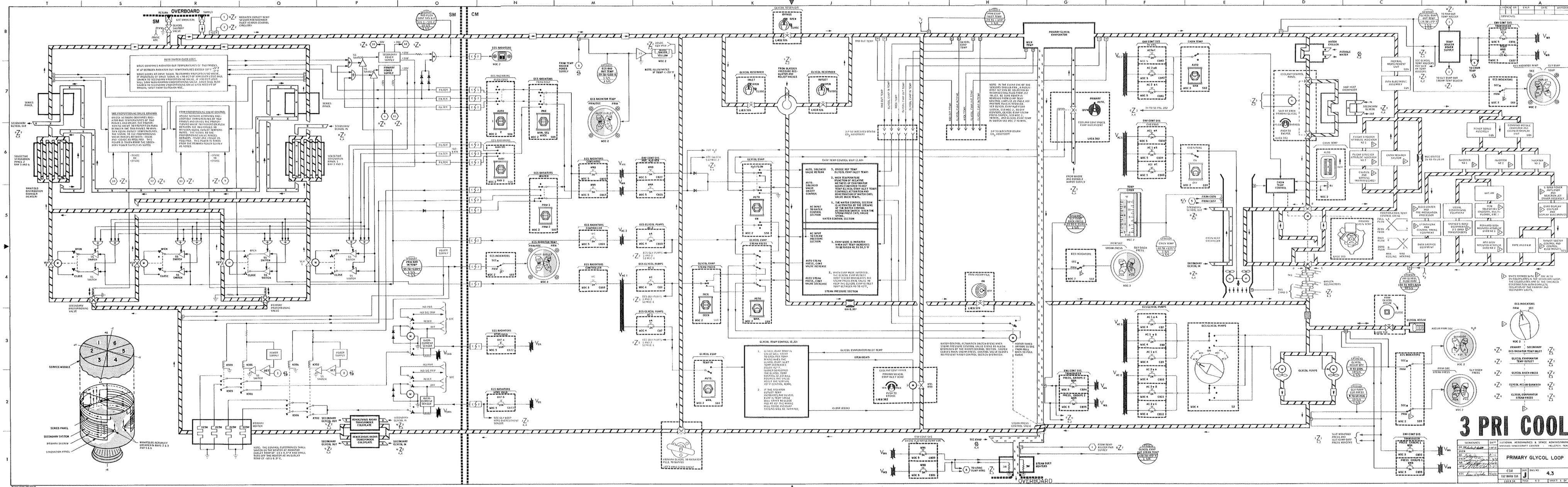
ENVIRONMENTAL CONTROL SYSTEM OVERVIEW
 4.1
 120-25 X-38 PAGE 4-1 SHEET 1 OF 3



2 PRESS

SUIT AND CABIN PRESSURIZATION

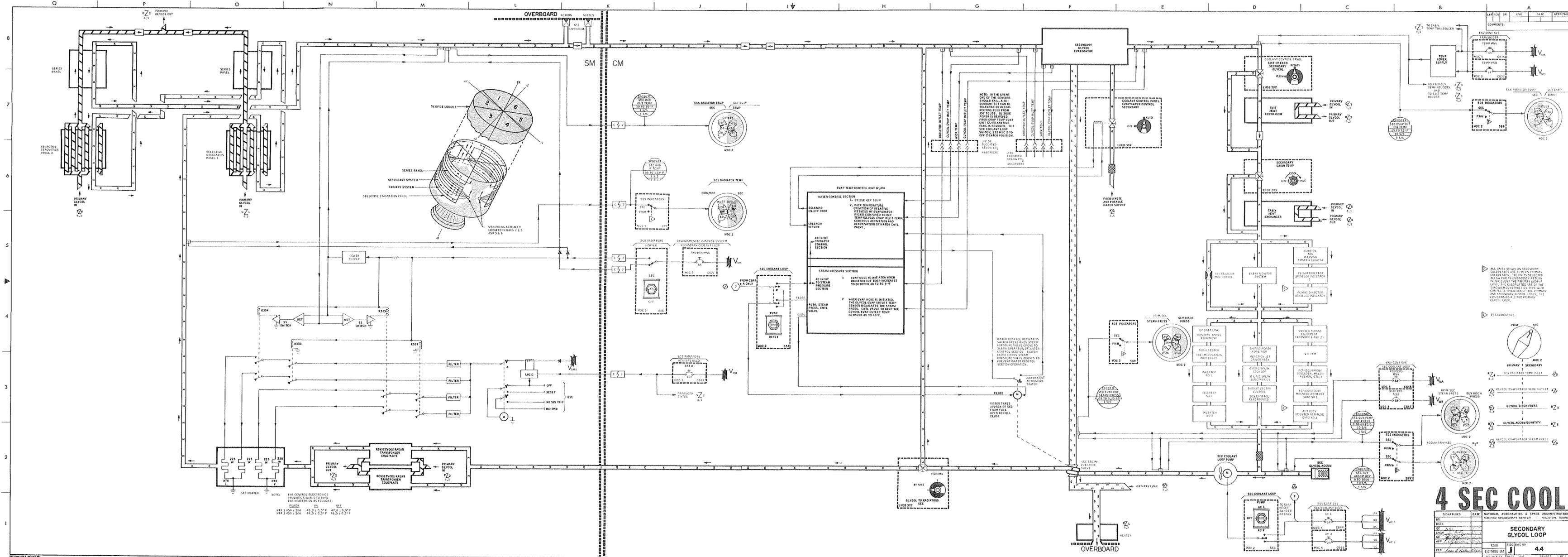
REV	DATE	DESCRIPTION
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2	12/15/61	REVISIONS TO SUIT PRESSURIZATION
3	1/10/62	REVISIONS TO CABIN PRESSURIZATION
4	2/15/62	REVISIONS TO SUIT PRESSURIZATION
5	3/15/62	REVISIONS TO CABIN PRESSURIZATION
6	4/15/62	REVISIONS TO SUIT PRESSURIZATION
7	5/15/62	REVISIONS TO CABIN PRESSURIZATION
8	6/15/62	REVISIONS TO SUIT PRESSURIZATION
9	7/15/62	REVISIONS TO CABIN PRESSURIZATION
10	8/15/62	REVISIONS TO SUIT PRESSURIZATION
11	9/15/62	REVISIONS TO CABIN PRESSURIZATION
12	10/15/62	REVISIONS TO SUIT PRESSURIZATION
13	11/15/62	REVISIONS TO CABIN PRESSURIZATION
14	12/15/62	REVISIONS TO SUIT PRESSURIZATION
15	1/15/63	REVISIONS TO CABIN PRESSURIZATION
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23	9/15/63	REVISIONS TO CABIN PRESSURIZATION
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63	1/15/67	REVISIONS TO CABIN PRESSURIZATION
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65	3/15/67	REVISIONS TO CABIN PRESSURIZATION
66	4/15/67	REVISIONS TO SUIT PRESSURIZATION
67	5/15/67	REVISIONS TO CABIN PRESSURIZATION
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74	12/15/67	REVISIONS TO SUIT PRESSURIZATION
75	1/15/68	REVISIONS TO CABIN PRESSURIZATION
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80	6/15/68	REVISIONS TO SUIT PRESSURIZATION
81	7/15/68	REVISIONS TO CABIN PRESSURIZATION
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83	9/15/68	REVISIONS TO CABIN PRESSURIZATION
84	10/15/68	REVISIONS TO SUIT PRESSURIZATION
85	11/15/68	REVISIONS TO CABIN PRESSURIZATION
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88	2/15/69	REVISIONS TO SUIT PRESSURIZATION
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91	5/15/69	REVISIONS TO CABIN PRESSURIZATION
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98	12/15/69	REVISIONS TO SUIT PRESSURIZATION
99	1/15/70	REVISIONS TO CABIN PRESSURIZATION
100	2/15/70	REVISIONS TO SUIT PRESSURIZATION



3 PRI COOL

REVISIONS	DATE	INITIALS	DESCRIPTION
1	11/27/54	J	ISSUED FOR CONSTRUCTION
2	12/1/54	J	REVISED TO SHOW CHANGES
3	12/1/54	J	REVISED TO SHOW CHANGES
4	12/1/54	J	REVISED TO SHOW CHANGES
5	12/1/54	J	REVISED TO SHOW CHANGES
6	12/1/54	J	REVISED TO SHOW CHANGES
7	12/1/54	J	REVISED TO SHOW CHANGES
8	12/1/54	J	REVISED TO SHOW CHANGES

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
 MANHATTAN SPACECRAFT CENTER - HOUSTON, TEXAS
 DRAWING NO. 112 1100 13A
 PAGE 4-3
 SHEET 1 OF 3



ALL UNITS SHOWN ON SECONDARY COOLING ARE ALIASES TO PRIMARY COOLING. THE UNITS SELECTED ALSO FOR AN ALIASES RETURN IN THE EVENT THE PRIMARY LOOP IS LOST. THE ALIASES ARE OF THE JANDANIN COOLING PIPE WITH SUPPLY FROM THE HEAD OF THE PRIMARY COOLING LOOP. SEE ECI DRAWING 4.3 FOR PRIMARY COOLING LOOP.

ECS INDICATORS

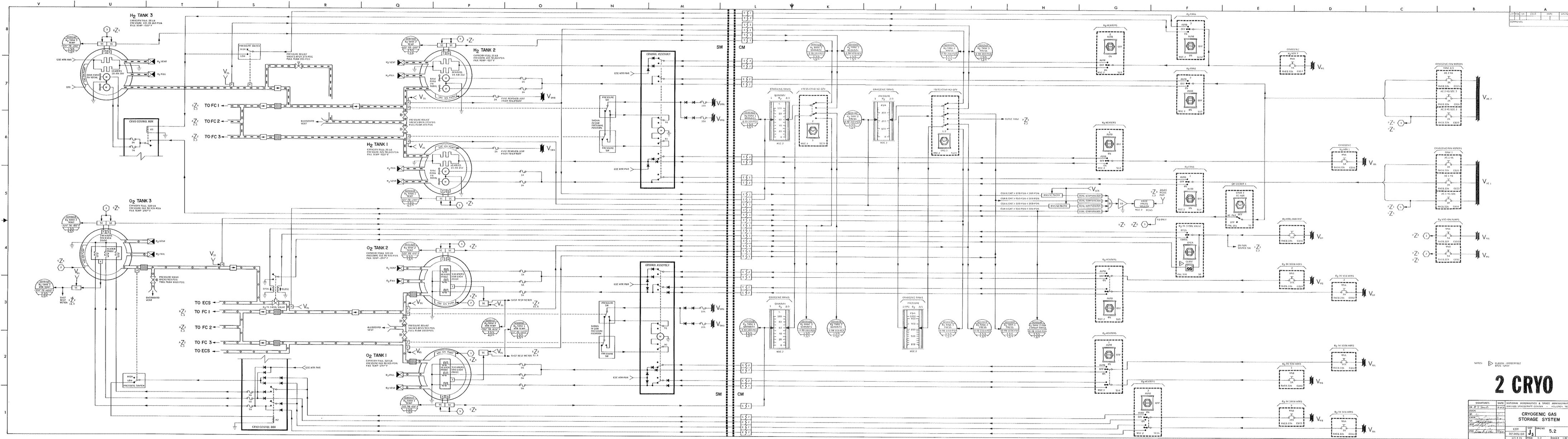


4 SEC COOL

SIGNALURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DESIGN		MANHATTAN BRANCH/NAVY CENTER - ACQUISITION TEAM
ENGINEER		
TESTER		
APPROVER		
DATE		
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CHK		
APP		
FILE		

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5 FUEL CELL/
CRYOGENICS
SYSTEM



2 CRYO

CRYOGENIC GAS STORAGE SYSTEM

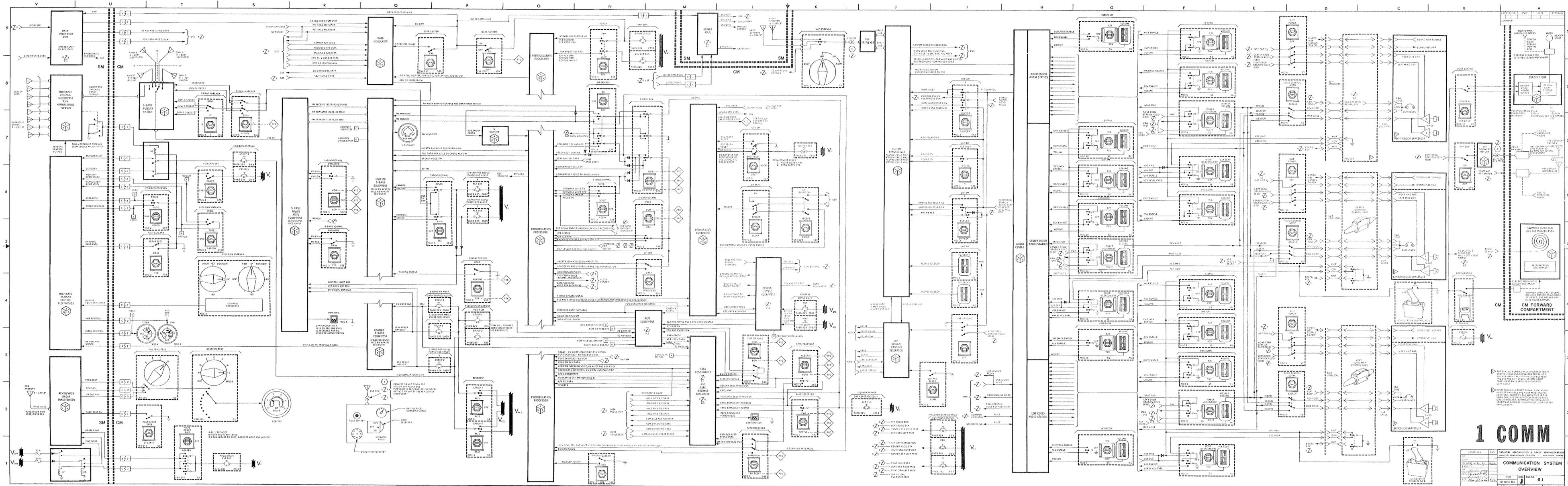
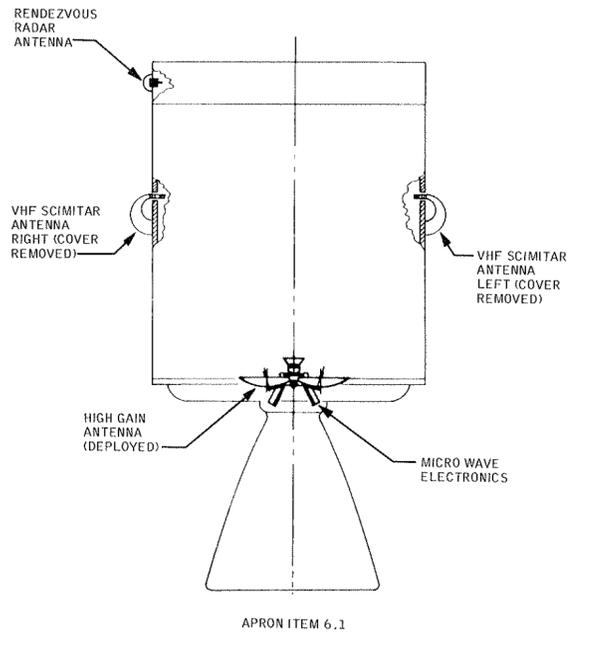
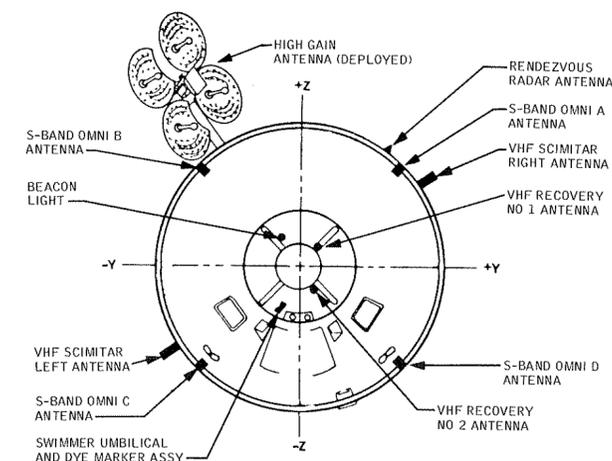
DATE: 2/7/70
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 CHECKED BY: J.S.
 APPROVED BY: J.S.

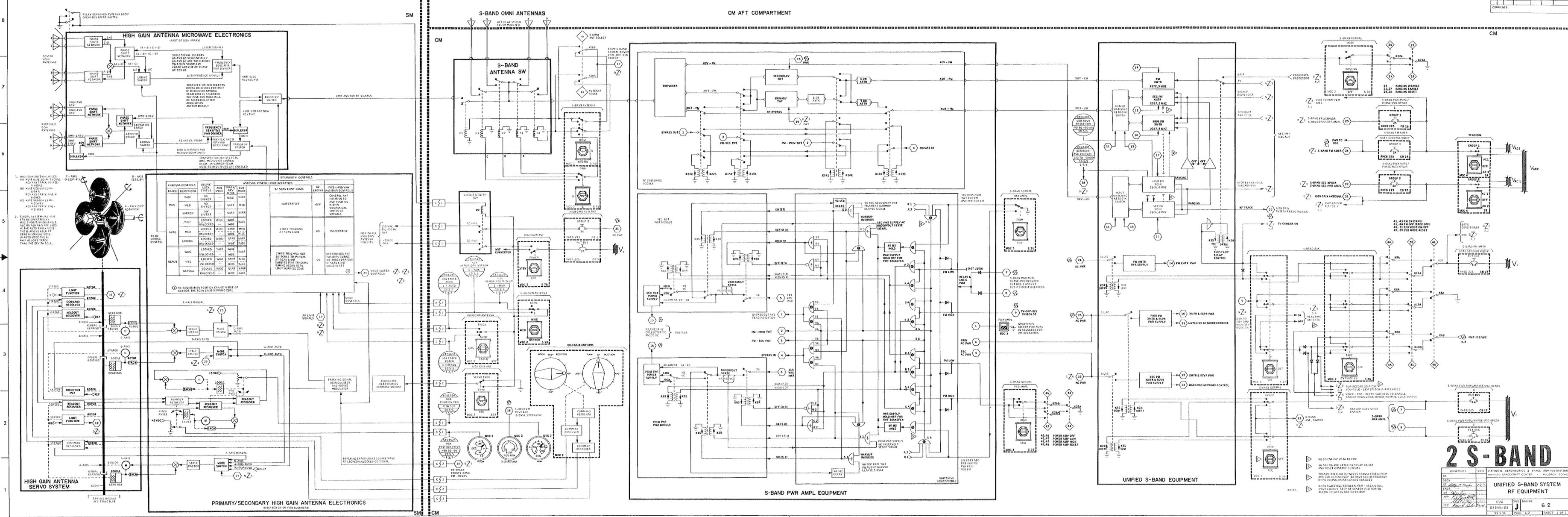
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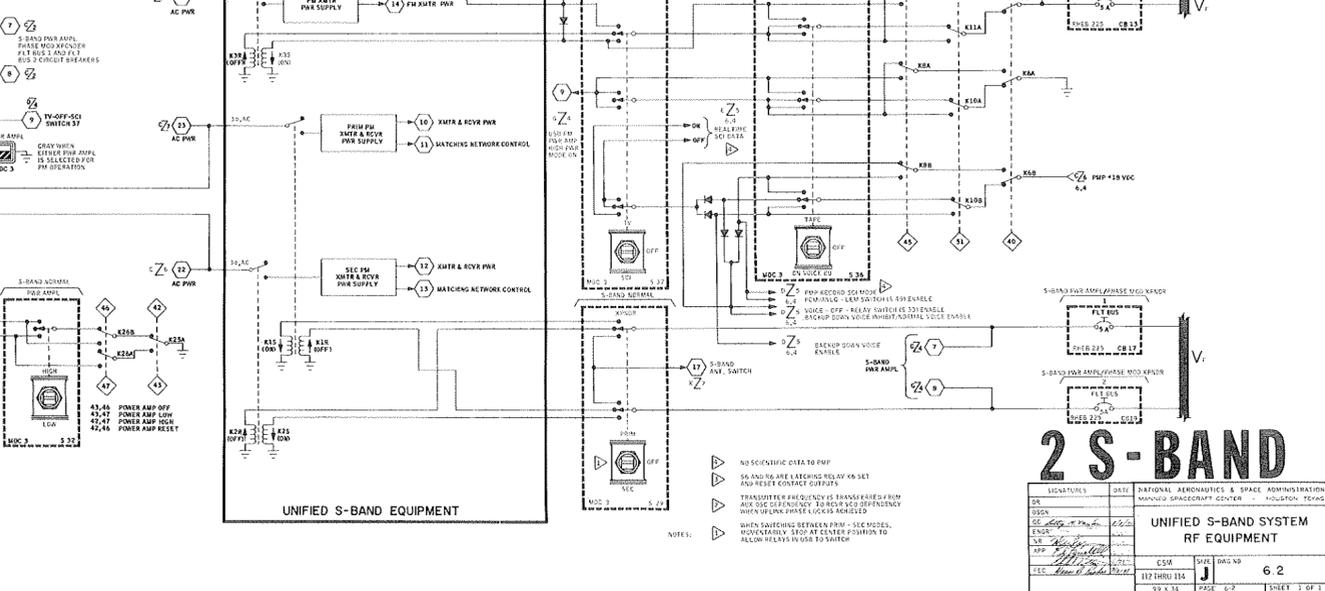
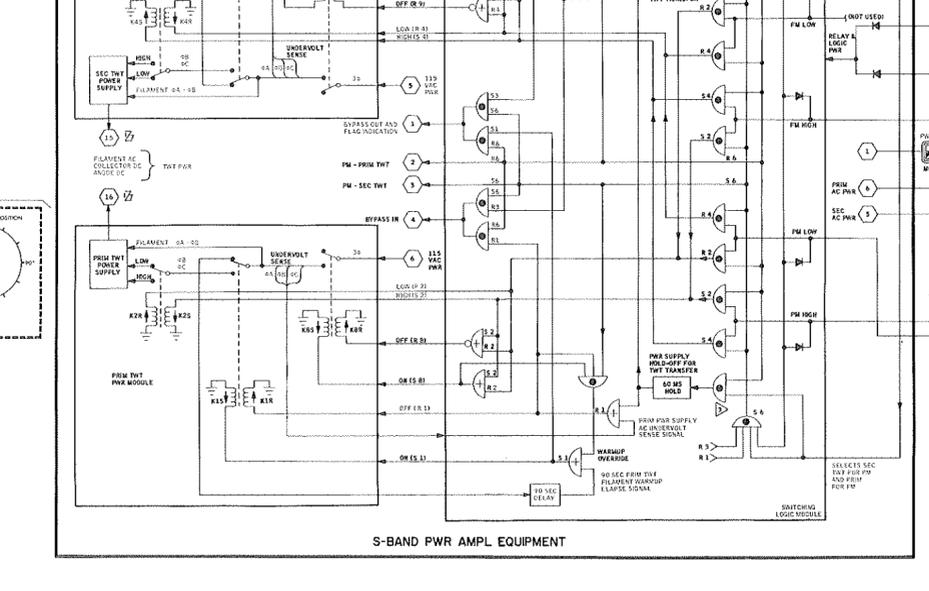
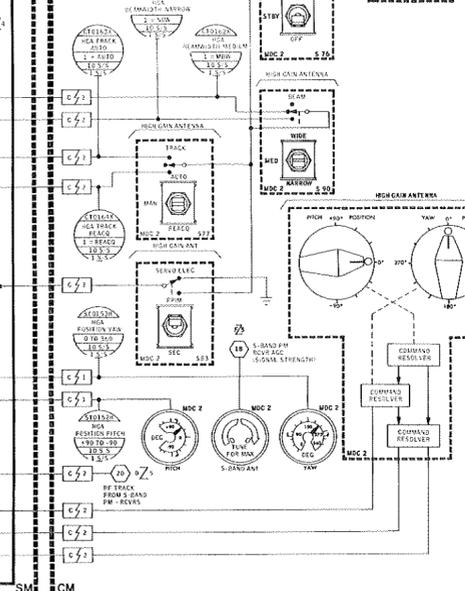
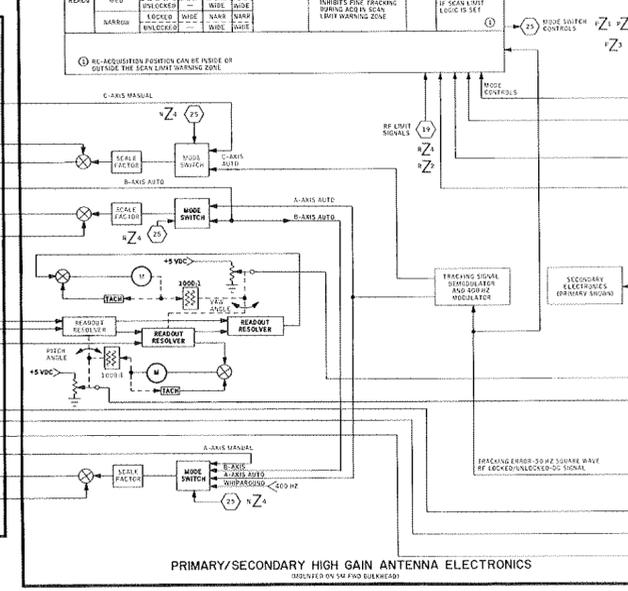
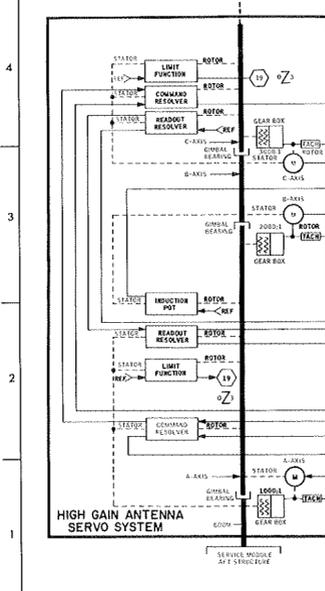
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 SHEET 1 OF 1

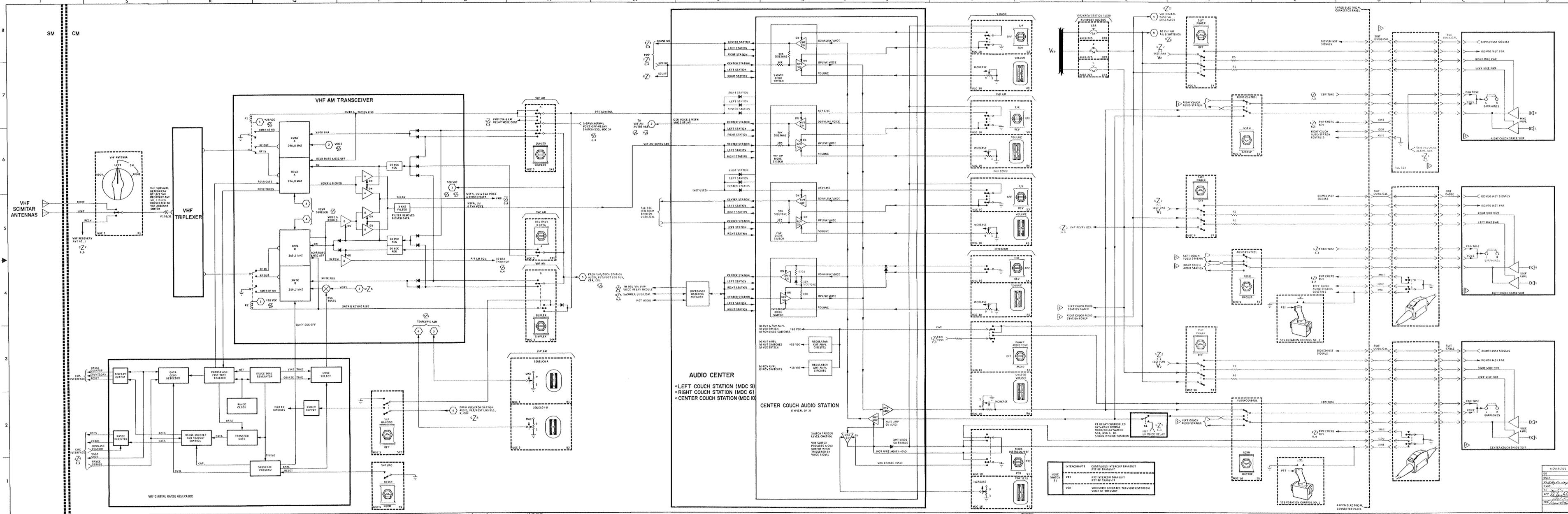
6 COMMUNI-
CATIONS
SYSTEM





ANTENNA CONTROLS				ANTENNA SYSTEM LOGIC OPERATION				BEAMFORMER CONTROLS				
TRACK	BEAMFORMER	LOCK	MODE	RF SCAN LIMIT LOGIC	RF LOCKING	FINISH AND WIN POSITION	CONTROL AND POSITION TO ANTENNA WITHIN MECHANICAL LIMITS OF COMBES	RF TRACKING	AT SCAN LIMIT	INOPERATIVE	OFF	INOPERATIVE
WIDE	NO EFFECT	WIDE	WIDE	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	
NARROW	NO EFFECT	NARROW	NARROW	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	
AUTO	NO EFFECT	WIDE	WIDE	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	
READA	NO EFFECT	WIDE	WIDE	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	NO EFFECT	





FOR VHF AM, AID UNIDIRECTIONAL IS DISCONNECTED FROM LEFT AND RIGHT COUCH STATIONS. THE VHF AMBIAL CABLE IS CONNECTED BETWEEN THE LEFT AND RIGHT COUCH STATIONS. USUAL COUCH CONFIGURATION IS SAME AS SHOWN FOR LEFT COUCH.

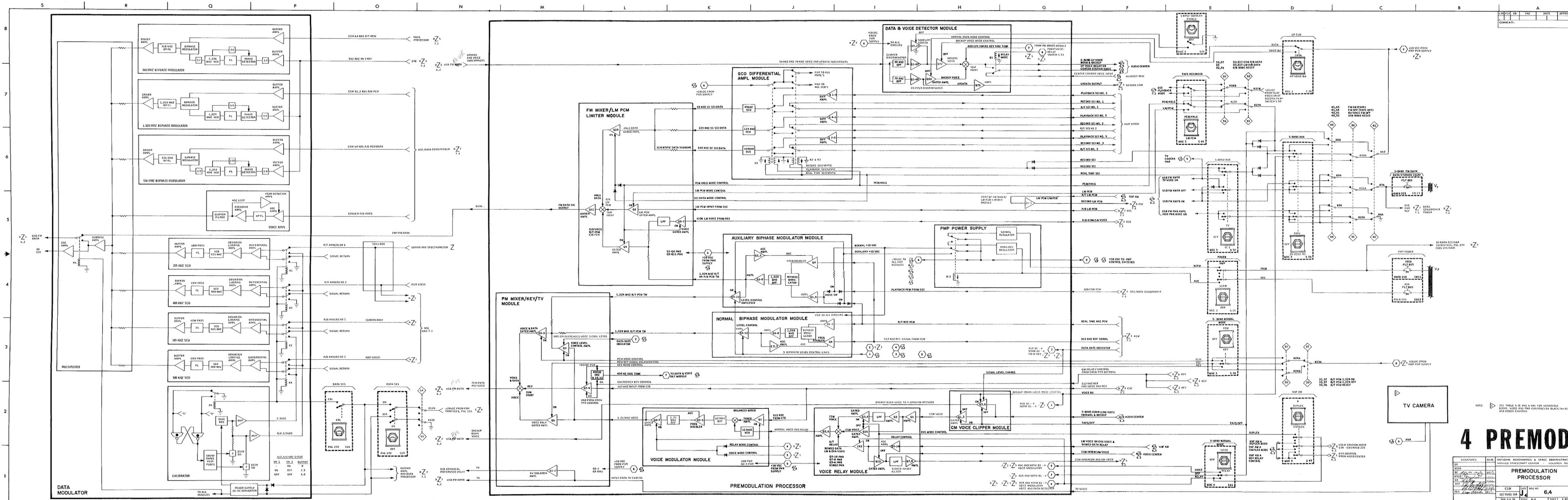
COUCH CENTER HEADSET SHOWN, DOWNLIGHT HEADSET MAY ONLY BE USED WITH THE VHF AMBIAL CABLE. PLUG IN THE COUCH WITH THE SHOWN PLUG INTO THE VHF AMBIAL CABLE. USUAL COUCH STATION ASSOCIATION IS LEFT-RIGHT, CENTER-LEFT COUCH AUDIO STATIONS.

3 VHF/ AUDIO

DATE	REVISION	DESCRIPTION
11/23/55	1	INITIAL DESIGN
12/15/55	2	REVISED FOR MANUFACTURING
1/10/56	3	REVISED FOR MANUFACTURING
2/15/56	4	REVISED FOR MANUFACTURING
3/15/56	5	REVISED FOR MANUFACTURING
4/15/56	6	REVISED FOR MANUFACTURING
5/15/56	7	REVISED FOR MANUFACTURING
6/15/56	8	REVISED FOR MANUFACTURING
7/15/56	9	REVISED FOR MANUFACTURING
8/15/56	10	REVISED FOR MANUFACTURING
9/15/56	11	REVISED FOR MANUFACTURING
10/15/56	12	REVISED FOR MANUFACTURING
11/15/56	13	REVISED FOR MANUFACTURING
12/15/56	14	REVISED FOR MANUFACTURING
1/15/57	15	REVISED FOR MANUFACTURING
2/15/57	16	REVISED FOR MANUFACTURING
3/15/57	17	REVISED FOR MANUFACTURING
4/15/57	18	REVISED FOR MANUFACTURING
5/15/57	19	REVISED FOR MANUFACTURING
6/15/57	20	REVISED FOR MANUFACTURING
7/15/57	21	REVISED FOR MANUFACTURING
8/15/57	22	REVISED FOR MANUFACTURING
9/15/57	23	REVISED FOR MANUFACTURING
10/15/57	24	REVISED FOR MANUFACTURING
11/15/57	25	REVISED FOR MANUFACTURING
12/15/57	26	REVISED FOR MANUFACTURING
1/15/58	27	REVISED FOR MANUFACTURING
2/15/58	28	REVISED FOR MANUFACTURING
3/15/58	29	REVISED FOR MANUFACTURING
4/15/58	30	REVISED FOR MANUFACTURING
5/15/58	31	REVISED FOR MANUFACTURING
6/15/58	32	REVISED FOR MANUFACTURING
7/15/58	33	REVISED FOR MANUFACTURING
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9/15/58	35	REVISED FOR MANUFACTURING
10/15/58	36	REVISED FOR MANUFACTURING
11/15/58	37	REVISED FOR MANUFACTURING
12/15/58	38	REVISED FOR MANUFACTURING
1/15/59	39	REVISED FOR MANUFACTURING
2/15/59	40	REVISED FOR MANUFACTURING
3/15/59	41	REVISED FOR MANUFACTURING
4/15/59	42	REVISED FOR MANUFACTURING
5/15/59	43	REVISED FOR MANUFACTURING
6/15/59	44	REVISED FOR MANUFACTURING
7/15/59	45	REVISED FOR MANUFACTURING
8/15/59	46	REVISED FOR MANUFACTURING
9/15/59	47	REVISED FOR MANUFACTURING
10/15/59	48	REVISED FOR MANUFACTURING
11/15/59	49	REVISED FOR MANUFACTURING
12/15/59	50	REVISED FOR MANUFACTURING

**VHF AM
TRANSCIEVERS AND AUDIO
EQUIPMENT**

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 112 X 35 J 6.3



4 PREMOD

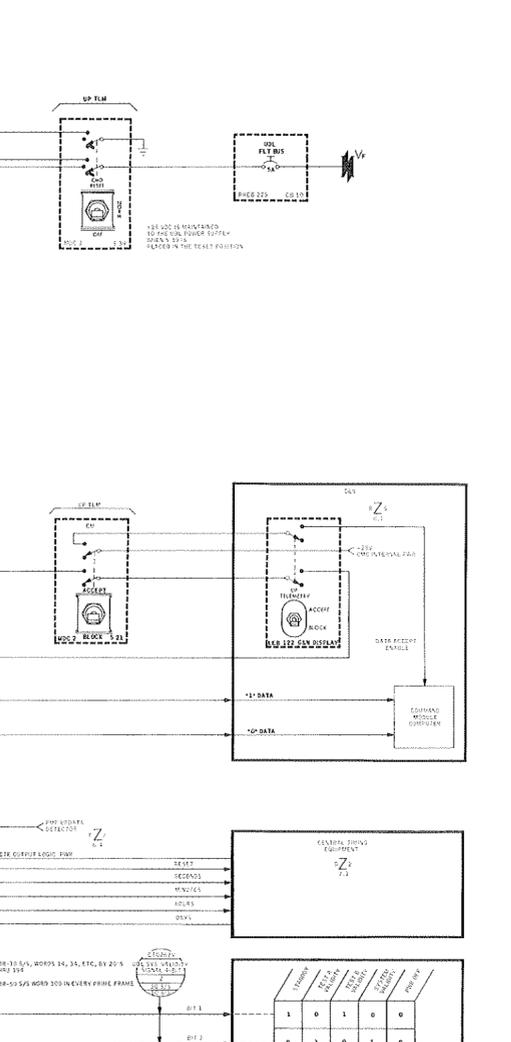
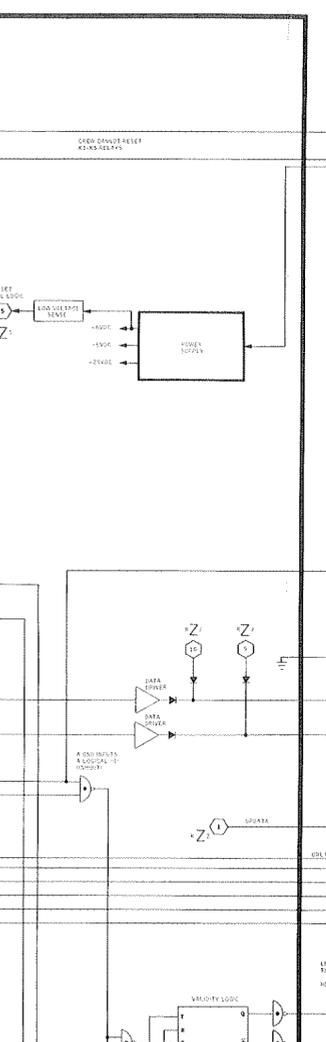
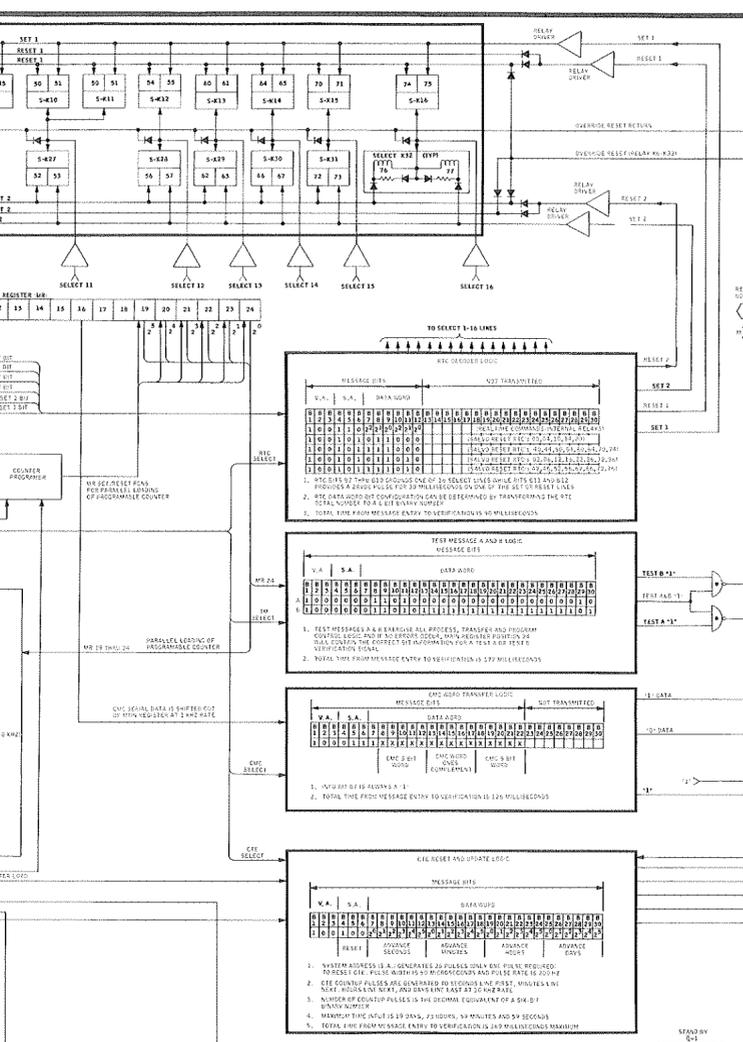
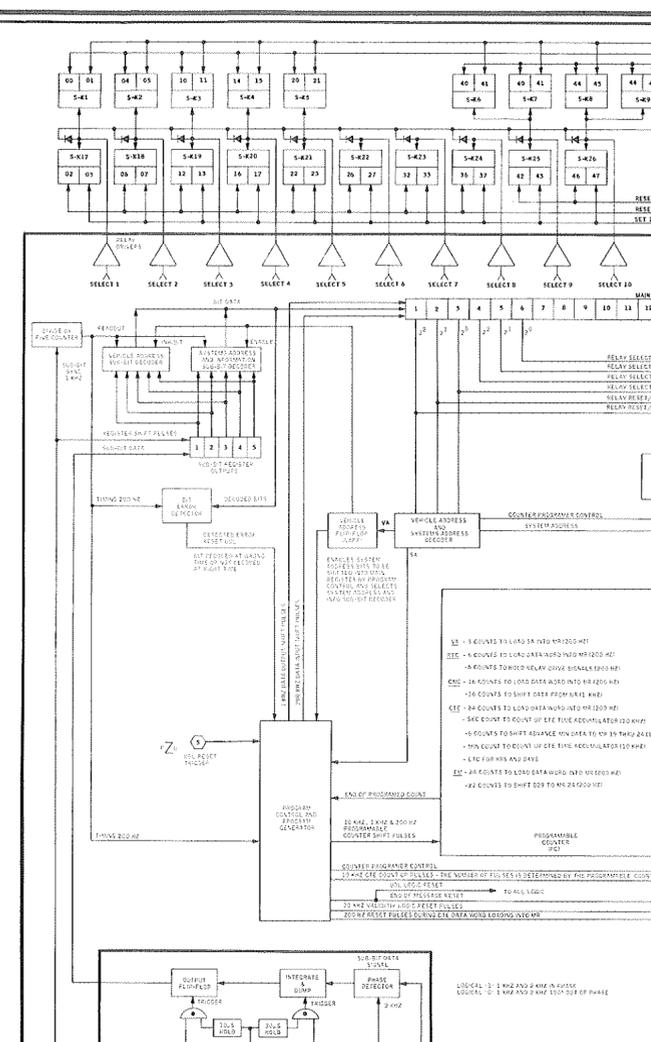
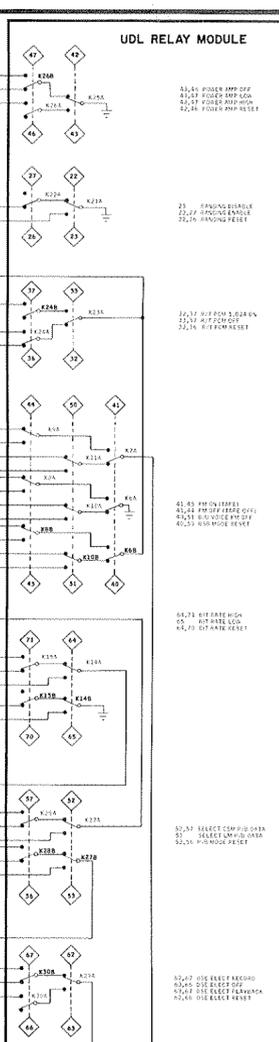
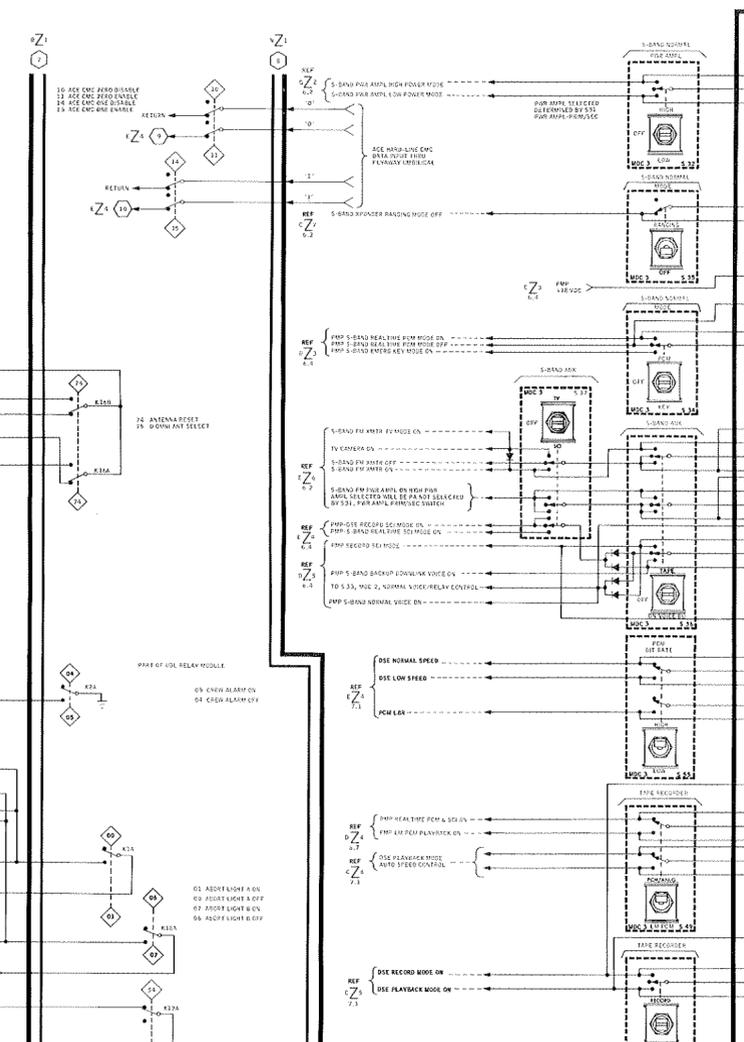
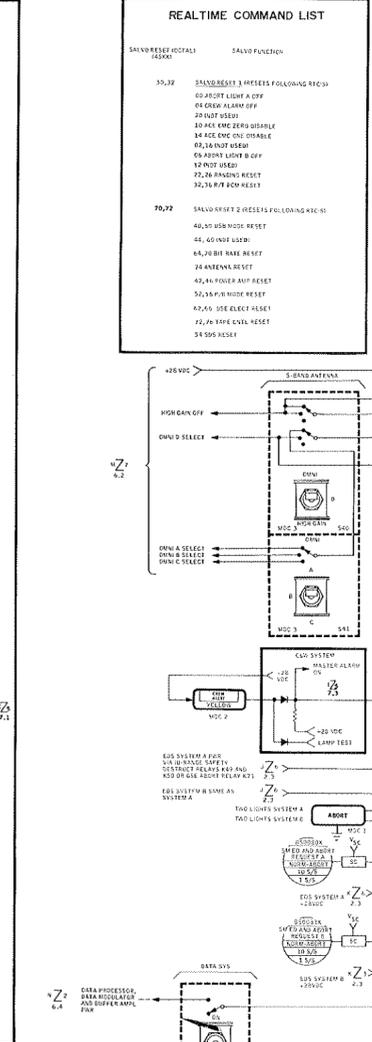
DR	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DESIGN		MANAGED ENGINEERING CENTER
REV		INDUSTRY TEAM
CHK		
APP		
REC		

CSM	512	512	6.4
112	THRU	114	
104	S	34	PAGE 2-4
			SHEET 1 OF 1

NOTE: SEE TABLE 6-8 AND 6-9 FOR AUTOMATIC LIGHT, VIDEO AND PWR CONTROLS ON BLACK, WHITE AND GREEN CHANNELS.

REALTIME COMMAND LIST

COMMAND FUNCTION	RELAY ADDRESS
00	00
01	01
02	02
03	03
04	04
05	05
06	06
07	07
08	08
09	09
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22,24	22,24
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24	24
25	25
26	26
27	27
28	28
29	29
30	30
31	31
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33	33
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35	35
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62	62
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65	65
66	66
67	67
68	68
69	69
70	70
71	71
72	72
73	73
74	74
75	75



5 UPDATA

UPDATA LINK EQUIPMENT

DATE: 10/68

REV: 10/68

BY: [Signature]

CHKD: [Signature]

APP: [Signature]

6.5

TABLE 6-I.- UNIFIED S-BAND TRANSPONDER AND FM TRANSMITTER

ITEM	FUNCTION and/or PARAMETERS
1. Weight	32 pounds
2. Cooling	ECS Primary and/or Secondary Glycol Loops
3. Electrical Power	
a. Dc Voltage	28 ± 4 Vdc (For control only)
b. Ac Voltage	115 Vac, 400 Hz, 3 phase
c. Power	
(1) PM Transponder	1.0 watts dc
(2) FM Transmitter	16.5 watts dc (Prim or Sec)
4. Activation Time	1.5 watts dc
5. PM Receiver (Prim/Sec)	6.7 watts ac
a. Type	1 minute maximum - PM Receiver, PM Transmitter, and FM Transmitter
b. Frequency (Center)	Double Conversion Superheterodyne, Phase Lock Loop
c. Phase Lock Tracking Loop	2106.40625 MHz
(1) In-Lock Range	±90 kHz for RF INPUT greater than -114 dbm and STATIC PHASE ERROR less than 15 degrees peak.
(2) In-Lock Rate	Linear rate of 35 kHz/second or less to ±90 kHz for RF INPUT greater than -114 dbm.
(3) Acquisition Probability	90 percent probability of acquisition on first sweep at above range and rates
(4) Predetection Noise Bandwidth	16 kHz
(5) Loop Noise Bandwidth (Optimizing Point)	800 Hz (0 db S/N @ -134.5 dbm)
(6) Threshold	-125 dbm, defined as the level of unmodulated CW signal below which lock cannot be maintained for a period of at least one minute with 90 percent probability.

TABLE 6-I.- UNIFIED S-BAND TRANSPONDER AND FM TRANSMITTER - Continued

ITEM	FUNCTION and/or PARAMETERS
(7) Phase Error	24 degrees maximum (Offset + Rate Errors)
d. Dynamic Range	-51 dbm to -124 dbm (Normal). -35 dbm to -51 dbm (Must maintain lock and must not damage Receiver).
e. Automatic Gain Control (AGC) (1) Attack Time (2) Decay	TBD 3 seconds (-51 dbm to -127 dbm)
f. Ranging Channel (1) Modulation (2) Bandwidth (3) PRN Bit Rate (4) PRN Clock (5) PRN Code Length	PM on Carrier 10 kHz to 1.5 MHz (3 db) 992.834 kbs 992.834 kbs (496.417 kHz Square wave) 5,456,682 bits (lunar Code)
g. High-Gain Antenna Track Channel (1) Pointing Error Signal (2) Earth Presence Signal	50 Hz amplitude modulated signal derived from the coherent AGC detector. DC signal superimpose on pointing error signal when RCVR is locked to incoming RF signal.
h. Outputs	(See Table 6-IV Modes)
6. PM Transmitter (Prim/Sec)	
a. Type	PM, S-band
b. Frequency	2287.5 MHz (Aux OSC Mode) or 240/221 times RCVR frequency when RCVR is phase locked to uplink RF signal. (See Auto OSC Control).
c. RF Output Power	301 to 374 milliwatts (Test Data)
d. Auto OSC Control	XMTR frequency is derived from XMTR Aux OSC prior to acquisition and RCVR VCO after acquisition. Switching is controlled using RCVR AGC signal.

TABLE 6-I.- UNIFIED S-BAND TRANSPONDER AND FM TRANSMITTER - Concluded

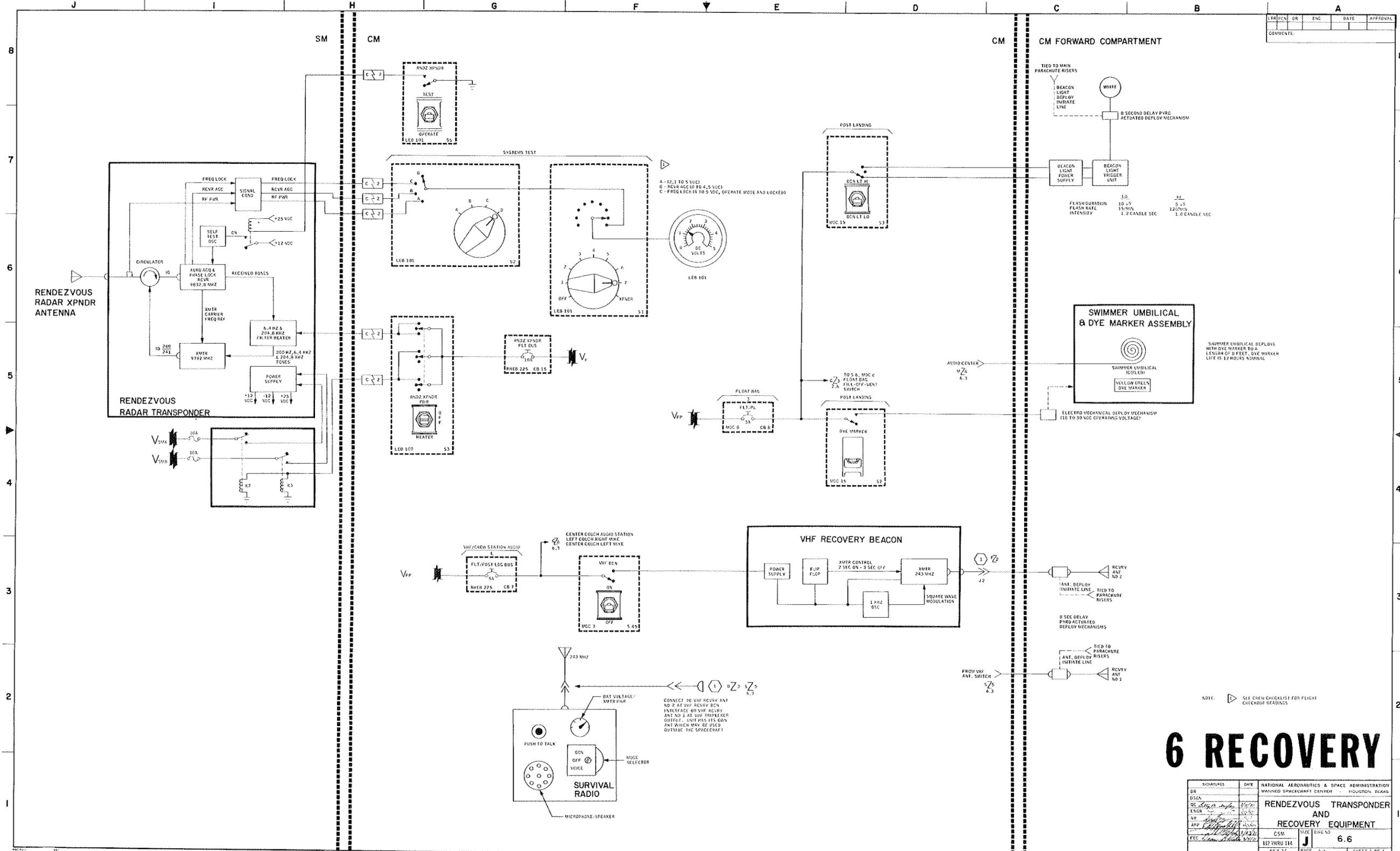
ITEM	FUNCTION and/or PARAMETERS
(1) Aux OSC to RCVR VCO Switching Time	Less than 0.25 seconds
(2) RCVR VCO to Aux OSC Switching Time	Less than 6 seconds (3 Seconds Nominal at -51 dbm)
(3) Switching Threshold	-127 dbm
e. Inputs	(See Table 6-III Modes)
7. FM Transmitter	
a. Type	FM, S-band
b. Frequency	2272.5 MHz \pm 455 kHz
c. Frequency Deviation	\pm 3 MHz maximum
d. RF Output	111 to 138 milliwatts (Test Data)
e. Inputs	(See Table 6-III Modes)
(1) TV (dc coupled)	f_o at +1.3 Vdc Input $\Delta f/V = 1$ MHz/V Response dc to 500 kHz
(2) Wideband (ac coupled)	$\Delta f/V =$ MHz/V Response 200 Hz to 300 kHz
8. Special Operating Instructions	When switching between primary and secondary transponders, momentarily stop at the OFF (Center) position to allow control relays to operate.

TABLE 6-II.- S-BAND POWER AMPLIFIER

ITEM	FUNCTION and/or PARAMETERS						
1. Weight	32 pounds maximum						
2. Cooling	ECS Primary and/or Secondary Glycol Loop						
3. Electrical Power							
a. Input Voltage	28 ± 4 Vdc control 115 Vac, 400 Hz, 3Ø						
b. Input Power							
(1) Control Power	5 watts maximum steady state and 350 watts during switching for 0.5 seconds maximum.						
(2) Ac Power	<table border="0"> <tr> <td>High Pwr Ampl Mode</td> <td>81 watts</td> </tr> <tr> <td>Low Pwr Ampl Mode</td> <td>32 watts</td> </tr> <tr> <td>Off/Bypass</td> <td>0 watts</td> </tr> </table>	High Pwr Ampl Mode	81 watts	Low Pwr Ampl Mode	32 watts	Off/Bypass	0 watts
High Pwr Ampl Mode	81 watts						
Low Pwr Ampl Mode	32 watts						
Off/Bypass	0 watts						
	Sum ac power values to obtain simultaneous power level operation of Prim and Sec power amplifiers.						
4. Power Amplification Activation Time	No RF amplification until 90 second nominal filament warm-up period complete.						
	RF transfer (PM or FM) from one power amplifier to the other, with a 60 millisecond RF amplification dropout, is possible without an additional 90 second delay (filament warm-up) if the desired power amplifier is operating at the time of transfer.						
5. RF Output							
a. PM Output - Prim or Sec Power Amplifier	<table border="0"> <tr> <td>High Pwr Mode:</td> <td>11.2 watts min</td> </tr> <tr> <td>Low Pwr Mode:</td> <td>2.8 watts min</td> </tr> <tr> <td>Bypass Mode:</td> <td>Less than 2.5 db below input</td> </tr> </table>	High Pwr Mode:	11.2 watts min	Low Pwr Mode:	2.8 watts min	Bypass Mode:	Less than 2.5 db below input
High Pwr Mode:	11.2 watts min						
Low Pwr Mode:	2.8 watts min						
Bypass Mode:	Less than 2.5 db below input						
b. FM Output - Prim or Sec Power Amplifier	High Pwr Mode: 11.2 watts min						

TABLE 6-II.- S-BAND POWER AMPLIFIER - Concluded

ITEM	FUNCTION and/or PARAMETERS
6. RF Input a. PM b. FM	275 to 400 milliwatts 100 to 145 milliwatts (For rated output)
7. Under Voltage Protection	Under-voltage protection circuit will remove ac pwr from power amplifier TWT if any phase of the ac input voltage falls below 95 Vac for 15 milliseconds or more. If this condition exists for 1 second or more, a 90 second filament warm-up delay will occur when ac voltage is restored.
8. Special Operating Instructions	Dc power should be applied before ac power and removed after ac power removal to prevent possible damage.



6 RECOVERY

REV	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DR		MANHATTAN SPACECRAFT CENTER HOUSTON TEXAS
DC		
ENGR		
DR		
APP		
REC		
RENDZVOUS TRANSPONDER AND RECOVERY EQUIPMENT		
CSM	SIZE	GRC NO
112 THRU 114	J	6.6
4-13-72	PAGE	6-6
		SHEET 1 OF 1

TABLE 6-III.- S-BAND DOWNLINK MODES AND MODULATION PROCESS

FM DOWNLINK MODES AVAILABLE	MODE NUMBER	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	0
		Channels Included	Carrier Voice (a)	Carrier Voice (a)	Carrier Voice (a)	Carrier Voice (a)	Carrier	Carrier	Carrier	Carrier	Carrier Voice	Carrier	Carrier Backup Voice (f)	Carrier Voice	Carrier Voice	Carrier	Carrier Backup Voice (g)	Carrier	Carrier Backup Voice	No Carrier
Modulation Schemes; Subcarrier Character- istics		PRN : FM directly on carrier (2287.5 MHz)	PRN : FM directly on carrier (2287.5 MHz)	PRN : FM/FM; 1.25-MHz subcarrier deviated ±7.5 kHz peak (+9 kHz peak for voice and biomed) (b)	TM : PCM/PSK/FM; 1.024 MHz subcarrier bi-phase modulated ±90°	Key : AM/FM; 512 kHz, 100 percent AM												
Peak Carrier Deviation- Radians (Δθ)		PRN : (c)	Normal Voice (a) : 0.7 for Modes 1, 2 1.2 for Modes 3, 4, 11, 12	Backup Voice : 0.7 for Modes 8, 14 1.2 for Modes 10, 16	TM : 1.2 for Modes 1, 2, 16 (51.2-kbps) and Mode 8 (1.6-kbps) 0.7 for Modes 3, 4 (1.6-kbps) 1.6 for Modes 5, 9 (1.6-kbps) and Modes 13, 15 (51.2-kbps)	Key : 1.0												
Channels Included		1:1 Playback of Recorded Voice, Re- corded CSM 51.2-kbps TM and Scien- tific Data (d)	32:1 Playback of Recorded Voice, Re- corded CSM 1.6-kbps TM and Scien- tific Data (d)	32:1 Playback of (CSM - Re- corded) LM 1.6-kbps TM	TV	Real-time Scientific (d)	Real-time 51.2-kbps TM (e)	Real-time 1.6-kbps TM (e)	1:1/32:1 Play- back of Scien- tific Data and Real-time 51.2-kbps TM	1:1/32:1 Play- back of Scien- tific Data and Real-time 1.6-kbps TM	8:1 Playback if (CSM-Re- corded) LM 1.6-kbps TM	Same as Mode 1 Except No Scientific Data	Same as Mode 2 Except No Scientific Data	Real-time Sim Anlg. and Sim 64-kbps TM. 1:1 Playback of Re- corded Voice, Sim (h) Anlg., Sim 64-kbps TM, and 51.2-kbps TM.	No Carrier			
Modulation Schemes; Subcarrier Character- istics		TV : FM Directly on carrier (2272.5 MHz)	Playback Voice (d) : FM Directly on carrier (2272.5 MHz)	Scientific Data (d) : FM/FM (3 subcarriers) 95 kHz 125 kHz 165 kHz	Playback LM TM : PCM/FM	Playback CSM TM (e) : PCM/PSK/FM; 1.024 MHz subcarrier bi-phase modulated ±90°	Real-time Sim Data: Anlg. No. 1, FM/FM (225 kHz) Anlg. No. 2, FM/FM (400 kHz) 64-kbps TM, PCM/PSK/FM (768 kHz)	Playback Sim Data: Anlg. No. 1, FM/FM (165 kHz) Anlg. No. 2, FM/FM (330 kHz) 64-kbps TM, PCM/PSK/FM (576 kHz) 51.2-kbps TM, PCM/PSK/FM (1.024 kHz) voice, baseband										
Peak Carrier Deviation (Δf)		Playback Voice : 100 kHz +20 percent -40 percent	Playback CSM TM (e) : 600 kHz ±15 percent	Playback LM TM : 200 kHz +25 percent -50 percent	TV : 1 MHz ±10 percent, f _c at 1.3 Vdc within 0 to +455 kHz,	Scientific Data (d) (Real-time) : FM/FM 75 kHz ±15 percent (95 kHz SC) 108 kHz ±15 percent (125 kHz SC) 168 kHz ±15 percent (165 kHz SC)	Sim Data : 260 kHz ±10 percent (165 kHz SC) 290 kHz ±10 percent (225 kHz SC) 320 kHz ±10 percent (300 kHz SC) 350 kHz ±10 percent (400 kHz SC) 400 kHz ±10 percent (576 kHz SC) 410 kHz ±10 percent (768 kHz SC) 550 kHz ±10 percent (1,024 kHz SC) 100 kHz ±10 percent (Voice)											

(a) Or voice and biomed
(b) In the event of an EVA, the EVA biomed data is relayed via the CSM S-band link on the voice subcarrier; otherwise the biomed data comes back as PCM telemetry.
(c) Varies with the received uplink.
(d) Scientific data not used.
(e) Auxiliary PMP mode will provide real time PCM with same USB-FM characteristics as playback PCM.
(f) For Mode 10 Backup Voice Mod Index, place TLM bit rate switch to HIGH. Use LOW for Mode 14 Mod Index.
(g) HBR Mod Index of 1.2 and 1.6 are actually 0.96 and 1.2 respectively due to HBR suppression of 1.024 MHz subcarrier.
(h) CSM 112 through 114 only. Mode number to be determined.

TABLE 6-IV.- S-BAND UPLINK MODES AND MODULATION PROCESS

PM UPLINK MODES AVAILABLE	MODE NUMBER	1	2	3	4	5	6	7	8	9	0
		Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier	Carrier
	PRN	--	--	PRN	PRN	PRN	PRN	--	PRN	--	--
	Channels Included	--	Voice	--	Voice	--	Voice	Voice	Backup Voice	--	--
		--	--	Update	--	Update	Update	Update	--	--	--
PM UPLINK MODULATION PROCESS	Modulation Schemes:	PRN : PM directly on carrier									
	Subcarrier	Voice : FM/PM; 30-kHz subcarrier deviated ± 7.5 kHz (peak)									
	Character- istics	Update : PSK/FM/PM; 70-kHz subcarrier deviated ± 5.0 kHz (peak)									
		Backup Voice: FM/PM; 70-kHz subcarrier deviated ± 5.0 kHz (peak)									
		MODE NUMBER	1	2	3	4	5	6	7	8	9	0
	Carrier										
	Phase										
	Deviation (Radians- Peak)*	PRN	1.34	--	--	0.38	0.38	0.44	--	0.38	
		Voice	--	1.85	--	1.20	--	1.00	1.10	--	NA
		Update	--	--	1.85	--	1.20	1.00	1.10	--	NA
		Backup Voice	--	--	--	--	--	--	--	1.20	

*All phase deviations have $\pm 10\%$ tolerance

TABLE 6-V.- PREMODULATION PROCESSOR

ITEM	FUNCTION and/or PARAMETERS
1. Weight	14.5 pounds
2. Cooling	ECS Primary and/or Secondary Glycol Loops
3. Electrical Power a. Input Voltage b. Input Power	28 ± 4 Vdc 8.5 watts
4. CM Down Voice Channel (Normal) a. Subcarrier b. Response	1.25 MHz derived from CTE 512 kHz. 300 to 3000 Hz flat within 6 db.
5. CM Down Voice Channel (Backup) a. Response	300 to 2300 Hz flat within 6 db.
6. LM/EVA Voice and LM Biomed Relay Channel a. Subcarrier b. Subcarrier Deviation c. Response d. LM Input e. EVA Input	1.25 MHz derived from CTE 512 kHz. LM Voice - 8 kHz EVA Voice and Biomed - 9 kHz 300 to 13,000 Hz flat within 2 db. Voice Voice and/or 7 Biomed Subcarriers 4.0 kHz ± 5% f _o 5.4 kHz ± 5% f _o 6.8 kHz ± 5% f _o 8.2 kHz ± 5% f _o 9.6 kHz ± 4% f _o 11.0 kHz ± 3% f _o 12.4 kHz ± 3% f _o
7. Tape Recorder Output - LM & CSM Voice a. Response	LM and CSM intercom voice are mixed and output to DSE for recording. 300 to 2300 Hz flat within 2 db.
8. LM PCM Output Channel a. Response	LM PCM (1.6 kbs) is limited and output to DSE for recording. 600 to 2800 Hz flat within 1 db.

TABLE 6-V.- PREMODULATION PROCESSOR - Continued

ITEM	FUNCTION and/or PARAMETERS
9. CM PCM Data Channel (Real-time and Playback) a. Input b. Subcarrier c. Modulation	51.2 kbs or 1.6 kbs NRZ PCM data. 1.024 MHz derived from PCM 512 kHz ref signal. Bi-phase
10. Scientific Data Channel (Real-Time) a. Response b. Frequency and Deviation	Flat within 2 db <u>Channel</u> 1 0 to 2850 Hz 2 0 to 3750 Hz 3 0 to 4950 Hz <u>Channel</u> 1 95 kHz +7.5% f_o 2 125 kHz +7.5% f_o 3 165 kHz +7.5% f_o
11. Scientific Data Channel (Playback) a. Response	Flat within 2 db <u>Channel 32:1 Playback</u> <u>1:1 Playback</u> 1 12.5 to 89 Hz 50 to 2850 Hz 2 12.5 to 117 Hz 50 to 3750 Hz 3 12.5 to 154 Hz 50 to 4950 Hz (Recorded data bandwidths)
12. Tape Recorder Input - LM PCM Channel a. Response	15 to 90 kHz flat within 1 db.
13. Uplink Subcarrier Detectors a. Up Voice b. Updata c. Response	30 kHz (normal) 70 kHz (backup) 70 kHz 300 to 4,000 kHz flat within 3 db.

TABLE 6-V.- PREMODULATION PROCESSOR - Concluded

ITEM	FUNCTION and/or PARAMETERS										
14. Emergency Key Control	512 kHz signal derived from CTE 512 kHz timing signal baseband modulates S-band PM carrier when key is depressed. A 400 Hz sidetone output to the audio center is provided when key is depressed.										
15. Data Rate Indicator Control	Dc signal from PCM to control modulation levels to PM and FM Modulator modules. HBR = 5.3 Vdc LBR = 0 Vdc										
16. Television Channel a. Direct Output b. Response c. Isolated Output d. Response	To S-band FM transmitter Dc to 500 kHz flat within 0.5 db. To GSE hardline 10 to 500,000 Hz flat within 3 db.										
17. Uplink Voice Squelch (30 kHz Discriminator Output) a. .Operation b. Threshold c. Squelch Level	Transistor switch actuated by voice subcarrier threshold detector. Switch grounds input to voice output amplifier. <table border="1"> <thead> <tr> <th><u>Mode</u></th> <th><u>Received Carrier Power</u></th> </tr> </thead> <tbody> <tr> <td>2</td> <td>-119 dbm</td> </tr> <tr> <td>4</td> <td>-111 dbm</td> </tr> <tr> <td>6</td> <td>-108 dbm</td> </tr> <tr> <td>7</td> <td>-109 dbm</td> </tr> </tbody> </table> Greater than 35 db squelch of audio output when threshold is reached.	<u>Mode</u>	<u>Received Carrier Power</u>	2	-119 dbm	4	-111 dbm	6	-108 dbm	7	-109 dbm
<u>Mode</u>	<u>Received Carrier Power</u>										
2	-119 dbm										
4	-111 dbm										
6	-108 dbm										
7	-109 dbm										

TABLE 6-VI.- VHF AM TRANSCEIVER EQUIPMENT

ITEM	FUNCTION and/or PARAMETERS																												
1. Weight	13 pounds maximum																												
2. Cooling	ECS Primary and/or Secondary Glycol Loop																												
3. Electrical Power																													
a. Input Voltage	28 ± 4 Vdc																												
b. Input Power	<table border="0"> <tr> <td>Duplex A (Key OFF)</td> <td>4.2 watts</td> </tr> <tr> <td>Duplex A (Key ON)</td> <td>28.8 watts</td> </tr> <tr> <td>Simplex A (Key OFF)</td> <td>4.1 watts</td> </tr> <tr> <td>Simplex A (Key ON)</td> <td>28.8 watts</td> </tr> <tr> <td colspan="2"> </td> </tr> <tr> <td>Duplex B (Key OFF)</td> <td>3.8 watts</td> </tr> <tr> <td>Duplex B (Key ON)</td> <td>27.6 watts</td> </tr> <tr> <td>Simplex B (Key OFF)</td> <td>4.0 watts</td> </tr> <tr> <td>Simplex B (Key ON)</td> <td>27.6 watts</td> </tr> <tr> <td colspan="2"> </td> </tr> <tr> <td>RCV A Only</td> <td>1.2 watts</td> </tr> <tr> <td>RCV B Only</td> <td>1.2 watts</td> </tr> <tr> <td colspan="2"> </td> </tr> <tr> <td>PTT (Key ON)</td> <td>1.3 watts</td> </tr> </table>	Duplex A (Key OFF)	4.2 watts	Duplex A (Key ON)	28.8 watts	Simplex A (Key OFF)	4.1 watts	Simplex A (Key ON)	28.8 watts			Duplex B (Key OFF)	3.8 watts	Duplex B (Key ON)	27.6 watts	Simplex B (Key OFF)	4.0 watts	Simplex B (Key ON)	27.6 watts			RCV A Only	1.2 watts	RCV B Only	1.2 watts			PTT (Key ON)	1.3 watts
Duplex A (Key OFF)	4.2 watts																												
Duplex A (Key ON)	28.8 watts																												
Simplex A (Key OFF)	4.1 watts																												
Simplex A (Key ON)	28.8 watts																												
Duplex B (Key OFF)	3.8 watts																												
Duplex B (Key ON)	27.6 watts																												
Simplex B (Key OFF)	4.0 watts																												
Simplex B (Key ON)	27.6 watts																												
RCV A Only	1.2 watts																												
RCV B Only	1.2 watts																												
PTT (Key ON)	1.3 watts																												
4. Transmitter (A or B)																													
a. Activation Time	<p>250 milliseconds maximum to reach standby condition.</p> <p>20 milliseconds maximum to reach full transmit power from PTT (Key ON)</p>																												
b. RF Output	5 dbW (average) minimum																												
c. Transmitter Frequency	<p>XMTR A 296.8 MHz ± 8.90 kHz</p> <p>XMTR B 259.7 MHz ± 7.79 kHz</p>																												
d. Modulation	<p>Modulated by clipped speech between 300 and 2000 Hz combined with a 30 kHz signal such that the ON-OFF duty cycle of the RF carrier (50 ± 5 percent) is speech signal dependent and the ON-OFF period is 30 kHz. When XMTR is keyed ON with no speech input the average RF Output is 5 dbw minimum.</p>																												

TABLE 6-VI.- VHF AM TRANSCEIVER EQUIPMENT - Concluded

ITEM	FUNCTION and/or PARAMETERS
<p>5. Receiver (A or B)</p> <p>a. Activation Time</p> <p>b. RCVR RF Input</p> <p>c. A&B Output Response</p> <p> (1) Output to Audio Center (Voice)</p> <p> (2) Output to PMP (Voice and Biomed Data)</p> <p>d. RCVR B LM PCM Output</p> <p>e. RCVR Squelch</p>	<p>500 milliseconds maximum to reach full receive operation from turn-on.</p> <p>100 milliseconds maximum to reach full receive operation from PTT release (Key OFF)</p> <p>2 to 625,000 microvolts</p> <p>300 to 3000 Hz, + 2 db - 3 db maximum variation, down 12 db minimum at 5000 Hz.</p> <p>300 to 13,000 (2 db).</p> <p>300 to 13,000 Hz (2 db).</p> <p>Adjustable by MDC 2 controls for between 0 and 10 to 25 microvolts. 9 on squelch control is maximum squelch (10 to 25 microvolt level)</p>
<p>6. VHF Digital Ranging Generator Interface</p> <p>a. RCVR A Gate Input</p> <p>b. RCVR A Tone Output</p> <p>c. XMTR B Tone Input</p> <p>d. XMTR B Quieting (SC Inhibit)</p>	<p>5.266 kHz early-late gate signal to gate fine tone error signal through RCVR IF AMPLS.</p> <p>RCVR A detected IF amplifier output to digital ranging generator.</p> <p>Coarse and module 2 sum of coarse and medium tone input during acquisition and fine tone input during range tracking.</p> <p>Inhibit to XMTR 30 kHz quieting OSC during fine tone transmissions.</p>

TABLE 6-VII.- AUDIO CENTER EQUIPMENT

ITEM	FUNCTION and/or PARAMETERS
1. Weight	7.9 pounds
2. Cooling	ECS Primary and/or Secondary Glycol Loop
3. Electrical Power	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	14.2 watts (3 Stations ON)
4. Stations	Left Couch Station Right Couch Station Center Couch Station
5. Microphone Amplifier (1 Each Station)	
a. Input	0 dbm sound pressure level (nominal)
b. Response	300 to 3000 Hz flat within 2 db
c. Automatic Volume Control	
(1) Range	Less than 4 db change for 20 db input change
(2) Attack Time	50 milliseconds
(3) Release Time	1 to 6 seconds
(4) Threshold	13 ± 3 db (referred to input)
d. Output	0 dbm ± 3 db at threshold
e. Isolation	30 db or greater between modulation output channels
6. Earphone Amplifier (1 Each Station)	
a. Input	Variable over 35 db range of given input signal
b. Output	With 13 db on input attenuator the output is 20 dbm ± 3 dbm
c. Response	300 to 3000 Hz flat within 2 db
d. Isolation	40 db or greater between input channels

TABLE 6-VII.- AUDIO CENTER EQUIPMENT - Concluded

ITEM	FUNCTION and/or PARAMETERS
7. Voice Operated Relay (VOX) a. VOX Sensitivity b. VOX Attack c. VOX Release	Adjustable for input from -10 dbm to +10 dbm Less than 50 milliseconds 2 ± 0.7 seconds
8. Intercom Bus a. GSE Output b. Swimmer Output c. Tape Recorder	(Not Used) For recovery voice to recovery swimmers Output for voice recording on DSE
9. Spacecraft/GSE Facility Hardline Voice Interface	The Pad COMM Switch and Volume Control are used to operate each audio station's input/output voice links with the checkout and launch facilities.

TABLE 6-VIII.- UPDATA LINK EQUIPMENT

ITEM	FUNCTION and/or PARAMETERS
1. Weight	21 pounds maximum
2. Cooling	ECS Primary and/or Secondary Glycol Loops
3. Electrical Power	
a. Input Voltage	28 + 2, -4 Vdc
b. Input Power	8.9 watts maximum
4. Information Signal	
a. Modulation	Phase shift key FM modulation of 70 kHz S-band Uplink subcarrier. Modulation deviation is ±5 kHz.
b. Sub-bit "One"	Sub-bit "one" begins when the positive transition of the 1 kHz information signal cross each other in-phase.
c. Sub-bit "Zero"	Sub-bit "zero" begins when the positive transition of the 1 kHz sync signal crosses the 2 kHz information signal 180 degrees out-of-phase.
d. Sub-bit Period	One millisecond.
e. Sub-bit Rate	1,000 bits per second.
5. Message Structure	
a. Sub-bit Code	5 sub-bits per information bit. Vehicle address sub-bit code is different than system address and data word. Sub-bit coding (see Drawing 6.5).
b. Message Code	Each message contains up to 30 information bits which consist of a vehicle address, system address, and data word (see Drawing 6.5).
(1) Vehicle Address	Eight possible codes selectable by hard wire on an external connector.

TABLE 6-VIII.- UPDATA LINK EQUIPMENT - Continued

ITEM	FUNCTION and/or PARAMETERS
(2) System Address	<ol style="list-style-type: none"> 1. Command Module Computer 2. Real-Time Command (Internal relays) 3. Real-Time Command (External relays) (not used) 4. Central Timing Equipment 5. Salvo RTC reset 6. Test message A & B 7. Auxiliary decoder (not used)
(3) Data Word	(See Drawing 6.5.)
6. Sub-bit Detector	The 1 kHz and 2 kHz PSK signals are separated to provide synchronization and sub-bit data.
a. Sub-bit Sync	Recovered by phase lock techniques. Three 5 sub-bit sequences must precede a command message to synchronize the UDL.
b. Sub-bit Data	Detected at a 1 kHz rate.
7. Decoder Operation	<p>The vehicle address decoded as "access" bits are decoded asynchronously (without sync). Message timing in the decoder is not established until after vehicle address is decoded.</p> <p>Vehicle address recognition disables access bit decoding and enables the decoding of the remaining message.</p> <p>The system address determines information for receiving the correct number of info bits and processing a particular data word. After the proper number of bits have been received and temporarily stored in the main register, the program control modifies the operation to enable processing or transfer of the data word.</p>

TABLE 6-VIII.- UPDATA LINK EQUIPMENT - Concluded

ITEM	FUNCTION and/or PARAMETERS																																		
<p>8. Verification Signal</p>	<p>When a complete message is received, processed or transferred without the detection of sub-bit or bit errors and without the occurrence of a logic power deviation, the parallel 4-bit verification code to the PCM TM will be as follows:</p> <table border="1"> <thead> <tr> <th>PCM BIT</th> <th>B1</th> <th>B2</th> <th>B3</th> <th>B4</th> </tr> </thead> <tbody> <tr> <td>UDL OFF</td> <td>0</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>*TEST A</td> <td>0</td> <td>1</td> <td>1</td> <td>0</td> </tr> <tr> <td>*TEST B</td> <td>1</td> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <td>*SYS VAL</td> <td>0</td> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>UDL STANDBY (ON)</td> <td>1</td> <td>0</td> <td>1</td> <td>0</td> </tr> </tbody> </table> <p>*Verification signal is presented to the PCM as follows:</p> <table border="1"> <tbody> <tr> <td>PCM HBR</td> <td>55 milliseconds</td> </tr> <tr> <td>PCM LBR</td> <td>250 milliseconds</td> </tr> </tbody> </table>	PCM BIT	B1	B2	B3	B4	UDL OFF	0	0	0	0	*TEST A	0	1	1	0	*TEST B	1	0	0	1	*SYS VAL	0	1	0	1	UDL STANDBY (ON)	1	0	1	0	PCM HBR	55 milliseconds	PCM LBR	250 milliseconds
PCM BIT	B1	B2	B3	B4																															
UDL OFF	0	0	0	0																															
*TEST A	0	1	1	0																															
*TEST B	1	0	0	1																															
*SYS VAL	0	1	0	1																															
UDL STANDBY (ON)	1	0	1	0																															
PCM HBR	55 milliseconds																																		
PCM LBR	250 milliseconds																																		
<p>9. Internal Relays</p> <p>a. Type</p> <p>b. Rating</p> <p>c. Actuation Time</p> <p>d. Dc current</p> <p>e. Latch-in Current</p>	<p>32 double-pole double-throw relays, magnetic latching</p> <p>2 ampere, minimum, contact rating</p> <p>Opening or closure less than 5 milliseconds.</p> <p>18.7 milliamperes per relay</p> <p>7.1 milliamperes per relay</p>																																		

TABLE 6-IX.- TELEVISION CAMERA, SLOW SCAN

ITEM	FUNCTION and/or PARAMETERS								
1. Weight	4.5 pounds								
2. Cooling	Not required								
3. Electrical Power									
a. Input Voltage	24 to 31 Vdc								
b. Input Power	5.8 watts								
4. Activation time	TBD								
5. Resolution	250 EIA Test Pattern Lines								
6. Scanning rates									
a. Lines	320 lines-per-second								
b. Frames	10 frames-per-second								
7. Video Bandwidth	40 to 400,000 Hz (3 db)								
	400 kHz to 500 kHz (+3, -12 db)								
	20 db rolloff								
8. Gray Scales	5 minimum (black to white is positive signal)								
9. Illumination levels	0.1 to 30 foot-candles								
	(20 watt flourescent lamp \approx 4870 foot-candles)								
10. Automatic Light Control Switch									
a. "IN" Position	Camera will operate under normal CM interior light conditions with no bright objects in view.								
b. "OUT" Position	Camera will operate with abnormally bright light objects in view.								
11. Optics									
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center; border-bottom: 1px solid black;">Near Object distance</th> <th style="text-align: center; border-bottom: 1px solid black;">Scene brightness (ft-lamberts)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">18 in.</td> <td style="text-align: center;">1.8 to 530</td> </tr> <tr> <td style="text-align: center;">18 in.</td> <td style="text-align: center;">2.2 to 645</td> </tr> <tr> <td style="text-align: center;">143 ft</td> <td style="text-align: center;">32 to 9720</td> </tr> </tbody> </table>	Near Object distance	Scene brightness (ft-lamberts)	18 in.	1.8 to 530	18 in.	2.2 to 645	143 ft	32 to 9720
Near Object distance	Scene brightness (ft-lamberts)								
18 in.	1.8 to 530								
18 in.	2.2 to 645								
143 ft	32 to 9720								
a. Wide-Angle (80 Degrees)									
b. Wide-Angle (160 Degrees)									
c. Telephoto (9 Degrees)									
12. Video Output	2 volts peak								
13. Power Control	OFF/ON								

TABLE 6-X.- RENDEZVOUS RADAR TRANSPONDER

ITEM	FUNCTION and/or PARAMETERS
1. Weight	13.63 pounds
2. Cooling	ECS SM Primary and/or Secondary Glycol Loops.
3. Electrical Power	
a. DC Voltage	25 to 31.5 Vdc
b. Power	70.5 watts (transponder) 14 watts (heater)
4. Activation Time	TBD
5. Receiver	
a. Type	Solid state coherent radar transponder
b. Frequency	9832.8 MHz \pm 30 kHz Offset by doppler \pm 49 kHz with maximum
c. Modulation	3 sinusoidal tones (PM on carrier) 204.8 kHz \pm 0.0015%, 20 \pm 2 degrees 6.4 kHz \pm 0.0015%, 20 \pm 2 degrees 0.2 kHz \pm 0.0015%, 24 \pm 2 degrees
d. Dynamic Range	-123 dbm to -18 dbm at antenna terminals.
e. Acquisition	Acquires rendezvous radar in 1.3 seconds at -123 dbm or greater.
6. Transmitter	
a. Type	Solid state coherent radar transponder
b. Frequency	
(1) Search	9792 MHz \pm 25 kHz and swept \pm 104 kHz minimum.
(2) Transpond	240/241 times receive frequency.
c. RF Output Power	Greater than 240 milliwatts
d. Modulation	Received tones transponded with modulation index same as received except \pm 4 degree tolerance.

TABLE 6-X.- RENDEZVOUS RADAR TRANSPONDER - Concluded

ITEM	FUNCTION and/or PARAMETERS
<p>7. Mode Operation</p> <p>a. Transponder</p> <p>b. Signal Search</p> <p>c. Self Test</p>	<p>In operation at all times a signal is being received</p> <p>In operation when no signal is being received. Transmit frequency is swept ± 104 kHz with a saw-tooth function at 200 kHz rate.</p> <p>Test checks receiver operation by inserting 40.8 MHz signal between mixer stage and preamp input to first IF.</p>
<p>8. Display Outputs</p> <p>a. AGC Monitor</p> <p>b. Frequency Lockup</p> <p>c. RF Power</p>	<p>0 to 5 Vdc</p> <p>0 ± 0.4 Vdc (Search Mode)</p> <p>4.5 ± 0.45 Vdc (Transponder Mode)</p> <p>2.5 ± 0.4 Vdc</p>
<p>9. Range</p> <p>a. Range Accuracy</p> <p>b. Range Rate Accuracy</p>	<p>Between 50 feet and 400 n.mi.</p> <p>200 Hz tone $\pm 12,044.74$ feet</p> <p>64 kHz tone ± 425.22 feet</p> <p>204.8 kHz tone ± 57.63 feet</p> <p>0.25 percent or 1 foot per second (whichever is greater) based on LM Guidance Computer sampling period of 100 milliseconds.</p>

TABLE 6-XI.- VHF RECOVERY BEACON

ITEM	FUNCTION and/or PARAMETERS
1. Weight	2.7 pounds maximum
2. Cooling	Not required
3. Electrical Power	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	6.9 watts maximum average over interruption cycle
4. RF Output Power	3 watts minimum during the ON time of the interruption cycle
5. XMT Frequency	243 ± 0.0126S MHz
6. Modulation	Carrier is amplitude - modulated by 1 kHz square wave, 20 to 40 percent.
7. Interruption Cycle	Modulated carrier is present at the output for 2 seconds and absent for 3 seconds.

TABLE 6-XII.- VHF SURVIVAL BEACON - TRANSCEIVER

ITEM	FUNCTION and/or PARAMETERS
1. Weight	5 pounds maximum including battery pack
2. Cooling	Not required
3. Electrical a. Dc Voltage b. Power	16.2 Vdc from self-contained battery Battery pack life 24 hours in 100% beacon operation
4. Activation Time	No appreciable warm-up period
5. Receiver a. Type b. Frequency Sensitivity ($\frac{S + N}{N} = 10 \text{ db}$)	Portable, VHF AM Beacon - transceiver with integral microphone, speaker, PTT pushbutton battery, antenna, and test meter 243 MHz -97 dbm minimum
6. Transmitter a. Frequency b. RF Output (1) Beacon (2) Voice c. Modulation (1) Beacon (2) Voice	243 MHz 1.25 watts (peak) 0.5 watts minimum (unmodulated) ON-OFF key by a swept square wave, which varies in frequency from 1000 Hz to 300 Hz at a sweep rate of 2.5 Hz
7. Antenna	1/4 wavelength flexible whip

TABLE 6-XIII.- ANTENNA SWITCH, S-BAND

ITEM	FUNCTION and/or PARAMETERS
1. Weight	2.5 pounds
2. Cooling	Not required
3. Electrical Power	
a. Input Voltage	23 to 30 Vdc
b. Input Power	12 watts (For omni position)
4. Actuation Time	150 milliseconds maximum
5. Mechanics	Non-latching, 5-position, break-before-make
6. Isolation	40 db minimum between RF lines

TABLE 6-XIV.- ANTENNA SWITCH, VHF

ITEM	FUNCTION and/or PARAMETERS
1. Weight	0.75 pounds maximum
2. Cooling	Not required
3. Electrical Power	
a. Input Voltage	None - manual switch
b. Input Power	None - manual switch
4. Actuation Time	Not applicable
5. Mechanics	Manual, 3-position, make-before-break
6. Isolation	40 db minimum between RF lines

TABLE 6-XV.- ANTENNA, S-BAND OMNI

ITEM	FUNCTION and/or PARAMETERS								
1. Type	Helix in loaded cavity								
2. Frequency	2100 MHz to 2300 MHz								
3. Gain	Greater than -3 db relative to isotropic source between $\theta > 45^\circ$ and $\theta > 145^\circ$ (See Item 5 below.)								
4. Polarization	Right-hand circular								
5. Coverage	The following coverage is applicable with sequential selection of the four antennas:								
	<table border="0"> <thead> <tr> <th>*GAIN</th> <th>SOLID ANGLE</th> </tr> </thead> <tbody> <tr> <td>> -3 db</td> <td>between $\theta = 45^\circ$ and 145°</td> </tr> <tr> <td>> -20 db</td> <td>between $\theta = 15^\circ$ and 165°</td> </tr> <tr> <td>> -24 db</td> <td>between $\theta = 10^\circ$ and 170°</td> </tr> </tbody> </table>	*GAIN	SOLID ANGLE	> -3 db	between $\theta = 45^\circ$ and 145°	> -20 db	between $\theta = 15^\circ$ and 165°	> -24 db	between $\theta = 10^\circ$ and 170°
*GAIN	SOLID ANGLE								
> -3 db	between $\theta = 45^\circ$ and 145°								
> -20 db	between $\theta = 15^\circ$ and 165°								
> -24 db	between $\theta = 10^\circ$ and 170°								
6. Power Rating	<p>GAIN WILL BE LESS THAN -24 db for cones, with solid angles of 20 degrees at the spacecraft nose and SPS nozzle.</p> <p>*Applicable for $\phi = 0^\circ$ to 360°</p> <p>15 watts of CW RF</p>								

TABLE 6-XVI.- ANTENNA, VHF SCIMITAR

ITEM	FUNCTION and/or PARAMETERS
1. Type	Scimitar blade - one inch thick cover for thermal protection
2. Frequency	225 MHz to 450 MHz
3. Gain	Greater than -3 db (on axis) relative to isotropic source.
4. Polarization	Slant linear
5. Coverage	Each antenna covers a hemisphere, approximately full coverage obtainable with antenna selection.
6. Power Rating	50 watts average

TABLE 6-XVII.- VHF RECOVERY

ITEM	FUNCTION and/or PARAMETERS
1. Type	10-inch erectible tape with ground-plane whiskers
2. Frequency	243 MHz tuned
3. Gain	+6 db with respect to isotropic source, -18 db null
4. Polarization	Vertical
5. Coverage	±70 degree elevation 360 degree azimuth
6. Power Rating	50 watts continuous

TABLE 6-XVIII.- ANTENNA, RENDEZVOUS RADAR TRANSPONDER

ITEM	FUNCTION and/or PARAMETERS
1. Type	Open ended waveguide
2. Frequency	9782 MHz to 9802 MHz (XMT) 9822 MHz to 9842 MHz (RCV)
3. Gain	Greater than 0 db above isotropic source
4. Polarization	Linear
5. Coverage	Gain is maintained over solid angle of 160 degrees (X-axis) by 105 degrees (axis at right angle to X-axis)

TABLE 6-XIX.- ANTENNA, HIGH-GAIN

ITEM	FUNCTION and/or PARAMETERS																								
1. Type	Multi-mode, variable gain, beamwidth, steerable antenna, consisting of four paraboloids, a central horn, three-axis gimbal system and control logic.																								
2. Frequency	Transmit: 2272.5 ± 2.5 MHz 2287.5 ± 2.5 MHz Receive: 2106.4 ± 2 MHz																								
3. Gain (RF Axis) and Beamwidth (3 db) for XDV-7 Antenna and Electronics Box	<table border="0"> <thead> <tr> <th><u>XMIT MODE</u></th> <th><u>GAIN</u></th> <th><u>BEAMWIDTH</u></th> </tr> </thead> <tbody> <tr> <td>Wide</td> <td>8.4 db</td> <td>40.0°</td> </tr> <tr> <td>Medium</td> <td>19.5 db</td> <td>7.0°</td> </tr> <tr> <td>ΔNarrow</td> <td>25.8 db</td> <td>3.9°</td> </tr> <tr> <th><u>RCV MODE</u></th> <th><u>GAIN</u></th> <th><u>BEAMWIDTH</u></th> </tr> <tr> <td>Wide</td> <td>8.4 db</td> <td>40.0°</td> </tr> <tr> <td>*Narrow</td> <td>22.8 db</td> <td>4.5°</td> </tr> <tr> <td>ΔNarrow</td> <td>25.8 db</td> <td>3.9°</td> </tr> </tbody> </table>	<u>XMIT MODE</u>	<u>GAIN</u>	<u>BEAMWIDTH</u>	Wide	8.4 db	40.0°	Medium	19.5 db	7.0°	ΔNarrow	25.8 db	3.9°	<u>RCV MODE</u>	<u>GAIN</u>	<u>BEAMWIDTH</u>	Wide	8.4 db	40.0°	*Narrow	22.8 db	4.5°	ΔNarrow	25.8 db	3.9°
<u>XMIT MODE</u>	<u>GAIN</u>	<u>BEAMWIDTH</u>																							
Wide	8.4 db	40.0°																							
Medium	19.5 db	7.0°																							
ΔNarrow	25.8 db	3.9°																							
<u>RCV MODE</u>	<u>GAIN</u>	<u>BEAMWIDTH</u>																							
Wide	8.4 db	40.0°																							
*Narrow	22.8 db	4.5°																							
ΔNarrow	25.8 db	3.9°																							
4. Polarization	Right-hand circular																								
5. Coverage	Spherical except for pointing angles where the MSFN to the high gain antenna (HGA) line of sight is shadowed by the CSM. Shadow area covers approximately 40 percent of sphere.																								
6. RF Power Rating	15 watts continuous																								
7. Electrical Power																									
a. Dc Voltage	28 + 2, - 4 Vdc																								
b. Ac Voltage	115/200 Vac, 400 Hz, 3-phase																								
c. Dc Power (watts)	16.45 (PRIM), 22.84 (SEC)																								
d. Ac Power (watts RMS)	34.5 (PRIM), 34.5 (SEC)																								
8. Weight	94 pounds maximum																								
9. Acquisition Range	60 degrees or less from boresight axis when line of sight is outside RF Scan Limits.																								
10. Track Mode Transfer	Wide track to narrow track switching occurs for tracking errors less than 1 degree. HGA will switch back to wide track if the tracking errors increase to greater than 3 degrees.																								
10. RF Scan Limit	Electronic limit set to correspond to CSM RF shadow profile.																								

TABLE 6-XIX.- ANTENNA, HIGH-GAIN - Concluded

ITEM	FUNCTION and/or PARAMETERS
<p>12. Gimbal Limits</p> <p style="padding-left: 20px;">A-axis B-axis C-axis</p>	<p>360° Rotation ±23.5° +125°, -4</p> <p>A-, B-, and C-axis are at 0 degrees when B-axis is parallel to CSM X-axis and C-axis forms a right angle with A-axis.</p> <p>When onboard pitch and yaw indicators read 0 degrees, A-axis equals 0 degrees, B-axis equals 0 degrees, and C-axis equals +90 degrees.</p>
<p>13. Scan Warning Light (Disabled)</p>	<p>Warning limit is set 15 ± 3 degrees outside RF Scan Limit.</p>
<p>14. Deployment</p>	<p>Deployment is initiated by SLA panel deployment. The HGA boom is pivoted in the deployment mechanism by spring-loaded push arms. Deployment period is nominally 10 seconds.</p>

TABLE 6-XX.- VHF DIGITAL RANGING GENERATOR

ITEM	FUNCTION and/or PARAMETERS
1. Weight	7 pounds maximum
2. Cooling	ECS Primary and/or Secondary Glycol Loop
3. Electrical Power	
a. Input Voltage	28 ± 4 Vdc
b. Input Power	10 watts maximum
4. Ranging Accuracy	±450 feet maximum error at 500 feet for ranging system: ±180 ft random ±270 ft bias
5. Range Tones	247 Hz (coarse), 3.9 kHz (medium), 31.6 kHz (fine)
6. EMS Interface	
a. Range Data Signal	Serial pulse train output to count up EMS range display to desired range in 0.01 n.mi. (60.761 feet) increments.
b. Maximum Unambiguous Range	327.68 n.mi. for intial range display.
c. Countdown Command Signal	When range is decreasing, a countdown command precedes each range data pulse.
d. Reset Pulse Signal	Resets EMS range display to zero when: <ul style="list-style-type: none"> a. Data good test fails b. Reacquisition sequence is initiated. c. Range rate is greater than 1,800 feet/second.
7. CMC Interface	
a. Range Data Signal	15-bit serial word with the "1" and "0" bits provided as pulse outputs on separate lines, most significant bit first.
b. Command Readout Input	3.2 kilobit/second Pulse train from CMC to clock out the range data signal
c. Range Strobe Input	3.2 kilobit/second pulse train from CMC to provide internal timing for loading range data into range data register.

TABLE 6-XXI.- COLOR TELEVISION CAMERA

CMS
S/C 112-114
BASIC

ITEM	FUNCTION and/or PARAMETERS										
1. Weight											
2. Cooling	Not required.										
3. Electrical Power											
a. Input Voltage	28 Vdc										
b. Input Power	23 watts (camera) 2.5 watts (monitor)										
4. Activation time	Instant on										
5. Resolution	200 TV lines-per-picture height										
6. Scanning rate											
a. Lines	30 frames per second										
b. Frames	525 scan lines per frame										
7. Video Bandwidth	2 MHz										
8. Illumination Levels	5 to 12,000 foot-candles by using f-stops. (20 watt flourescent lamp \approx 4870 foot-candles.)										
9. Aspect Ratio	4:3										
10. Optics	<table border="0"> <tr> <td><u>Field of View</u></td> <td><u>Near Object Distance</u></td> </tr> <tr> <td>7 degrees</td> <td>Focused 24 in. to ∞</td> </tr> <tr> <td>43 degrees</td> <td>Focused 20 in. to ∞</td> </tr> <tr> <td colspan="2">4.4 to 44 continuously variable</td> </tr> <tr> <td colspan="2">25 to 150 mm</td> </tr> </table>	<u>Field of View</u>	<u>Near Object Distance</u>	7 degrees	Focused 24 in. to ∞	43 degrees	Focused 20 in. to ∞	4.4 to 44 continuously variable		25 to 150 mm	
<u>Field of View</u>	<u>Near Object Distance</u>										
7 degrees	Focused 24 in. to ∞										
43 degrees	Focused 20 in. to ∞										
4.4 to 44 continuously variable											
25 to 150 mm											
a. Zoom Lens (6:1)											
b. f-stops											
c. Focal Length											
11. Video Output	3.5 volts peak-to-peak, dark negative, bandpass 4.5 MHz										
12. Connectors	One video, one power										
13. Automatic Light Control											
a. Peak	(Bright object in scene)										
b. Average	(Uniform scene lighting) 1000:1 light range										
14. Monitor	The monitor provides crew viewing of actual camera picture transmitted so that f-stop, light level, zoom position and focus can be properly accomplished.										
15. Video Control											
a. Transmit	Normal video output										
b. Standby	Picture content of video is inhibited										

TABLE 6-XXII. DATA MODULATOR

ITEM	FUNCTION and/or PARAMETERS
1. Weight	4.5 pounds
2. Cooling	Not required (not ECS coldplated)
3. Electrical Power	
a. Input Voltage	28^{+2}_{-3} Vdc
b. Power Consumption	22 Watts
4. Activation Time	30 seconds to stabilize
5. Real-time Analog NBR 1	
a. Subcarrier Frequency	225 kHz
b. Modulation	FM
c. Input Frequency Response	0 to 5000 Hz
d. Input Level	0 to +5 Vdc $\pm 10\%$
e. Frequency Deviation	0 Vdc -12.35 kHz $\pm 5\%$ 5 Vdc $+12.35$ kHz $\pm 5\%$
f. SCO Stability	2.5 Vdc $\pm 0.1\%$ yields $f_o \pm 0.2\%$
g. Output Filter	Low pass (1 db); $f_o \pm 12.3$ kHz, with an upper band-edge rolloff of 36 db per octave.
6. Real-time Analog NBR 2	
a. Subcarrier Frequency	400 Hz
b. Modulation	FM
c. Input Frequency Response	0 to 9000 Hz
d. Input Level	0 to +5 Vdc $\pm 10\%$
e. Frequency Deviation	0 Vdc -22.5 kHz $\pm 5\%$ 5 Vdc $+22.5$ kHz $\pm 5\%$
f. SCO Stability	2.5 Vdc $\pm 0.01\%$ yields $f_o \pm 0.2\%$
g. Output Filter	Low pass (1 db); $f_o \pm 22.5$ kHz, with an upper band-edge rolloff of 36 db per octave.
7. Real-time PCM	
a. Subcarrier Frequency	768 kHz, derived from 512 kHz ref. signal.
b. Bit Rate	64 kbps
c. Modulation	Bi-phase
d. Type	NRZ-L

TABLE 6-XXII.- DATA MODULATOR - Continued

ITEM	FUNCTION and/or PARAMETERS
e. Input Level	0 to 5 Vdc
f. Output Filters	Passband (3 db); f_o -67.5, +100 kHz, with a final rolloff of 36 db per octave.
8. Playback Analog NBR 1	
a. Subcarrier Frequency	165 kHz
b. Modulation	FM
c. Input Frequency Response	0 to 5000 Hz
d. Input Level	0 to 5 Vdc $\pm 10\%$
e. Frequency Deviation	-2.5 Vdc -12.35 kHz $\pm 5\%$ +2.5 Vdc +12.35 kHz $\pm 5\%$
f. SCO Stability	0 Vdc yields $f_o \pm 0.2\%$
g. Output Filter	Low pass (1 db); $f_o \pm 12.3$ kHz, with a final rolloff of 36 db per octave.
9. Playback Analog NBR 2	
a. Subcarrier Frequency	300 kHz
b. Modulation	FM
c. Input Frequency Response	0 to 9000 Hz
d. Input Level	0 to 5 Vdc $\pm 10\%$
e. Frequency Deviation	-2.5 Vdc -22.5 kHz $\pm 5\%$ +2.5 Vdc +22.5 kHz $\pm 5\%$
f. SCO Stability	0 Vdc yields $f_o \pm 0.2\%$
g. Output Filter	Low pass (1 db); $f_o \pm 22.5$ kHz, with an upper band-edge rolloff of 36 db per octave.
10. Playback SIM PCM	
a. Subcarrier Frequency	576 kHz, derived from 512 kHz ref. signal.
b. Bit Rate	64 kbps
c. Modulation	Bi-phase
d. Type	NRZ-L
e. Input Level	0 to 6 Vdc
f. Output Filter	Passband (3 db); f_o -67.5, +100 kHz, with a final rolloff of 36 db per octave.

TABLE 6-XXII.- DATA MODULATOR - Concluded

ITEM	FUNCTION and/or PARAMETERS
11. Playback CSM PCM	
a. Subcarrier Frequency	1.024 MHz, derived from 512 kHz ref. signal.
b. Bit Rate	51.2 kbps
c. Modulation	Bi-Phase
d. Type	NRZ-L
e. Input Level	0 to 6 Vdc
f. Output Filter	Passband (3 db); f_o -67.5, +100 kHz, with a final rolloff of 36 db per octave.
12. Playback LM & CSM Voice	
a. Subcarrier	Baseband
b. Frequency Response	300 to 2300 Hz
c. Input Level	5.7 volts peak-to-peak
13. Clock Input	
a. Frequency	512 kHz
b. Wave Form	50 percent square wave
c. Input Voltage	3 volts peak-to-peak
d. Frequency Stability	2.2 parts per million
14. Output Signal-to-Noise Ratio (SNR)	Greater than 36 db
15. Calibration Scheme	

Output SCO	Calibration Voltage		
	Step 1	Step 2	Step 3
165 kHz	+2.5 V	0 V	-2.5 V
225 kHz	+5 V	+2.5 V	0 V
300 kHz	+2.5 V	0 V	-2.5 V
400 kHz	+5 V	+2.5 V	0 V

An astronaut initiated switch activation will be required for each step of the calibration scheme.

TABLE 6-XXIII.- BUFFER AMPLIFIER

CSM
S/C 112-114
BASIC

ITEM	FUNCTION and/or PARAMETERS
1. Weight	2.5 pounds
2. Cooling	Not required (not ECS coldplated)
3. Electrical Power	
a. Input Voltage	28 ⁺² ₋₃ Vdc
b. Power Consumption	5 Watts
4. Input Signals	
a. Serial Time Code (STC) Timing	IRIG "B" without optional final straight binary seconds count
b. 1 PPS Timing	1 Hz square wave
5. Output Signals	
a. STC Timing	There are four (4) electrically isolated IRIG "B" time code outputs
b. 1 PPS Timing	There are four (4) electrically isolated 1 PPS outputs
6. Phase correleation and coincidence	The inputs and their respective isolated outputs are within 100 nanoseconds
7. Input-output Isolation	Short circuit protection between channels, inputs, and outputs
8. SNR	70 db (min) for each output

TABLE 6-XXIV.- DATA STORAGE EQUIPMENT (DSE)

ITEM	FUNCTION and/or PARAMETERS
1. Weight	42.5 pounds
2. Cooling	ECS primary glycol loop
3. Electrical Power	
a. DC Voltage	28^{+2}_{-3} Vdc
b. AC Voltage	115/200 Vac, 400 Hz, 3-phase
c. Total Power Consumption	50 Watts
4. Operational Stability	
a. Record Speed	3 seconds (max) from activation
b. Playback Speed	5 seconds (max) from activation
c. Tape Speed	The speeds will be within $\pm 0.5\%$ of specification with a 400 Hz absolute power frequency
d. Flutter	
(1) 7.5 ips Record and Playback	3% peak-to-peak (max) with no vibration present; flutter bandwidth will be from 0.2 to 1250 Hz.
(2) 1.875 ips Record and 60 ips Playback	3% peak-to-peak (max) with no vibration present; flutter bandwidth will be from 0.2 to 2500 Hz.
5. CSM PCM Input	
a. Bit Rate	1.6 or 51.2 kbps
b. Level	"1" = 6 ± 0.8 Vdc "0" = $0^{+0.8}_{-0.0}$ Vdc
c. Type	NRZ-L
d. Frequency Stability	5 parts in 10^4
6. CSM PCM Output	
a. Bit Rate	51.2 kbps. There are two equal outputs. One is routed to the PMP, and one is routed to the Data Modulator.
b. Level	"1" = 6 ± 0.6 Vdc "0" = $0^{+0.5}_{-0.0}$ Vdc
c. Type	NRZ-L

TABLE 6-XXIV.- DATA STORAGE EQUIPMENT (DSE) - Continued

ITEM	FUNCTION and/or PARAMETERS
d. Bit Error Rate (1) HBR Dump (2) LBR Dump	1 in 10^5 (max) 3 in 10^5 (max)
7. CSM PCM Data Rate Timing a. Wave Form b. Frequency c. Level	Square 1.6 or 51.2 kHz "1" = $6 \pm .8$ V "0" = $0 \begin{smallmatrix} +.8 \\ -.0 \end{smallmatrix}$ V
8. SIM PCM Input a. Bit Rate b. Level c. Type	64 kbps "1" = 5 ± 1 Vdc "0" = $0 \pm .6$ Vdc NRZ-L
9. SIM PCM Output a. Bit Rate b. Level c. Type d. Error Rate	64 kbps "1" = $6 \pm .6$ Vdc "0" = $0 \begin{smallmatrix} +.5 \\ -.0 \end{smallmatrix}$ Vdc NRZ-L 3 in 10^5 (max)
10. SIM PCM Data Rate Timing a. Wave Form b. Frequency c. Level	Positive "Rectangular" Pulse 64 $\pm 1\%$ kHz "1" = 5 ± 1 V "0" = $0 \pm .6$ V
11. LM PCM Data a. Bit Rate b. Type	1.6 kbps Serial, Manchester Code
12. Analog Inputs a. Level b. Frequency (1) 1.875 ips	0 to 5 Vdc 12.5 to 2500 Hz

TABLE 6-XXIV.- DATA STORAGE EQUIPMENT (DSE) - Continued

ITEM	FUNCTION and/or PARAMETERS
(2) 7.5 ips	50 Hz to 10 kHz
c. Frequency Response	
(1) 7.5 ips Record and Playback	4 db (max) between 50 and 5000 Hz, 6 db (max) between 50 and 10,000 Hz.
(2) 1.875 ips Record and 60 ips Playback	6 db (max) between 12.5 and 2500 Hz.
d. Playback Voltage	Within 2 db of the input at 1000 Hz.
e. Distortion	2% (max)
f. Signal-to-Noise Ratio (SNR)	
(1) 1000 Hz output of 5 volts peak-to-peak	35 db (min)
(2) 10,000 Hz output of 5 volts peak-to-peak	30 db (min)
g. Output Voltage	5 Vdc \pm 5% peak-to-peak at 1000 Hz
13. Capabilities and Characteristics	
a. Tape Length	2262 ft (min)
b. Tape Width	1 inch
c. Record Times	4 hrs, at 1.875 ips 60 min, at 7.5 ips
d. Playback Times	7.5 min LBR at 60 ips 60 min HBR at 7.5 ips
e. Rewind Time	7.5 min (full tape) at 60 ips
f. Record/Playback Tracks	
(1) 6-Analog	3 active and 3 spare
(2) 1-CSM PCM	1.6 or 51.2 kbps, NRZ-L
(3) 1-SDS PCM	64 kbps, NRZ-L
(4) 1-LM PCM	1.6 kbps, Manchester split-phase
(5) 1-Voice	CSM/LM
(6) 1-Timing	500 Hz in LBR No Timing in HBR

TABLE 6-XXIV.- DATA STORAGE EQUIPMENT (DSE) - Concluded

ITEM		FUNCTION and/or PARAMETERS				
14. Tape Recorder Mode:						
Data Source	Record			Playback		
	Speed	Control	Data	Speed	Control	Data
CSM	1.875 ips	Bit Rate Select Switch	Voice 1.6 kbps	60 ips (32:1)	Auto Speed Select ②	Voice 51.2 kbps
	7.5 ips		Voice 51.2 kbps	7.5 ips (1:1)		Voice 51.2 kbps
SDS ①	7.5 ips	Bit Rate Select Switch	64 kbps Analog	7.5 ips	Auto Speed Select ②	64 kbps Analog
LM	1.875 ips	Bit Rate Select Switch	1.6 kbps	60 ips	Tape Recorder LM PCM Switch (S49)	51.2 kbps
	7.5 ips					12.8 kbps

NOTES: ① Requires CSM HBR selection.
② Auto Speed Select circuitry is controlled by the presence (LBR) or absence (HBR) of a 500 Hz signal on track NBR. 1 of the tape.

7 INSTRU-
MENTATION

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SECTION 7
INSTRUMENTATION

7.1 GENERAL

This section contains instrumentation data for CSM's 112 through 114. The notes, definitions, and tables are arranged to precede the drawings to which they are related.

TABLE 7-1.- SIGNAL CONDITIONING EQUIPMENT (SCE) PARAMETER LIST

MEAS ID	MEAS DESCRIPTION	MODULE TYPE	OUTPUT	SIGNAL	DIST
			PCM	DISPLAY		C&W
SC0039P	H ₂ TK 1 PRESS (5V BIAS)	--	--	--	C&W
SC0040P	H ₂ TK 2 PRESS (5V BIAS)	--	--	--	C&W
CC0175T	INVERTER 1 TEMP	DBA	PCM	--	C&W
CC0176T	INVERTER 2 TEMP	DBA	PCM	--	C&W
CC0177T	INVERTER 3 TEMP	DBA	PCM	--	C&W
CC0200V	AC BUS 1 ϕ A VOLTS	AC	PCM	--	--
CC0203V	AC BUS 2 ϕ A VOLTS	AC	PCM	--	--
CC0206V	MAIN BUS A VOLTS	AA	PCM	--	--
CC0207V	MAIN BUS B VOLTS	AA	PCM	--	--
CC0210V	BAT BUS A VOLTS	AA	PCM	--	--
CC0211V	BAT BUS B VOLTS	AA	PCM	--	--
CC0232V	BAT RELAY BUS VOLTS	AA	PCM	SEL MTR	--
CC0215C	BAT CHGR	DA	PCM	--	--
CC0222C	BAT A CUR	DA	PCM	--	--
CC0223C	BAT B CUR	DA	PCM	--	--
CC0224C	BAT C CUR	DA	PCM	--	--
SC2081T	FC 1 COND EXH TEMP	DBA	PCM	SEL MTR	C&W
SC2082T	FC 2 COND EXH TEMP	DBA	PCM	SEL MTR	C&W
SC2083T	FC 3 COND EXH TEMP	DBA	PCM	SEL MTR	C&W
SC2084T	FC 1 SKIN TEMP	DBA	PCM	SEL MTR	C&W
SC2085T	FC 2 SKIN TEMP	DBA	PCM	SET MTR	C&W
SC2086T	FC 3 SKIN TEMP	DBA	PCM	SEL MTR	C&W
SC2113C	FC 1 CUR	DA	PCM	--	--
SC2114C	FC 2/AUX BAT CUR	DA	PCM	--	--
SC2115C	FC 3 CUR	DA	PCM	--	--
CC2962C	LM HEATER CURRENT	DA	PCM	SEL MTR	--
SF0266X	RAD FLOW CONT SYS 1 OR 2	AA	PCM	--	--
BS0080X	SM EDS ABORT REQUEST A	AA	PCM	--	--
BS0081X	SM EDS ABORT REQUEST B	AA	PCM	--	--
CS0150X	MASTER CAUTION WARNING ON	AA	PCM	--	--
CT0015V	SCE POS SUPPLY VOLTS	PS	PCM	--	--
CT0016V	SCE NEG SUPPLY VOLTS	PS	PCM	--	--
CT0017V	SENSOR EXCITATION 5 VOLTS	PS	PCM	--	--
CT0018V	SENSOR EXCITATION 10 VOLTS	PS	PCM	--	--
CH3635X	B MAG MODE SW - ROLL ATT 1 RT 2	AA	PCM	--	--
CH3636X	B MAG MODE SW - ROLL RATE 2	AA	PCM	--	--
CH3638X	B MAG MODE SW - PITCH ATT 1 RT 2	AA	PCM	--	--
CH3639X	B MAG MODE SW - PITCH RATE 2	AA	PCM	--	--
CH3641X	B MAG MODE SW - YAW ATT 1 RT 2	AA	PCM	--	--
CH3642X	B MAG MODE SW - YAW RATE 2	AA	PCM	--	--
SPO062T*	SPS INJECTOR FLANGE TEMP 2	DBA	PCM	--	--
BS0050P	S-II FUEL TK/S-IVB OX TK PRESS A	DA	--	SEL MTR	--
BS0052P	S-IVB FUEL PRESS A	DA	--	SEL MTR	--
BS0051P	S-II FUEL TK/S-IVB OX TK PRESS B	DA	--	SEL MTR	--
BS0053P	S-IVB FUEL PRESS B	DA	--	SEL MTR	--

*Not on S/C 112.

TABLE 7-II.- INSTRUMENTATION - POWER DISTRIBUTION

1. PANEL 276 CB 1(V₁) INSTRUMENTATION POWER DISTRIBUTION

A. V₁ CURRENT LIMITER BOX C28A6 (FUSES 1 THROUGH 9).

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
CF0461T	H ₂ O DUMP TEMP	5	PCM	--	--
CR0001P	CM He TK 1 PRESS	4	PCM	SEL MTR	--
CR0003T	CM He TK 1 TEMP	6	PCM	SEL MTR	--
CR0035P	CM He MANIF 1 PRESS	9	PCM	--	C&W
CR0038P	CM He MANIF 2 PRESS	2	--	SEL MTR	C&W
CR2103T	SYS 1 ENG 16 INJECT TEMP	8	--	SEL MTR	--
CR2114T	SYS 1 ENG 12 INJECT TEMP	7	--	SEL MTR	--

2. PANEL 276 CB 2(V₂) INSTRUMENTATION POWER DISTRIBUTION

A. V₂ CURRENT LIMITER BOX C28A5.

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
CC0188P	BATT MANIF PRESS	2	--	SEL MTR	--
CE0001X	DROGUE DEP RELAY A	7 (3)	PCM	--	--
CE0002X	DROGUE DEP RELAY B	19 (3)	PCM	--	--
CE0003X	MAIN DEPLOY RELAY A	7 (3)	PCM	--	--
CE0004X	MAIN DEPLOY RELAY B	19 (3)	PCM	--	--
CE0321X	MAIN CHUTE DISC RELAY A	7 (3)	PCM	--	--
CE0322X	MAIN CHUTE DISC RELAY B	19 (3)	PCM	--	--
CF0003P	SUIT - CABIN DELTA PRESS	18	PCM	METER	--
CF0006P	SURGE TANK PRESS	3	PCM	SEL MTR	--
CF0120P	H ₂ O TK - GLY RES PRESS	20	PCM	--	--
CF0157R	PRI GLYCOL FLOW RATE	13	PCM	--	--
CF0181T	PRI EVAP INLET TEMP	1	PCM	--	--
CJ0060J	ASTRO 1 EKG AXIS 1	12 (2)	PCM	--	--
CJ0061J	ASTRO 2 EKG AXIS 1	10 (2)	PCM	--	--
CJ0062J	ASTRO 3 EKG AXIS 1	11 (2)	PCM	--	--
CJ0200R	ASTRO 1 RESPIR	12 (2)	PCM	--	--
CJ0201R	ASTRO 2 RESPIR	10 (2)	PCM	--	--
CJ0202R	ASTRO 3 RESPIR	11 (2)	PCM	--	--
CK0026A	CM X-AXIS ACCEL	5	PCM	--	--
CK0027A	CM Y-AXIS ACCEL	9	PCM	--	--
CK0028A	CM Z-AXIS ACCEL	6	PCM	--	--
CK1051K	DOSIMETER 1 RADIATION	4 (3)	PCM	--	--
CK1052K	DOSIMETER 2 RADIATION	4 (3)	PCM	--	--
CK1053R	DOSIMETER RATE	4 (3)	PCM	--	--

*Fuses 1 through 27 are 0.25 Amps. Fuses 28, 29 and 30 are 3.0 Amps. Numbers in parenthesis indicate number of parameters on same fuse.

TABLE 7-II.- INSTRUMENTATION - POWER DISTRIBUTION - Continued

A. V₂ CURRENT LIMITER BOX C28A5 - Concluded

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
CR2100T	SYS 1 ENG 14 INJECT TEMP	17	--	SEL MTR	--
CR2110T	SYS 2 ENG 24 INJECT TEMP	14	--	SEL MTR	--
CS0220T	DOCKING PROBE TEMP	8	PCM	--	--

B. V₂ CURRENT LIMITER BOX C28A6 (FUSES 10 THROUGH 27)

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
CA1820T	SIDE HS SURF LOC 1 TEMP	13 (4)	PCM	--	--
CA1821T	SIDE HS SURF LOC 5 TEMP	13 (4)	PCM	--	--
CA1822T	SIDE HS SURF LOC 7 TEMP	13 (4)	PCM	--	--
CA1823T	SIDE HS SURF LOC 10 TEMP	13 (4)	PCM	--	--
CF0460T	URINE DUMP NOZZLE TEMP	11	PCM	--	--
CR0002T	CM He TK 2 PRESS	20	PCM	SEL MTR	--
CR0004T	CM He TK 2 TEMP	19	PCM	SEL MTR	--
CR0036P	CM He MANIF 2 PRESS	22	PCM	--	C&W
CR0037P	CM He MANIF 1 PRESS	23	--	SEL MTR	C&W
CR2116T	SYS 2 ENG 25 INJECT TEMP	21	--	SEL MTR	--
CR2119T	SYS 2 ENG 21 INJECT TEMP	16	--	SEL MTR	--

3.	PANEL 276 CB 3(V_{3S}) INSTRUMENTATION POWER DISTRIBUTION
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A. V_{3S} CURRENT LIMITER BOX S28A9

MEAS ID	MEAS DESCRIPTION	FUSE NO.*	PCM	DISPLAY	C&W
SA1830T**	SKIN TEMP 1A (SENSOR)	27 (6)	PCM	--	--
SA1832T**	SKIN TEMP 7A (SENSOR)	27 (6)	PCM	--	--
SC0038P	O ₂ TK 2 PRESS	20	PCM	SEL MTR	--
SC0040P	H ₂ TK 2 PRESS	21	PCM	SEL MTR	C&W
SC2061P	FC 2 N ₂ PRESS (GSE ONLY)	1	--	--	--
SC2062P	FC 3 N ₂ PRESS (GSE ONLY)	8	--	--	--
SC2067P	FC 2 O ₂ PRESS	2	PCM	SEL MTR	--
SC2068P	FC 3 O ₂ PRESS	9	PCM	SEL MTR	--
SC2070P	FC 2 H ₂ PRESS	3	PCM	SEL MTR	--
SC2071P	FC 3 H ₂ PRESS	7	PCM	SEL MTR	--
SC2088 T	FC 2 RAD OUT TEMP	11	PCM	SEL MTR	C&W
SC2089T	FC 3 RAD OUT TEMP	12	PCM	SEL MTR	C&W
SC2140R	FC 2 H ₂ FLOW	15	PCM	SEL MTR	C&W
SC2141R	FC 3 H ₂ FLOW	17	PCM	SEL MTR	C&W

*Fuses 1 through 27 are 0.25 Amps. Fuses 28, 29 and 30 are 3.0 Amps. Numbers in parenthesis indicate number of parameters on same fuse.

**Not on S/C 112.

TABLE 7-II.- INSTRUMENTATION - POWER DISTRIBUTION - Continued

A. V_{3S} CURRENT LIMITER BOX S28A9 - Concluded

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
SC2143R	FC 2 O ₂ FLOW	16	PCM	SEL MTR	C&W
SC2144R	FC 3 O ₂ FLOW	18	PCM	SEL MTR	C&W
SP0001P	He TK PRESS	4	PCM	--	--
SP0003P	OX TK PRESS	5	PCM	METER	C&W
SP0022H	FU/OX VLV 1 POS	27 (6)	PCM	--	--
SP0024H	FU/OX VLV 3 POS	27 (6)	PCM	--	--
SP0027H	FU/OX VLV 2 POS	27 (6)	--	METER	--
SP0029H	FU/OX VLV 4 POS	27 (6)	--	METER	--
SP0048T	SPS FU FEED LINE TEMP	23	PCM	METER	--
SP0054T**	OX LINE 1 TEMP	24	PCM	--	--
SP0055T	BAY 2 OXID SUMP TK SURF TEMP	19	PCM	--	--
SP0056T	BAY 5 FUEL SUMP TK SURF TEMP	13	PCM	--	--
SP0600P	SPS VLV ACT PRESS PRI	14	PCM	SEL MTR	--
SP0661P	ENG CHAMBER PRESS	10	PCM	SEL MTR	--
SP0930P	FUEL SM/ENG INTERFACE P	6	PCM	--	--
SM RCS	QUAD A (S19A1)	28 (9)			
SM RCS	QUAD C (S19A3)	29 (9)			
ST0820K	PROTON CT RATE CHAN 1	25 (8)	PCM	--	--
ST0821K	PROTON CT RATE CHAN 2	25 (8)	PCM	--	--
ST0822K	PROTON CT RATE CHAN 3	25 (8)	PCM	--	--
ST0823K	PROTON CT RATE CHAN 4	25 (8)	PCM	--	--
ST0830K	ALPHA CT RATE CHAN 1	25 (8)	PCM	--	--
ST0831K	ALPHA CT RATE CHAN 2	25 (8)	PCM	--	--
ST0832K	ALPHA CT RATE CHAN 3	25 (8)	PCM	--	--
ST0838K	PROTON INTEG CT RATE	25 (8)	PCM	--	--

B. V_{3S} CURRENT LIMITER BOX S28A13

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
SA1830T**	SKIN TEMP 1A (SIG COND)	8	PCM	--	--
SA1832T**	SKIN TEMP 7A (SIG COND)	6	PCM	--	--
SC0069P	O ₂ TK 2/3 MANIF PRESS	11	PCM	--	C&W
SC0071T	O ₂ TK 2 HTR TEMP	10	PCM	SEL MTR	--
SC2091T	FC 2 RAD IN TEMP	1	PCM	--	--
SC2092T	FC 3 RAD IN TEMP	2	PCM	--	--
	SIM CUR LIMITER S28A34	29 (10)			
	SIM CUR LIMITER S28A35	28 (4)			

*Fuses 1 through 27 are 0.25 Amps. Fuses 28, 29 and 30 are 3.0 Amps. Numbers in parenthesis indicate number of parameters on same fuse.

**Not on S/C 112.

TABLE 7-II.- INSTRUMENTATION - POWER DISTRIBUTION - Continued

C. V_{3S} SM RCS QUAD A CURRENT LIMITER BOX S19A1 S28A10.

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
SR500TP	SM He TK A PRESS	10	PCM	SEL MTR	--
SR5013T	SM He TK A TEMP	5	PCM	SEL MTR	--
SR5025Q	SM He PRESS/TEMP RATIO A	7	PCM	SEL MTR	--
SR5065T	SM ENG PACKAGE A TEMP	11	PCM	SEL MTR	C&W
SR5069T	OXID FEED LINE FILTER A TEMP	2	PCM	--	--
SR5073T	PRI OXID TK OUT SURF A TEMP	1	PCM	--	--
SR5729P	SM He MANF A PRESS	12	PCM	--	--
SR5733P	SM OX MANF A PRESS	17	PCM	--	--
SR5737P	SM FU MANF A PRESS	14	PCM	SEL MTR	C&W

D. V_{3S} SM RCS QUAD C CURRENT LIMITER BOX S19A3 S28A10.

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
SR5003P	SM He TK C PRESS	10	PCM	SEL MTR	--
SR5015T	SM He TK C TEMP	5	PCM	SEL MTR	--
SR5027Q	SM He PRESS/TEMP RATIO C	7	PCM	SEL MTR	--
SR5067T	SM ENG PACKAGE C TEMP	11	PCM	SEL MTR	C&W
SR5071T	OXID FEED LINE FILTER C TEMP	2	PCM	--	--
SR5075T	PRI OXID TK OUT SURF C TEMP	1	PCM	--	--
SR5817P	SM He MANF C PRESS	12	PCM	--	--
SR5820P	SM OX MANF C PRESS	17	PCM	--	--
SR5822P	SM FU MANF C PRESS	14	PCM	SEL MTR	C&W

E. V_{3S} CURRENT LIMITER BOX S28A14.

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
SC0052P	H ₂ TK 3 PRESS	18 (S/C 112) 17 (S/C 113,114)	PCM	SEL MTR	--
SC0053P	O ₂ TK 3 PRESS	6	PCM	SEL MTR	--
SC0072T	O ₂ TK 3 HTR TEMP	10	PCM	SEL MTR	--

F. V_{3S} SIM CURRENT LIMITER BOX S28A34.

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
SL1043P	PAN CAMERA N ₂ TK PRESS	1	PCM	--	--
SL1080X***	SUBSATELLITE LAUNCHED	19	(64KBPS)	--	--
SL1204T	SIM THERMAL LOC 4 TEMP	9	PCM	--	--
SL1206T	SIM THERMAL LOC 6 TEMP	5	PCM	--	--
SL1211T	SIM THERMAL LOC 11 TEMP	11	PCM	--	--
SL1212T	SIM THERMAL LOC 12 TEMP	13	PCM	--	--

*Fuses 1 through 27 are 0.25 Amps. Fuses 28, 29 and 30 are 3.0 Amps. Numbers in parenthesis indicate number of parameters on same fuse.

***Not on S/C 113.

TABLE 7-II.- INSTRUMENTATION - POWER DISTRIBUTION - Continued

F. V_{3S} SIM CURRENT LIMITER BOX S28A34 - Concluded.

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
SL1215T	SIM THERMAL LOC 15 TEMP	15	PCM	--	--
SL1217T	SIM THERMAL LOC 17 TEMP	3	PCM	--	--
ST0562T	TLM 2 MASTER UNIT TEMP	29	PCM	--	--
ST0563T	TLM 2 SLAVE UNIT TEMP	30	PCM	--	--

G. V_{3S} SIM CURRENT LIMITER BOX S28A35.

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
SL1201T	SIM THERMAL LOC 1 TEMP	1	PCM	--	--
SL1202T	SIM THERMAL LOC 2 TEMP	3	PCM	--	--
SL1205T	SIM THERMAL LOC 5 TEMP	5	PCM	--	--
SL1208T	SIM THERMAL LOC 8 TEMP	7	PCM	--	--

4.	PANEL 276 CB 4(V_{4S}) INSTRUMENTATION POWER DISTRIBUTION
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A. V_{4S} CURRENT LIMITER BOX S28A12.

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
SC0037P	O ₂ TK 1 PRESS	20	PCM	SEL MTR	C&W
SC0039P	H ₂ TK 1 PRESS	5	PCM	METER	C&W
SC0070T	O ₂ TK 1 HTR TEMP	10	PCM	SEL MTR	--
SC2060P	FC 1 N ₂ PRESS (GSE ONLY)	8	--	--	--
SC2066P	FC 1 O ₂ PRESS	9	PCM	SEL MTR	--
SC2069P	FC 1 H ₂ PRESS	7	PCM	SEL MTR	--
SC2087T	FC 1 RAD OUT TEMP	12	PCM	SEL MTR	C&W
SC2139R	FC 1 H ₂ FLOW	17	PCM	SEL MTR	C&W
SC2142R	FC 1 O ₂ FLOW	18	PCM	SEL MTR	C&W
SP0045T	SPS VLV BODY TEMP	13	PCM	--	--
SP0057T**	FU LINE 1 TEMP	15	PCM	--	--
ST0840T**	NUCLEAR PART DET TEMP (SENSOR)	2 (2)			
	(SIG COND)	3	PCM	--	--
ST0841T**	NUCLEAR PART ANAL TEMP (SENSOR)	2 (2)			
	(SIG COND)	1	PCM	--	--

B. V_{4S} CURRENT LIMITER BOX S28A7.

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
SA1831T**	SKIN TEMP 4A (SENSOR)	22 (6)	PCM	--	--
	(SIG COND)	26			
SA1833T**	SKIN TEMP 10A (SENSOR)	22 (6)	PCM	--	--
	(SIG COND)	24			
SC2090T	FC 1 RAD IN TEMP	13	PCM	--	--

*Fuses 1 through 27 are 0.25 Amps. Fuses 28, 29 and 30 are 3.0 Amps. Numbers in parenthesis indicate number of parameters on same fuse.

**Not on S/C 112.

TABLE 7-II.- INSTRUMENTATION - POWER DISTRIBUTION - Concluded

B. V_{4S} CURRENT LIMITER BOX S28A7 - Concluded.

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
SP0006P	FU TK PRESS	1	PCM	METER	C&W
SP0017T	LOWER He TANK TEMP	5	PCM	--	--
SP0023H	FU/OX VLV 2 POS	22 (6)	PCM	--	--
SP0025H	FU/OX VLV 4 POS	22 (6)	PCM	--	--
SP0026H	FU/OX VLV 1 POS	22 (6)	--	METER	--
SP0028H	FU/OX VLV 3 POS	22 (6)	--	METER	--
SP0035P	He TK PRESS	8	--	SEL MTR	--
SP0049T	SPS OX FEED LINE TEMP	18	PCM	SEL MTR	--
SP0058T	OXID STORAGE TK SURF TEMP	7	PCM	--	--
SP0059T	FUEL STORAGE TK SURF TEMP	11	PCM	--	--
SP0601P	SPS VLV ACT PRESS SEC	14	PCM	SEL MTR	--
SP0931P	OX SM/ENG INTERFACE PRESS	3	PCM	--	--
SM RCS	QUAD B (S19A2)	28 (9)			
SM RCS	QUAD D (S19A4)	29 (9)			

C. V_{4S} SM RCS QUAD B CURRENT LIMITER S19A2 S28A10.

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
SR5002P	SM He TK B PRESS	10	PCM	SEL MTR	--
SR5014T	SM He TK B TEMP	5	PCM	SEL MTR	--
SR5026Q	SM He PRESS/TEMP RATIO B	7	PCM	SEL MTR	--
SR5066T	SM ENG PACKAGE B TEMP	11	PCM	SEL MTR	C&W
SR5070T	OXID FEED LINE FILTER B TEMP	2	PCM	--	--
SR5074T	PRI OXID TK OUT SURF B TEMP	1	PCM	--	--
SR5776P	SM He MANF B PRESS	12	PCM	--	--
SR5780P	SM OX MANF B PRESS	17	PCM	--	--
SR5784P	SM FU MANF B PRESS	14	PCM	SEL MTR	C&W

D. V_{4S} SM RCS QUAD D CURRENT LIMITER S19A4 S28A10.

<u>MEAS ID</u>	<u>MEAS DESCRIPTION</u>	<u>FUSE NO.*</u>	<u>PCM</u>	<u>DISPLAY</u>	<u>C&W</u>
SR5004P	SM He TK D PRESS	10	PCM	SEL MTR	--
SR5016T	SM He TK D TEMP	5	PCM	SEL MTR	--
SR5028Q	SM He PRESS/TEMP RATIO D	7	PCM	SEL MTR	--
SR5068T	SM ENG PACKAGE D TEMP	11	PCM	SEL MTR	C&W
SR5072T	OXID FEED LINE FILTER D TEMP	2	PCM	--	--
SR5076T	PRI OXID TK OUT SURF D TEMP	1	PCM	--	--
SR5821P	SM OX MANF D PRESS	17	PCM	--	--
SR5823P	SM FU MANF D PRESS	14	PCM	SEL MTR	C&W
SR5830P	SM He MANF D PRESS	12	PCM	--	--

*Fuses 1 through 27 are 0.25 Amps. Fuses 28, 29 and 30 are 3.0 Amps. Numbers in parenthesis indicate number of parameters on same fuse.

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CSM
S/C 112-114

7.2 PCM EQUIPMENT (51.2 KBPS) SYSTEM NOTES

7.2.1 General Description

The PCM equipment consists of a programmer, an analog multiplexer, an analog coder, a digital multiplexer, and an output shift register. The programmer maintains primary control of all functioning units and may be commanded to operate in a high-bit rate (51.2 kbps) format or a low-bit rate (16. kbps) format.

7.2.2 Programmer Timing

The programmer timing is provided by a 512 kHz signal from the central timing equipment (CTE). However, if the CTE signal is not present, the programmer will automatically switch to an internal oscillator.

7.2.3 Backup Circuits

Quad redundant circuits, fail safe circuits, two of three voting logic circuits, and block redundant circuits are used such that a single component failure will cause the loss of no more than five parameters. The programmer, frame counter, analog coder, and the output shaft register are block redundant circuits, which are initialized to the primary block when power is first applied. Error detection circuits will cause automatic switch-over to the redundant block for a primary block failure.

7.2.4 Formats

The programmer may be commanded to operate in a high-bit rate (51.2 kbps) format or a low-bit rate (1.6 kbps) format as shown on Drawing 7.2. The format ID word will indicate a requested format change one subframe prior to NRZ output change.

*

CSM
S/C 112-114

- 7.2.4.1 High-bit rate formats.- In HBR, all input parameter gates will be sampled at least once during a data cycle at sampling rates from 1 s/s to 200 s/s.
- 7.2.4.2 Low-bit rate formats.- In LBR, only selected input parameter gates will be sampled at 1 s/s with both the command module computer gate (51DS1) and UDL validity gate (51DP2) being sampled at 10 s/s.
- 7.2.5 Parameter Capabilities
PCM equipment parameter capabilities, both HBR and LBR, are listed in Table 7-III.
- 7.2.6 Operating Characteristics
PCM equipment operating characteristics are shown in Table 7-IV.

TABLE 7-III.- PCM EQUIPMENT PARAMETER CAPABILITIES

<u>ITEM NO.</u>	<u>ITEM DESCRIPTION</u>	<u>HBR FORMAT</u>	<u>LBR FORMAT</u>
1.	BIT RATE	51.2 KBPS	1.6 KBPS
2.	WORD RATE (8-BIT WORDS)	6400 W/S	200 W/S
3.	FRAME RATE	50 F/S	1 F/S
4.	HL ANALOG CHANNELS (0-5 VDC)	4 @ 200 S/S	--
		16 @ 100 S/S	--
		15 @ 50 S/S	--
		180 @ 10 S/S	50 @ 1 S/S
		150 @ 1 S/S	50 @ 1 S/S
5.	32-BIT PARALLEL DIGITAL CHANNEL	1 @ 10 S/S	1 @ 1 S/S
6.	16-BIT PARALLEL DIGITAL CHANNELS	1 @ 200 S/S	--
7.	8-BIT PARALLEL DIGITAL CHANNELS	1 @ 50 S/S	1 @ 10 S/S
		31 @ 10 S/S	29 @ 1 S/S
8.	40-BIT SERIAL DIGITAL CHANNEL	1 @ 50 S/S	1 @ 10 S/S
9.	8-BIT SYNC WORDS	3 @ 50 S/S	3 @ 1 S/S
	WORD 1 - 00000101		
	WORD 2 - 01111001		
	WORD 3 - 10110111		
10.	8-BIT FRAME COUNT WORD (TWO "ONE" BITS PLUS 6 BITS FRAME COUNT)	1 @ 50 S/S	1 @ 1 S/S
11.	8-BIT FORMAT ID WORD	1 @ 1 S/S	1 @ 1 S/S
	HBR - 01100110		
	LBR - 10011001		
12.	8-BIT OUTPUT SHIFT REGISTER TEST WORDS	2 @ 10 S/S	2 @ 1 S/S
13.	UNAVAILABLE 8-BIT WORDS	29 @ 1 S/S	--

TABLE 7-IV.- PCM EQUIPMENT OPERATING CHARACTERISTICS

<u>ITEM NO.</u>	<u>ITEM DESCRIPTION</u>	<u>FUNCTION OR VALUE</u>
1.	WEIGHT	40 LBS MAX
2.	POWER	21 WATTS AC MAX
3.	INPUT VOLTAGE	115 VAC, 3-PHASE, 400 Hz
4.	OPERATING TEMP	32 TO 135° F
5.	WARMUP TIME	10 SEC
6.	EXTERNAL CLOCK AND SUBFRAME SYNC	
	EXTERNAL CLOCK FREQ (FROM CTE)	512 KHz
	SUBFRAME SYNC PRR	1 PPS
	PULSE VOLTAGE	3 ± 0.5 VOLTS
	INTERPULSE VOLTAGE	0 TO 0.2 VOLTS
7.	GSE POWER INPUT (FOR PCM RZ OUTPUT)	
	VOLTAGE	11 ± 0.3 VOLTS
	CURRENT	400 MA MAX
8.	DATA INPUT	
8.1	ANALOG INPUTS	
	MAX VOLTAGE RANGE	-1 TO +16 VOLTS
	DATA VOLTAGE RANGE	0 TO 5 VOLTS
	SOURCE IMPEDANCE	5K OHMS MAX
	SAMPLING IMPEDANCE	1 MEGOHM MIN
	NON-SAMPLING IMPEDANCE	50 MEGOHM MIN
	UNUSED INPUTS	NORMALLY GROUNDED
8.2	PARALLEL DIGITAL INPUTS	
	MAX VOLTAGE RANGE	-2 TO +32 VOLTS
	LOGIC ONE	4.0 TO 10.0 VOLTS
	LOGIC ZERO	0 ± 0.5 VDC
	SOURCE IMPEDANCE	5K OHMS MAX
	NO CONNECTION	LOGIC ONE
	UNUSED INPUTS	NORMALLY OPEN
9.	SERIAL DIGITAL INTERFACE	
	MAX VOLTAGE RANGE	-6.0 TO +13.0 VOLTS
	LOGIC ONE	4.5 TO 10.0 VOLTS
	LOGIC ZERO	-6.0 TO +0.5 VOLTS
	START PULSE (1 BIT TIME PRIOR TO FIRST CLOCK PULSE)	4.5 ± 1 VOLT

TABLE 7-IV.- PCM EQUIPMENT OPERATING CHARACTERISTICS - Concluded

<u>ITEM NO.</u>	<u>ITEM DESCRIPTION</u>	<u>FUNCTION OR VALUE</u>
9.	SERIAL DIGITAL INTERFACE - Concluded	
	40 CLOCK PULSES (AT OUTPUT BIT RATE)	4.5 ± 1 VOLT
	STOP PULSE (1 BIT TIME AFTER LAST CLOCK PULSE)	4.5 ± 1 VOLT
10.	CALIBRATION SIGNALS	
	15% VOLTAGE	0.75 ± .01 VOLT
	85% VOLTAGE	4.25 ± .01 VOLT
11.	ANALOG ENCODING (8-BIT	
	ZERO OR LESS VOLTS	00000001
	5.00 OR GREATER VOLTS	11111110
	NO EXTERNAL CONNECTION	RANDOM OUTPUT
	ACCURACY	±2 COUNTS
	OUTPUT SEQUENCE	MSB FIRST
12.	ISOLATED PCM OUTPUTS	
12.1	NRZ-C OUTPUTS (TO PMP AND DSE)	
	LOGIC ONE	6 ± 0.6 VOLTS
	LOGIC ZERO	0 TO 0.8 VOLTS
12.2	RZ OUTPUT (TO GSE)	
	LOGIC ONE	4.0 TO 6.5 VOLTS
	LOGIC ZERO	-0.25 TO 0.0 VOLTS
13.	DATA RATE TIMING (TO DSE)	
	FREQUENCY (SQUARE WAVE)	1.6 OR 51.2 Kbps
	P-P VOLTAGE	4.0 TO 6.5 VOLTS
	PHASING TO RZ OUTPUT	±0.6 μ SEC
14.	SUBCARRIER REFERENCE (TO PMP)	
	FREQUENCY (SQUARE WAVE)	512 kHz
	P-P VOLTAGE	4.0 TO 6.5 VOLTS
	PHASING TO RZ OUTPUT	± 1 μ SEC
15.	DATA RATE INDICATOR (TO PMP AND UDL)	
	HBR	5.5 ± 1.0 VOLT
	LBR	0 ± 0.8 VOLT
	TRANSITION TIME PRIOR TO NRZ OUTPUT CHANGE	2 TO 6 μ SEC

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7.3 COLUMN DEFINITIONS FOR PCM EQUIPMENT PARAMETER LOADING
TABLES 7-V THROUGH 7-XVIII.

7.3.1 Column 1 - "MEAS ID"

The measurement ID consists of seven characters: two letters followed by four numbers and one letter.

A. Module Code

The first character, a letter, designates the measurement location by module according to the following code:

- A - adapter
- B - booster
- C - command module
- L - launch escape tower
- S - service module

B. Functional Subsystem Code

The second character, also a letter, denotes the subsystem wherein the measurement originates according to this code:

- A - structures
- C - electrical power
- D - master events sequence controller
- E - earth landing sequence controller
- F - environment control
- G - guidance & navigation
- H - stabilization control
- J - crew equipment
- K - flight technology
- L - scientific equipment
- P - service propulsion
- R - reaction control
- S - L/V emergency detection
- T - communications and instrumentation

C. Discrete Number

The next four characters, three through six, are discrete numbers, listed sequentially within each subsystem.

D. Measurement Classification

The last character denotes the type of measurement according to the following code:

- A - acceleration
- B - phase
- C - current
- D - vibration
- E - power
- F - frequency
- G - force
- H - position/attitude
- J - biomedical
- K - radiation
- L - velocity
- M - mass
- N - camera/resistance
- P - pressure
- Q - quantity
- R - rate
- S - strain
- T - temperature
- U - undefined
- V - voltage
- W - time
- X - discrete event
- Y - accoustical
- Z - pH - acidity

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7.3.2 Column 2 - "MEAS DESCRIPTION"

The measurement description is a brief, definitive title for each measurement. Standard abbreviations are used where applicable.

7.3.3 Column 3 - "TM"

The telemetry column contains an alpha character and a numeral.

A. The alpha character indicates the type of signal measured as follows:

H - high level analog

E - event (one bit)

D - digital word (more than one bit)

S - serial digital word (more than one bit)

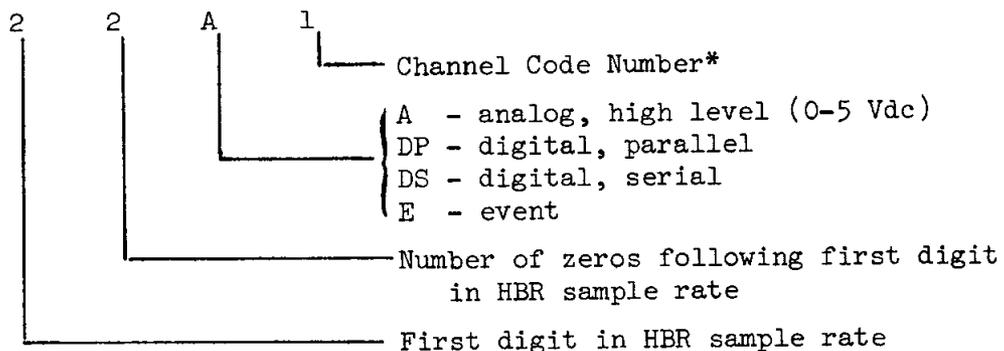
B. The numeric character indicates the telemetry format as follows:

1 - HBR format only

2 - HBR and LBR formats

7.3.4 Column 4 - "CHAN CODE"

The channel code contains information giving the high-bit rate (HBR) sample rate, the type of parameter measurement (analog, digital, etc.), and the channel code number associated with that type of measurement as in the following example:



*In the case of events, this number will be followed by a hyphen and a second number. The second number will refer to the bit location in an 8-bit word.

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CSM
S/C 112-114

7.3.5 Column 5 - "HBR FR - WD"

This column, consisting of two numbers followed by a hyphen and three more numbers, designates the high-bit rate frame and word location of the first sample of the parameter.

7.3.6 Column 6 - "LBR WD"

The three digit number in this column refers to the Parameter low-bit rate word location if applicable.

7.3.7 Column 7 - "DATA RANGE"

The data range column indicates the required PCM range of the parameter. The specific calibration curve should be used to determine the actual parameter range. For bilevel parameters, a PCM "one" state will be listed under HIGH and a PCM "zero" state will be listed under LOW.

7.3.8 Column 8 - "INST BUS"

- A. The instrumentation bus column will indicate the power source for a parameter. Some measurements are sensed and/or signal condition within a particular system using that systems' power and will be indicated by the acronym for that system (e.g., EPS, SEQ, LES, EDS, ECS, G&N, S&C, C&W, or C&I).
- B. The instrumentation system distributes +28 Vdc power directly to certain sensors and signal conditioners. These instrumentation power buses are listed in Paragraph 1.8.5.3 of this document and are designated as follows:

V₁ - CM ESS INST BUS PWR FROM RHEB PNL 276-CB1
V₂ - CM ESS INST BUS PWR FROM RHEB PNL 276-CB2
V_{3S} - SM ESS INST BUS PWR FROM RHEB PNL 276-CB3
V_{4S} - SM ESS INST BUS PWR FROM RHEB PNL 276-CB4
V_{SC} - SCE PWR REQ'D FOR SIGNAL CONDITIONING (+20, -20, and/or +10 Vdc).

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CSM
S/C 112-114

7.3.9 Column 9 - "SIG COND"

The signal conditioner column uses the following code to indicate the type of SCE module that is used to condition the signal.

AA - dc active attenuator
DA - dc differential amplifier
DBA - dc differential bridge amplifier
AC - ac to dc converter

7.3.10 Column 10 - "O/B DISPL"

The following acronyms indicate the type of onboard display used for parameters that appear both onboard and in the PCM bit stream:

(An acronym followed by an * means the parameter is displayed on the C&W system.)

M - displayed on meter
SM - displayed on selectable meter
L - displayed on lamp indicator
TB - displayed on talk back (FLAG)
STB - displayed on selectable talk back (FLAG)
SMB - displayed on selectable meter and talk back

7.3.11 Column 11 - "SIG DIST"

The following acronyms indicate common circuit characteristics of the PCM parameters being displayed to the crew:

CS - common signal drives display and PCM
SS - separate signal drives display and PCM
TSC - common sensor but PCM is signal conditioned

7.3.12 Column 12 - "CSMSH DWG - ZONE"

This column will reference the CSMSH drawing zone for system information.

TABLE 7-V.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - STRUCTURES

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		LBR WD	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR	WD		LOW	HIGH	UNITS					
CA1820T	SIDE HS SURF LOC 1 TEMP	H1	10A65	22	- 084	---	-260	+830	DEG F	V ₂	---	---	---	--
CA1821T	SIDE HS SURF LOC 4 TEMP	H1	10A70	24	- 052	---	-260	+830	DEG F	V ₂	---	---	---	--
CA1822T	SIDE HS SURF LOC 7 TEMP	H1	10A74	25	- 084	---	-260	+830	DEG F	V ₂	---	---	---	--
CA1823T	SIDE HS SURF LOC 10 TEMP	H1	10A79	27	- 052	---	-260	+830	DEG F	V ₂	---	---	---	--
SA1830T*	SKIN TEMP 1A	H1	10A40	14	- 052	--	-109	+264	DEG F	V _{3S}	---	---	---	--
SA1831T*	SKIN TEMP 4A	H1	10A143	48	- 084	---	-109	+264	DEG F	V _{4S}	---	---	---	--
SA1832T*	SKIN TEMP 7A	H1	10A41	14	- 084	---	-109	+264	DEG F	V _{3S}	---	---	---	--
SA1833T*	SKIN TEMP 10A	H1	10A145	49	- 052	---	-109	+264	DEG F	V _{4S}	---	---	---	--

*NOT ON S/C 112.

TABLE 7-VI.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - ELECTRICAL POWER SYSTEM

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		LBR WD	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR	WD		LOW	HIGH	UNITS					
SC0030Q	H ₂ TK 1 QTY	H2	10A141	47	116	056	0	100	PCT	EPS	--	M	CS	5.2
SC0031Q	H ₂ TK 2 QTY	H2	10A144	48	116	096	0	100	PCT	EPS	--	SM	CS	5.2
SC0032Q	O ₂ TK 1 QTY	H2	10A147	49	116	136	0	100	PCT	EPS	--	M	CS	5.2
SC0033Q	O ₂ TK 2 QTY	H2	10A42	14	116	139	0	100	PCT	EPS	--	SM	CS	5.2
SC0037P	O ₂ TK 1 PRESS	H2	10A150	50	116	176	50	1050	PSIA	V _{4S}	--	SM*	CS	5.2
SC0038P	O ₂ TK 2 PRESS	H2	10A66	22	116	077	50	1050	PSIA	V _{3S}	--	SM	CS	5.2
SC0039P	H ₂ TK 1 PRESS	H2	10A36	12	116	059	0	350	PSIA	V _{4S}	--	M*	CS	5.2
SC0040P	H ₂ TK 2 PRESS	H2	10A39	13	116	099	0	350	PSIA	V _{3S}	--	SM*	CS	5.2
SC0041T	O ₂ TK 1 TEMP	H2	10A54	18	116	100	-325	+80	DEG F	EPS	--	--	--	5.2
SC0042T	O ₂ TK 2 TEMP	H2	10A57	19	116	140	-325	+80	DEG F	EPS	--	--	--	5.2
SC0043T	H ₂ TK 1 TEMP	H2	10A60	20	116	180	-425	-200	DEG F	EPS	--	--	--	5.2
SC0044T	H ₂ TK 2 TEMP	H2	10A63	21	116	037	-425	-200	DEG F	EPS	--	--	--	5.2
SC0050Q	H ₂ TK 3 QTY	H2	10A3	01	116	017	0	100	PCT	EPS	--	SM	CS	
SC0051Q	O ₂ TK 3 QTY	H2	11A154	05	041	125	0	100	PCT	EPS	--	SM	CS	
SC0052P	H ₂ TK 3 PRESS	H2	11A48	02	043	087	0	350	PSIA	V _{3S}	--	SM	CS	
SC0053P	O ₂ TK 3 PRESS	H2	11A148	05	012	064	50	1050	PSIA	V _{3S}	--	SM	CS	
SC0054T	H ₂ TK 3 TEMP	H2	10A117	39	116	160	-425	-200	DEG F	EPS	--	--	--	
SC0055T	O ₂ TK 3 TEMP	H2	10A84	28	116	118	-325	+80	DEG F	EPS	--	--	--	
SC0069P	O ₂ TK 2/3 MANIF PRESS	H2	11A49	02	044	088	50	1050	PSIA	V _{3S}	--	L*	CS	
SC0070T	O ₂ TK 1 HTR TEMP	H2	10A108	36	116	040	-300	+600	DEG F	V _{4S}	--	SM	CS	
SC0071T	O ₂ TK 2 HTR TEMP	H2	10A111	37	116	080	-300	+600	DEG F	V _{3S}	--	SM	CS	
SC0072T	O ₂ TK 3 HTR TEMP	H2	10A135	45	116	175	-300	+600	DEG F	V _{3S}	--	SM	CS	
CC0175T	INVERTER 1 TEMP	H1	10A86	29	084	--	+32	+248	DEG F	V _{SC}	DBA	L*	CS	3.3
CC0176T	INVERTER 2 TEMP	H1	10A88	30	052	--	+32	+248	DEG F	V _{SC}	DBA	L*	CS	3.3
CC0177T	INVERTER 3 TEMP	H1	10A89	30	084	--	+32	+248	DEG F	V _{SC}	DBA	L*	CS	3.3
CC0200V	AC BUS 1 ϕ A VOLTS	H2	11A147	05	011	063	0	150	VAC	V _{SC}	AC	SM*	TSC	3.3
CC0203V	AC BUS 2 ϕ A VOLTS	H2	11A56	02	074	146	0	150	VAC	V _{SC}	AC	SM*	TSC	3.3
CC0206V	MAIN BUS A VOLTS	H2	11A57	02	075	147	0	+45	VDC	V _{SC}	AA	SM*	TSC	3.2
CC0207V	MAIN BUS B VOLTS	H2	11A58	02	076	148	0	+45	VDC	V _{SC}	AA	SM*	TSC	3.2
CC0210V	BAT BUS A VOLTS	H2	11A91	03	073	165	0	+45	VDC	V _{SC}	AA	SM	TSC	3.2
CC0211V	BAT BUS B VOLTS	H2	11A93	03	075	167	0	+45	VDC	V _{SC}	AA	SM	TSC	3.2
CC0215C	BAT CHGR	H2	11A73	03	009	025	0	+5	AMPS	V _{SC}	DA	SM	TSC	3.2
CC0222C	BAT A CUR	H2	11A74	03	010	026	0	+100	AMPS	V _{SC}	DA	SM	TSC	3.2
CC0223C	BAT B CUR	H2	11A109	04	009	045	0	+100	AMPS	V _{SC}	DA	SM	TSC	3.2
CC0224C	BAT C CUR	H2	11A110	04	010	046	0	+100	AMPS	V _{SC}	DA	SM	TSC	3.2

TABLE 7-VI. - PCM EQUIPMENT TELEMETRY (51.2 KBPS) - ELECTRICAL POWER SYSTEM - Concluded

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		LBR WD	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR	WD		LOW	HIGH	UNITS					
SC0230V	AUX BAT VOLTS	H1	11A150	05 - 025	--	0	+40	VDC	EPS	--	--	--	3.2	
CC0232V	BAT RELAY BUS VOLTS	H2	11A75	03 - 011	027	0	+45	VDC	V _{SC}	AA	SM	CS	3.2	
SC2066P	FC 1 O ₂ PRESS	H1	11A67	02 - 108	--	0	75	PSIA	V _{4S}	--	SM	CS	5.3	
SC2067P	FC 2 O ₂ PRESS	H1	11A68	02 - 113	--	0	75	PSIA	V _{3S}	--	SM	CS	5.3	
SC2068P	FC 3 O ₂ PRESS	H1	11A69	02 - 121	--	0	75	PSIA	V _{3S}	--	SM	CS	5.3	
SC2069P	FC 1 H ₂ PRESS	H1	11A70	02 - 122	--	0	75	PSIA	V _{4S}	--	SM	CS	5.3	
SC2070P	FC 2 H ₂ PRESS	H1	11A71	02 - 123	--	0	75	PSIA	V _{3S}	--	SM	CS	5.3	
SC2071P	FC 3 H ₂ PRESS	H1	11A72	02 - 124	--	0	75	PSIA	V _{3S}	--	SM	CS	5.3	
SC2081T	FC 1 COND EXH TEMP	H2	10A51	17 - 116	060	+145	+250	DEG F	V _{SC}	DBA	SM*	CS	5.3	
SC2082T	FC 2 COND EXH TEMP	H2	10A123	41 - 116	015	+145	+250	DEG F	V _{SC}	DBA	SM*	CS	5.3	
SC2083T	FC 3 COND EXH TEMP	H2	10A69	23 - 116	117	+145	+250	DEG F	V _{SC}	DBA	SM*	CS	5.3	
SC2084T	FC 1 SKIN TEMP	H2	10A72	24 - 116	157	+80	+550	DEG F	V _{SC}	DBA	SM*	CS	5.3	
SC2085T	FC 2 SKIN TEMP	H2	10A75	25 - 116	197	+80	+550	DEG F	V _{SC}	DBA	SM*	CS	5.3	
SC2086T	FC 3 SKIN TEMP	H2	10A78	26 - 116	038	+80	+550	DEG F	V _{SC}	DBA	SM*	CS	5.3	
SC2087T	FC 1 RAD OUT TEMP	H2	10A126	42 - 116	055	-50	+300	DEG F	V _{4S}	--	SMB*	CS	5.3	
SC2088T	FC 2 RAD OUT TEMP	H2	10A129	43 - 116	095	-50	+300	DEG F	V _{3S}	--	SMB*	CS	5.3	
SC2089T	FC 3 RAD OUT TEMP	H2	10A132	44 - 116	135	-50	+300	DEG F	V _{3S}	--	SMB*	CS	5.3	
SC2090T	FC 1 RAD IN TEMP	H1	10A130	44 - 052	--	-50	+300	DEG F	V _{4S}	--	--	--	5.3	
SC2091T	FC 2 RAD IN TEMP	H1	10A131	44 - 084	--	-50	+300	DEG F	V _{3S}	--	--	--	5.3	
SC2092T	FC 3 RAD IN TEMP	H1	10A67	23 - 052	--	-50	+300	DEG F	V _{3S}	--	--	--	5.3	
SC2113C	FC 1 CUR	H2	11A76	03 - 012	028	0	+100	AMPS	V _{SC}	DA	SM	TSC	5.3	
SC2114C	FC 2/AUX BAT CUR	H2	11A84	03 - 043	103	0	+100	AMPS	V _{SC}	DA	SM	TSC	5.3	
SC2115C	FC 3 CUR	H2	11A85	03 - 044	104	0	+100	AMPS	V _{SC}	DA	SM	TSC	5.3	
SC2139R	FC 1 H ₂ FLOW	H1	11A77	03 - 017	--	0	0.2	LB/HR	V _{4S}	--	SM*	CS	5.3	
SC2140R	FC 2 H ₂ FLOW	H1	11A78	03 - 025	--	0	0.2	LB/HR	V _{3S}	--	SM*	CS	5.3	
SC2141R	FC 3 H ₂ FLOW	H1	11A79	03 - 026	--	0	0.2	LB/HR	V _{3S}	--	SM*	CS	5.3	
SC2142R	FC 1 O ₂ FLOW	H1	11A80	03 - 027	--	0	1.6	LB/HR	V _{4S}	--	SM*	CS	5.3	
SC2143R	FC 2 O ₂ FLOW	H1	11A81	03 - 028	--	0	1.6	LB/HR	V _{3S}	--	SM*	CS	5.3	
SC2144R	FC 3 O ₂ FLOW	H1	11A82	03 - 041	--	0	1.6	LB/HR	V _{3S}	--	SM*	CS	5.3	
SC2160X	FC 1 PH	E2	11E28-1	05 - 066	102	NORM	HIGH	EVENT	EPS	--	STB*	CS	5.3	
SC2161X	FC 2 PH	E2	11E28-2	05 - 066	102	NGRM	HIGH	EVENT	EPS	--	STB*	CS	5.3	
SC2162X	FC 3 PH	E2	11E28-3	05 - 066	102	NORM	HIGH	EVENT	EPS	--	STB*	CS	5.3	
CC2962C	LM HEATER CURRENT	H2	11A47	02 - 042	086	0	+10	AMPS	V _{SC}	DA	SM	CS	2.8	

TABLE 7-VII.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - LAUNCH ESCAPE SYSTEM

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR	LBR	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR - WD	WD	LOW	HIGH	UNITS					
CD0005V	PYRO BUS A VOLTS	H1	11A9	01 - 028	--	0	+40	VDC	SEQ	--	--	--	2.2
CD0006V	PYRO BUS B VOLTS	H1	11A5	01 - 017	--	0	+40	VDC	SEQ	--	--	--	2.2
CD0023X	CM-SM SEP RELAY A	E2	11E22-1	04 - 067	195		SEP	EVENT	SEQ	--	--	--	2.4
CD0024X	CM-SM SEP RELAY B	E2	11E23-1	04 - 068	196		SEP	EVENT	SEQ	--	--	--	2.4
CD0123X	SLA SEP RELAY A	E2	11E22-5	04 - 067	195		SEP	EVENT	SEQ	--	--	--	2.4
CD0124X	SLA SEP RELAY B	E2	11E23-7	04 - 068	196		SEP	EVENT	SEQ	--	--	--	2.4
CD0130X	CREW ABORT A	E2	11E13-3	03 - 065	115		ABORT	EVENT	SEQ	--	--	--	2.3
CD0131X	CREW ABORT B	E2	11E13-6	03 - 065	115		ABORT	EVENT	SEQ	--	--	--	2.3
CD0132X	EDS ABORT VOTE 1	E2	11E14-1	03 - 066	116	VOTE/OFF	ARM	EVENT	EDS	--	--	--	2.3
CD0133X	EDS ABORT VOTE 2	E2	11E14-2	03 - 066	116	VOTE/OFF	ARM	EVENT	EDS	--	--	--	2.3
CD0134X	EDS ABORT VOTE 3	E2	11E14-4	03 - 066	116	VOTE/OFF	ARM	EVENT	EDS	--	--	--	2.3
CD0135X	EDS ABORT A	E2	11E13-7	03 - 065	115		ABORT	EVENT	EDS	--	--	--	2.3
CD0136X	EDS ABORT B	E2	11E13-4	03 - 065	115		ABORT	EVENT	EDS	--	--	--	2.3
CD0170X	SCS CHANNEL ENABLE RCS A	E2	11E22-3	04 - 067	195		ENABLE	EVENT	SEQ	--	--	--	2.4
CD0171X	SCS CHANNEL ENABLE RCS B	E2	11E23-3	04 - 068	196		ENABLE	EVENT	SEQ	--	--	--	2.4
CD0173X	CM RCS PRESS SIG A	E2	11E22-7	04 - 067	195		PRESS	EVENT	SEQ	--	--	--	2.4
CD0174X	CM RCS PRESS SIG B	E2	11E23-5	04 - 068	196		PRESS	EVENT	SEQ	--	--	--	2.4
CD0200V	LOGIC BUS A VOLTS	H1	11A8	01 - 027	--	0	+40	VDC	SEQ	--	--	--	2.2
CD0201V	LOGIC BUS B VOLTS	H1	11A6	01 - 025	--	0	+40	VDC	SEQ	--	--	--	2.2
CD0230X	FWD HS JET A	E2	11E24-1	04 - 097	043		JETT	EVENT	SEQ	--	--	--	2.5
CD0231X	FWD HS JET B	E2	11E26-5	04 - 099	081		JETT	EVENT	SEQ	--	--	--	2.5
CD0412X	SIM PYRO BUS A ARM	E2	11E18-1	03 - 098	161		ARM	EVENT	SEQ	--	--	--	
CD0413X	SIM PYRO BUS B ARM	E2	11E18-2	03 - 098	161		ARM	EVENT	SEQ	--	--	--	
CD1154X	CSM-LM LOCK RING SEP RELAY A	E2	11E15-6	03 - 067	141		SEP	EVENT	SEQ	--	--	--	2.8
CD1155X	CSM-LM LOCK RING SEP RELAY B	E2	11E15-7	03 - 067	141		SEP	EVENT	SEQ	--	--	--	2.8

TABLE 7-VIII.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - EARTH LANDING SEQUENCE CONTROLLER

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		LBR	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR -	WD		WD	LOW	HIGH						UNITS
CE0001X	DROGUE DEP RELAY A	E2	11E29-1	05 -	067	155		DEPLOY	EVENT	V ₂	--	--	--	2.5
CE0002X	DROGUE DEP RELAY B	E2	11E30-6	05 -	068	163		DEPLOY	EVENT	V ₂	--	--	--	2.5
CE0003X	MAIN DEPLOY RELAY A	E2	11E29-8	05 -	067	155		DEPLOY	EVENT	V ₂	--	--	--	2.5
CE0004X	MAIN DEPLOY RELAY B	E2	11E30-3	05 -	068	163		DEPLOY	EVENT	V ₂	--	--	--	2.5
CE0321X	MAIN CHUTE DISC RELAY A	E2	11E29-5	05 -	067	155		DISC	EVENT	V ₂	--	--	--	2.5
CE0322X	MAIN CHUTE DISC RELAY B	E2	11E30-8	05 -	067	163		DISC	EVENT	V ₂	--	--	--	2.5

TABLE 7-IX.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - ENVIRONMENTAL CONTROL SYSTEM

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		LBR WD	DATA RANGE			INST BUS	SIC COND	O/R DISPL	SIG DIST	CSH DWG
				FR	WD		LOW	HIGH	UNITS					
CF0001P	CABIN PRESS	H2	10A6	02	- 116	057	0	17	PSIA	ECS	--	M	CS	4.2
CF0002T	CABIN TEMP	H1	10A128	43	- 084	--	+40	+125	DEG F	ECS	--	M	CS	4.3
CF0003P	SUIT-CABIN DELTA PRESS	H1	11A37	02	- 009	--	-5	+5	IN H ₂ O	V ₂	--	M	CS	1.2
CF0005P	CO ₂ PARTIAL PRESS	H1	10A1	01	- 052	--	0	30	MM Hg	ECS	--	M*	SS	4.2
CF0006P	SURGE TANK PRESS	H2	11A4	01	- 012	008	50	1050	PSIA	V ₂	--	SM	CS	4.2
CF0008T	SUIT AIR HX OUT TEMP	H2	10A45	15	- 116	179	+20	+95	DEG F	ECS	--	M	CS	4.2
CF0009Q	WASTE H ₂ O QTY	H2	10A9	03	- 116	097	0	100	PCT	ECS	--	SM	CS	4.5
CF0010Q	POTABLE H ₂ O QTY	H2	10A81	27	- 116	078	0	100	PCT	ECS	--	SM	CS	4.5
CF0012P	SUIT MANF ABS PRESS	H2	11A1	01	- 009	005	0	17	PSIA	ECS	--	M	CS	4.2
CF0015P	SUIT COMP DELTA P	H2	11A2	01	- 010	006	0	1	PSID	ECS	--	M*	CS	4.2
CF0016P	GLY PUMP OUT PRESS	H2	11A3	01	- 011	007	0	60	PSIG	ECS	--	SM	CS	4.3
CF0017T	GLY EVAP OUT STEAM TEMP	H1	10A133	45	- 052	--	+20	+95	DEG F	ECS	--	--	--	4.3
CF0018T	GLY EVAP OUT TEMP	H2	10A12	04	- 116	137	+25	+75	DEG F	ECS	--	SM	CS	4.3
CF0019Q	GLY ACCUM QTY	H2	11A13	01	- 044	068	0	100	PCT	ECS	--	SM	CS	4.3
CF0020T	ECS RAD OUT TEMP	H2	10A15	05	- 116	177	-50	+100	DEG F	ECS	--	M*	CS	4.3
CF0034P	GLY EVAP BACK PRESS	H1	10A4	02	- 052	--	+0.05	+0.25	PSIA	ECS	--	SM	CS	4.3
CF0035R	ECS O ₂ FLOW O ₂ SUPPLY MANF	H1	11A14	01	- 049	--	0.2	1.0	LB/HR	ECS	--	M*	CS	4.2
CF0036P	O ₂ SUPPLY MANF PRESS	H2	11A55	02	- 073	145	0	150	PSIG	ECS	--	--	--	4.2
CF0070P	SEC GLY PUMP OUT PRESS	H2	11A157	05	- 044	128	0	60	PSIG	ECS	--	SM	CS	4.4
CF0071T	SEC EVAP OUT LIQ TEMP	H2	11A118	04	- 041	105	+25	+75	DEG F	ECS	--	SM	CS	4.4
CF0072Q	SEC GLY ACCUM QUANTITY	H2	11A129	04	- 075	183	0	100	PCT	ECS	--	SM	CS	4.4
CF0073P	SEC EVAP OUT STEAM PRESS	H1	10A8	03	- 084	--	0.05	0.25	PSIA	ECS	--	SM	CS	4.4
CF0120P	H ₂ O TANK - GLY RES PRESS	H1	10A101	34	- 084	--	0	50	PSIA	V ₂	--	--	--	4.2
CF0157R	PRI GLYCOL FLOW RATE	H1	11A87	03	- 057	--	130	+300	LB/HR	V ₂	--	--	--	4.3
CF0181T	PRI EVAP INLET TEMP	H1	10A100	34	- 052	--	+35	+100	DEG F	V ₂	--	--	--	4.3
SF0260T	PRI RAD IN TEMP	H2	10A48	16	- 116	020	+55	+120	DEG F	ECS	--	SM	CS	4.3
SF0262T	SEC RAD IN TEMP	H2	10A87	29	- 116	158	+55	+120	DEG F	ECS	--	SM	CS	4.4
SF0263T	SEC RAD OUT TEMP	H2	10A90	30	- 116	198	+30	+70	DEG F	ECS	--	M	CS	4.4
SF0266X	RAD FLOW CONT SYS 1 OR 2	E2	11E4-8	01	- 098	041	SYS 1	SYS 2	EVENT	V _{SC}	AA	TB	TSC	4.3
CF0460T	URINE DUMP NOZZLE TEMP	H2	10A114	38	- 116	120	0	+100	DEG F	V ₂	--	--	--	4.5
CF0461T	H ₂ O DUMP TEMP	H1	10A82	28	- 052	--	0	+100	DEG F	V ₁	--	--	--	4.5

TABLE 7-X.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - GUIDANCE AND NAVIGATION SYSTEM

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		LBR WD	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR	WD		LOW	HIGH	UNITS					
CG0001V	CPTR DIG DATA - 40 BITS	S2	51D51	01 - 032	009					--	--	--	--	8.1
CG1040V	PIPA + 120 VDC	H1	10A83	28 - 084	--	+85	+135	VDC	G&N	--	--	--	--	8.5
CG1110V	TM BIAS 2.5 VDC	H2	10A138	46 - 116	016	0	5	VDC	G&N	--	--	--	--	8.4
CG1201V	IMU 28 VAC 800HZ	H1	10A91	31 - 052	--	0	31.1	VRMS	G&N	--	--	--	--	8.5
CG1331V	3.2 KHZ 28V SUPPLY	H1	10A86	29 - 052	--	0	31.1	VRMS	G&N	--	--	--	--	8.5
CG1513X	IMU HTR +28 VDC	E2	11E15-2	03 - 067	141	OFF	STBY	EVENT	G&N	--	--	--	--	8.5
CG1523X	CMC OPERATE +28 VDC	E2	11E15-3	03 - 067	141	OFF	OPR	EVENT	G&N	--	--	--	--	8.4
CG1533X	OPTX OPERATE 28 VAC	E2	11E15-4	03 - 067	141	OFF	OPR	EVENT	G&N	--	--	--	--	8.4
CG2112V	IG IX RSVR OUT SIN	H1	11A54	02 - 060	--	-50/+230	+50/+130	DEG	G&N	--	--	--	--	8.5
CG2113V	IG IX RSVR OUT COS	H1	11A59	02 - 081	--	+130/+230	+50/+310	DEG	G&N	--	--	--	--	8.5
CG2117V	IGA SERVO ERR IN PHASE	H1	12A2	01 - 014	--	-3.0	+3.0	MRAD	G&N	--	--	--	--	8.5
CG2142V	MG IX RSVR OUT SIN	H1	11A60	02 - 089	--	-50/+230	+50/+130	DEG	G&N	--	--	--	--	8.5
CG2143V	MG IX RSVR OUT COS	H1	11A61	02 - 090	--	+130/+230	+50/+310	DEG	G&N	--	--	--	--	8.5
CG2147V	MGA SERVO ERR IN PHASE	H1	12A1	01 - 013	--	-3.0	+3.0	MRAD	G&N	--	--	--	--	8.5
CG2172V	OG IX RSVR OUT SIN	H1	11A62	02 - 091	--	-50/+230	+50/+130	DEG	G&N	--	--	--	--	8.5
CG2173V	OG IX RSVR OUT COS	H1	11A63	02 - 092	--	+130/+230	+50/+310	DEG	G&N	--	--	--	--	8.5
CG2177V	OGA SERVO ERR IN PHASE	H1	12A3	01 - 015	--	-3.0	+3.0	MRAD	G&N	--	--	--	--	8.5
CG2300T	PIPA TEMP	H2	10A96	32 - 116	079	+120	+140	DEG F	G&N	--	--	--	--	8.5
CG3721V	SHAFT CDU DAC OUT	H1	11A52	02 - 058	--	-12	+12	VRMS	G&N	--	--	--	--	8.9
CG3722V	TRUNNION CDU OUT	H1	11A53	02 - 059	--	-12	+12	VRMS	G&N	--	--	--	--	8.9
CG5040X	CMC WARNING	E2	11E19-1	04 - 099	162	WARN		EVENT	G&N	--	L*	SS	--	8.6

TABLE 7-XI.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - STABILIZATION AND CONTROL SYSTEM

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		LBR WD	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR	WD		LOW	HIGH	UNITS					
CH3500H	PITCH ATT ERR	H1	51A5	01	- 062	--	-5/15	+5/15	DEG	S&C	--	M	TSC	8.8
CH3501H	YAW ATT ERR	H1	51A6	01	- 063	--	-5/15	+5/15	DEG	S&C	--	M	TSC	8.8
CH3502H	ROLL ATT ERR	H1	12A4	01	- 016	--	-5/12.5/20/50	+5/12.5/20/50	DEG	S&C	--	M	TSC	8.8
CH3503R	SCS PITCH BODY RATE	H1	12A5	01	- 021	--	-1/5/10	+1/5/10	DEG/S	S&C	--	M	TSC	8.8
CH3504R	SCS YAW BODY RATE	H1	12A6	01	- 022	--	-1/5/10	+1/5/10	DEG/S	S&C	--	M	TSC	8.8
CH3505R	SCS ROLL BODY RATE	H1	12A7	01	- 023	--	-1/5/50	+1/5/50	DEG/S	S&C	--	M	TSC	8.8
CH3517H	PITCH GMBL POS 1 OR 2	H1	12A8	01	- 024	--	-5.0	+5.0	DEG	S&C	--	SM	TSC	8.9
CH3518H	YAW GMBL POS 1 OR 2	H1	12A10	01	- 046	--	-5.0	+5.0	DEG	S&C	--	SM	TSC	8.9
CH3546X	+PITCH/+X ENG	E1	22E1-1	01	- 018	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3547X	-PITCH/+X ENG	E1	22E2-2	01	- 018	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3548X	+PITCH/-X ENG	E1	22E3-3	01	- 018	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3549X	-PITCH/-X ENG	E1	22E4-4	01	- 018	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3550X	+YAW/+X ENG	E1	22E5-5	01	- 018	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3551X	-YAW/+X ENG	E1	22E6-6	01	- 018	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3552X	+YAW/-X ENG	E1	22E7-7	01	- 018	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3553X	-YAW/-X ENG	E1	22E8-8	01	- 018	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3554X	+ROLL/+Z ENG	E1	22E9-1	01	- 019	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3555X	-ROLL/+Z ENG	E1	22E13-5	01	- 019	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3556X	+ROLL/-Z ENG	E1	22E14-6	01	- 019	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3557X	-ROLL/-Z ENG	E1	22E10-2	01	- 019	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3558X	+ROLL/+Y ENG	E1	22E15-7	01	- 019	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3559X	-ROLL/+Y ENG	E1	22E11-3	01	- 019	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3560X	+ROLL/-Y ENG	E1	22E12-4	01	- 019	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3561X	-ROLL/-Y ENG	E1	22E16-8	01	- 019	--	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.10
CH3574X	TRANS CNTL +X CMD	E2	11E22-4	04	- 067	195	OFF	ON	EVENT	S&C	--	--	--	8.10
CH3575X	TRANS CNTL -X CMD	E2	11E22-6	04	- 067	195	OFF	ON	EVENT	S&C	--	--	--	8.10
CH3576X	TRANS CNTL +Y CMD	E2	11E22-8	04	- 067	195	OFF	ON	EVENT	S&C	--	--	--	8.10
CH3577X	TRANS CNTL -Y CMD	E2	11E23-6	04	- 068	196	OFF	ON	EVENT	S&C	--	--	--	8.10
CH3578X	TRANS CNTL +Z CMD	E2	11E23-8	04	- 068	196	OFF	ON	EVENT	S&C	--	--	--	8.10
CH3579X	TRANS CNTL -Z CMD	E2	11E24-2	04	- 097	043	OFF	ON	EVENT	S&C	--	--	--	8.10
CH3582V	SCS TVC PITCH AUTO CMD	H1	12A15	01	- 055	--	+10	-10	VDC	S&C	--	--	--	8.9
CH3583V	SCS TVC YAW AUTO CMD	H1	12A13	01	- 053	--	+10	-10	VDC	S&C	--	--	--	8.9
CH3585H	MTVC PITCH CMD	H1	51A11	01	- 096	--	-10	+10	DEG	S&C	--	--	--	8.9
CH3586H	MTVC YAW CMD	H1	51A12	01	- 125	--	-10	+10	DEG	S&C	--	--	--	8.9
CH3587H	ROT ROLL CMD	H1	51A13	01	- 126	--	-10	+10	DEG	S&C	--	--	--	8.9

TABLE 7-XI.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - STABILIZATION AND CONTROL SYSTEM - Concluded

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		LBR WD	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR	WD		LOW	HIGH	UNITS					
CH3588X	ATT DEADBAND MIN	E2	11E8-2	02	- 067	075	MAX	MIN	EVENT	S&C	--	--	--	8.9A
CH3590X	HI RATE LIMIT	E2	11E8-4	02	- 067	075	LOW	HIGH	EVENT	S&C	--	--	--	8.9A
CH3592X	FDAI ERR 5 RATE 5	E2	11E8-5	02	- 067	075	OFF	ON	EVENT	S&C	--	--	--	8.3
CH3593X	FDAI SCALE ERR 50/15	E2	11E8-6	02	- 067	075	OFF	ON	EVENT	S&C	--	--	--	8.3
CH3600X	AV CG LM/CSM	E2	11E9-3	02	- 068	076	CSM	LM/CSM	EVENT	S&C	--	--	--	8.9A
CH3601X	DIRECT RCS NO. 1	E2	11E24-3	04	- 097	043	OFF	ENABLE	EVENT	S&C	--	--	--	8.7
CH3602X	DIRECT RCS NO. 2	E2	11E24-4	04	- 097	043	OFF	ENABLE	EVENT	S&C	--	--	--	8.7
CH3604X	SPS SOL DRIVER 1	E2	11E4-4	01	- 098	041	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.9
CH3605X	SPS SOL DRIVER 2	E2	11E9-4	02	- 068	076	FIRE/OFF	ARM	EVENT	S&C	--	--	--	8.9
CH3606X	LIMIT CYCLE SWITCH	E2	11E25-1	04	- 098	044	ON	OFF	EVENT	S&C	--	--	--	8.9A
CH3607X	S/C CNTL SCS	E2	11E9-5	02	- 068	076	CMC	SCS	EVENT	S&C	--	--	--	8.9
CH3609X	MANUAL ROLL ACCEL CMD	E2	11E25-7	04	- 098	044	OFF	ON	EVENT	S&C	--	--	--	8.9A
CH3610X	MANUAL ROLL MIN IMP CMD	E2	11E25-8	04	- 098	044	OFF	ON	EVENT	S&C	--	--	--	8.9A
CH3612X	MANUAL PITCH ACCEL CMD	E2	11E25-3	04	- 098	044	OFF	ON	EVENT	S&C	--	--	--	8.9A
CH3613X	MANUAL PITCH MIN IMP CMD	E2	11E25-4	04	- 098	044	OFF	ON	EVENT	S&C	--	--	--	8.9A
CH3615X	MANUAL YAW ACCEL CMD	E2	11E25-5	04	- 098	044	OFF	ON	EVENT	S&C	--	--	--	8.9A
CH3616X	MANUAL YAW MIN IMP CMD	E2	11E25-6	04	- 098	044	OFF	ON	EVENT	S&C	--	--	--	8.9A
CH3623X	GYRO 1 COMB SMRD	E2	11E8-7	02	- 067	075	LOW	NORM	EVENT	S&C	--	--	--	8.9
CH3624X	GYRO 2 COMB SMRD	E2	11E8-8	02	- 067	075	LOW	NORM	EVENT	S&C	--	--	--	8.9
CH3635X	BMAG MODE SW-ROLL ATT 1 RT 2	E1	11E33-1	05	- 099	--	OFF	ON	EVENT	V _{SC}	AA	--	--	8.9A
CH3636X	BMAG MODE SW-ROLL RATE 2	E1	11E33-2	05	- 099	--	OFF	ON	EVENT	V _{SC}	AA	--	--	8.9A
CH3638X	BMAG MODE SW-PITCH ATT 1 RT 2	E1	11E33-3	05	- 099	--	OFF	ON	EVENT	V _{SC}	AA	--	--	8.9A
CH3639X	BMAG MODE SW-PITCH RATE 2	E1	11E33-4	05	- 099	--	OFF	ON	EVENT	V _{SC}	AA	--	--	8.9A
CH3641X	BMAG MODE SW-YAW ATT 1 RT 2	E1	11E33-5	05	- 099	--	OFF	ON	EVENT	V _{SC}	AA	--	--	8.9A
CH3642X	BMAG MODE SW-YAW RATE 2	E1	11E33-6	05	- 099	--	OFF	ON	EVENT	V _{SC}	AA	--	--	8.9A
CH3666C	PITCH DIFF CLUTCH CURRENT	H1	22A4	01	- 008	--	-0.807	+0.807	AMP	S&C	--	--	--	8.9
CH3667C	YAW DIFF CLUTCH CURRENT	H1	12A16	01	- 056	--	-0.807	+0.807	AMP	S&C	--	--	--	8.9

TABLE 7-XII.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - LIFE SYSTEM

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		LBR WD	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DNG
				FR	WD		LOW	HIGH	UNITS					
CJ0060J	ASTRO 1 EKG AXIS 1	H1	22A3	01	007	--	-2.5	+2.5	MV	V ₂	--	--	--	
CJ0061J	ASTRO 2 EKG AXIS 1	H1	22A1	01	005	--	-2.5	+2.5	MV	V ₂	--	--	--	
CJ0062J	ASTRO 3 EKG AXIS 1	H1	22A2	01	006	--	-2.5	+2.5	MV	V ₂	--	--	--	
CJ0200R	ASTRO 1 RESPIR	H1	51A7	01	064	--	-5	+5	OHMS	V ₂	--	--	--	
CJ0201R	ASTRO 2 RESPIR	H1	51A8	01	093	--	-5	+5	OHMS	V ₂	--	--	--	
CJ0202R	ASTRO 3 RESPIR	H1	51A9	01	094	--	-5	+5	OHMS	V ₂	--	--	--	

TABLE 7-XIII.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - FLIGHT TECHNOLOGY

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		LBR WD	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR	WD		LOW	HIGH	UNITS					
CK0026A	CM X-AXIS ACCEL	H1	12A9	01 - 045	--	-2	+10	G	V ₂	--	--	--		
CK0027A	CM Y-AXIS ACCEL	H1	12A11	01 - 047	--	-2	+2	G	V ₂	--	--	--		
CK0028A	CM Z-AXIS ACCEL	H1	12A12	01 - 048	--	-2	+2	G	V ₂	--	--	--		
CK1040X	16 MM DATA ACQ CAMERA SHUTTER OPEN	H1	51A3 & 51A10	01 - 031	--	CLOSED	OPEN	EVENT	CAMERA	--	--	--	11.2	
CK1043X	70 MM CAMERA SHUTTER OPEN	H1		01 - 031	--	CLOSED	OPEN	EVENT	CAMERA	--	--	--	11.2	
CK1051K	DOSIMETER 1 RADIATION	H1	11A169	05 - 090	--	0	1K	RAD/H	V ₂	--	--	--		
CK1052K	DOSIMETER 2 RADIATION	H1	11A16	01 - 058	--	0	1K	RAD/H	V ₂	--	--	--		
CK1053R	DOSIMETER RATE	H1	10A149	50 - 084	--	0	5	VDC	V ₂	--	--	--		

TABLE 7-XIV.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - SCIENTIFIC EQUIPMENT

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HRB		LBR MD	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR	WD		LOW	HIGH	UNITS					
SL1001U	SCI EXP NO. 1	H1	10A25	09	052	--								
SL1002U	SCI EXP NO. 2	H1	10A148	50	052	--								
SL1003U	SCI EXP NO. 3	H1	10A104	35	084	--								
SL1004U	SCI EXP NO. 4	H1	10A106	36	052	--								
SL1005U	SCI EXP NO. 5	H1	10A107	36	084	--								
SL1006U	SCI EXP NO. 6	H1	10A109	37	052	--								
SL1007U	SCI EXP NO. 7	H1	10A110	37	084	--								
SL1008U	SCI EXP NO. 8	H1	10A112	38	052	--								
SL1009U	SCI EXP NO. 9	H1	10A113	38	084	--								
SL1010U	SCI EXP NO. 10	H1	10A115	39	052	--								
SL1011U	SCI EXP NO. 11	H1	10A116	39	084	--								
SL1012U	SCI EXP NO. 12	H1	10A118	40	052	--								
SL1013U	SCI EXP NO. 13	H1	10A119	40	084	--								
SL1014U	SCI EXP NO. 14	H1	10A121	41	052	--								
SL1015U	SCI EXP NO. 15	H1	10A122	41	084	--								
SL1016U	SCI EXP NO. 16	D2	11D16	03	068	--								
SL1017U	SCI EXP NO. 17	D2	11D3	01	097	--								
SL1018U	SCI EXP NO. 18	D2	11D5	01	099	--								
SL1019U	SCI EXP NO. 19	D2	11D6	02	065	--								
SL1020U	SCI EXP NO. 20	D2	11D7	02	066	--								
SL1021U	SCI EXP NO. 21	D2	11D10	02	097	--								
SL1022U	SCI EXP NO. 22	D2	11D11	02	098	--								
SL1023U	SCI EXP NO. 23	D2	11D12	02	099	--								
SL1024U	SCI EXP NO. 24	D2	11D17	03	097	--								
SL1025U	SCI EXP NO. 25	D2	11D18	03	098	--								
SL1043P	PAN CAMERA N ₂ TK PRESS	H1	11A36	01	124	--	0	5000	PSIA	V _{3S}	--	--	--	
SL1085*	GAMMA RAY DETECTOR TEMP	H1	11A97	03	090	--	-40	+158	DEG F	EXP	--	--	--	
SL1086*	GAMMA RAY ELECT PKG TEMP	H1	11A99	03	092	--	-40	+158	DEG F	EXP	--	--	--	
SL1201T	SIM THERMAL LOC 1 TEMP	H1	11A64	02	105	--	-100	+200	DEG F	V _{3S}	--	--	--	
SL1202T	SIM THERMAL LOC 2 TEMP	H1	11A15	01	057	--	-100	+200	DEG F	V _{3S}	--	--	--	
SL1204T	SIM THERMAL LOC 4 TEMP	H1	11A122	04	049	--	-100	+200	DEG F	V _{3S}	--	--	--	
SL1205T	SIM THERMAL LOC 5 TEMP	H1	11A7	01	026	--	-100	+200	DEG F	V _{3S}	--	--	--	
SL1206T	SIM THERMAL LOC 6 TEMP	H1	11A44	02	027	--	-100	+200	DEG F	V _{3S}	--	--	--	
SL1208*	SIM THERMAL LOC 8 TEMP	H1	11A124	04	058	--	-100	+200	DEG F	V _{3S}	--	--	--	

*Not on S/C 114.

TABLE 7-XIV.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - SCIENTIFIC EQUIPMENT - Concluded

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HRB		LBR WD	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR	WD		LOW	HIGH	UNITS					
SL12117	SIM THERMAL LOC 11 TEMP	H1	11A134	04	091	--	-100	+200	DEG F	V _{3S}	--	--	--	
SL1212T	SIM THERMAL LOC 12 TEMP	H1	11A135	04	092	--	-100	+200	DEG F	V _{3S}	--	--	--	
SL1215T	SIM THERMAL LOC 15 TEMP	H1	11A174	05	107	--	-100	+200	DEG F	V _{3S}	--	--	--	
SL1217T	SIM THERMAL LOC 17 TEMP	H1	11A180	05	124	--	-100	+200	DEG F	V _{3S}	--	--	--	

TABLE 7-XV.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - SERVICE PROPULSION SYSTEM

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR	LBR	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR - WD	WD	LOW	HIGH	UNITS					
SP0001P	He TK PRESS	H2	11A10	01 - 041	065	0	5K	PSIA	V _{3S}	--	--	--	9.1
SP0003P	Ox TK PRESS	H2	11A11	01 - 042	066	0	250	PSIA	V _{3S}	--	M*	CS	9.1
SP0006P	FU TK PRESS	H2	11A12	01 - 043	067	0	250	PSIA	V _{4S}	--	M*	CS	9.1
SP0017T	LO...R He TANK TEMP	H1	10A16	06 - 052	--	-100	+200	DEG F	V _{4S}	--	--	--	
SP0022H	FU/OX VLV 1 POS	H1	11A31	01 - 108	--	0	90	DEG	V _{3S}	--	--	--	9.1
SP0023H	FU/OX VLV 2 POS	H1	11A32	01 - 113	--	0	90	DEG	V _{4S}	--	--	--	9.1
SP0024H	FU/OX VLV 3 POS	H1	11A33	01 - 121	--	0	90	DEG	V _{3S}	--	--	--	9.1
SP0025H	FU/OX VLV 4 POS	H1	11A34	01 - 122	--	0	90	DEG	V _{4S}	--	--	--	9.1
SP0045T	SPS VLV BODY TEMP	H1	10A37	13 - 052	--	0	200	DEG F	V _{4S}	--	--	--	9.1
SP0048T	SPS FU FEED LINE TEMP	H1	11A173	05 - 106	--	0	200	DEG F	V _{3S}	--	M	CS	9.1
SP0049T	SPS OX FEED LINE TEMP	H2	10A120	40 - 116	200	0	200	DEG F	V _{4S}	--	SM	CS	9.1
SP0054T**	OX LINE 1 TEMP	H1	10A44	15 - 084	--	0	200	DEG F	V _{3S}	--	--	--	9.1
SP0055T	BAY 2 OXID SUMP TK SURF TEMP	H1	10A142	48 - 052	--	0	150	DEG F	V _{3S}	--	--	--	
SP0056T	BAY 5 FUEL SUMP TK SURF TEMP	H1	10A139	47 - 052	--	0	150	DEG F	V _{3S}	--	--	--	
SP0057T**	FU LINE 1 TEMP	H1	10A59	20 - 084	--	0	200	DEG F	V _{4S}	--	--	--	9.1
SP0058T	OXID STORAGE TK SURF TEMP	H1	10A137	46 - 084	--	0	150	DEG F	V _{4S}	--	--	--	
SP0059T	FUEL STORAGE TK SURF TEMP	H1	10A140	47 - 084	--	0	150	DEG F	V _{4S}	--	--	--	
SP0062T**	SPS INJECTOR FLANGE TEMP 2	H1	10A49	17 - 052	--	0	600	DEG F	V _{5C}	DBA	--	CS	9.1
SP0600P	SPS VLV ACT PRESS PRI	H1	10A10	04 - 052	--	0	5K	PSIA	V _{3S}	--	SM	CS	9.1
SP0601P	SPS VLV ACT PRESS SEC	H1	10A11	04 - 084	--	0	5K	PSIA	V _{4S}	--	SM	CS	9.1
SP0655Q	OX TK 1 QTY -TOTAL AUX	H1	10A26	09 - 084	--	0	50	PCT	SPS	--	--	--	9.2
SP0656Q	OX TK 2 QTY	H1	10A28	10 - 052	--	0	60	PCT	SPS	--	--	--	9.2
SP0657Q	FU TK 1 QTY-TOTAL AUX	H1	10A29	10 - 084	--	0	50	PCT	SPS	--	--	--	9.2
SP0658Q	FU TK 2 QTY	H1	10A31	11 - 052	--	0	60	PCT	SPS	--	--	--	9.2
SP0661P	ENG CHAMBER PRESS	H1	12A14	01 - 054	--	0	150	PSIA	V _{3S}	--	SM	CS	9.1
SP0030P	FUEL SM/ENG INTERFACE P	H1	11A152	05 - 027	--	0	300	PSIA	V _{3S}	--	--	--	9.1
SP0931P	OX SM/ENG INTERFACE P	H1	11A161	05 - 059	--	0	300	PSIA	V _{4S}	--	--	--	9.1

**Not on S/C 112.

TABLE 7-XVI. - PCM EQUIPMENT TELEMETRY (51.2 KBPS) - REACTION CONTROL SYSTEM

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR	LBR	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR - WD	WD	LOW	HIGH	UNITS					
CR0001P	CM He TK 1 PRESS	H2	10A18	06 - 116	018	0	5K	PSIA	V ₁	--	SM	CS	10.2
CR0002P	CM He TK 2 PRESS	H2	10A21	07 - 116	058	0	5K	PSIA	V ₂	--	SM	CS	10.2
CR0003T	CM He TK 1 TEMP	H2	11A155	05 - 042	126	0	300	DEG F	V ₁	--	SM	CS	10.2
CR0004T	CM He TK 2 TEMP	H2	11A156	05 - 043	127	0	300	DEG F	V ₂	--	SM	CS	10.2
CR0035P	CM He MANIF 1 PRESS	H2	11A21	01 - 075	143	0	400	PSIA	V ₁	--	L*	CS	10.2
CR0036P	CM He MANIF 2 PRESS	H2	11A22	01 - 076	144	0	400	PSIA	V ₂	--	L*	CS	10.2
SR5001P	SM He TK A PRESS	H2	10A24	08 - 116	098	0	5K	PSIA	V _{3S}	--	SM	CS	10.1
SR5002P	SM He TK B PRESS	H2	10A27	09 - 116	138	0	5K	PSIA	V _{4S}	--	SM	CS	10.1
SR5003P	SM He TK C PRESS	H2	10A30	10 - 116	178	0	5K	PSIA	V _{3S}	--	SM	CS	10.1
SR5004P	SM He TK D PRESS	H2	10A33	11 - 116	019	0	5K	PSIA	V _{4S}	--	SM	CS	10.1
SR5013T	SM He TK A TEMP	H2	11A163	05 - 073	185	0	100	DEG F	V _{3S}	--	SM	CS	10.1
SR5014T	SM He TK B TEMP	H2	11A164	05 - 074	186	0	100	DEG F	V _{4S}	--	SM	CS	10.1
SR5015T	SM He TK C TEMP	H2	11A165	05 - 075	187	0	100	DEG F	V _{3S}	--	SM	CS	10.1
SR5016T	SM He TK D TEMP	H2	11A166	05 - 076	188	0	100	DEG F	V _{4S}	--	SM	CS	10.1
SR5025Q	SM He PRESS/TEMP RATIO A	H2	10A93	31 - 116	039	0	100	PCT	V _{3S}	--	SM	CS	10.1
SR5026Q	SM He PRESS/TEMP RATIO B	H2	10A99	33 - 116	119	0	100	PCT	V _{4S}	--	SM	CS	10.1
SR5027Q	SM He PRESS/TEMP RATIO C	H2	10A102	34 - 116	159	0	100	PCT	V _{3S}	--	SM	CS	10.1
SR5028Q	SM He PRESS/TEMP RATIO D	H2	10A105	35 - 116	199	0	100	PCT	V _{4S}	--	SM	CS	10.1
SR5065T	SM ENG PACKAGE A TEMP	H1	10A136	46 - 052	--	0	300	DEG F	V _{3S}	--	SM*	CS	10.1
SR5066T	SM ENG PACKAGE B TEMP	H1	10A17	06 - 084	--	0	300	DEG F	V _{4S}	--	SM*	CS	10.1
SR5067T	SM ENG PACKAGE C TEMP	H1	10A19	07 - 052	--	0	300	DEG F	V _{3S}	--	SM*	CS	10.1
SR5068T	SM ENG PACKAGE D TEMP	H1	10A20	07 - 084	--	0	300	DEG F	V _{4S}	--	SM*	CS	10.1
SR5069T	OXID FEED LINE FILTER A TEMP	H1	11A131	04 - 081	--	0	150	DEG F	V _{3S}	--	--	--	--
SR5070T	OXID FEED LINE FILTER B TEMP	H1	11A132	04 - 089	--	0	150	DEG F	V _{4S}	--	--	--	--
SR5071T	OXID FEED LINE FILTER C TEMP	H1	10A2	01 - 084	--	0	150	DEG F	V _{3S}	--	--	--	--
SR5072T	OXID FEED LINE FILTER D TEMP	H1	11A133	04 - 090	--	0	150	DEG F	V _{4S}	--	--	--	--
SR5073T	PRI FUEL TK OUT SURF A TEMP	H1	11A136	04 - 105	--	0	150	DEG F	V _{3S}	--	--	--	--
SR5074T	PRI FUEL TK OUT SURF B TEMP	H1	11A137	04 - 106	--	0	150	DEG F	V _{4S}	--	--	--	--
SR5075T	PRI FUEL TK OUT SURF C TEMP	H1	11A138	04 - 107	--	0	150	DEG F	V _{3S}	--	--	--	--
SR5076T	PRI FUEL TK OUT SURF D TEMP	H1	11A139	04 - 108	--	0	150	DEG F	V _{4S}	--	--	--	--
SR5729P	SM He MANF A PRESS	H2	11A39	02 - 011	023	0	400	PSIA	V _{3S}	--	--	--	10.1
SR5733P	SM OX MANF A PRESS	H1	11A23	01 - 081	--	0	300	PSIA	V _{3S}	--	--	--	10.1
SR5737P	SM FU MANF A PRESS	H2	11A92	03 - 074	166	0	400	PSIA	V _{3S}	--	SM*	CS	10.1
SR5776P	SM He MANF B PRESS	H2	11A40	02 - 012	024	0	400	PSIA	V _{4S}	--	--	--	10.1
SR5780P	SM OX MANF B PRESS	H1	11A24	01 - 089	--	0	300	PSIA	V _{4S}	--	--	--	10.1
SR5784P	SM FU MANF B PRESS	H2	11A94	03 - 076	168	0	400	PSIA	V _{4S}	--	SM*	CS	10.1

TABLE 7-XVI.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - REACTION CONTROL SYSTEM - Concluded

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR FR - WD	LBR WD	DATA RANGE		UNITS	INST BUS	SIC COMP	O/B DISPL	SIC DIST	CSH DWG
						LOW	HIGH						
SR5817P	SM He MANF C PRESS	H2	11A46	02 - 041	085	0	400	PSIA	V _{3S}	--	--	--	10.1
SR5820P	SM OX MANF C PRESS	H1	11A27	01 - 092	--	0	300	PSIA	V _{3S}	--	--	--	10.1
SR5821P	SM OX MANF D PRESS	H1	11A28	01 - 105	--	0	300	PSIA	V _{4S}	--	--	--	10.1
SR5822P	SM FU MANF C PRESS	H2	11A111	04 - 011	047	0	400	PSIA	V _{3S}	--	S*	CS	10.1
SR5823P	SM FU MANF D PRESS	H2	11A112	04 - 012	048	0	400	PSIA	V _{4S}	--	S*	CS	10.1
SR5830P	SM He MANF D PRESS	H2	11A130	04 - 076	184	0	400	PSIA	V _{4S}	--	--	--	10.1

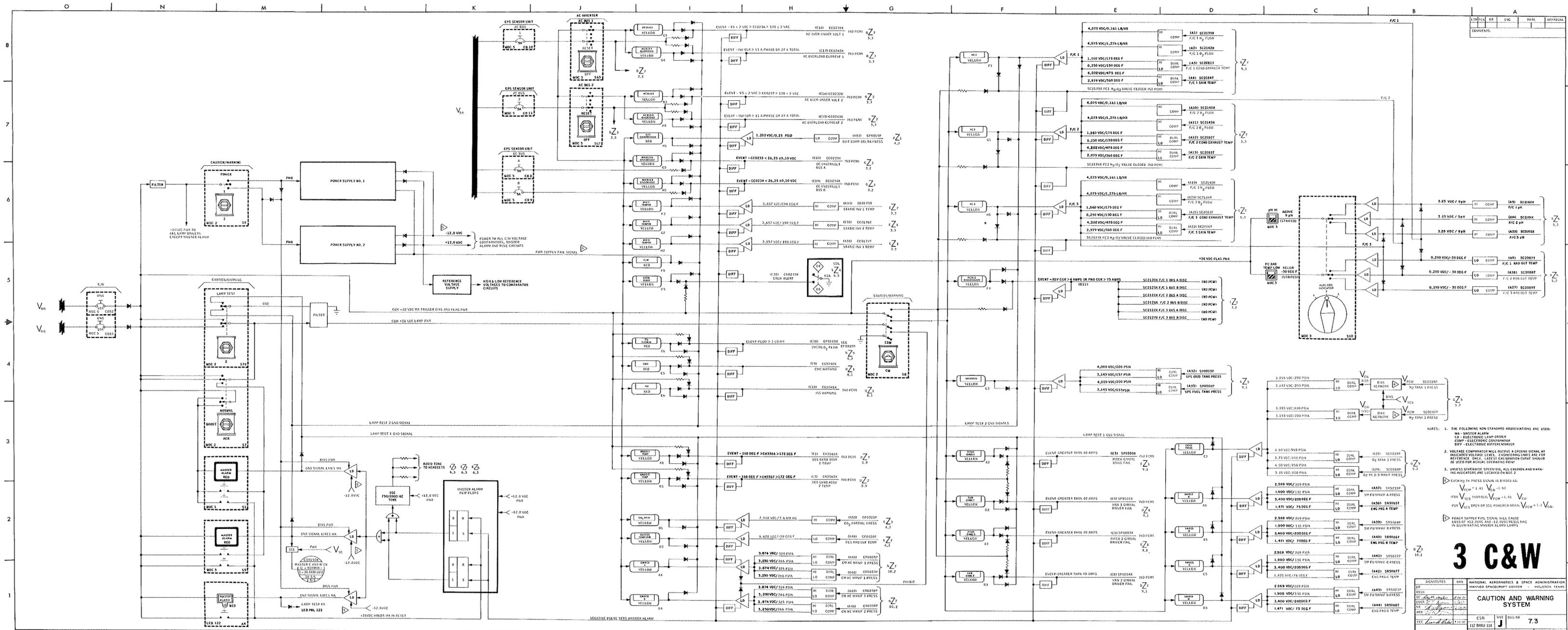
TABLE 7-XVII.- PCM EQUIPMENT TELEMETRY (51.2 KBPS) - CREW SAFETY SYSTEM

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		LBR	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DNG
				FR	WD		WD	LOW	HIGH						UNITS
BS0060X	SM EDS ABORT REQUEST A	E2	11E4-5	01 - 098	041		NORM	ABORT	EVENT	V _{SC}	AA	L	TSC	2.3
BS0081X	SM EDS ABORT REQUEST B	E2	11E4-3	01 - 098	041		NORM	ABORT	EVENT	V _{SC}	AA	L	TSC	2.3
CS0150X	MASTER CAUTION WARNING ON	E2	11E4-6	01 - 098	041		WARN/OFF	NORM	EVENT	V _{SC}	AA	L*	TSC	7.3
LS0200H	ANGLE OF ATTACK	H1	11A51	02 - 057	--		0	+5	VDC	EPS	--	SM	CS	
CS0220T	DOCKING PROBE TEMP	H1	10A22	08 - 052	--		-100	+300	DEG F	V ₂	--	--	--	2.7

TABLE 7-XVIII.- PCM EQUIPMENT TELEMETRY (61.2 KBPS) - COMMUNICATION AND INSTRUMENTATION

MEAS ID	MEAS DESCRIPTION	TM	CHAN CODE	HBR		LBR WD	DATA RANGE			INST BUS	SIG COND	O/B DISPL	SIG DIST	CSH DWG
				FR	WD		LOW	HIGH	UNITS					
CT0012X	DSE TAPE MOTION	E2	11E14-5	03	- 066	116	OFF	MOTION	EVENT	DSE	--	TB	SS	7.1
CT0015V	SCE POS SUPPLY VOLTS	H1	11A29	01	- 106	--	0	22	VDC	SCE	--	--	--	7.1
CT0016V	SCE NEG SUPPLY VOLTS	H1	11A30	01	- 107	--	0	-22	VDC	SCE	--	--	--	7.1
CT0017V	SENSOR EXCITATION 5 VOLTS	H1	11A179	05	- 123	--	0	5.5	VDC	SCE	--	--	--	7.1
CT0018V	SENSOR EXCITATION 10 VOLTS	H1	11A45	02	- 028	--	0	11.0	VDC	SCE	--	--	--	7.1
CT0120X	PCM BIT RATE CHANGE 8-BIT	D2	10D1	01	- 020	021	--	--	--	PCM	--	--	--	7.1
CT0125V	PCM HI LEVEL 85 PCT REF	H1	11A175	05	- 108	--	0	+5	VDC	PCM	--	--	--	7.1
CT0126V	PCM HI LEVEL 15 PCT REF	H1	11A35	01	- 123	--	0	+1.0	VDC	PCM	--	--	--	7.1
CT0145F	CTE TIME FROM LAUNCH 32-BIT	D2	11D2	01	- 065	121	--	--	--	CTE	--	--	--	7.1
ST0152H	HIGH GAIN ANT PITCH POS	H2	11A119	04	- 042	106	-90	+90	DEG	HGA	--	M	CS	
ST0153H	HIGH GAIN ANT YAW POS	H2	11A120	04	- 043	107	0	360	DEG	HGA	--	M	CS	
CT0161X	HGA BEAMWIDTH SW - NAR	E2	11E9-1	02	- 068	076		NAR	EVENT	HGA	--	--	--	
CT0162X	HGA BEAMWIDTH SW - MED	E2	11E9-2	02	- 068	076		MED	EVENT	HGA	--	--	--	
CT0163X	HGA TRACK SW - AUTO	E2	11E9-7	02	- 068	076		AUTO	EVENT	HGA	--	--	--	
CT0164X	HGA TRACK SW - REACQ	E2	11E9-8	02	- 068	076		REACQ	EVENT	HGA	--	--	--	
CT0262V	UDL VALIDITY SIG, 4-BITS	D2	51D	01	- 100	014	--	--	--	UDL	--	--	--	6.5
CT0340X	PCM SYNC SOURCE EXT OR INT	E1	11E32-8	05	- 098	--	INT	EXT	EVENT	PCM	--	--	--	7.1
ST0562T	TLM 2 MASTER UNIT TEMP	H1	11A170	05	- 091	--	-20	+155	DEG F	V _{3S}	--	--	--	7.1
ST0563T	TLM 2 SLAVE UNIT TEMP	H1	11A171	05	- 092	--	-20	+155	DEG F	V _{3S}	--	--	--	7.1
CT0620E	USB RCVR AGC VOLTAGE	H2	11A121	04	- 044	108	-130	-50	DBM	S-BND	--	M	CS	6.2
CT0640F	USB RCVR PHASE ERR	H1	11A50	02	- 049	--	-90K	+90K	Hz	S-BND	--	--	--	6.2
ST0820K	PROTON CT RATE CHAN 1	H1	11A17	01	- 059	--	1	100K	C/S	V _{3S}	--	--	--	
ST0821K	PROTON CT RATE CHAN 2	H1	11A18	01	- 060	--	0.1	10K	C/S	V _{3S}	--	--	--	
ST0822K	PROTON CT RATE CHAN 3	H1	11A19	01	- 073	--	0.1	10K	C/S	V _{3S}	--	--	--	
ST0823K	PROTON CT RATE CHAN 4	H1	11A20	01	- 074	--	0.1	10K	C/S	V _{3S}	--	--	--	
ST0830K	ALPHA CT RATE CHAN 1	H1	11A38	02	- 010	--	0.1	10K	C/S	V _{3S}	--	--	--	
ST0831K	ALPHA CT RATE CHAN 2	H1	11A41	02	- 017	--	0.1	10K	C/S	V _{3S}	--	--	--	
ST0832K	ALPHA CT RATE CHAN 3	H1	11A42	02	- 025	--	0.1	10K	C/S	V _{3S}	--	--	--	
ST0838K	PROTON INTEG CT RATE	H1	11A43	02	- 026	--	1	100K	C/S	V _{3S}	--	--	--	
ST0840T*	NUCLEAR PARTICLE DET TEMP	H1	10A61	21	- 052	--	-109	+200	DEG F	V _{4S}	--	--	--	
ST0841T*	NUCLEAR PARTICLE ANAL TEMP	H1	10A62	21	- 084	--	-109	+200	DEG F	V _{4S}	--	--	--	

*Not on S/C 112.



DATE	DR	ENGR	DATE	APPROVAL

- NOTES: 1. THE FOLLOWING NON-STANDARD ABBREVIATIONS ARE USED:
 MA - MASTER ALARM
 LO - ELECTRONIC LAMP DRIVER
 COMP - ELECTRONIC COMPARATOR
 DIFF - ELECTRONIC DIFFERENCE CIRCUIT
2. VOLTAGE COMPARATOR WILL OUTPUT A SECOND SIGNAL AT INDICATED VOLTAGE LEVEL. IF NOMINAL VALUES ARE FOR REFERENCE ONLY. LATEST CALIBRATION DATE SHOULD BE SHOWN FOR ALL DIFFERENCE CIRCUITS.
3. UNLESS OTHERWISE SPECIFIED, ALL CAUTION AND WARNING INDICATORS ARE LOCATED ON UIC 2.
- ▷ EACH TX PRESS SIGNAL IS BIASED AS:
 $V_{CM} = 1.41 V_{CC} - 1.58$
 FOR V_{CC} SHORTED, $V_{CM} = 1.41 V_{CC}$
 FOR V_{CC} OPEN OR SCL POWERED DOWN, $V_{CM} = 3.1 V_{CC}$
- ▷ POWER SUPPLY FAIL SIGNAL WILL CAUSE LOSS OF +12.0VDC AND -12.0VDC REGULATOR IN ILLUMINATING MASTER ALARM LAMPS

3 C&W

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DR		MANHATTAN SPACECRAFT CENTER - HOUSTON, TEXAS
ENGR		
CHK		
APP		

CAUTION AND WARNING SYSTEM

CSM SHEET DWG NO
 112 DIRU 114 J 7.3
 02/5/34 PAGE 7/39 SHEET 1 OF 1

*

CSM
S/C 112-114

7.4 DATA PROCESSOR (64 KBPS) SYSTEM NOTES

7.4.1 General Description

The data processor consists of a master unit and a slave unit, each with its own power supply, multiplexers, and analog-to-digital conversion.

7.4.2 Master Unit

The master unit contains the basic timing and format memory systems, which perform the functions described below.

7.4.2.1 Timing system functions.- The timing system uses an internal oscillator with external bit rate select signals to process a selected data format at a selected bit rate. The external clock and sync input capability will not be used and the bit rate select inputs will be "wired" to select the 64 kbps output bit rate.

7.4.2.2 Format memory system functions.- The format memory system uses external format select signals to select one of up to four "instruction memory" formats. Since the format select signals are externally "wired" to only one format, changes in format cannot be made. An instruction memory address counter is used to read sequentially from the memory a 10-bit instruction word at the selected output word rate (8 kwps for 64 kbps). The first instruction memory word sets the initial data cycle address of the data cycle memory address counter. The second instruction memory word is compared with the frame count and coincidence determines the final frame. The last instruction memory word signals the last word of the main frame and causes the instruction memory address counter to be reset. The rest of the instruction memory words are used to determine the

main frame data format. Bit 10 of the 10-bit instruction word is used to initiate a data cycle readout and to advance the data cycle memory address counter. Bits one through nine of the 10-bit instruction memory word are used to address a main frame multiplexer or a main frame serial digital gate located within the master unit. These bits, one through nine, are loaded with "fill" bits during periods when the data cycle data is being processed. The 10-bit data cycle instruction word is used to address a remote multiplexer channel located in the slave unit or to address an addressable 16-bit serial digital gate located in the master unit.

7.4.2.3 Other master unit functions.- The master unit also interleaves all processed data (digitized analog, discrete, and serial digital) into a serial NRZ-C PCM output wave train with synchronization patterns.

7.4.3 Slave Unit

The slave unit consists of both prime and redundant converters and multiplexers. However, only the prime converter and prime multiplexers will be used.

The converter performs the following interface functions between the master unit and remote multiplexers:

- A. Receives, processes, and transmits channel address to the multiplexers
- B. Digitizes the multiplexer returned PAM 1 and PAM 2 signals as single-ended or differential data as defined by multiplexer code plug configuration (The multiplexer code plugs are programmed to digitize only PAM 1 or PAM 2 as single-ended data.)

*

- C. Buffers discrete data from multiplexer
- D. Transmits processed data to the master unit

7.4.4 Parameter Capabilities

Table 7-XIX lists both the total parameter capability and the programmed parameter capability of the data processor.

7.4.5 Operating Characteristics

Table 7-XX lists some of the operating specifications of the data processor.

TABLE 7-XIX.- DATA PROCESSOR PARAMETER CAPABILITIES

<u>ITEM NO.</u>	<u>ITEM DESCRIPTION</u>	<u>TOTAL CAPABILITY</u>	<u>PROGRAMED CAPABILITY</u>
1.	STORED FORMATS	4	1
2.	BIT RATE (KBPS)	4, 8, 16, 32, 64, 128, 256	64
3.	MAIN FRAME WORD LENGTH (8-BIT WORDS)	5 TO 128	80
4.	DATA CYCLE LENGTH (FRAMES)	1 TO 128	100
5.	8-BIT HL ANALOG CHANNELS	120	112 (S/C 112, 113) 113 (S/c 114)
6.	4-BIT HL ANALOG CHANNELS	8	0
7.	1-BIT DISCRETES	96	96
8.	SERIAL DIGITAL CHANNELS (8 BITS OR LONGER IN 4-BIT INCREMENTS)	4	1 - 8-BIT @ 100 S/S 1 - 8-BIT @ 400 S/S (S/C 114) 1 - 16-BIT @ 800 S/S (S/C 112,113) 1 - 24-BIT @ 100 S/S
9.	16-BIT SERIAL DIGITAL CHANNELS	12	1 @ 1 S/S 4 @ 10 S/S 1 @ 100 S/S
10.	ANALOG CHANNEL SAMPLE RATES	0.03 TO 8000 S/S	38 @ 1 S/S 26 @ 2 S/S 2 @ 4 S/S 20 @ 10 S/S 2 @ 20 S/S 22 @ 100 S/S 1 @ 400 S/S (S/C 114) 2 @ 800 S/S (S/C 112,113) 3 @ 800 S/S (S/C 114)
11.	DISCRETE SAMPLE RATES	0.03 TO 8000 S/S	64 @ 10 S/S 24 @ 100 S/S 8 @ 800 S/S
12.	8-BIT SYNC WORDS WORD 1 - 11001100 WORD 2 - 10100001 WORD 3 - 11110101	3	3
13.	8-BIT FRAME COUNT WORD	1 TO 128	1 TO 100

TABLE 7-XX.- DATA PROCESSOR OPERATING CHARACTERISTICS

<u>ITEM NO.</u>	<u>ITEM DESCRIPTION</u>	<u>FUNCTION OR VALUE</u>
1.	WEIGHT	
	MASTER UNIT	16.5 LBS MAX
	SLAVE UNIT	14.0 LBS MAX
2.	POWER	
	MASTER UNIT	25 WATTS MAX
	SLAVE UNIT	8 WATTS MAX
	TEMP SENSOR (EA)	0.2 WATTS MAX
3.	INPUT VOLTAGE	25 TO 30 VDC NO DAMAGE TO 35 VDC.
4.	OPERATING TEMP RANGE	-30 TO +160 °F
5.	WARMUP TIME	2 SECONDS MAX
	MAX ON-OFF CYCLING	1/MIN
	MIN ON TIME	2 SECONDS
6.	GSE MEMORY OPERATING CAPABILITY	
	LOAD	10 MIN MAX
	VERIFY	25 MIN MAX
7.	EXTERNAL CLOCK AND MAIN FRAME SYNC (NOT USED)	
	EXT. CLOCK FREQ.	1.024 KHZ ± 10 Hz
	MAIN FRAME RESET PRR	4 PPS MIN.
	PULSE VOLTAGE	4 ± 1 VOLTS
	INTERPULSE VOLTAGE	0 ± 0.6 VOLTS
8.	DATA INPUT CHARACTERISTICS	
8.1	ANALOG INPUTS	
	MAX VOLTAGE RANGE	-4 TO +35 VOLTS
	DATA VOLTAGE RANGE	0 TO 5.06 VOLTS
	SOURCE IMPEDANCE	10K OHMS MAX
	GATE BIASED TO -3 VOLTS THROUGH 10 MEGOHMS RESISTANCE	
8.2	DISCRETE INPUTS	
	MAX VOLTAGE RANGE	-4 TO +35 VOLTS
	LOGIC ONE	+3 TO +30 VOLTS
	LOGIC ZERO	-4 TO +1 VOLTS
	NO CONNECTION	LOGIC ZERO
	SOURCE IMPEDANCE	50K OHMS MAX

TABLE 7-XX.- DATA PROCESSOR OPERATING CHARACTERISTICS - Continued

<u>ITEM NO.</u>	<u>ITEM DESCRIPTION</u>	<u>FUNCTION OR VALUE</u>
9.	SERIAL DIGITAL INTERFACE	
	LOGIC ONE	4.5 ± 1.5 VOLTS
	LOGIC ZERO	0 ± 1 VOLTS
	ENABLE GATE (N + 1/2-BIT DURATION)	5 ± 1 VOLTS
	CLOCK PULSE (AT OUTPUT BIT RATE)	5 ± 1 VOLTS
	INTERPULSE	0 ± 0.6 VOLTS
10.	ANALOG ENCODING	
10.1	8-BIT ANALOG	
	ZERO OR LESS VOLTS	00000001
	5.06 OR GREATER VOLTS	11111110
	NO EXTERNAL CONNECTION	00000001
	GRANULARITY	20 MV/COUNT
	ACCURACY	±1/2 COUNT
	OUTPUT SEQUENCE	MSB FIRST
10.2	4-BIT ANALOG (NOT USED)	
	ZERO OR LESS VOLTS	0000
	4.94 OR GREATER VOLTS	1111
	NO EXTERNAL CONNECTION	0000
	GRANULARITY	320 MV/COUNT
	OUTPUT SEQUENCE	MSB FIRST
11.	EXTERNAL SUPER COMMUTATING CAPABILITY	8 CHAN MIN.
12.	ISOLATED PCM OUTPUTS A, B, AND C	
	TYPE	NRZ-C
	LOGIC ONE	5 ± 1 VOLTS
	LOGIC ZERO	0 ± 0.6 VOLTS
	OUTPUT A AND B FILTERED FOR 256 Kbps	
	OUTPUT C FILTERED FOR 64 Kbps	
13.	MASTER TO SLAVE INSTRUCTIONS	
	TYPE	BI-LEVEL, AMPLITUDE MODULATED SINUSOIDAL SIGNAL
	BIT RATE	384 Kbps
	WORD RATE (AS REQUIRED)	32 KWPS MAX
	BITS/WORD	12
	INSTRUCTION CONTENTS	1 SYNC BIT 10 ADDRESS BITS 1 EXECUTE BIT

TABLE 7-XX.- DATA PROCESSOR OPERATING CHARACTERISTICS - Concluded

<u>ITEM NO.</u>	<u>ITEM DESCRIPTION</u>	<u>FUNCTION OR VALUE</u>
14.	SLAVE TO MASTER DATA	
	TYPE	BI-LEVEL, AMPLITUDE MODULATED SINUSOIDAL SIGNAL
	BIT RATE	384 KBPS
	WORD RATE (AS REQUIRED)	32 KWPS MSX
	BITS/WORD	12
	DATA CONTENTS:	1 SYNC BIT 8 DATA BITS 3 EXECUTE BITS
	DATA SEQUENCE	MSB FIRST
15.	BIT-RATE OUTPUT	
	FREQUENCY (SQUARE WAVE)	SELECTED BIT RATE (64 KHz)

*

7.5 COLUMN DEFINITIONS FOR DATA PROCESSOR PARAMETER
LOADING TABLES 7-XXI AND 7-XXII

7.5.1 Column - "MEAS ID"

The measurement ID has the same make up and follows the same code as the measurement ID for the PCM equipment parameter loading tables (see Paragraph 7.3.1), except that it is prefixed with a "J-."

7.5.2 Column 2 - "MEAS DESCRIPTION"

The measurement description is a brief, definitive title given to each measurement. Standard abbreviations are used where applicable.

7.5.3 Column - "FORMAT SR-FR-WD"

The format sample rate - frame number - word number column contains, for each measurement, a code number which indicates the location of the first sample of a parameter in the output wave train and the number of times the parameter is sampled each second. This latter information derives from the sample rate number where the second digit is the "times ten" multiplier of the first digit (e.g., 82 is 8 x 10 x 10 or 800 samples per second).

7.5.4 Column 4 - "INPUT GATE"

The input gate designator is an alphanumeric code, which indicates the unit, multiplexer, and channel location as follows:

MFD-X Channel X of master unit main frame serial
digital multiplexer

M-WX-Y Bit Y of word WX of master unit main frame
discrete multiplexer

*

M-AX Channel AX of master Unit main frame 8-bit
analog multiplexer

M-ADX Channel ADX of master unit addressable serial
digital multiplexer

S-AD-WX-Y Bit Y of discrete word WX of slave unit analog/
discrete multiplexer

S-AD-X Analog channel X of slave unit analog/discrete
multiplexer

S-A-X Channel X of slave unit analog multiplexer

7.5.5 Column 5 - "INST BUS"

The instrumentation bus designators are the same as for the PCM equipment parameter loading tables and are described in Paragraph 7.3.8.

7.5.6 Column 6 - "DATA RANGE"

The data range column indicates the total specified PCM range of the parameter. For bilevel parameters, a PCM "one" state will be listed under HIGH and a PCM "zero" state will be listed under LOW.

7.5.7 Column 7 - "O/B DISPLAY"

The onboard display designators are the same as used in the PCM equipment parameter loading tables. These acronyms are listed and described in Paragraph 7.3.10.

7.5.8 Column 8 - "CSMSH, DWG - ZONE"

This column will reference the CSMSH drawing and zone for system information.

TABLE 7-XXI.- DATA PROCESSOR PCM TELEMETRY (64 KBPS) - SCIENTIFIC EQUIPMENT

NEAS ID	NEAS DESCRIPTION	FORMAT	INPUT GATE	INST BUS	DATA RANGE			Q/C DISPL	CSH DMG
		SR - FR - WD			LOW	HIGH	UNITS		
J-SL1030V	PAN CAMERA V/H CMD VOLTS	11-01-030	S-A-19	EXP	10.1	20	MRAD	--	
J-SL1031X	PAN CAMERA AIR SOLENOID	11-05-071F	S-AD-W4-6	EXP	CLOSE	OPEN	EVENT	--	
J-SL1032T	PAN CAMERA FILM MAG TEMP	10-10-071	S-A-10	EXP	+30	+110	DEG F	--	
J-SL1033H	PAN CAMERA FRAMING ROLL POS	11-02-030	S-AD-4	EXP	0	47	INCHES	--	
J-SL1034H	PAN CAMERA SHUTTLE POS	11-03-030	S-A-18	EXP	0	14.38	INCHES	--	
J-SL1035C	PAN CAMERA LENS TORQUE CUR	11-04-030	S-AD-12	EXP	0	10	AMP	--	
J-SL1036X	PAN CAMERA CAPPING SHUTTER POS	11-05-071G	S-AD-W4-7	EXP	CLOSE	OPEN	EVENT	--	
J-SL1037V	PAN CAMERA FMC TACH VOLTS	11-05-030	S-A-26	EXP	0	20	MRAD/S	--	
J-SL1038H	PAN CAMERA EXPOSURE CMD	11-06-030	S-A-3	EXP	0	2000	FT L	--	
J-SL1039T	PAN CAMERA LENS BARREL TEMP	10-09-030	S-A-21	EXP	+75	+105	DEG F	--	
J-SL1040T	PAN CAMERA FWD LENS TEMP	10-10-030	S-A-29	EXP	+75	+105	DEG F	--	
J-SL1041T	PAN CAMERA AFT LENS TEMP	10-19-030	S-AD-20	EXP	+75	+105	DEG F	--	
J-SL1042T	PAN CAMERA MECH TEMP	10-89-030	S-A-4	EXP	+30	+110	DEG F	--	
J-SL1044H	PAN CAMERA SLIT WIDTH	11-07-053	S-AD-8	EXP	0	0.30	INCH	--	
J-SL1050K*	X-RAY PULSE HGT, 8-BIT	11-01-071	S-AD-W1	EXP	--	--	--	--	
J-SL1051V*	X-RAY LVPS SUMMED MONITOR	10-80-072	S-A-2	EXP	0	23.13	VDC	--	
J-SL1053V*	X-RAY DISCRIMINATOR REF VOLTS	10-20-071	S-A-1	EXP	0	-15.0	VDC	--	
J-SL1054V*	X-RAY ANALOG 6.75 VOLTS	10-30-071	S-AD-1	EXP	0	8.44	VDC	--	
J-SL1055V*	X-RAY DIGITAL 5.0 VOLTS	10-40-071	S-A-9	EXP	0	6.25	VDC	--	
J-SL1056T*	X-RAY PROCESSOR TEMP	10-50-071	S-AD-9	EXP	-16	+77	DEG C	--	
J-SL1057T*	X-RAY DETECTOR TEMP	10-60-071	S-A-17	EXP	-16	+77	DEG C	--	
J-SL1059T*	X-RAY LVPS TEMP	10-70-071	S-A-25	EXP	-16	+77	DEG C	--	
J-SL1060T*	X-RAY LUNAR DET TEMP	10-80-071	S-AD-2	EXP	-16	+77	DEG C	--	
J-SL1061T*	X-RAY SOLAR DET TEMP	10-90-071	S-A-33	EXP	-16	+77	DEG C	--	
J-SL1065K*	ALPHA PART COUNT, 8-BIT	11-01-072	S-AD-W8	EXP	--	--	--	--	
J-SL1066V*	ALPHA PART DETECTOR ID	11-09-072	S-A-11	EXP	0	5.0	VDC	--	
J-SL1067V*	ALPHA PART COUNT RATE METER	11-07-030	S-AD-17	EXP	0	100	MSEC	--	
J-SL1068T*	ALPHA PART DET TEMP NO. 1	10-10-072	S-A-13	EXP	-40	+56	DEG C	--	
J-SL1069V*	ALPHA PART 6.75 VOLTS P/S MON	11-09-071	S-AD-10	EXP	0	8.44	VDC	--	
J-SL1070T*	ALPHA PART DET TEMP NO. 2	10-20-072	S-A-41	EXP	-40	+56	DEG C	--	
J-SL1071T*	ALPHA PART LVPS TEMP	10-30-072	S-AD-18	EXP	-16	+77	DEG C	--	
J-SL1072V*	ALPHA PART DET BIAS VOLTS	10-40-072	S-A-49	EXP	0	-60	VDC	--	

*Not on SC 114.

TABLE 7-XXI.- DATA PROCESSOR PCM TELEMETRY (64 KBPS) - SCIENTIFIC EQUIPMENT - Concluded

MEAS ID	MEAS DESCRIPTION	FORMAT		INPUT GATE	INST BUS	DATA RANGE			O/B ISPL	CSH DWG
		SR	FR			WD	LOW	HIGH			UNITS
J-SL1073V*	ALPHA PART DISCR - 12 VOLTS REF	10-50-072		S-AD-3	EXP	0	-15	VDC	--	
J-SL1074V*	ALPHA PART ADC 6.75 VOLTS P/S	10-60-072		S-A-57	EXP	0	8.44	VDC	--	
J-SL1075V*	ALPHA PART DIGITAL 5 VOLTS P/S	10-70-072		S-AD-11	EXP	0	6.25	VDC	--	
J-SL1076V*	ALPHA PART LVPS SUMMED MON.	10-90-072		S-AD-19	EXP	0	31.4A	VDC	--	
J-SL1080X**	SUBSATELLITE LAUNCHED	11-05-071D		S-AD-W4-4	V _{3S}	LAUNCH		EVENT	--	
J-SL1082K*	MASS SPEC SERIAL DATA A, 10-BIT	11-02-071		M-AD1	EXP	--	--	--	--	
J-SL1083K*	MASS SPEC SERIAL DATA B, 10-BIT	11-04-071		M-AD2	EXP	--	--	--	--	
J-SL1084X*	MASS SPEC SWEEP START FLAG C	11-07-072H		S-AD-W7-B	EXP	OFF	ON	EVENT	--	
J-SL1091V	LASER ALT REG 5.0 VOLTS	11-01-053		S-A-45	EXP	ABSENT	PRESENT	EVENT	--	
J-SL1092V	LASER ALT PHOTO MULT VOLTS	11-04-053		S-A-43	EXP	0	-1800	VOLTS	--	
J-SL1093V	LASER ALT PFN VOLTS	11-05-053		S-A-59	EXP	0	+3000	VOLTS	--	
J-SL1094T	LASER ALT CAVITY TEMP	11-02-053		S-A-53	EXP	-13	+167	DEG F	--	
J-SL1122K	LASER ALT SERIAL DATA, 24 BITS	12-01-011		MFD-1	EXP	--	--	--	--	
J-SL1124V	MASS SPEC COMB DATA	11-06-053		S-AD-7	EXP		MULTI	EVENT	--	
J-SL1160T	METRIC LENS FRONT ELEMENT TEMP	10-69-030		S-A-51	EXP	5	45	DEG C	--	
J-SL1161T	METRIC LENS BARREL TEMP	10-50-030		S-AD-6	EXP	5	45	DEG C	--	
J-SL1162T	STELLAR LENS FRONT ELEMENT TEMP	10-29-030		S-AD-5	EXP	5	45	DEG C	--	
J-SL1163T	MC STELLAR LENS BARREL TEMP	10-30-030		S-A-42	EXP	5	45	DEG C	--	
J-SL1164T	MC SUPPLY CASSETTE TEMP	10-49-030		S-A-58	EXP	5	45	DEG C	--	
J-SL1165X	MC IMAGE MOTION CMD	10-39-030		S-AD-13	EXP	OFF	ON	EVENT	--	
J-SL1166R	METRIC SHUTTER DISC SPEED	10-59-030		S-A-27	EXP	62.5	1000	RPM	--	
J-SL1168X	MAP CAMERA DEPLOY/FILM CUT	10-60-030		S-AD-14	EXP	CUT	DEPLOY	EVENT	--	
J-SL1173X	FILM MOTION/METRIC EXPOSURE	11-08-030		S-A-50	EXP	MOTION	EXPOSE	EVENT	--	
J-SL1176Q	METRIC FILM REMAINING	10-40-030		S-AD-21	EXP	0	1500	FT	--	
J-SL1177X	MC CYCLE RTE/METRIC SHTR CTR EXP	82-01-009B		M-W1-2	EXP		CR/EXP	EVENT	--	
J-SL1180X	IRIG B/PT/DR/AM/STELLAR FILM MOTION	11-05-071H		S-AD-W4-8	EXP		MULTI	EVENT	--	
J-SL1181X	MAP CAMERA V/H INCREASE LEVEL	10-20-030		S-A-34	EXP	11	16	MRAD/S	--	

*Not on SC 114.

**Not on SC 113.

TABLE 7-XXII.- DATA PROCESSOR PCM TELEMETRY (64 KBPS) - COMMUNICATION AND INSTRUMENTATION

MEAS ID	MEAS DESCRIPTION	FORMAT		INPUT GATE	INST BUS	DATA RANGE			O/B DISPL	CSH DWG
		SR	FR			WD	LOW	HIGH			UNITS
J-ST0564W	TLM 2 IRIG B TIMING	82-01-009A		M-W1-1	C&I	--	--	--	--	7.1
J-ST0565V	TLM 2 FORMAT SIGNAL MON	10-80-030		S-A-38	C&I	0	5.0	VDC	--	7.4
J-ST0567V	TLM 2 MASTER UNIT 5 VOLT REF	12-01-014		M-A2	V _{3S}	0	5.0	VDC	--	
J-ST0568V	TLM 2 SLAVE UNIT 5 VOLT REF	11-03-053		S-A-35	V _{3S}	0	5.0	VDC	--	

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TABLE 7-XXIII, DATA PROCESSOR
PROGRAMED FORMATS, IS PRINTED
ON THE BACK SIDE OF THIS PAGE
TO FACILITATE ITS USE WITH THE
DATA PROCESSOR DRAWING 7.4.

TABLE 7-XXIII. - DATA PROCESSOR PROGRAMED FORMATS

(For use with Dwg 7.4)

MAIN FRAME FORMAT - WORD LOCATION
(S/C 112 AND 113)

1	2	3	4	5	6	7	8	9	10
SYNC WD 1	SYNC WD 2	SYNC WD 3	FRAME ID	MFD-3	MFD-3	M-A1	M-A9	M-W1 M-W2	M-W3 M-W4
11	12	13	14	15	16	17	18	19	20
MFD-1	MFD-1	MFD-1	M-A2						M-A3
21	22	23	24	25	26	27	28	29	30
M-A4	M-A5	SUBCOM 1	SUBCOM 2						SUBCOM 3
31	32	33	34	35	36	37	38	39	40
MFD-2	M-A6	M-A7	M-A8						M-A10
41	42	43	44	45	46	47	48	49	50
M-A11	M-A12	M-A13	M-A14						M-W5 M-W6
51	52	53	54	55	56	57	58	59	60
M-A15	M-A16	SUBCOM 4	M-A17						M-A18
61	62	63	64	65	66	67	68	69	70
M-A19	M-A20	M-A21	M-A22						M-A23
71	72	73	74	75	76	77	78	79	80
SUBCOM 5	SUBCOM 6	M-A24	SUBCOM 7	MFD-3	MFD-3	M-A1	M-A9	M-W1 M-W2	M-W7 M-W8

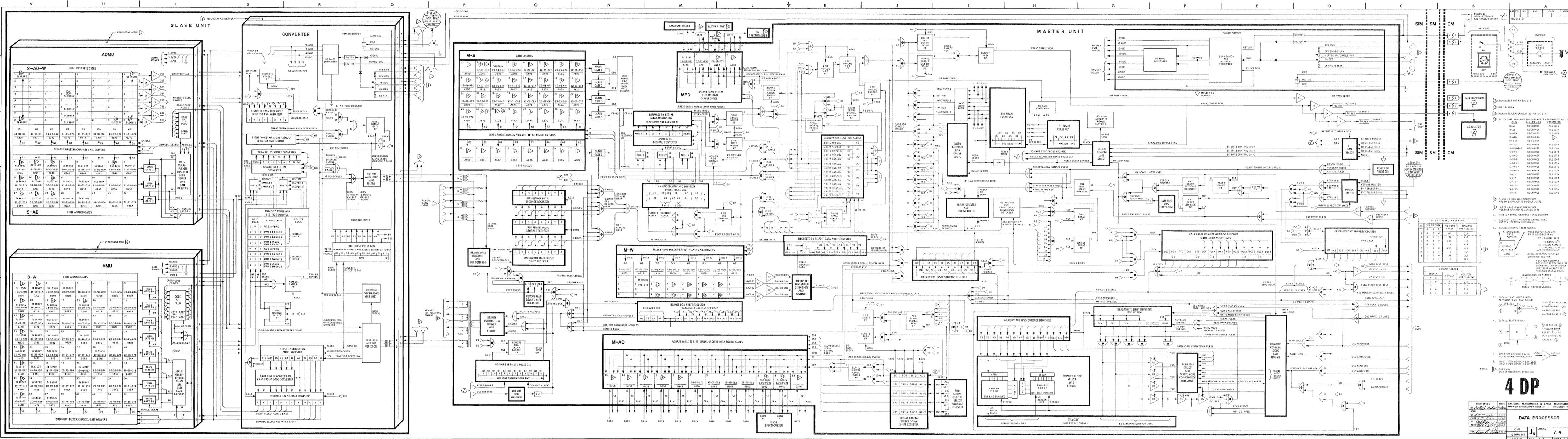
SUBCOM WORDS FORMAT - FRAME LOCATION
(S/C 112, 113 AND 114)

SC NO	WD NO	FRAME 1	11	21	31	41	51	61	71	81	91
1	23	M-AD4									M-AD4
2	24	M-AD4									M-AD4
3	30	S-A-19									S-A-19
4	53	S-A-45									S-A-45
5	71	S-AD-W1									S-AD-W1
6	72	S-AD-W8									S-AD-W8
7	74	S-AD-23									S-AD-23
		FRAME 2	12	22	32	42	52	62	72	82	92
1	23	M-AD4									M-AD4
2	24	M-AD4									M-AD4
3	30	S-AD-4									S-AD-4
4	53	S-A-53									S-A-53
5	71	M-AD1									M-AD1
6	72	M-AD1									M-AD1
7	74	S-AD-24									S-AD-24
		FRAME 3	13	23	33	43	53	63	73	83	93
1	23	M-AD4									M-AD4
2	24	M-AD4									M-AD4
3	30	S-A-18									S-A-18
4	53	S-A-35									S-A-35
5	71	S-AD-W2									S-AD-W2
6	72	S-AD-W3									S-AD-W3
7	74	S-A-8	S-A-22	S-A-32	S-A-44	S-A-55	S-A-8	S-A-22	S-A-32	S-A-44	S-A-55
		FRAME 4	14	24	34	44	54	64	74	84	94
1	23	M-AD4									M-AD4
2	24	M-AD4									M-AD4
3	30	S-AD-12									S-AD-12
4	53	S-A-43									S-A-43
5	71	M-AD2									M-AD2
6	72	M-AD2									M-AD2
7	74	S-A-12	S-A-23	S-A-36	S-A-46	S-A-56	S-A-12	S-A-23	S-A-36	S-A-46	S-A-56
		FRAME 5	15	25	35	45	55	65	75	85	95
1	23	M-AD4									M-AD4
2	24	M-AD4									M-AD4
3	30	S-A-26									S-A-26
4	53	S-A-59									S-A-59
5	71	S-AD-W4									S-AD-W4
6	72	S-AD-W5									S-AD-W5
7	74	S-A-14	S-A-24	S-A-39	S-A-47	S-A-60	S-A-14	S-A-24	S-A-39	S-A-47	S-A-60
		FRAME 6	16	26	36	46	56	66	76	86	96
1	23	M-AD4									M-AD4
2	24	M-AD4									M-AD4
3	30	S-A-3									S-A-3
4	53	S-AD-7									S-AD-7
5	71	M-AD3									M-AD3
6	72	M-AD3									M-AD3
7	74	S-AD-23									S-AD-23
		FRAME 7	17	27	37	47	57	67	77	87	97
1	23	M-AD4									M-AD4
2	24	M-AD4									M-AD4
3	30	S-AD-17									S-AD-17
4	53	S-AD-8									S-AD-8
5	71	S-AD-W6									S-AD-W6
6	72	S-AD-W7									S-AD-W7
7	74	S-AD-24									S-AD-24
		FRAME 8	18	28	38	48	58	68	78	88	98
1	23	M-AD4									M-AD4
2	24	M-AD4									M-AD4
3	30	S-A-50									S-A-50
4	53	S-AD-15									S-AD-15
5	71	M-AD5									M-AD5
6	72	M-AD5									M-AD5
7	74	S-A-15	S-A-28	S-A-8	S-A-48	S-A-62	S-A-15	S-A-28	S-A-8	S-A-48	S-A-62
		FRAME 9	19	29	39	49	59	69	79	89	99
1	23	M-AD4									M-AD4
2	24	M-AD4									M-AD4
3	30	S-A-21	S-AD-20	S-AD-5	S-AD-13	S-A-58	S-A-27	S-A-51	S-A-61	S-A-4	S-A-6
4	53	S-AD-16									S-AD-16
5	71	S-AD-10									S-AD-10
6	72	S-A-11									S-A-11
7	74	S-A-16	S-A-30	S-A-12	S-A-52	S-A-63	S-A-16	S-A-30	S-A-12	S-A-52	S-A-63
		FRAME 10	20	30	40	50	60	70	80	90	100
1	23	M-AD4									M-AD4
2	24	M-AD4									M-AD4
3	30	S-A-29	S-A-34	S-A-42	S-AD-21	S-AD-6	S-AD-14	S-A-37	S-A-38	S-A-5	S-A-7
4	53	S-AD-22									S-AD-22
5	71	S-A-10	S-A-1	S-AD-1	S-A-9	S-AD-9	S-A-17	S-A-25	S-AD-2	S-A-33	M-AD6
6	72	S-A-13	S-A-41	S-AD-18	S-A-49	S-AD-3	S-A-57	S-AD-11	S-A-2	S-AD-19	M-AD6
7	74	S-A-20	S-A-31	S-A-40	S-A-54	S-A-64	S-A-20	S-A-31	S-A-40	S-A-54	S-A-64

MAIN FRAME FORMAT - WORD LOCATION
(S/C 114)

1	2	3	4	5	6	7	8	9	10
SYNC WD 1	SYNC WD 2	SYNC WD 3	FRAME ID	M-A25	MFD-3	M-A1	M-A9	M-W1 M-W2	M-W3 M-W4
11	12	13	14	15	16	17	18	19	20
MFD-1	MFD-1	MFD-1	M-A2		M-A26				M-A3
21	22	23	24	25	26	27	28	29	30
M-A4	M-A5	SUBCOM 1	SUBCOM 2		MFD-3				SUBCOM 3
31	32	33	34	35	36	37	38	39	40
MFD-2	M-A6	M-A7	M-A8		M-A26				M-A10
41	42	43	44	45	46	47	48	49	50
M-A11	M-A12	M-A13	M-A14		MFD-3				M-W5 M-W6
51	52	53	54	55	56	57	58	59	60
M-A15	M-A16	SUBCOM 4	M-A17		M-A26				M-A18
61	62	63	64	65	66	67	68	69	70
M-A19	M-A20	M-A21	M-A22		MFD-3				M-A23
71	72	73	74	75	76	77	78	79	80
SUBCOM 5	SUBCOM 6	M-A24	SUBCOM 7	M-A25	M-A26	M-A1	M-A9	M-W1 M-W2	M-W7 M-W8

NOTES:
 ▷ MINIMUM SAMPLE RATE IS 1 SAMPLE PER SECOND
 ▷ MINIMUM SAMPLE RATE IS 100 SAMPLES PER SECOND



REV	DATE	BY	CHKD	APP'D
1	11-10-68	...	...	...
2	12-10-68	...	...	...
3	01-10-69	...	...	...
4	03-10-69	...	...	...
5	05-10-69	...	...	...
6	07-10-69	...	...	...
7	09-10-69	...	...	...
8	11-10-69	...	...	...
9	01-10-70	...	...	...
10	03-10-70	...	...	...
11	05-10-70	...	...	...
12	07-10-70	...	...	...
13	09-10-70	...	...	...
14	11-10-70	...	...	...
15	01-10-71	...	...	...
16	03-10-71	...	...	...
17	05-10-71	...	...	...
18	07-10-71	...	...	...
19	09-10-71	...	...	...
20	11-10-71	...	...	...
21	01-10-72	...	...	...
22	03-10-72	...	...	...
23	05-10-72	...	...	...
24	07-10-72	...	...	...
25	09-10-72	...	...	...
26	11-10-72	...	...	...
27	01-10-73	...	...	...
28	03-10-73	...	...	...
29	05-10-73	...	...	...
30	07-10-73	...	...	...
31	09-10-73	...	...	...
32	11-10-73	...	...	...
33	01-10-74	...	...	...
34	03-10-74	...	...	...
35	05-10-74	...	...	...
36	07-10-74	...	...	...
37	09-10-74	...	...	...
38	11-10-74	...	...	...
39	01-10-75	...	...	...
40	03-10-75	...	...	...
41	05-10-75	...	...	...
42	07-10-75	...	...	...
43	09-10-75	...	...	...
44	11-10-75	...	...	...
45	01-10-76	...	...	...
46	03-10-76	...	...	...
47	05-10-76	...	...	...
48	07-10-76	...	...	...
49	09-10-76	...	...	...
50	11-10-76	...	...	...

4 DP

8 GUIDANCE AND
CONTROL
SYSTEM

TABLE 8-1.- CMC INPUT/OUTPUT CHANNELS ON TELEMETRY

BITS	OUTPUT					INPUT			
	CHANNEL								
	77 WD69b	11 WD91a	12 WD91b	13 WD92a	14 WD92b	30 WD93a	31 WD93b	32 WD94a	33 WD94b
1	PARITY FAIL F or E	ISS WARN	OCDU ZERO	RANGING		S4 ULLAGE	+P RHC	+P MIC	
2	E PARITY (B 1 & 2)	COMP ACTV	OPT EC EN	RANGING		RCS XFER	-P RHC	-P MIC	RANGING
3	TC TRAP	UPL ACTV		RANGING		SPS READY	+Y RHC	+Y MIC	
4	RUPTLOC	TEMP CAUT	COAR ALGN	RANGING		S4 SP/ABT	-Y RHC	-Y MIC	CMC/MAN
5	NIGHT WTMN	KEY REL	ICDU ZERO			CMC L/O	+R RHC	+R MIC	ZERO/MAN
6	VOLT FAIL	FLASH	IMU EC EN	BL INLINK	GY ENABLE		-R RHC	-R MIC	
7	COUNT FAIL	OPR ERR		DN WD ORD	GY SEL B*	OCDU FAIL	+X TRANS		
8	SCALAR FAIL		TVC ENABLE		GY SEL A*		-X TRANS		
9	SCALER D FREQ	TST CONN	IVB TK/EN		GY SIGN-*	IMU OPER	+Y TRANS		
10		CAUT REST	ZERO OPT	TST ALARM	GY ACT	SAT TAKO	-Y TRANS		UP TM BLK
11			DIS O DAC	EN STBY	DR CDU S	IMU CAGE	+Z TRANS	LM ATTACH	UPL FAST
12				RST T 31A	DR CDU T	ICDU FAIL	-Z TRANS		DNL FAST
13		ENG ON	S-IVB INJ	RST T 31B	DR CDU Z	IMU FAIL	FREE/AUTO		PIPA FAIL
14			S-IVB CO	RST T 32	DR CDU Y	ISS TN ON	HOLD/AUTO	PROCEED	CMC WARN
15			ISS TURN ON DELAY COMPLETE	EN T6 RUPT	DR CDU X	IMU TEMP	A/P CONT		OSC ALARM

* GYRO SELECT	
BITS 7,8,9	GYRO TORQUE
0 0 0	NO TORQUE
0 0 1	NO TORQUE
0 1 0	+Y
0 1 1	-Y
1 0 0	+X
1 0 1	-X
1 1 0	+Z
1 1 1	-Z

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CSM
S/C 112-114

TABLE 8-II.- CSM ALARM CODES

<u>ALARM CODE (CODE)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
00100	NONE	<u>NO MARK SINCE LAST MK REJ.</u> - THE PROCESS OF MARKING SETS BIT 10 OF MARKSTAT TO ENABLE A MARK REJECT. IF MARKING IS BEING ACCEPTED BY PROGRAM WHEN MARK REJECT IS ACTIVATED, BIT 10 OF MARKSTAT IS FOUND TO BE ZERO. THIS INDICATES NO MARK HAS BEEN MADE WHICH CAN BE REJECTED. PROGRAM ALARM WILL BE DISPLAYED.
00113	DETERMINE IF AN INPUT CHANNEL BIT(S) FAILURE HAS OCCURRED.	<u>NO INBITS</u> - IF A MARKRUPT OR KEYRUPT 2 (SAME RUPT) OCCURS AND THE RUPT ROUTINE DETECTS, BITS 1 THROUGH 7 ARE RESET (I.E., NO KEYCODE, MARK OR MARK REJECT IS PRESENT). PROGRAM ALARM WILL BE DISPLAYED.
00114	SELECT THE DESIRED PROGRAM BEFORE TAKING MARKS, OR TOO MANY MARKS HAVE BEEN MADE. NO OTHER ACTION REQUIRED.	<u>MARK MADE BUT NOT DESIRED</u> - THE PROGRAM USING THE MARK ROUTINE STORES THE NUMBER OF MARKS DESIRED IN BITS 12 THROUGH 14 OF MARKSTAT. IF A MARK IS MADE WITH NO MARKS DESIRED AS INDICATED BY BITS 12 THROUGH 14 = 0, PROGRAM ALARM IS DISPLAYED.
00115	PLACE OPTICS SWITCH TO CMC.	<u>OPTICS TORQUE REQUEST WITH SWITCH NOT AT CMC</u> - OCCURS WHEN AN EXTENDED VERB 41 AND NOUN 91 IS REQUESTED FOR A COARSE ALIGN OF THE OCDU'S WITH THE OPTICS MODE SWITCH NOT IN THE CMC POSITION. THIS WILL RESULT IN A PROGRAM ALARM DISPLAY.
00116	REZERO THE OPTICS.	<u>OPTICS SWITCH ALTERED BEFORE 15 SEC ZERO TIME ELAPSED</u> - POSITIONING OF THE OPTICS ZERO SWITCH TO THE ZERO POSITION INITIATES A COMPUTER ROUTINE, WHICH HAS A 15 SECOND TIME DELAY TO ALLOW THE OPTICS TO ZERO BEFORE RESET OF THE SHAFT AND TRUNNION COUNTERS. ALTERING OF THE ZERO SWITCH TO THE OFF POSITION PRIOR TO COMPLETION OF THE TIME DELAY RESULTS IN A PROGRAM ALARM DISPLAY.

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CSM
S/C 112-114

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
00117	WAIT UNTIL INTERNAL USE OF OPTICS IS TERMINATED.	<u>OPTICS TORQUE REQUEST WITH OPTICS NOT AVAILABLE</u> - OCCURS WHEN A VERB 41 NOUN 91 IS REQUESTED FOR A COARSE ALIGN OF THE OCDU'S AND AN INTERNAL CMC FUNCTION IS USING THE OCDU'S, I.E., AUTO POSITIONING OF THE OPTICS OR USE OF THE OCDU DAC'S FOR GIMBAL POSITIONING DURING TVC RESULTING IN A PROGRAM ALARM DISPLAY.
00120	ZERO THE OPTICS AND PROCEED.	<u>OPTICS TORQUE REQUEST WITH OPTICS NOT ZEROED</u> - BIT 10 OF OPTMODES IS A FLAG WHICH IS SET DURING OPTICS ZEROING AND IS RESET BY A FRESH START OR RESTART. IF THE OPTICS MODE SWITCH IS IN THE CMC POSITION WITH BIT 10 = 0, THIS INDICATES THE OPTICS ARE AVAILABLE FOR TORQUING WITHOUT HAVING BEEN ZEROED SINCE THE LAST FRESH START OR RESTART. SINCE THIS CAN RESULT IN DISAGREEMENT BETWEEN CMC AND OCDU ANGLES, A PROGRAM ALARM WILL BE DISPLAYED.
00121	REPEAT MARK.	<u>CDU'S NOT GOOD AT TIME OF MARK</u> - THERE EXISTS IN THE CDU'S FINE ERROR SWITCHING TRANSIENTS WHICH MAY RESULT IN ERRONEOUS CDU SAMPLINGS AT TIME OF MARK. A DOUBLE SAMPLING TECHNIQUE IS USED IN PROGRAM TO DETECT THESE TRANSIENTS, AND SHOULD THEY OCCUR, THE MARK IS IGNORED AND PROGRAM ALARM IS DISPLAYED.
00205	REF MALF. PROCEDURES.	<u>BAD PIPA READING</u> - SERVICER HAS DETECTED AT LEAST ONE PIPA IS SATURATED AND IS OUTPUTTING PULSES AT A 3200 PPS RATE. THIS RESULTS IN A BYPASS OF DELTA V COMPUTATIONS AND PROGRAM ALARM DISPLAY.

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TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
00206	POSITION GIMBAL OUT OF GIMBAL LOCK & REPEAT.	<u>ZERO ENCODE NOT ALLOWED WITH COARSE ALIGN AND GIMBAL LOCK</u> - SINCE A ZERO ENCODE (V40N20) SETS THE PLATFORM INERTIAL, THE ZEROING ROUTINE IS CONSIDERED ILLEGAL IF THE ISS IS IN COARSE ALIGN MODE AND IS IN THE GIMBAL LOCK REGION. THE ZERO WILL NOT BE EXECUTED AND PROGRAM ALARM WILL BE DISPLAYED.
00207	REF MALF. PROCEDURES	<u>ISS TURNON REQUEST NOT PRESENT FOR 90 SEC</u> - TURNON OF IMU POWER CAUSES A TURNON REQUEST INPUT TO THE CMC. THE CMC INITIATES A 90 SEC DELAY BEFORE ISSUING TURNON DELAY COMPLETE. THIS SEQUENCE CAGES THE PLATFORM TO ALLOW FOR WHEEL RUNUP AND PIPA POWER SUPPLY WARMUP. REMOVAL OF THE TURNON REQUEST (IMU POWERDOWN) BEFORE THE TIME DELAY IS COMPLETE WILL RESULT IN PROGRAM ALARM.
00210	REF MALF. PROCEDURES	<u>IMU NOT OPERATING</u> - VARIOUS COMPUTER ROUTINES PERFORM A STATUS CHECK ON BIT 9 IMODES 30 TO DETERMINE IF THE IMU IS OPERATING BEFORE COMPUTATIONS DEPENDENT ON THE IMU ARE MADE. IF THIS BIT INDICATES THE IMU IS NOT OPERATING (IMU POWER OFF), PROGRAM ALARM IS DISPLAYED.
00211	REF MALF. PROCEDURES	<u>COARSE ALIGN ERROR GREATER THAN 2 DEGREES</u> - IF, DURING AN IMU COARSE ALIGN (EITHER V41N20 OR ALIGNMENT PROGRAM), THE GIMBAL ANGLE ATTAINED IS GREATER THAN 2 DEGREES IN ERROR FROM THE DESIRED ANGLE, A PROGRAM ALARM IS DISPLAYED.
00212	REF MALF. PROCEDURES	<u>PIPA FAIL BUT PIPA NOT BEING USED</u> - A PIPA FAIL CAN CAUSE AN ISS WARNING OR PROGRAM ALARM ONLY DEPENDING ON THE STATE OF BIT 1 OF IMODES 30. THIS BIT IS CONTROLLED BY AVERAGE G WHICH ALLOWS FOR AN ISS WARNING WHEN THE PIPA INPUT IS BEING USED AND INHI- BITS IT WHEN NOT IN USE. WHEN NOT IN USE, AND PROVIDING THE PROGRAM CAUTION INHIBIT (BIT 5 IMODES 30) IS RESET, A PROGRAM ALARM WILL BE DISPLAYED.

8

CSM
S/C 112-114

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
00213	REF MALF. PROCEDURES	<u>IMU NOT OPERATING WITH TURNON REQUEST</u> - UPON RECEIPT OF A TURNON REQUEST, THE CMC WILL CHECK THE OPERATE BIT (BIT 9 IMODES 30). IF THE OPERATE BIT INDICATES THE IMU IS NOT POWERED UP, A PROGRAM ALARM WILL BE DISPLAYED.
00214	REACTIVATE IMU IF PROGRAM USING IMU IS CRITICAL - OTHERWISE TERMINATE PROGRAM.	<u>PROGRAM USING IMU WHEN TURNED OFF</u> - WHEN THE IMU IS TURNED OFF, AS INDICATED BY BIT 9 IMODES 30, THE CMC CHECKS THE STATUS OF BIT 8 FLAGWORD 0 (IMU IN USE FLAG). IF A PROGRAM HAD BEEN USING THE IMU AND HAD SET THIS BIT, A PROGRAM ALARM WILL BE DISPLAYED.
00217	REF MALF. PROCEDURES	<u>BAD RETURN FROM STALL ROUTINES</u> - DETECTION BY THE MODE SWITCHING LOGIC OF THE IMU INITIALIZATION BIT (BIT 6 OF IMODES 30) PROVIDES A FLAG FOR THE IMU STALL ROUTINE TO PERFORM AN ERROR RETURN TO THE SLEEPING PROGRAM (PRIMARILY P51 OR P53). THE ERROR RETURN IS TO ROUTINE CURTAINS WHICH CAUSES A PROGRAM ALARM DISPLAY.
00220	REALIGN IMU.	<u>IMU NOT ALIGNED (BAD REFSMMAT)</u> - ANY MAJOR PROGRAM WHICH USES THE IMU ATTITUDE INFORMATION AND THE REFSMMAT WILL PERFORM A CHECK WITH ROUTINE R02BOTH, ON THE REFSMMAT FLAG (BIT 13 OF FLAGWORD 3) AND THE IMU OPERATE BIT (BIT 9 OF IMODES 30), TO INSURE THE IMU IS OPERATING AND THE REFSMMAT IS VALID. THE THRUSTING, ALIGNMENT, AND NAVIGATION PROGRAMS ALL USE THIS INFORMATION; AND, IF THE REFSMMAT IS FOUND INVALID WHILE THE IMU IS OPERATING, A PROGRAM ALARM WILL BE DISPLAYED.
00401	MANEUVER AND REINITIATE PROGRAM TO AVOID GIMBAL LOCK.	<u>DESIRED ANGLES YIELD GIMBAL LOCK</u> - CALCGA COMPUTES DESIRED IMU GIMBAL ANGLES FROM A SET OF N.B. VECTORS AND DESIRED S.M. VECTORS FOR PRELAUNCH AND INFLIGHT ALIGNMENT PROGRAMS. IF THE DESIRED IMU ATTITUDE WILL RESULT IN A MIDDLE GIMBAL ANGLE OF GREATER THAN 60°, GLOK FAIL (BIT 14 OF FLAGWORD 3) IS SET AND PROGRAM ALARM IS DISPLAYED.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
00402	CREW MUST TORQUE PLATFORM BACK TO PRE-PLANE CHANGE ALIGNMENT.	<u>CREW MUST HONOR 2ND MINKEY TORQUE REQUEST</u> - SET IN P52 DURING RENDEZVOUS SEQUENCE WHEN CREW HAS TORQUED PLATFORM FOR PLANE CHANGE BUT FAILED TO TORQUE BACK TO PRE-PLANE CHANGE ALIGNMENT.
00404	<ol style="list-style-type: none"> 1. TERMINATE, REINITIATE PROGRAM, AND RESELECT A NEW PAIR OF STARS. 2. MANEUVER AND PROCEED WITH RECOMPUTATION OF DESIRED OPTICS ANGLES. 	<u>TARGET OUT OF VIEW ($A_t > 90$ DEG)</u> - IF A SELECTED STAR IS OCCULTED BY EARTH, SUN, MOON OR IF COMPUTATION OF DESIRED TRUNNION ANGLE IS GREATER THAN 90° , THE CULTFLAG (BIT 7 OF FLAGWORD 3) WILL BE SET. PROVIDING THE TARGET BEING SIGHTED IS NOT THE LM, THE OPTICS AUTO-POSITION ROUTINE WILL DISPLAY PROGRAM ALARM AND ERROR CODE 404 WITH AN OPTIONAL CREW RESPONSE REQUIRED.
00405	<ol style="list-style-type: none"> 1. PROCEED WITH SIGHTINGS USING MANUALLY SELECTED STARS. 2. MANEUVER AND RECYCLE THROUGH THE STAR SELECTION ROUTINE. 	<u>TWO STARS NOT AVAILABLE</u> - IF THE STAR SELECTION ROUTINE CANNOT FIND TWO STARS WHICH ARE NOT OCCULTED BY THE SUN, EARTH, OR MOON, AND DO NOT HAVE SATISFACTORY ANGLE SEPARATION, TRUNNION DRIVE IS INHIBITED AND PROGRAM ALARM AND ERROR CODE 405 WILL BE DISPLAYED WITH AN OPTIONAL CREW RESPONSE REQUIRED.
00406	ACTIVATE P20 BEFORE REQUESTING SIGHTINGS.	<u>RENDEZVOUS NAVIGATION NOT OPERATING</u> - REQUESTS FOR RENDEZVOUS SIGHTING MARKS (V57, V54) ARE REJECTED IF THE RENDEZVOUS NAVIGATION PROGRAM (P20) IS NOT RUNNING AS INDICATED BY THE RNDVZFLG (FWI BIT 7) AND THE TRACKFLG (FWI BIT 5). IF THE REQUEST IS MADE, A PROGRAM ALARM WILL BE DISPLAYED AND THE REQUEST IS TERMINATED.
00421	<ol style="list-style-type: none"> 1. GROUND UPDATE S.V. 2. PERFORM SUFFICIENT NUMBER OF NAVIGATION MARKS TO REINITIALIZE W-MATRIX AND ELIMINATE S.V. ERROR. 	<u>W-MATRIX OVERFLOW</u> - IF, DURING STATE VECTOR UPDATE, THE ORBITAL INTEGRATION PACKAGE DETECTS AN OVERFLOW IN ANY W-MATRIX ELEMENT, AN ERRONEOUS STATE VECTOR WILL RESULT AND A PROGRAM ALARM WILL BE DISPLAYED.

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CSM
S/C 112-114

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
00600	RECYCLE TO START OF PROGRAM AND ADJUST INPUT PARAMETERS.	<u>IMAGINARY ROOTS ON FIRST ITERATION</u> - IF ON THE FIRST ITERATION FOR THE PRE-CSI MANEUVER NO REAL SOLUTION EXISTS FOR AN EQUATION DEFINING TPI LINE OF SIGHT FROM THE ACTIVE VEHICLE, THE PROGRAM IS EXITED AND PROGRAM ALARM IS DISPLAYED WITH ERROR CODE 600.
00601	RECYCLE AND ADJUST INPUT PARAMETERS FOR NEW SOLUTION.	<u>PERIGEE ALTITUDE LIMIT P MIN 1</u> - IF THE ALTITUDE OF PERIGEE AFTER THE COMPUTED CSI MANEUVER IS LESS THAN THE LIMIT OF 35K FT (LUNAR ORBIT) OR 85 N.MI. (EARTH ORBIT), A PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 601.
00602	RECYCLE AND ADJUST INPUT PARAMETERS FOR NEW SOLUTION.	<u>PERIGEE ALTITUDE LIMIT P MIN 2</u> - IF THE ALTITUDE OF PERIGEE AFTER THE COMPUTED CDH MANEUVER IS LESS THAN THE LIMIT OF 35K FT (LUNAR ORBIT) OR 85 N.MI. (EARTH ORBIT), A PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 602.
00603	RECYCLE AND ADJUST INPUT PARAMETERS FOR NEW SOLUTION.	<u>CSI TO CDH TIME LIMIT P MIN 22</u> - IF THE COMPUTED ΔT BETWEEN THE CSI AND CDH MANEUVERS FOR THE CSI OR CDH MANEUVER SOLUTION IS LESS THAN 10 MINUTES, A PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 603.
00604	RECYCLE AND ADJUST INPUT PARAMETERS FOR NEW SOLUTION.	<u>CDH TO TPI TIME LIMIT P MIN 23</u> - IF THE COMPUTED ΔT BETWEEN THE CDH AND TPI MANEUVERS FOR THE CSI MANEUVER SOLUTION IS LESS THAN 10 MINUTES, A PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 604.
00605	RECYCLE THE PROGRAM USING ALTERED INPUT PARAMETERS.	<u>NUMBER OF ITERATIONS EXCEEDS LOOP MAXIMUM</u> - THE MANEUVER SOLUTION DESIRED IS A RESULT OF A NUMBER OF PROGRAM ITERATIONS. IF THE NUMBER OF ITERATIONS EXCEEDS 15 WITH NO SOLUTION, A PROGRAM ALARM IS DISPLAYED WITH ERROR CODE 605.

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TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
00606	IF NO SOLUTION IS FOUND, THE PROGRAM MUST BE RECYCLED.	<u>DV EXCEEDS MAXIMUM</u> - IF TWO SUCCEEDING ITERATIONS YIELD A DV SOLUTION FOR THE CSI MANEUVER OF GREATER THAN 1000 FT/SEC, A PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 606.
00611	PROCEED WITH DISPLAYS OR RECYCLE PROGRAM WITH NEW INPUT PARAMETERS.	<u>NO TIG FOR ELEVATION ANGLE</u> - THE PRE-CDH PROGRAM USES THE TPI TIME AND THE ELEVATION ANGLE (DESIRED LINE OF SIGHT TO PASSIVE VEHICLE AT TPI) COMPUTED IN THE PRE-CSI MANEUVER PROGRAM. IF NO CDH SOLUTION IS FOUND FOR THE DESIRED E ANGLE AND TPI TIME, A PROGRAM ALARM IS DISPLAYED WITH ERROR CODE 611.
00612	DELAY COMPUTATIONS UNTIL VEHICLE CO-ORDINATES ARE IN EARTH SPHERE.	<u>STATE VECTOR IN WRONG SPHERE OF INFLUENCE</u> - THE RETURN-TO-EARTH TARGETING COMPUTATIONS ARE VALID ONLY IF THE VEHICLE IS OUTSIDE THE LUNAR SPHERE OF INFLUENCE. IF CM00NFLAG (BIT 12 FWD8) IS SET INDICATING LUNAR SPHERE, THE RESULT WILL INDIRECTLY BE A DISPLAY OF PROGRAM ALARM WITH ERROR CODE 612.
00613	RECYCLE PROGRAM AND ADJUST INPUT PARAMETER.	<u>REENTRY ANGLE OUT OF LIMITS</u> - IF THE PRECISION TRAJECTORY SOLUTION FOR THE REENTRY ANGLE HAS NOT CONVERGED TO THE CONIC SOLUTION WITHIN LIMITS, A PROGRAM ALARM WILL BE DISPLAYED WITH ERROR CODE 613.
00777	REF MALF. PROCEDURE G&N 6.	<u>PIPA FAIL CAUSED THE ISS WARNING</u> - WHEN AN ISS FAIL INPUT (IMU, CDU, PIPA) IS DETECTED BY T4RUPT, THE INPUT WHICH CAUSES THE ALARM IS COMMUNICATED TO THE "VARALARM" ROUTINE WHICH PROVIDES FOR AN ERROR CODED DISPLAY OF THE FAIL INPUT. THOSE FAIL BITS OF IMODES 30 (BITS 13, 12, 10) WHICH ARE NOT INHIBITED (BITS 4, 3, AND 1) WILL CAUSE ISS WARNING AND THE SUM OF THESE FAIL BITS MINUS 1 WILL YIELD THE ERROR CODE. (BIT 10 - 1 = 01000 ₈ - 1 = 0777 ₈) AND A PROGRAM ALARM IS DISPLAYED.
01102	REF MALF. PROCEDURES.	<u>CMC SELF TEST ERROR</u> - IF AN ERROR IS DETECTED DURING THE CMC SELF TEST, REGARDLESS OF OPTION, A PROGRAM ALARM WILL BE DISPLAYED.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
01105	REF MALF. PROCEDURES	<u>DOWNLINK TOO FAST</u> - TRANSMISSION OF THE CMC DOWNLINK DATA TO THE PCM IS INITIATED BY A DOWNLINK START PULSE FOLLOWED BY SYNC PULSES WHICH SERIALLY GATE THE DOWNLINK WORDS TO THE PCM. FOLLOWING THE TRANSMISSION OF THE WORDS FROM THE OUTCOUNTERS, A DOWNLINK END PULSE IS SENT TO THE COMPUTER WHICH INITIATES RELOADING OF THE OUTCOUNTERS WITH THE NEXT TWO WORDS OF THE DOWNLIST. RECEIPT OF THE DOWNLINK END PULSE IS ENABLED AT A RATE OF 100 PPS. IF TWO END PULSES ARE RECEIVED WITHIN A 10 MSEC PERIOD, THE DOWNLINK TOO-FAST BIT (CH33 BIT 12) IS RESET AND WHEN DETECTED BY THE T4RUPT ROUTINE, A PROGRAM ALARM IS DISPLAYED.
01106	REF MALF. PROCEDURES	<u>UPLINK TOO FAST</u> - TRANSMISSION OF EACH SERIAL UPLINK BIT IS ENABLED AT A 6400 PPS RATE. IF TWO UPLINK BITS (EITHER 1'S OR 0'S) ARE RECEIVED WITHIN A 156 MSEC PERIOD, THE UPLINK TOO-FAST BIT (CH 33 BIT 11) IS RESET AND WHEN DETECTED BY THE T4RUPT ROUTINE, A PROGRAM ALARM IS DISPLAYED.
01107	REF MALF. PROCEDURES. IMU REALIGN MAY BE NECESSARY.	<u>PHASE TABLE FAILURE - ASSUMING ERASABLE MEMORY IS DESTROYED</u> - AT VARIOUS POINTS IN A PROGRAM, THE PHASE TABLE IS SET UP TO ESTABLISH A RESTART POINT IN THE PROGRAM SHOULD A RESTART OCCUR. ESSENTIALLY, TWO TABLES ARE SET UP, ONE BEING THE INVERSE OF THE OTHER. THESE TABLES ARE CHECKED FOR AGREEMENT DURING A RESTART. IF PHASE TABLE DISAGREEMENT OCCURS IT IS ASSUMED THAT ERASABLE MEMORY HAS BEEN ALTERED, AND A FRESH START IS PERFORMED. E MEMORY MUST THEN BE REESTABLISHED. DETECTION OF THE ABOVE RESULTS IN A PROGRAM ALARM DISPLAY.
01301	RECYCLE PROGRAM WHICH IS UTILIZING COMPUTATIONS.	<u>ARCSIN - ARCCOS INPUT ANGLE TOO LARGE</u> - IF THE ARCSIN OR ARCCOS IS GREATER THAN 1, THE COMPLEMENT ROUTINE WILL DISPLAY A PROGRAM ALARM.

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CSM
S/C 112-114

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
01407	REF MALF. PROCEDURES	<u>Vg INCREASING</u> - A CHECK IS MADE IN P40, WHICH ESSENTIALLY CHECKS THAT THE DIRECTION OF THE MEASURED DV ACCUMULATED IS THE SAME AS THAT OF Vg. IF THRUST IS IN THE WRONG DIRECTION, A PROGRAM ALARM IS DISPLAYED.
1426	REALIGN OR USE EMS FOR ENTRY.	<u>IMU UNSATISFACTORY</u> - A CHECK IS MADE ON THE IMU ORIENTATION TO INSURE THAT THE +Y SM VECTOR IS WITHIN 30 DEGREES OF THE (V X R) VECTOR. IF NOT, A CHECK IS MADE TO INSURE THE -Y SM VECTOR IS WITHIN -30 DEGREES OF THE (V X R) VECTOR. (SEE ALARM CODE 1427.) IF NEITHER OF THESE CONDITIONS EXIST, A PROGRAM ALARM AND ERROR CODE 1426 ARE DISPLAYED.
1427	FDAI DISPLAY IS REVERSED.	<u>IMU REVERSED</u> - IF THE -Y SM VECTOR IS WITHIN -30° OF THE (V X R) VECTOR (SEE ALARM CODE 1426), A PROGRAM ALARM WITH ERROR CODE 1427 IS DISPLAYED.
1520	WAIT UNTIL MODE CHANGE IS PERMITTED OR CALL P00 BEFORE CALLING DESIRED PROGRAM.	<u>V37 REQUEST NOT PERMITTED AT THIS TIME</u> - IF A MAJOR MODE CHANGE REQUEST IS MADE DURING IMU INITIALIZATION (IMODES 30 BIT 6) OR IF OTHER THAN A P00 REQUEST IS INHIBITED BY ANOTHER PROGRAM, A PROGRAM ALARM WILL BE DISPLAYED.
01600	REPEAT TEST PROGRAM FOR VALID DATA.	<u>OVERFLOW IN DRIFT TEST</u> - THIS ALARM IS PECULIAR TO PRELAUNCH TESTING ONLY AND IS MECHANIZED FOR A COMPUTATIONAL OVERFLOW IN THE PRELAUNCH GYRO DRIFT TEST. THIS OVERFLOW WILL RESULT IN A PROGRAM ALARM DISPLAY.
01601	REPEAT TEST PROGRAM AS TEST RESULTS MAY BE INVALID.	<u>BAD IMU TORQUE</u> - THIS ALARM IS THE RESULT OF A BAD RETURN FROM THE IMU STALL ROUTINE IN THE PRELAUNCH ALIGNMENT PROGRAM. IT IS INDICATIVE OF A BAD COARSE ALIGN OR IMU TORQUE AND WILL RESULT IN A PROGRAM ALARM DISPLAY.

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TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
01703	PROCEED. TIG WILL SLIP BY AN AMOUNT NECESSARY TO ALLOW FOR INTEGRATION.	<u>INSUFFICIENT TIME FOR INTEGRATION - TIG WAS SLIPPED</u> - IN THE BURN PROGRAM, THE STATE VECTOR IS INTEGRATED TO TIG - 30 AND IS INPUT TO THE SERVICER. IF THERE IS INSUFFICIENT TIME (12.5 SECONDS) PRIOR TO TIG - 30 TO ALLOW FOR THIS INTEGRATION, A PROGRAM ALARM WILL BE DISPLAYED.
03777	REFER TO MALF. PROCEDURE G&N 6.	<u>ICDU FAIL CAUSED THE ISS WARNING</u> - WHEN AN ICDU FAIL (IMODES 30 BIT 12) IS DETECTED BY T4RUPT ROUTINE WITH NO FAIL INHIBIT PRESENT, ISS WARNING IS DISPLAYED, AND THE ROUTINE VARALARM WILL GENERATE AN ERROR CODE OF THE FAIL BIT VALUE MINUS 1 (04000 - 1 = 03777) AND WILL DISPLAY A PROGRAM ALARM.
04777	REFER TO MALF. PROCEDURE G&N 6.	<u>ICDU, PIPA FAILS CAUSED ISS WARNING</u> - WHEN BOTH ICDU (IMODES 30 BIT 12) AND PIPA (IMODES 30 BIT 10) UNINHIBITED FAILS ARE DETECTED BY THE T4RUPT ROUTINE, ISS WARNING IS DISPLAYED, AN ERROR CODE OF THE FAIL BIT VALUES MINUS 1 (05000 - 1 = 4777) IS GENERATED AND A PROGRAM ALARM IS DISPLAYED.
07777	REFER TO MALF. PROCEDURE G&N 6.	<u>IMU FAIL CAUSED THE ISS WARNING</u> - WHEN AN UNINHIBITED IMU FAIL (IMODES 30 BIT 13) IS DETECTED BY THE T4RUPT ROUTINE, ISS WARNING IS DISPLAYED, AN ERROR CODE OF THE FAIL BIT VALUE MINUS 1 (10000 - 1 = 07777) IS GENERATED, AND A PROGRAM ALARM IS DISPLAYED.
10777	REFER TO MALF. PROCEDURE G&N 6.	<u>IMU, PIPA FAILS CAUSED THE ISS WARNING</u> - WHEN BOTH UNINHIBITED IMU FAIL (IMODES 30 BIT 13) AND PIPA FAIL (IMODES 30 BIT 10) ARE DETECTED BY T4RUPT ROUTINE, ISS WARNING IS DISPLAYED, AN ERROR CODE OF THE FAIL BIT VALUES MINUS 1 (11000 - 1 = 10777) IS GENERATED, AND A PROGRAM ALARM IS DISPLAYED.
13777	REFER TO MALF. PROCEDURE G&N 6.	<u>IMU, ICPU FAILS CAUSED THE ISS WARNING</u> - WHEN BOTH UNINHIBITED IMU FAIL (IMODES 30 BIT 13) AND ICPU FAIL (IMODES 30 BIT 12) ARE DETECTED BY THE T4RUPT ROUTINE, ISS WARNING IS DISPLAYED, AN ERROR CODE OF THE FAIL BIT VALUES MINUS 1 (14000 - 1 = 13777) IS GENERATED, AND A PROGRAM ALARM IS DISPLAYED.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
14777	REFER TO MALF. PROCEDURE G&N 6.	<u>IMU, ICDU, PIPA FAILS CAUSED ISS</u> <u>WARNING</u> - WHEN UNINHIBITED IMU FAIL, (IMODES 30 BIT 13), PIPA FAIL (IMODES 30 BIT 10), AND ICDU FAIL (IMODES 30 BIT 12) ARE DETECTED BY T4RUPT ROUTINE, ISS WARNING IS DISPLAYED, AN ERROR CODE OF THE FAIL BIT VALUES MINUS 1 (15000 - 1 = 14777) IS GENERATED, AND A PROGRAM ALARM IS DISPLAYED.
20430	UPLINK NEW S.V.	<u>INTEGRATION ABORT DUE TO SUBSURFACE</u> <u>S.V.</u> - IF STATE VECTOR POSITION MAGNI- TUDE BECOMES TOO LOW DUE TO A "BAD" S.V. CAUSING OVERFLOW IN THE INTEGRA- TION ROUTINE WHICH RECTIFICATION CANNOT ELIMINATE, A SOFTWARE RESTART IS GENERATED AND, PROVIDING AVERAGE-G IS NOT RUNNING, ALL RESTART GROUPS ARE RESET. PROGRAM ALARM WILL BE DISPLAYED AND PROGRAM FLOW WILL ENTER GOTOPOOH.
20607	RECYCLE PROGRAM WITH ADJUSTED INPUT PARAMETERS.	<u>NO SOLUTION FROM TIME THETA OR TIME</u> <u>RADIUS ROUTINE</u> - THESE ROUTINES PRO- VIDE TRANSFER TIME SOLUTIONS FOR TWO BODIES WITH INPUTS OF POSITION AND VELOCITY VECTORS AND THE TRANSFER ANGLE TO THE TERMINAL POSITION OR THE RADIUS MAGNITUDE. IF THE CONIC TRAJECTORY IS PARABOLIC OR HYPERBOLIC AND THE DESIRED TRANSFER ANGLE LIES BEYOND THE ASYMPTOTE TO THE TRAJECTORY OR THE ECCENTRICITY OF ORBIT IS LESS THAN 2-18, NO SOLUTION IS AVAILABLE FOR THE ROUTINE AND A POODOO ALARM WILL OCCUR. A SOFTWARE RESTART WILL BE GENERATED, AND PROGRAM ALARM WILL BE DISPLAYED WITH AN ENTRANCE TO GOTOPOOH.
20610	RECYCLE PROGRAM AND ADJUSTING	<u>LAMBDA LESS THAN UNITY</u> - IF THE POSI- TION VECTOR IS LESS THAN 400,000 FT ABOVE THE PAD RADIUS AT TIG FOR THE RTE MANEUVER, THIS SIGNIFIES THE POSI- TION VECTOR IS TOO SMALL FOR THE MANEUVER. PROGRAM ALARM WILL BE DISPLAYED, AND PROGRAM WILL PROCEED TO GOTOPOOH.

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
21206	REF MALF. PROCEDURES.	<u>SECOND JOB ATTEMPTS TO GO TO SLEEP VIA KEYBOARD AND DISPLAY PROGRAM - WHEN JOB IS PUT TO SLEEP WITH A DSKY DISPLAY WHILE WAITING FOR A CREW RESPONSE OR DSKY RELEASE, THE RETURN ADDRESS OF THE SLEEPING JOB IS STORED IN CADRSTOR OR DSPLIST. IF ANOTHER ATTEMPT IS MADE BY PROGRAM TO PUT A JOB TO SLEEP USING THESE LOCATIONS, A PROGRAM ALARM IS DISPLAYED, A SOFTWARE RESTART IS EXECUTED, AND THE PROGRAM WILL PROCEED TO GOTOPOOH.</u>
21210	REF MALF. PROCEDURES.	<u>TWO PROGRAMS USING SAME DEVICE AT SAME TIME - IF TWO JOBS TRY TO UTILIZE ANY OF THE STALL ROUTINES OR THE AUTO MANEUVER ROUTINE, ALL OF WHICH CONTAIN RETURN ADDRESS INFORMATION TO THE PROGRAM USING THESE DEVICES, A PROGRAM ALARM WILL BE DISPLAYED, A SOFTWARE RESTART I IS EXECUTED, AND THE PROCESSING WILL PROCEED TO GOTOPOOH.</u>
21302	REF MALF. PROCEDURES.	<u>SQRT CALLED WITH NEGATIVE ARGUMENT - IF A SQUARE ROOT IS ATTEMPTED WITH A NEGATIVE NUMBER WHICH IS LESS NEGATIVE THAN -2^{-14}, THE SQUARE ROOT IS 0. IF THE ARGUMENT IS MORE NEGATIVE THAN -2^{-14}, A PROGRAM ALARM IS DISPLAYED, A SOFTWARE RESTART IS EXECUTED, AND PROCESSING PROCEEDS TO GOTOPOOH.</u>

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CSM
S/C 112-114

TABLE 8-II.- CSM ALARM CODES - CONTINUED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
21501	REF MALF. PROCEDURES.	<u>KEYBOARD AND DISPLAY ALARM DURING INTERNAL USE (NVSUB)</u> - IF AN INTERNAL USER OF THE DISPLAY SYSTEM FAILS TO COMMUNICATE A VERB NOUN PATTERN OR AN ILLEGAL PATTERN, A PROGRAM ALARM WILL BE DISPLAYED, A SOFTWARE RESTART IS EXECUTED, AND PROCESSING WILL PROCEED TO GOTOPOOH. AN ERROR FOR AN EXTERNAL USER OF THE DSKY WILL RESULT IN AN OPERATE ERROR LIGHT.
21502	REF MALF. PROCEDURES.	<u>ILLEGAL FLASHING DISPLAY</u> - IF A REQUEST FOR A FLASHING DISPLAY IS MADE WITH ONE ALREADY ACTIVATED IN THE DISPLAY SYSTEM, A PROGRAM ALARM WILL BE DISPLAYED AND PROCESSING WILL PROCEED TO GOTOPOOH.
21521	DO NOT REQUEST P01, P07 AFTER LIFTOFF.	<u>P01, P07 ILLEGALLY SELECTED</u> - AT LIFTOFF WHEN P11 IS STARTED, THE NODOP01 FLAG (FW1 BIT 12) IS SET AND REMAINS SET THEREAFTER. IF P01, P07 ARE ATTEMPTED AFTER LIFTOFF, THE STATE OF THE FLAG BIT WILL CAUSE A PROGRAM ALARM DISPLAY, A SOFTWARE RESTART, AND PROCESSING WILL PROCEED TO GOTOPOOH.
31104	REF MALF. PROCEDURES.	<u>DELAY ROUTINE BUSY</u> - THE ROUTINE DELAYJOB CAN HANDLE FOUR DELAY REQUESTS. IF MORE THAN FOUR JOBS ATTEMPT TO USE THE ROUTINE, A BAILOUT ABORT IS GENERATED WHICH PERFORMS A SOFTWARE RESTART FOR A RESTARTABLE PROGRAM. PROGRAM ALARM IS DISPLAYED.
31201	REF MALF. PROCEDURES.	<u>EXECUTIVE OVERFLOW - NO VAC AREAS</u> - THE PROCESS OF JOB SCHEDULING BY THE EXECUTIVE ROUTINE RESERVES VAC AREAS OR INTERPRETER WORK AREAS FOR THE JOBS ON THE EXECUTIVE CORE SET LIST. IF A JOB IS REQUESTED AND NO VAC AREAS EXIST, A BAILOUT ABORT IS GENERATED WHICH PERFORMS A SOFTWARE RESTART AND DISPLAYS PROGRAM ALARM.
31202	REF MALF. PROCEDURES.	<u>EXECUTIVE OVERFLOW - NO CORE SETS</u> - WHEN A JOB IS REQUESTED, THE EXECUTIVE ROUTINE PLACES THE JOB ON THE CORE SET LIST AND RESERVES A CORESET AREA FOR USE BY THE JOB. IF NO CORE SETS ARE AVAILABLE TO SCHEDULE A REQUESTED JOB, A BAILOUT ABORT IS GENERATED WHICH PERFORMS A SOFTWARE RESTART AND DISPLAYS PROGRAM ALARM.

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CSM
S/C 112-114

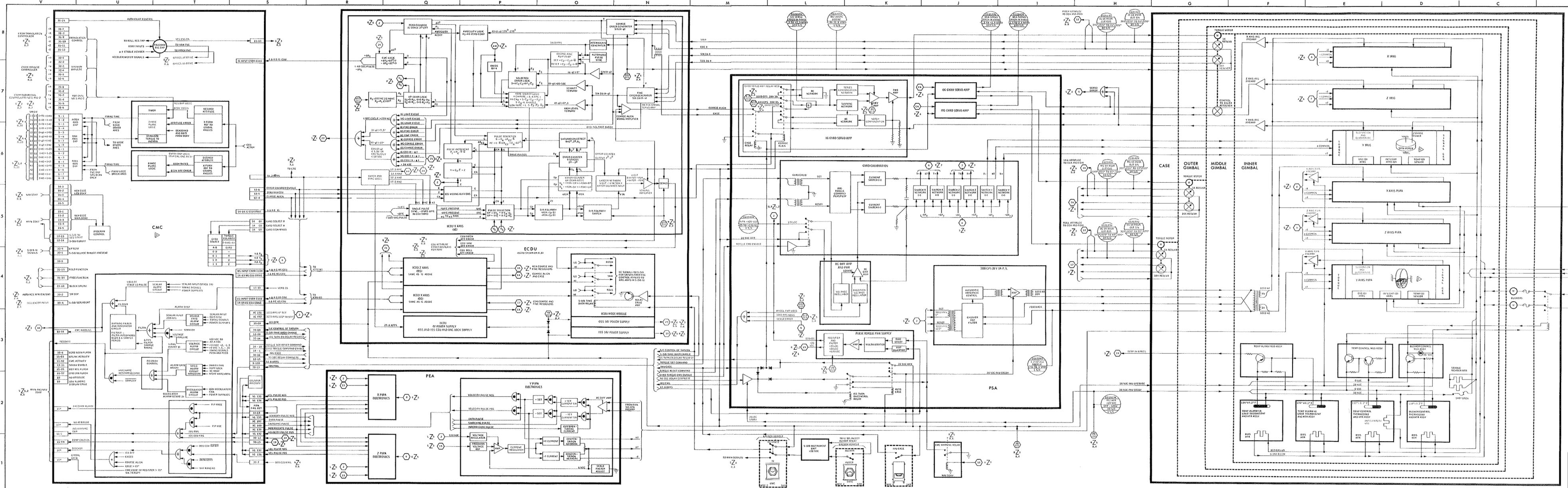
TABLE 8-II.- CSM ALARM CODES - CONCLUDED

<u>ALARM CODE (OCTAL)</u>	<u>ACTION</u>	<u>TITLE-DESCRIPTION</u>
31203	REF MALF. PROCEDURES.	<u>WAITLIST OVERFLOW - TOO MANY TASKS</u> - THE WAITLIST ROUTINE HAS CAPABILITY OF SCHEDULING NINE TIME-DEPENDENT TASKS. IF A TASK IS REQUESTED AND NO VACANT ENTRIES EXIST ON THE LIST, A BAILOUT ABORT IS GENERATED WHICH PERFORMS A SOFTWARE RESTART AND DIS- PLAYS PROGRAM ALARM.
31211	REF MALF. PROCEDURES.	<u>ILLEGAL INTERRUPT OF EXTENDED VERB</u> - THE MARKING SYSTEM PERFORMS A CHECK OF THE EXTENDED VERB ACTIVITY BITS (EXTVBACT BITS 2, 3) BEFORE THE MARK SYSTEM IS ACTIVATED. IF THE MARK SYSTEM INTERRUPTS AN EXTENDED VERB IN PROCESS, A BAILOUT ABORT IS GENERA- TED WHICH PERFORMS A SOFTWARE RESTART, AND A PROGRAM ALARM IS DISPLAYED.

TABLE 8-III.- G&N/SCA ASSOCIATED POWER SUPPLY/POWER SWITCH

PARAMETERS	NAME	OPTICS OPERATE PWR	HTR PWR ISS STBY	ISS OPERATE PWR	CMC OPERATE PWR	ISS 800 HZ 1% CG1201V	2.5 VDC REF BIAS CG1110V #1	3200 HZ CG1331V
CG0001V	DIG DATA 40 BITS				X			
CG1040V	PIPA +120 VDC			X		X	X	
CG1110V	TM BIAS 2.5 VDC			X		X	X	
CG1201V	IMU 28V 800 HZ			X		X		
CG1331V	3.2 KHZ 28V SUPP		X					X
CG1513X	IMU HTR +28 VDC		X					
CG1523X	CMC OPER +28 VDC		X		X			
CG1533X	OPTX OPER +28 VDC	X						
CG2112V	IG RSVR SIN			X		X	X	
CG2113V	IG RSVR COS			X		X	X	
CG2117V	IGA SERV ERR		X	X		X	X	X
CG2142V	MG RSVR SIN			X		X	X	
CG2143V	MG RSVR COS			X		X	X	
CG2147V	MGA SERV ERR		X	X		X	X	X
CG2172V	OG RSVR SIN			X		X	X	
CG2173V	OG RSVR COS			X		X	X	
CG2177V	OGA SERV ERR		X	X		X	X	X
CG2300T	PIPA TEMP		X					
**CG3721V	SHFT CDU DAC OUT	X		X		X	X	
**CG3722V	TRUN CDU DAC OUT	X		X		X	X	
CG5040X	CMC WARNING		X		X			X

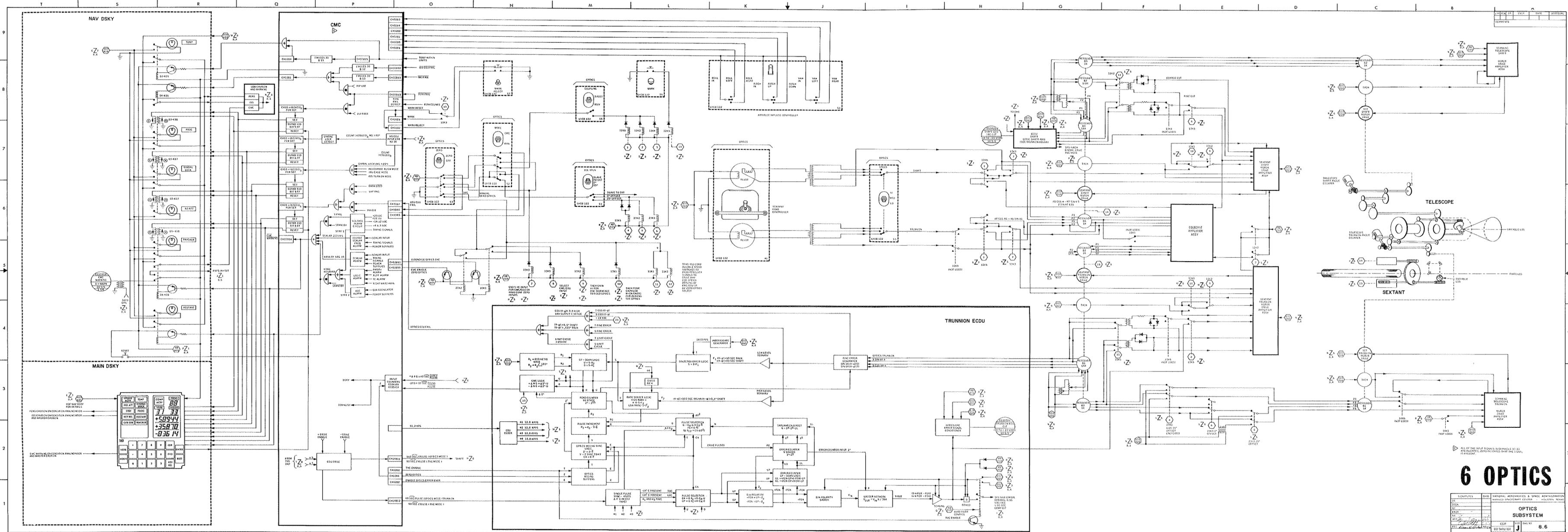
**The OPTICS OPERATE power may be off during an SPS burn. In this case, the shaft and trunion CDU DAC outputs will still be operational because a TVC relay operated during the burn switches the 28V 800 cycle power from the OPTICS 800 cycle source to the ISS 800 cycle source. The 28 Vdc power to the DAC's is "ored" from the ISS OPERATE or OPTICS OPERATE power sources.



5 ISS
 INERTIAL SUBSYSTEM

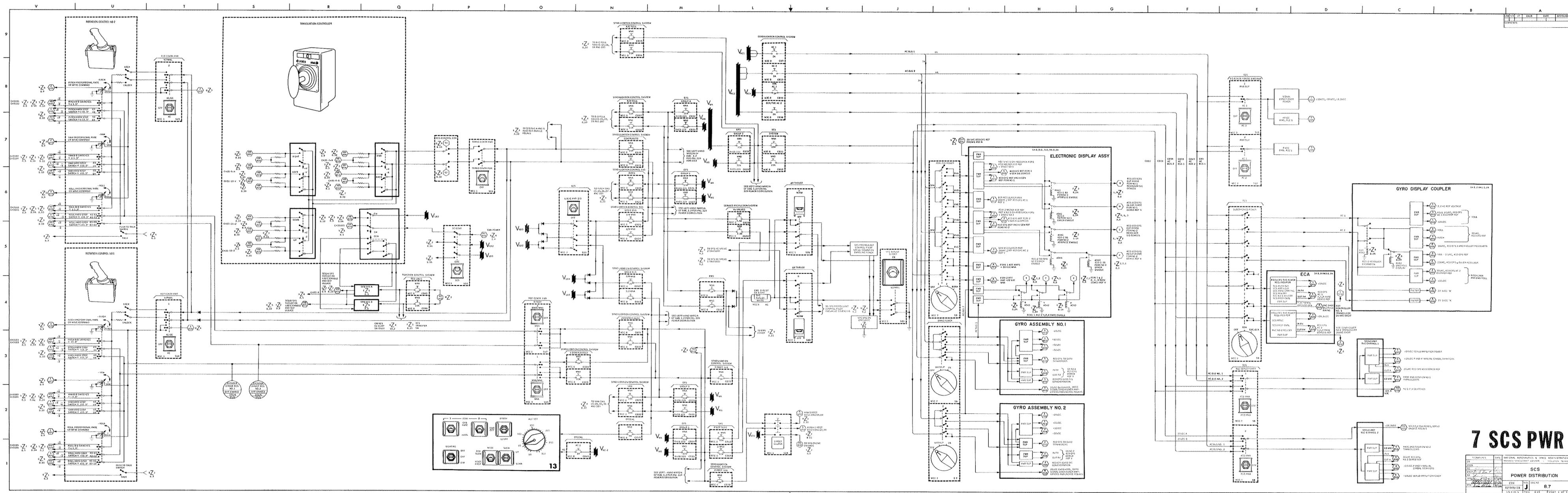
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 SPACE SHUTTLE CENTER - HOUSTON, TEXAS
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 SHEET 1 OF 1

NOTES:
 1. ALL OF THE PULSE SIGNALS IN CHANNELS TO 33 ARE CONNECTED TO CHANNELS 33 AND 34 IN THE ISS. CHANNELS 33 AND 34 ARE CONNECTED TO CHANNELS 33 AND 34 IN THE ISS.
 2. ALL OF THE PULSE SIGNALS IN CHANNELS TO 33 ARE CONNECTED TO CHANNELS 33 AND 34 IN THE ISS. CHANNELS 33 AND 34 ARE CONNECTED TO CHANNELS 33 AND 34 IN THE ISS.
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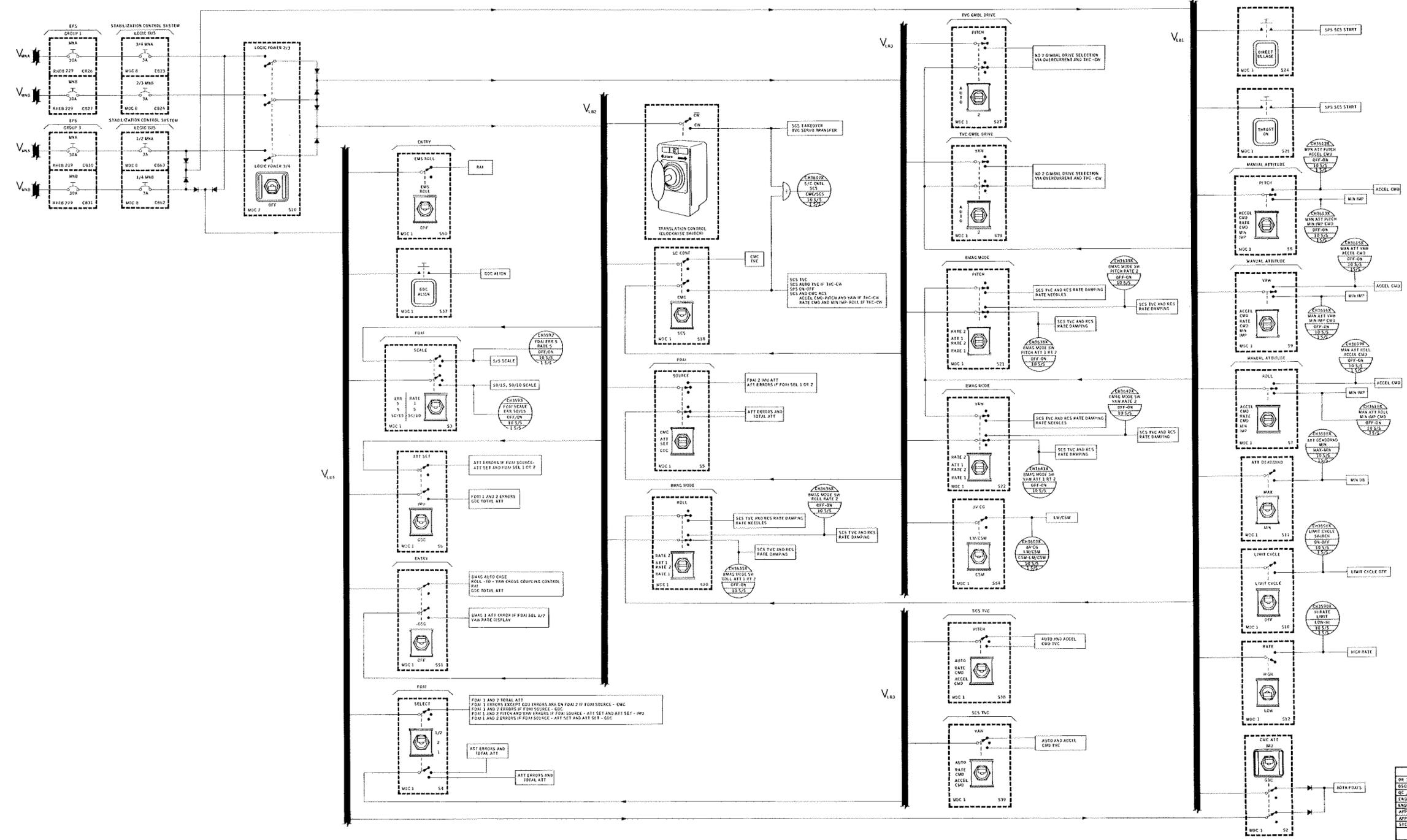
6 OPTICS

NO.	DESCRIPTION	DATE	BY	CHKD	APP'D
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3	REVISED DESIGN	10/20/68	J. J. J.		
4	REVISED DESIGN	10/25/68	J. J. J.		
5	REVISED DESIGN	10/30/68	J. J. J.		
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8	REVISED DESIGN	11/15/68	J. J. J.		
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91	REVISED DESIGN	1/10/70	J. J. J.		
92	REVISED DESIGN	1/15/70	J. J. J.		
93	REVISED DESIGN	1/20/70	J. J. J.		
94	REVISED DESIGN	1/25/70	J. J. J.		
95	REVISED DESIGN	2/1/70	J. J. J.		
96	REVISED DESIGN	2/5/70	J. J. J.		
97	REVISED DESIGN	2/10/70	J. J. J.		
98	REVISED DESIGN	2/15/70	J. J. J.		
99	REVISED DESIGN	2/20/70	J. J. J.		
100	REVISED DESIGN	2/25/70	J. J. J.		

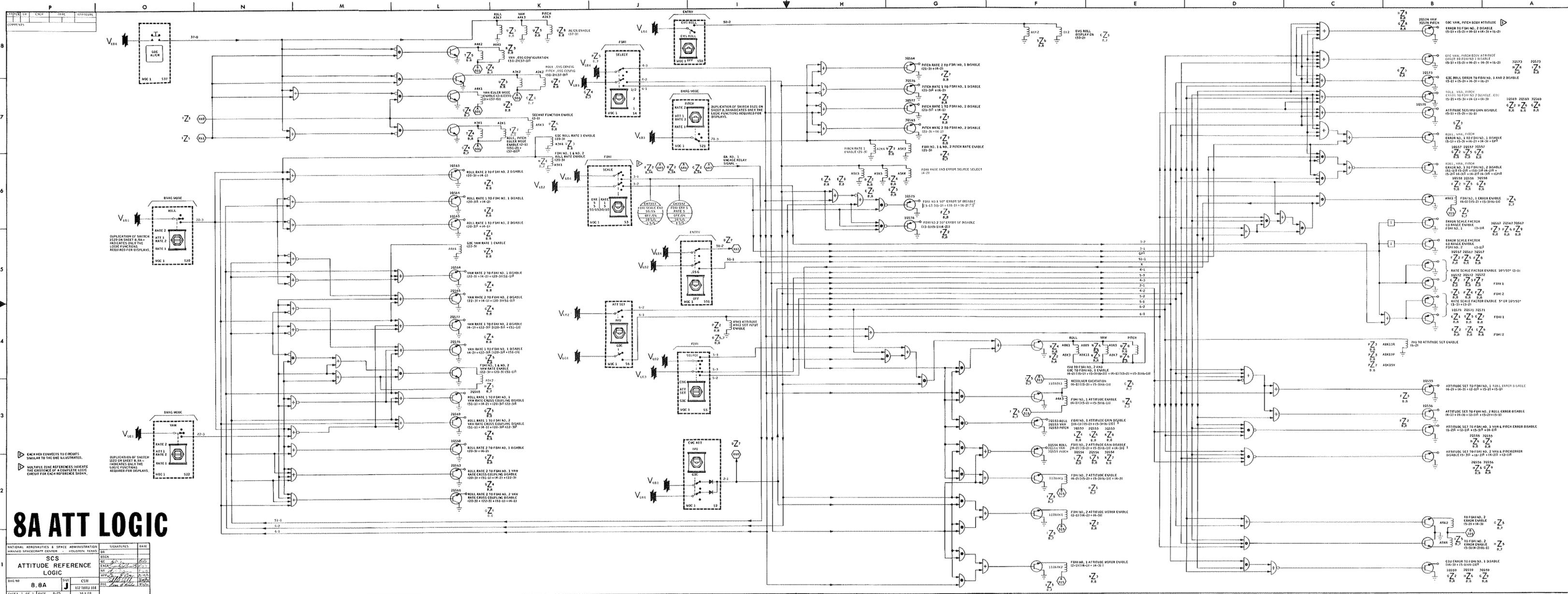


7 SCS PWR
POWER DISTRIBUTION

REVISION	DATE	BY	CHKD	APP'D
1	12-26-54	J	J	J
2	1-10-55	J	J	J
3	1-10-55	J	J	J
4	1-10-55	J	J	J
5	1-10-55	J	J	J
6	1-10-55	J	J	J
7	1-10-55	J	J	J
8	1-10-55	J	J	J
9	1-10-55	J	J	J
10	1-10-55	J	J	J



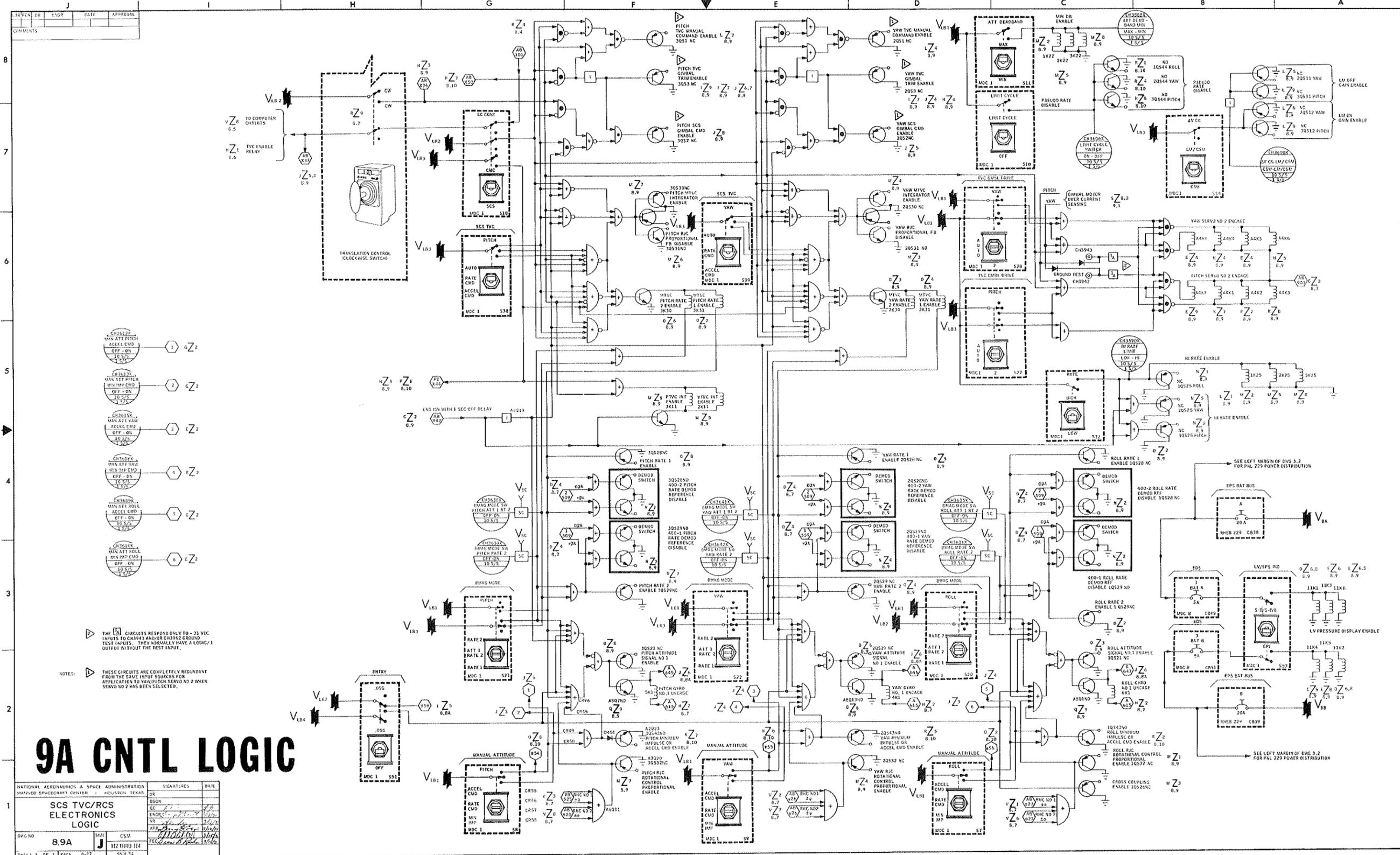
SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
DR <i>[Signature]</i>	2-22-77	MANHATTAN SPACECRAFT CENTER HOUSTON, TEXAS
DESIGNER <i>[Signature]</i>	2-22-77	
ENGINEER <i>[Signature]</i>	2-22-77	
APPROVER <i>[Signature]</i>	2-22-77	
DATE	CSM	FIGURE NO.
112 THRU 114	J	FIGURE 8-1
35 X 65	1	PAGE 8-24 SHEET 1 OF 1



8A ATT LOGIC

NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER - HOUSTON, TEXAS		SIGNALS	DATE
SCS ATTITUDE REFERENCE LOGIC		DB	
DNC NO. 8.8A		REV.	
SHEET 1 OF 1 PAGE 8-25 31 X 52		DATE	





9A CNTL LOGIC

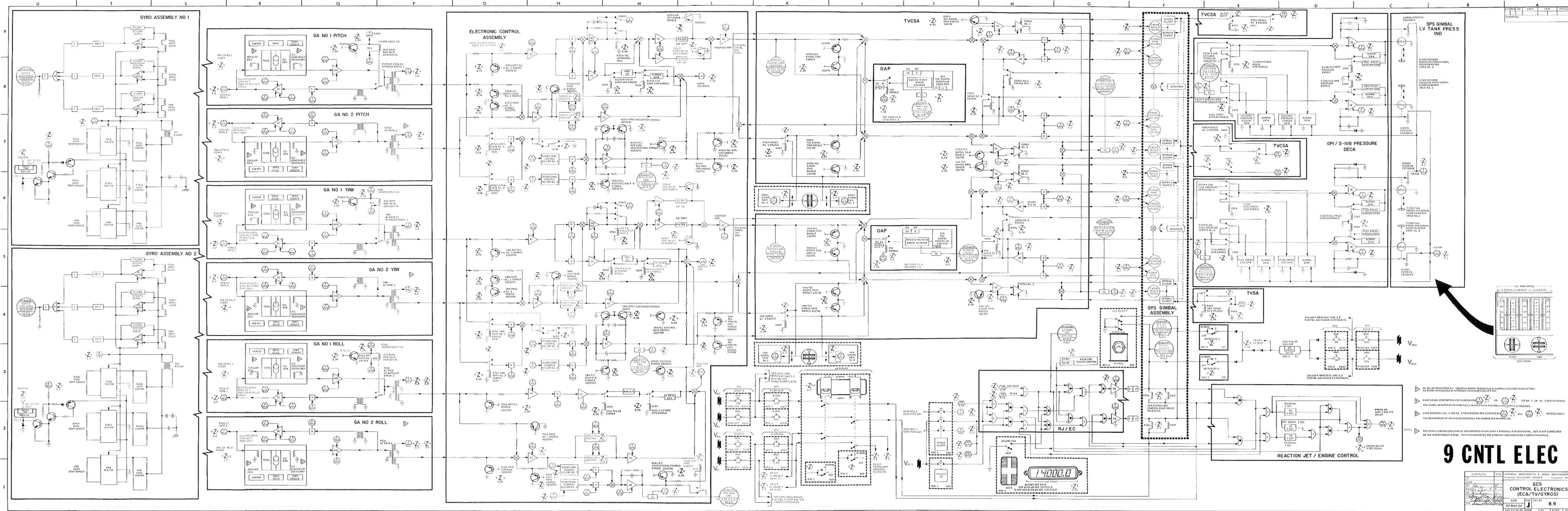
NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER		SIGNATURES		DATE
DESIGNER	CSM			
ENGINEER	CSM			
TESTER	CSM			
TECHNICAL	CSM			
DRG NO	8.9A	REV	112 THRU 114	
SHEET 1 OF 1	PAGE 0-27	55X 24		

NOTES:

- THE [] CIRCUITS RESPOND ONLY TO -35 VDC INPUTS TO CH31815 AND/OR CH3182 GROUND TEST INPUTS. THEY NORMALLY HAVE A LOGIC/1 OUTPUT WITHOUT THE TEST INPUT.
- THESE CIRCUITS ARE COMPLETELY REDUNDANT FROM THE SAME INPUT SOURCES FOR APPLICATION TO WHOPITCH SERVO NO 2 WHEN SERVO NO 2 HAS BEEN SELECTED.

SEE LEFT MARGIN OF DRG 3.2 FOR PNL 229 POWER DISTRIBUTION

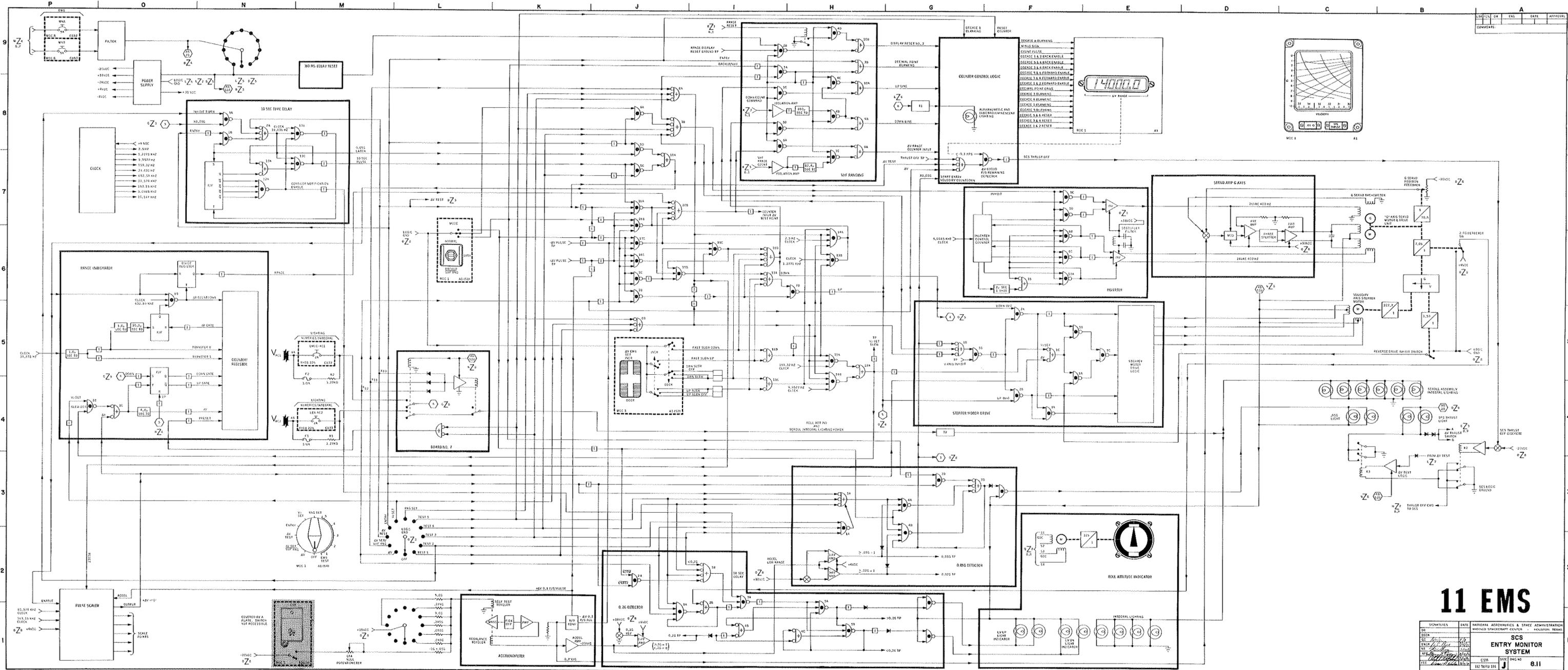
SEE LEFT MARGIN OF DRG 3.2 FOR PNL 229 POWER DISTRIBUTION



- TVCSA IN TRANSFER NO. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.

9 CNTL ELEC

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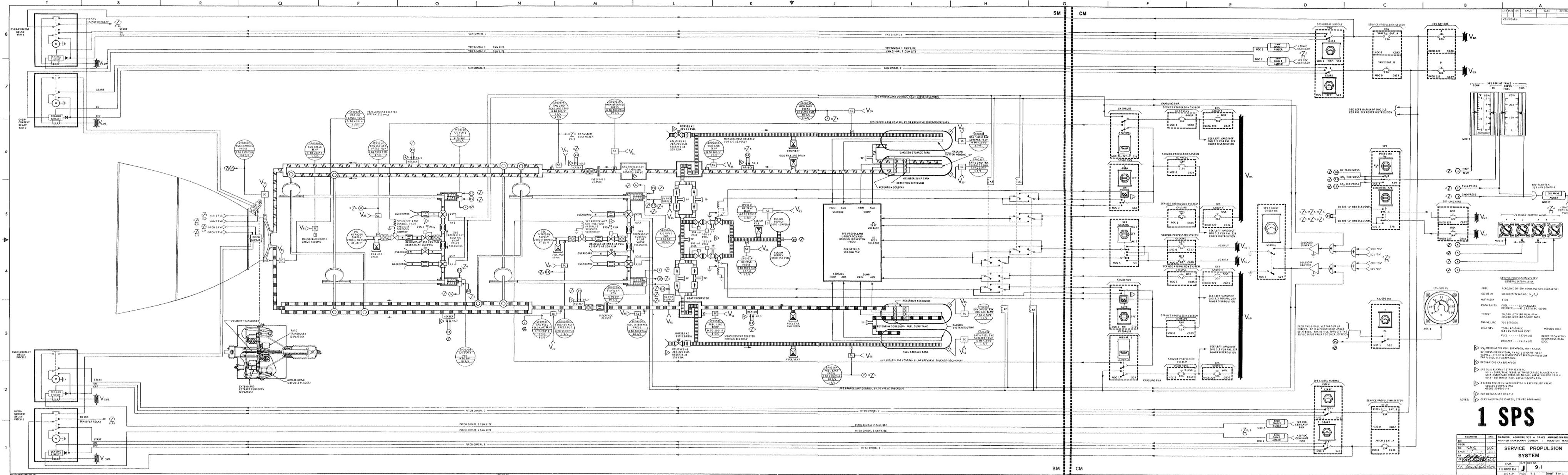


11 EMS

DATE	BY	REVISION	DESCRIPTION
11/15/68	J. J. ...	1	INITIAL DESIGN
12/10/68	J. J. ...	2	REVISED FOR MANUFACTURING
01/15/69	J. J. ...	3	REVISED FOR TESTING
02/10/69	J. J. ...	4	REVISED FOR PRODUCTION

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
 MANHATTAN SPACEPORT CENTER
SCS ENTRY MONITOR SYSTEM
 DRAWING NO. 8.11
 SHEET 8 OF 30

9 SERVICE
PROPULSION
SYSTEM



DATE	APPROVAL

DATE	APPROVAL

DATE	APPROVAL

DATE	APPROVAL

DATE	APPROVAL

DATE	APPROVAL

DATE	APPROVAL

DATE	APPROVAL

DATE	APPROVAL

DATE	APPROVAL

1 SPS

SERVICE PROPULSION SYSTEM

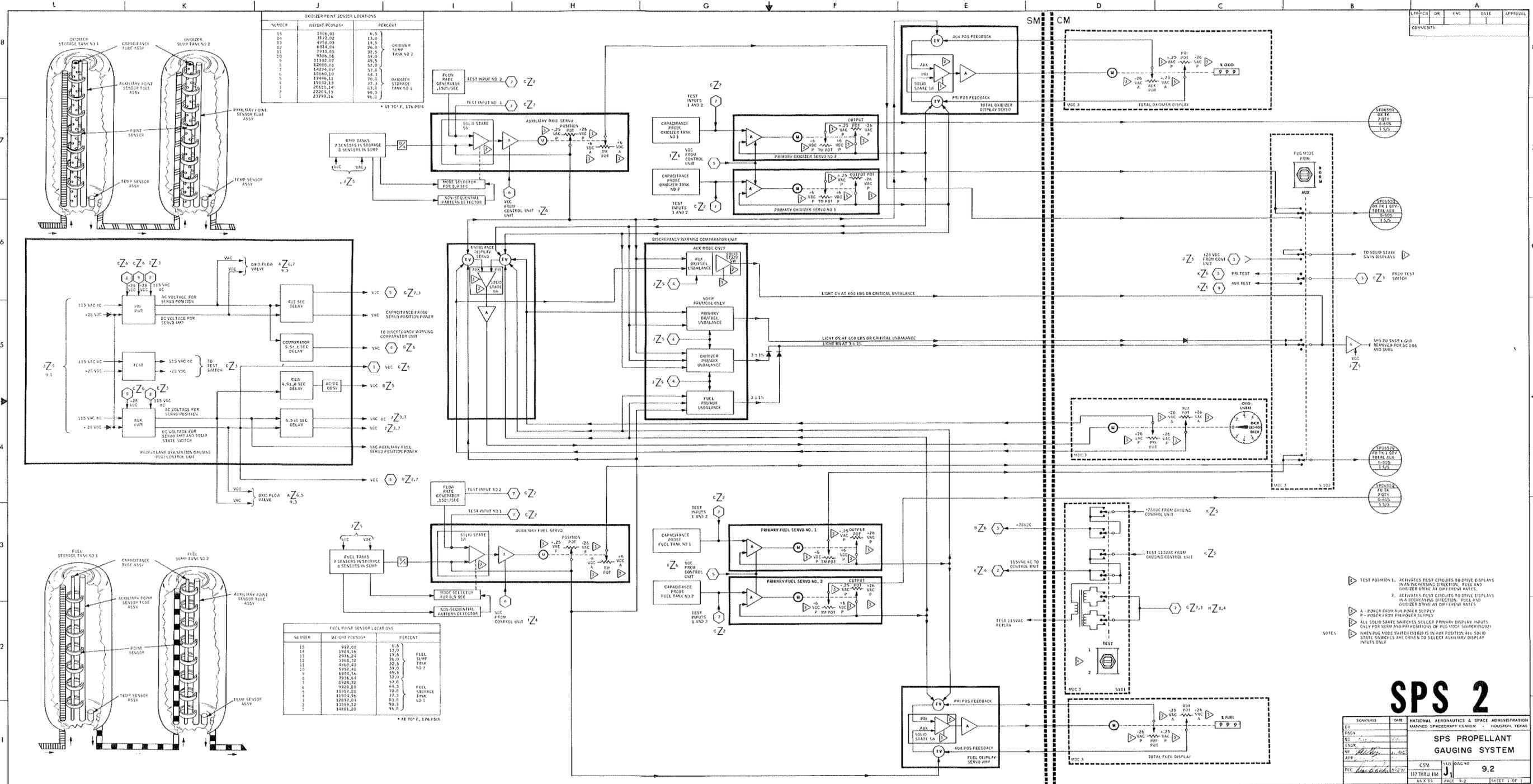
CSM SIZE (DAG-10) 9.1
112 THRU 114
110 X 34 PAGE 9.1 SHEET 1 OF 1

SERVICE PROPULSION SYSTEM GENERAL INFORMATION

FUEL: ALUMINUM SILICIDE (ALUMINA AND SILICON DIOXIDE)
OXIDIZER: NITROGEN TETRAOXIDE (N₂O₄)
MIX RATIO: 1.8:1
FLOW RATES: FUEL: 22.9 LB/SEC; OXIDIZER: 41.3 LB/SEC (TOTAL: 64.2 LB/SEC)
THRUST: 20,300 ± 200 LBS (SEA LEVEL); 20,000 ± 200 LBS (30,000 FT)
ENGINE LIFE: 350 SECONDS
COUNTRY: TOTAL LOADABLE (A) 125 PSIA AND 79°F; FUEL: 17,750 LBS; OXIDIZER: 17,750 LBS
MISSION AID: REFER TO SYSTEMS OPERATIONS DATA EDR

EN: REGULATORS SHALL BE CLOSED, WITH A LOSS OF PRESSURE UPSTREAM, AN ACTION OF PILOT VALVES. THERE IS INSUFFICIENT TRAP/NO PRESSURE FOR A SAFE VALVE ACTIVATION.
REGULATORS CAN BACKFLOW.
SPS OVAL KEYS IN STRIP HEADS: 10-2 - SHIP MAN REGULATOR TO INTERFACE FLANGE 9.1-9.1-2 - INTERFACE FLANGE TO MAIN VALVE HOUSING 10.1-10.1-2 - BOTTOM OF MAIN VALVE HOUSING 10.1-10.1-2
A BLEED DEVICE IS INCORPORATED IN EACH RELIEF VALVE CLOSURE 100 PSIA MAX OPENING PRESSURE.
FOR DETAILS SEE HUG 9.3
GRAY WHEN VALVE IS OPEN, STRIPED OTHERWISE

NOTES:



OXIDIZER POINT SENSOR LOCATIONS

NUMBER	WEIGHT POUNDS*	PERCENT
15	1558.03	6.5
14	3272.02	13.0
13	4758.09	19.5
12	6244.16	25.0
11	7730.23	30.5
10	9216.30	36.0
9	10702.37	41.5
8	12188.44	47.0
7	13674.51	52.5
6	15160.58	58.0
5	16646.65	63.5
4	18132.72	69.0
3	19618.79	74.5
2	21104.86	80.0
1	22590.93	85.5

* AT 70° F, 174 PSIA

FUEL POINT SENSOR LOCATIONS

NUMBER	WEIGHT POUNDS*	PERCENT
15	922.08	6.5
14	1642.16	13.0
13	2362.24	17.0
12	3082.32	22.0
11	3802.40	27.0
10	4522.48	32.0
9	5242.56	37.0
8	5962.64	42.0
7	6682.72	47.0
6	7402.80	52.0
5	8122.88	57.0
4	8842.96	62.0
3	9563.04	67.0
2	10283.12	72.0
1	11003.20	77.0

* AT 70° F, 174 PSIA

DATE: 1/27/68
 DRAWN: J. J. JONES
 CHECKED: J. J. JONES
 APPROVED: J. J. JONES

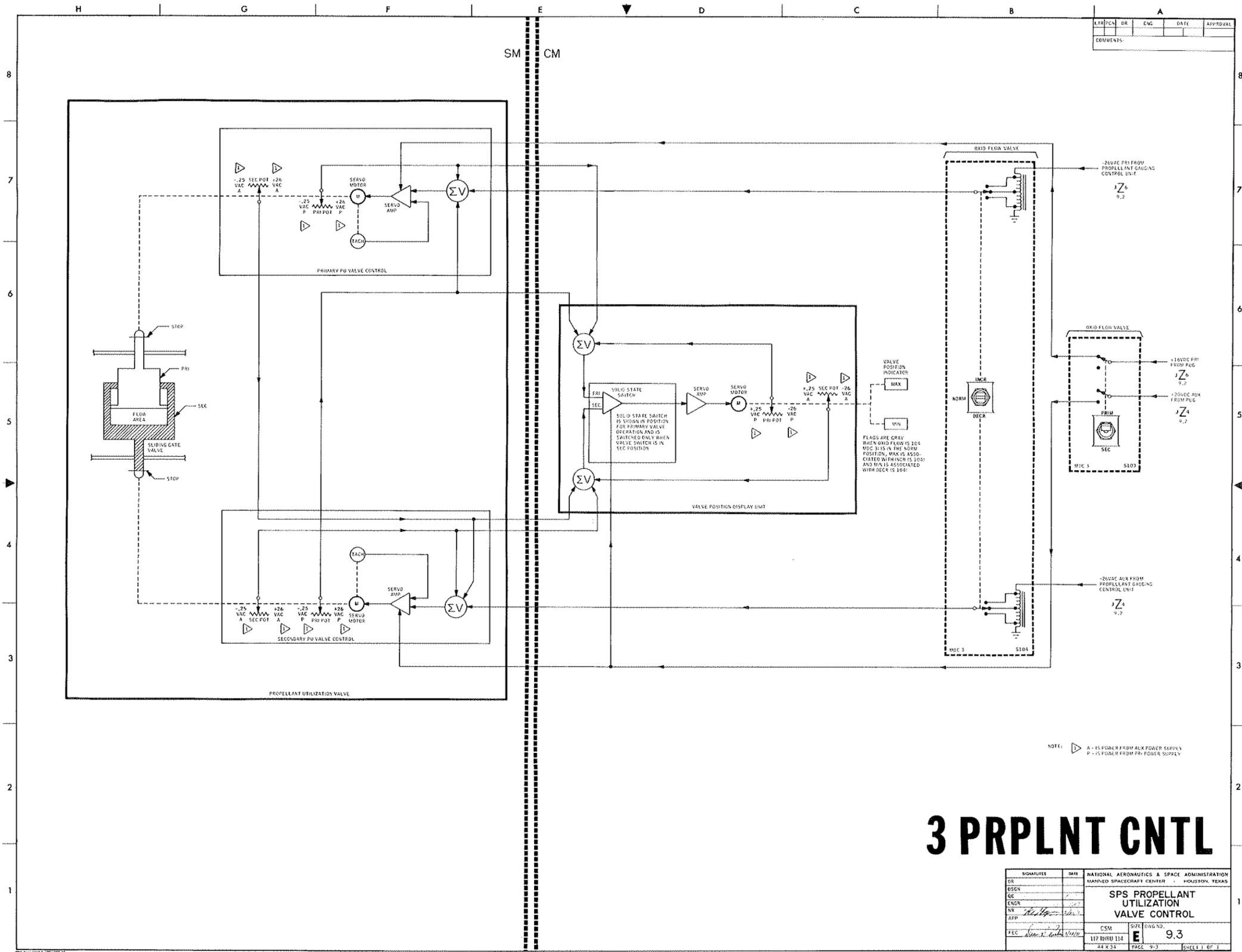
COMMENTS:

TEST POSITION 1. ACTIVATES TEST CIRCUITS TO DRIVE DISPLAYS IN AN INCREASING DIRECTION. FUEL AND OXIDIZER DRIVE AT DIFFERENT RATES.
 2. ACTIVATES TEST CIRCUITS TO DRIVE DISPLAYS IN A DECREASING DIRECTION. FUEL AND OXIDIZER DRIVE AT DIFFERENT RATES.

A - POWER FROM AIR PROVER SUPPLY
 P - POWER FROM PROPANER SUPPLY

ALL SOLID STATE SWITCHES SELECT PRIMARY DISPLAY INPUTS.
 ALL POSITIVE AND POSITIVE POSITIONS OF FUG MODE SWITCHES (202) WHEN FUG MODE SWITCH (100) IS IN AUX POSITION ALL SOLID STATE SWITCHES ARE DOWN TO SELECT AUXILIARY DISPLAY INPUTS ONLY.

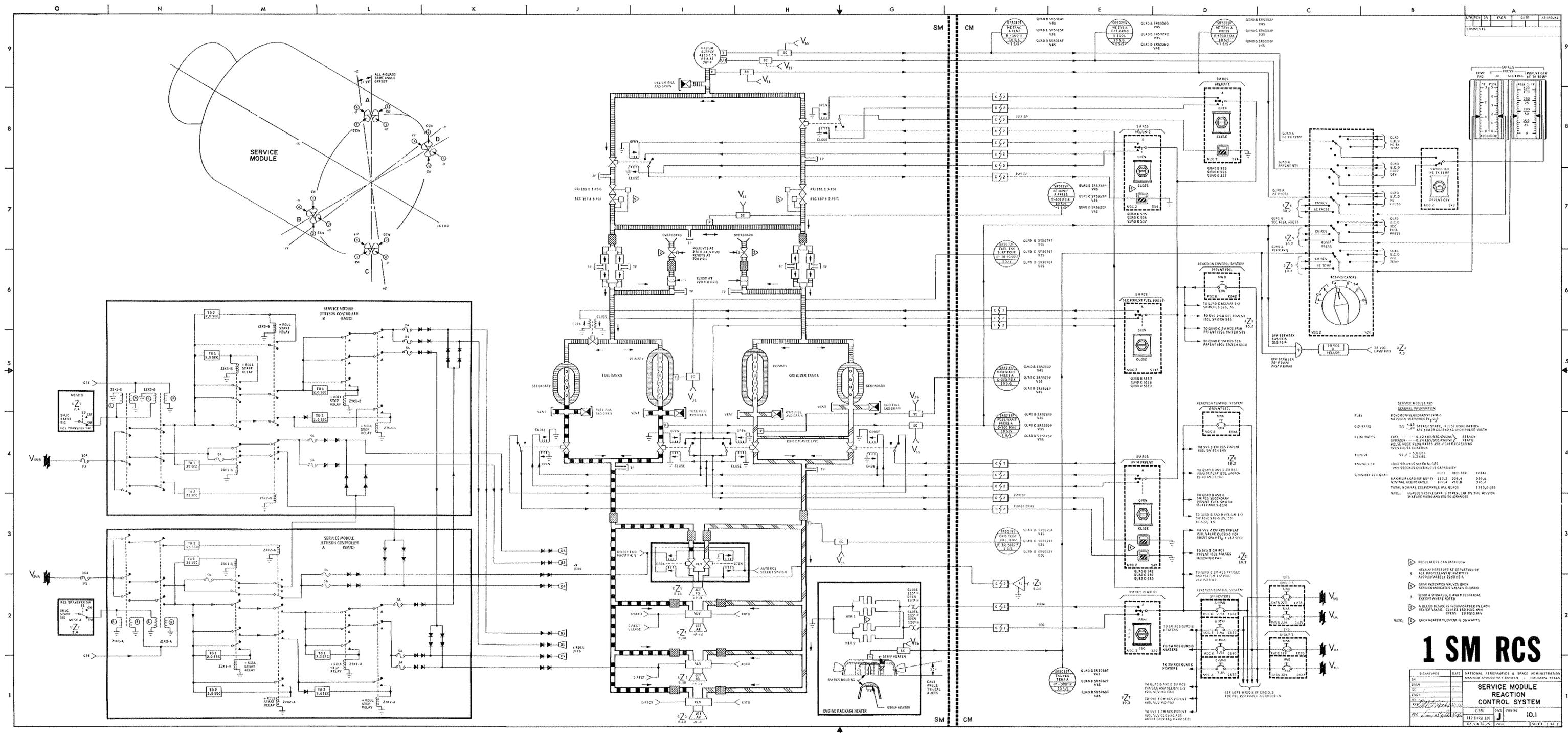
SPS 2
 SPS PROPellant GAUGING SYSTEM
 SHEET 1 OF 1



3 PRPLNT CNTL

SIGNATURES	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER HOUSTON, TEXAS		
DR		SPS PROPPELLANT UTILIZATION VALVE CONTROL		
DSGN				
QC				
ENGR				
APP				
SEC		CSM	SIZE	FIG. NO.
		117 HIRU 114	E	9.3
		44 X 34	PAGE 3-3	SHEET 1 OF 1

10 REACTION
CONTROL
SYSTEM



SERVICE MODULE RCS SENSING INFORMATION

ITEM	DESCRIPTION	UNIT	STATUS
FUEL	WATER/ETHANOL/PROPANE/NIPOXEN TERNARY (V ₂)	2.5	STEADY STATE, FUEL MODE MAINTAINED
PROP. RATE	FUEL FLOW RATE (GPM)	0.12 (1.0 SEC/INCH)	STEADY
THRUST	THRUST (LBS)	99.7	5.8 LBS
IGNITE LIFE	1000 SECONDS MINIMUM CAPABILITY	1000	SECONDS CONTINUOUS CAPABILITY
QUANTITY PER QUAD	QUANTITY PER QUAD	151.2	226.4
	TOTAL QUANTITY	604.8	905.6
	TOTAL NORMAL CARRYOVER	107.4	226.0
	TOTAL NORMAL CARRYOVER ALL QUADS	428.8	905.6

NOTE: USABLE PROPellant IS DEPENDENT ON THE MISSION VALUE AND ANALYSIS DISCREPANCIES

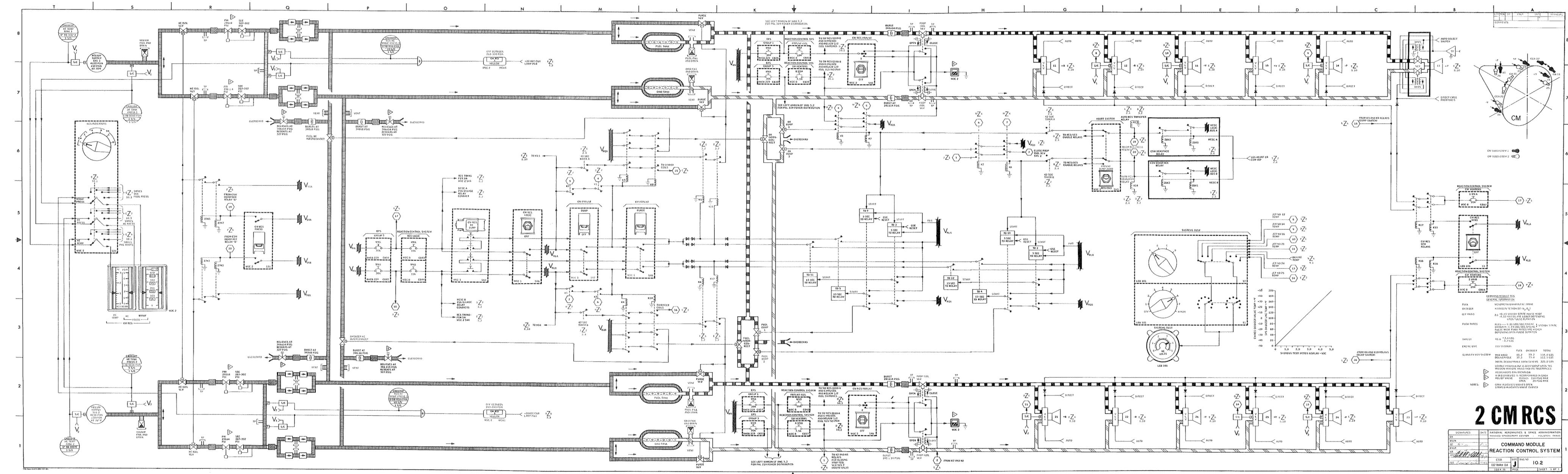
1 SM RCS

DATE	REVISION	DESCRIPTION
10/1/68	1	ISSUED FOR DESIGN
10/1/68	2	REVISED TO REFLECT CHANGES
10/1/68	3	REVISED TO REFLECT CHANGES
10/1/68	4	REVISED TO REFLECT CHANGES
10/1/68	5	REVISED TO REFLECT CHANGES
10/1/68	6	REVISED TO REFLECT CHANGES
10/1/68	7	REVISED TO REFLECT CHANGES
10/1/68	8	REVISED TO REFLECT CHANGES
10/1/68	9	REVISED TO REFLECT CHANGES
10/1/68	10	REVISED TO REFLECT CHANGES

SERVICE MODULE REACTION CONTROL SYSTEM

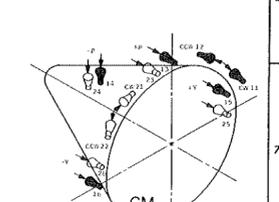
CSM 10.1

REVISED TO REFLECT CHANGES

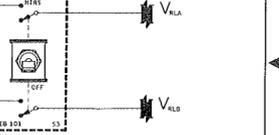
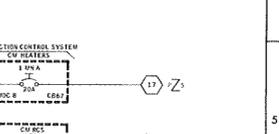


REVISION	NO.	DATE	BY	REASON
1	1			

CONTENTS



CM SUBSYSTEM 1
CM SUBSYSTEM 2



GENERAL PURPOSE RES	MAXIMUM	MINIMUM	TOTAL
PROPellant	45.2	39.2	132.0 LBS
DELIVERABLE	37.3	75.0	112.5 LBS

NOTES:
 1. ALL PRESSURE RELAYS ARE NORMALLY CLOSED.
 2. ALL PRESSURE RELAYS ARE NORMALLY OPEN.
 3. ALL PRESSURE RELAYS ARE NORMALLY CLOSED.
 4. ALL PRESSURE RELAYS ARE NORMALLY OPEN.

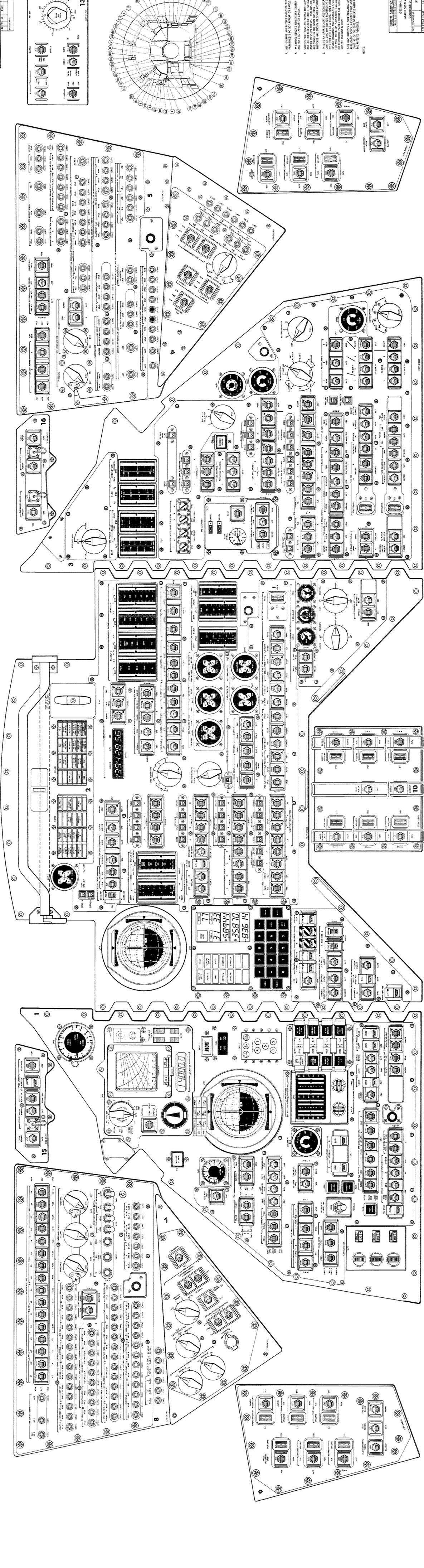
2 CM RCS

COMMAND MODULE REACTION CONTROL SYSTEM

DATE: 11/27/68
 DRAWN: J. J. JENSEN
 CHECKED: J. J. JENSEN
 DESIGNED: J. J. JENSEN
 APPROVED: J. J. JENSEN

CSM 102
 117 THRU 132
 11/27/68

11 MISCELLANEOUS



DESIGN LAYOUT - MAIN DISPLAY CONSOLE COMMAND MODULE 119

1. ALL NUMBERS AND LETTERS ENCLOSED WITH PARALLELS DO NOT APPEAR ON PANEL.

2. THIS IS AN ARRANGEMENT AND MONITORING INSTRUMENTS ARE NOT NECESSARILY REFLECT OPERATING POSITIONS. THESE INSTRUMENTS ARE SHOWN IN CENTER POSITION.

3. THESE INSTRUMENTS ARE OPERATED BY THE MAIN DISPLAY CONSOLE COMMAND MODULE 119.

4. W SYMBOL DENOTES INDICATOR SWITCH POSITION AND DOES NOT APPEAR ON PANEL.

5. THESE INSTRUMENTS ARE OPERATED BY THE MAIN DISPLAY CONSOLE COMMAND MODULE 119.

6. THESE INSTRUMENTS ARE OPERATED BY THE MAIN DISPLAY CONSOLE COMMAND MODULE 119.

7. THESE INSTRUMENTS ARE OPERATED BY THE MAIN DISPLAY CONSOLE COMMAND MODULE 119.

8. THESE INSTRUMENTS ARE OPERATED BY THE MAIN DISPLAY CONSOLE COMMAND MODULE 119.

9. THESE INSTRUMENTS ARE OPERATED BY THE MAIN DISPLAY CONSOLE COMMAND MODULE 119.

10. THESE INSTRUMENTS ARE OPERATED BY THE MAIN DISPLAY CONSOLE COMMAND MODULE 119.

11. THESE INSTRUMENTS ARE OPERATED BY THE MAIN DISPLAY CONSOLE COMMAND MODULE 119.

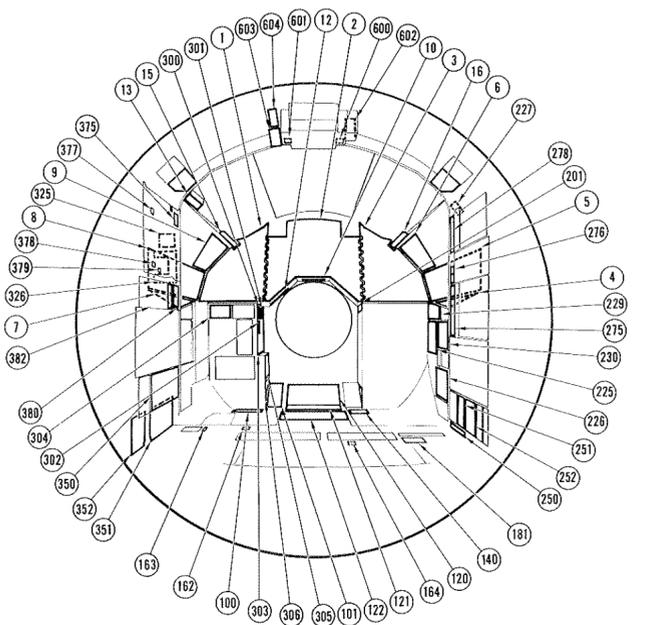
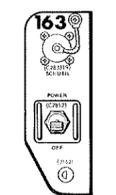
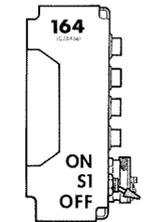
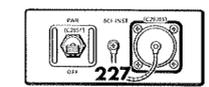
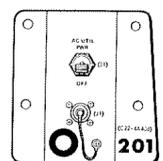
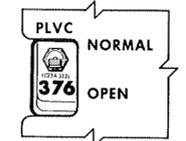
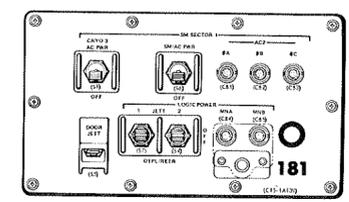
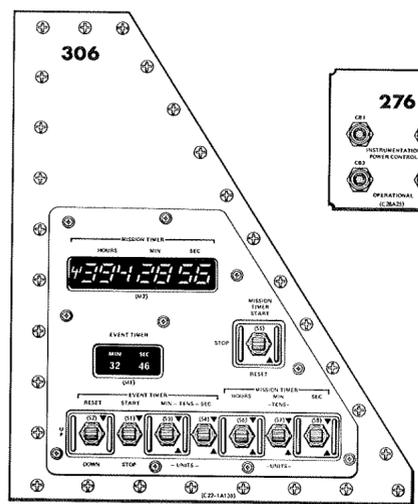
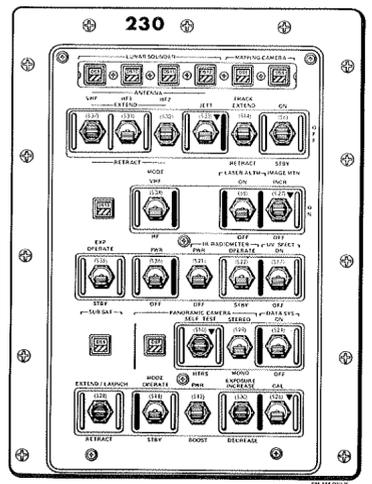
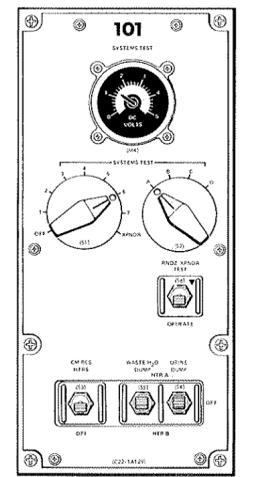
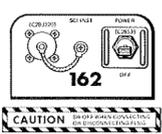
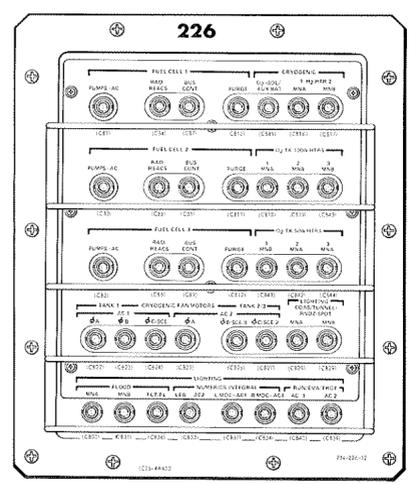
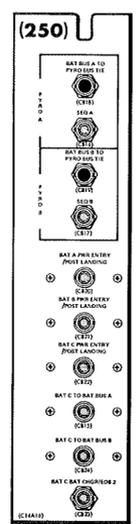
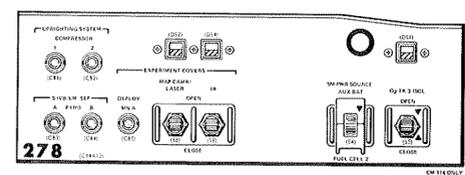
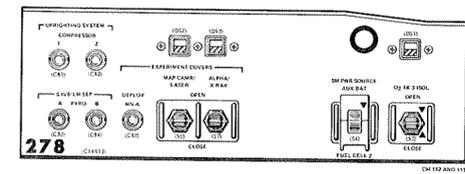
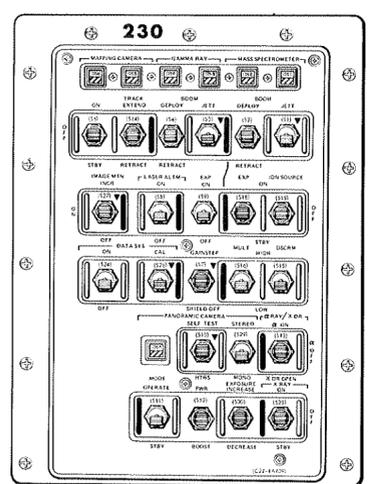
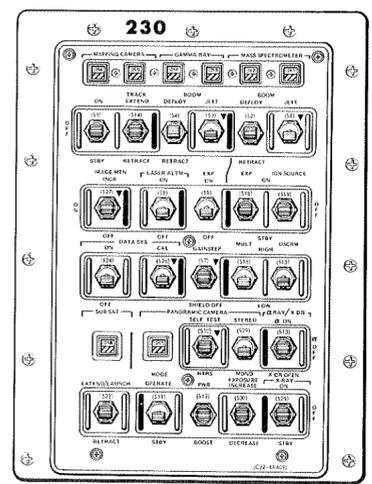
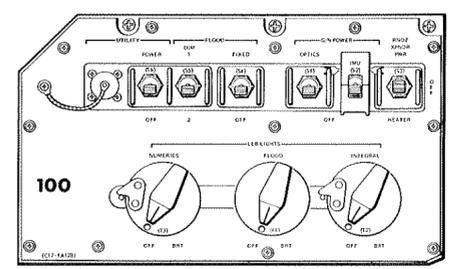
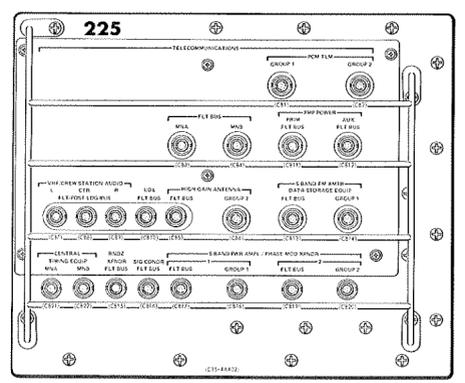
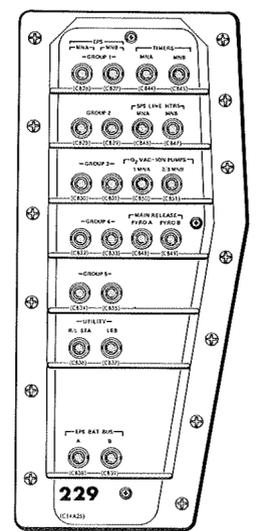
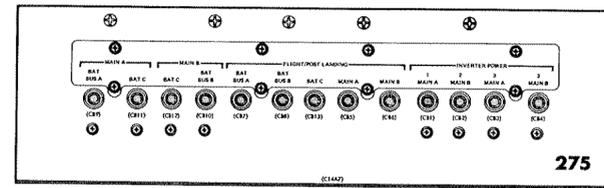
12. THESE INSTRUMENTS ARE OPERATED BY THE MAIN DISPLAY CONSOLE COMMAND MODULE 119.

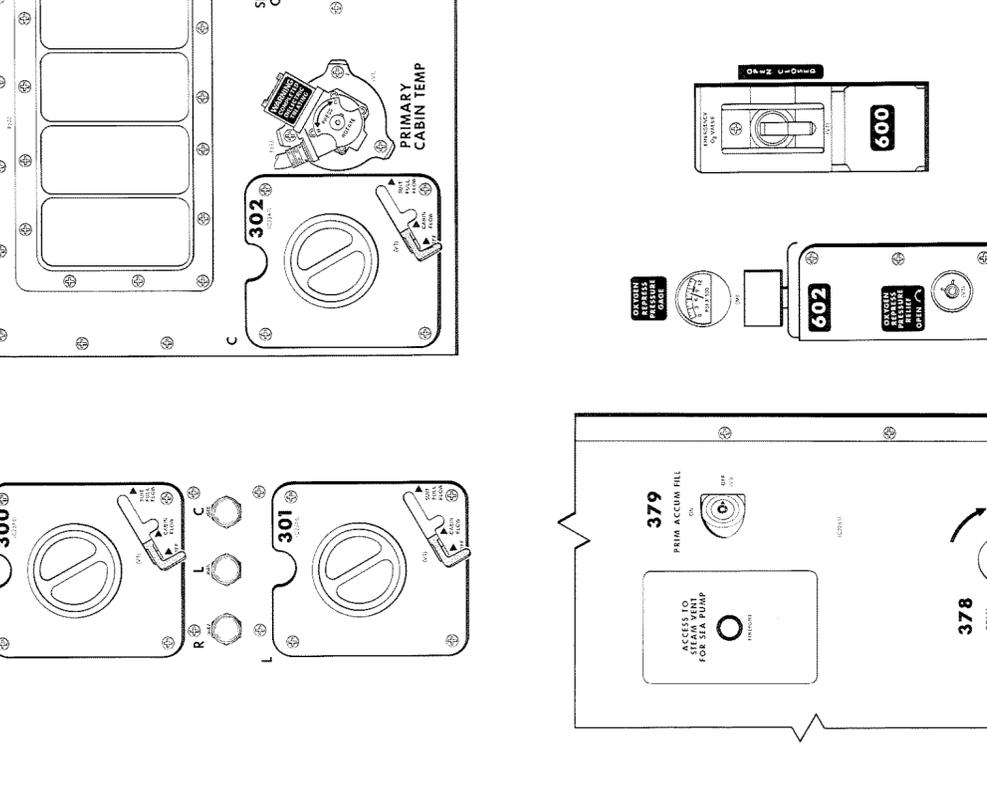
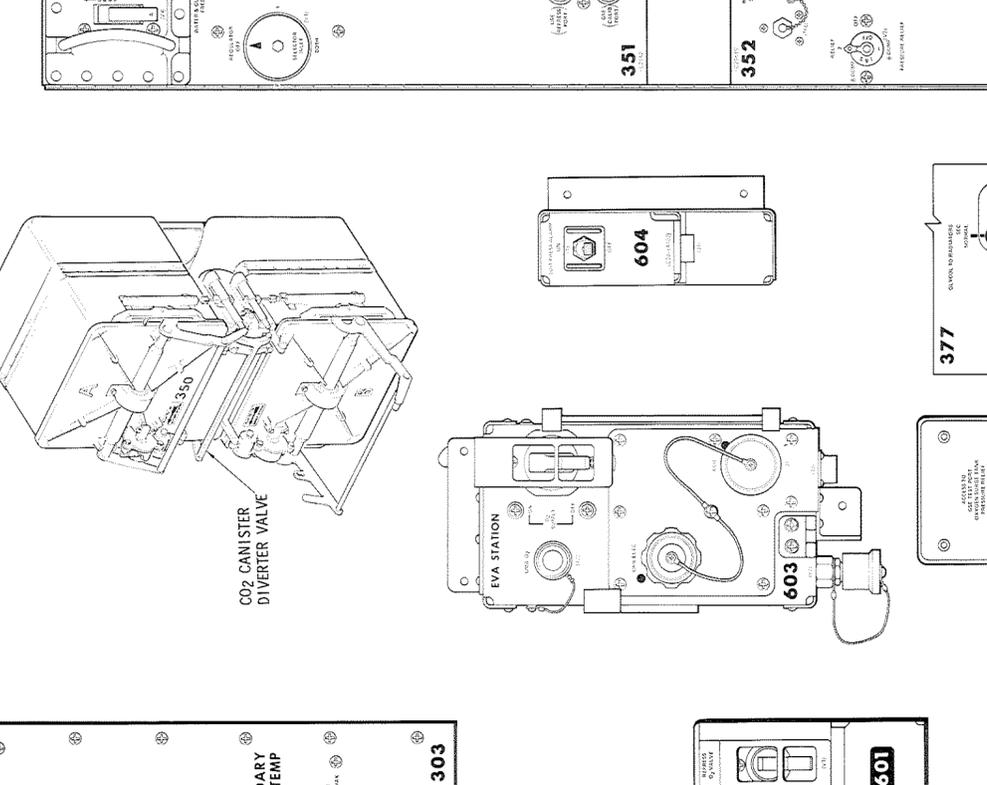
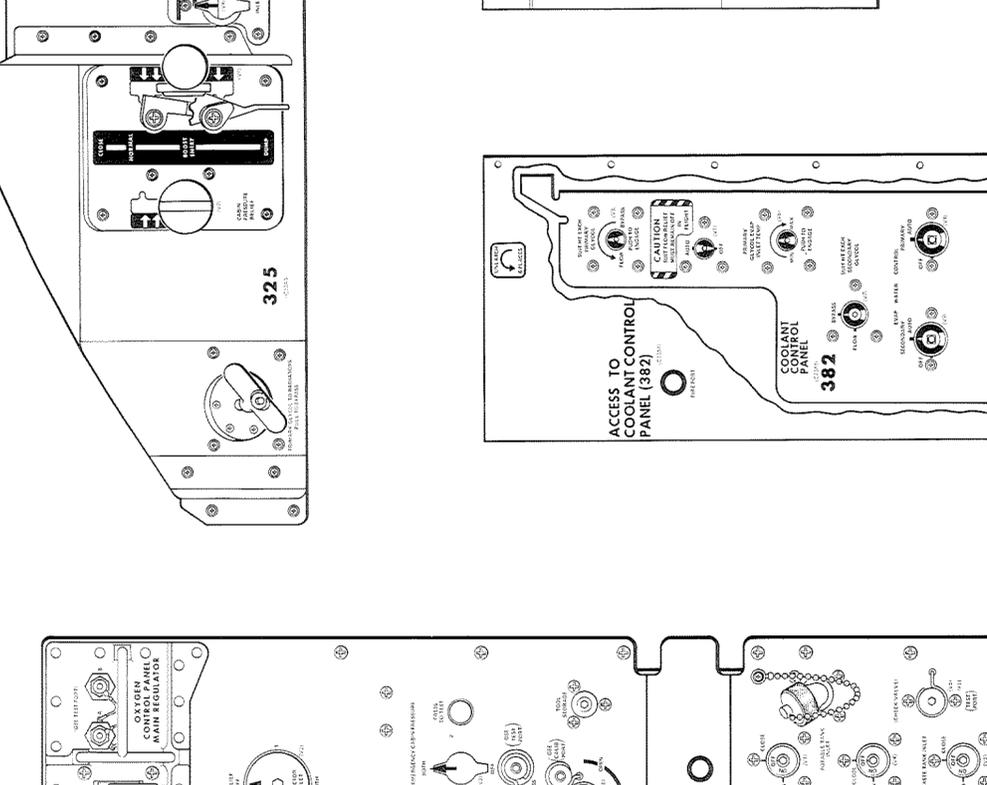
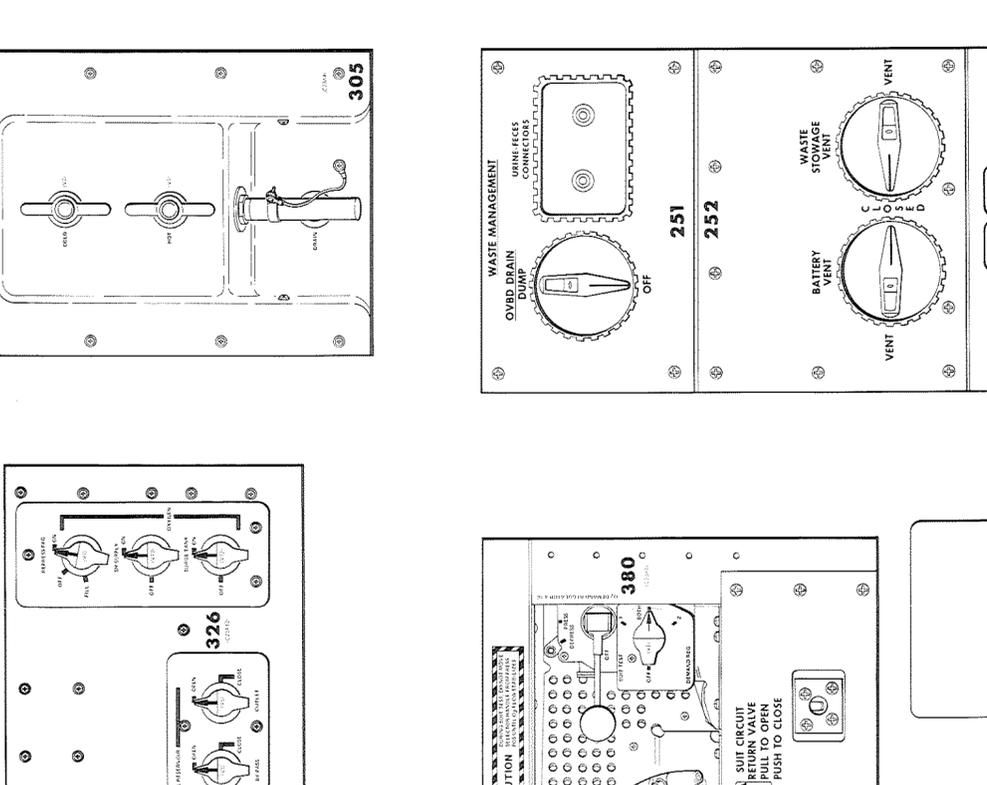
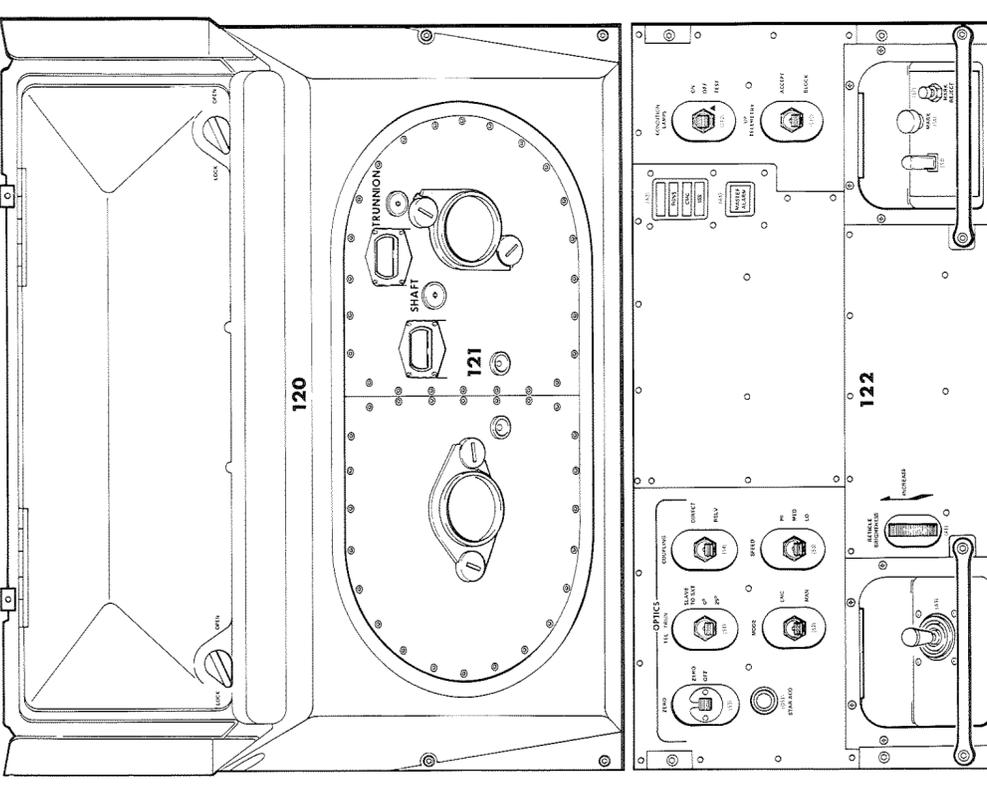
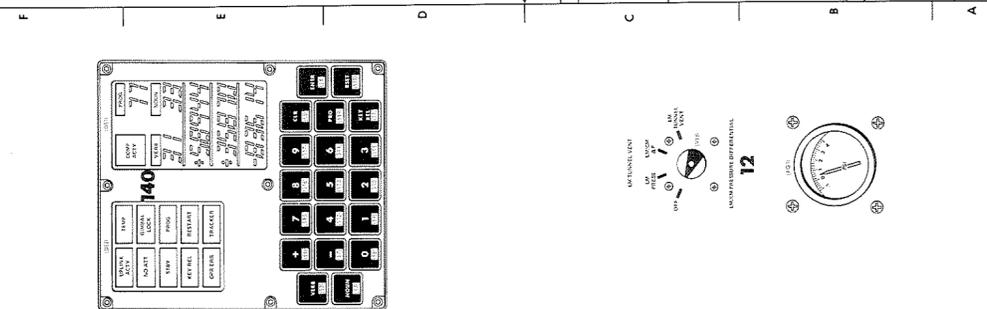
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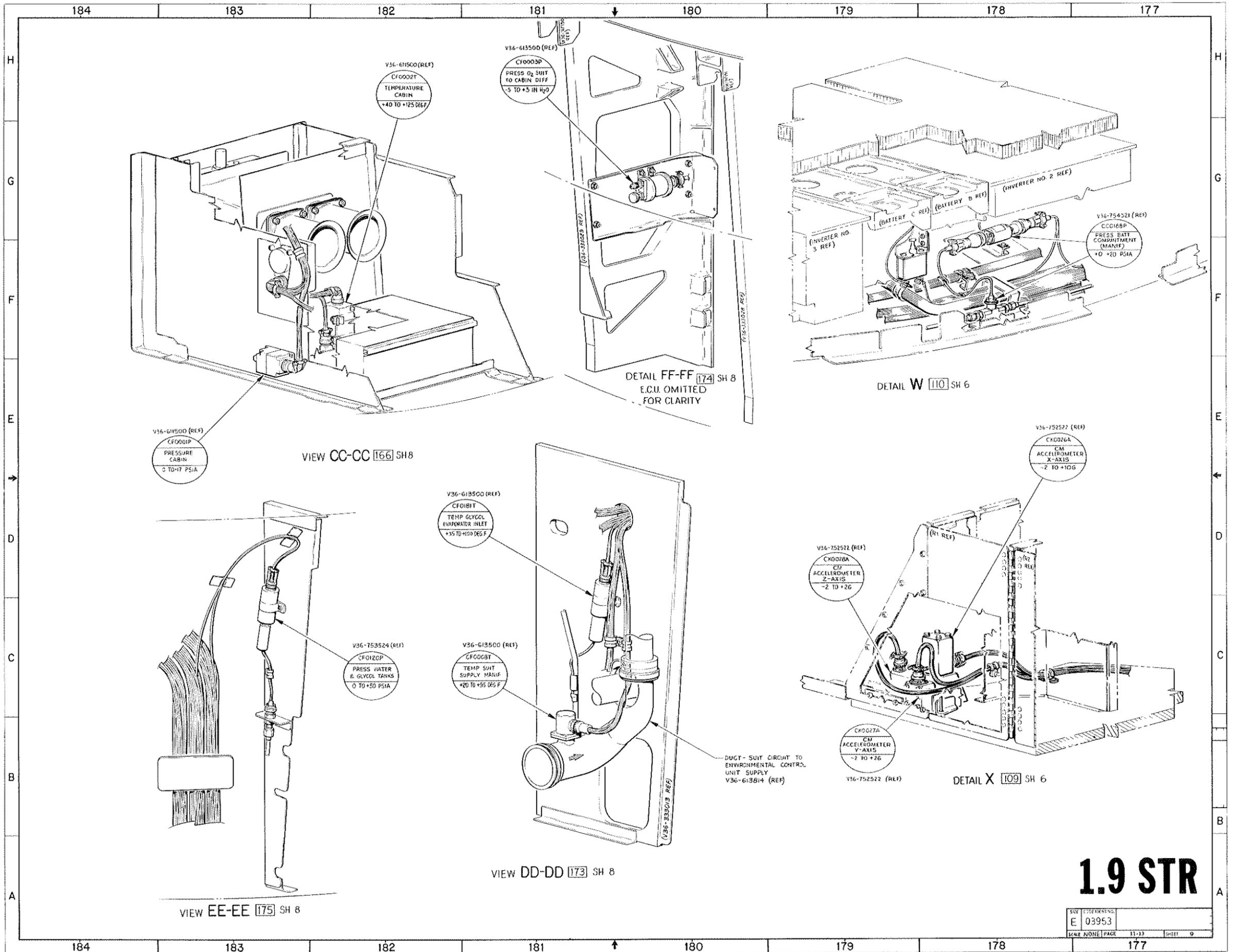
14. THESE INSTRUMENTS ARE OPERATED BY THE MAIN DISPLAY CONSOLE COMMAND MODULE 119.

15. THESE INSTRUMENTS ARE OPERATED BY THE MAIN DISPLAY CONSOLE COMMAND MODULE 119.

16. THESE INSTRUMENTS ARE OPERATED BY THE MAIN DISPLAY CONSOLE COMMAND MODULE 119.

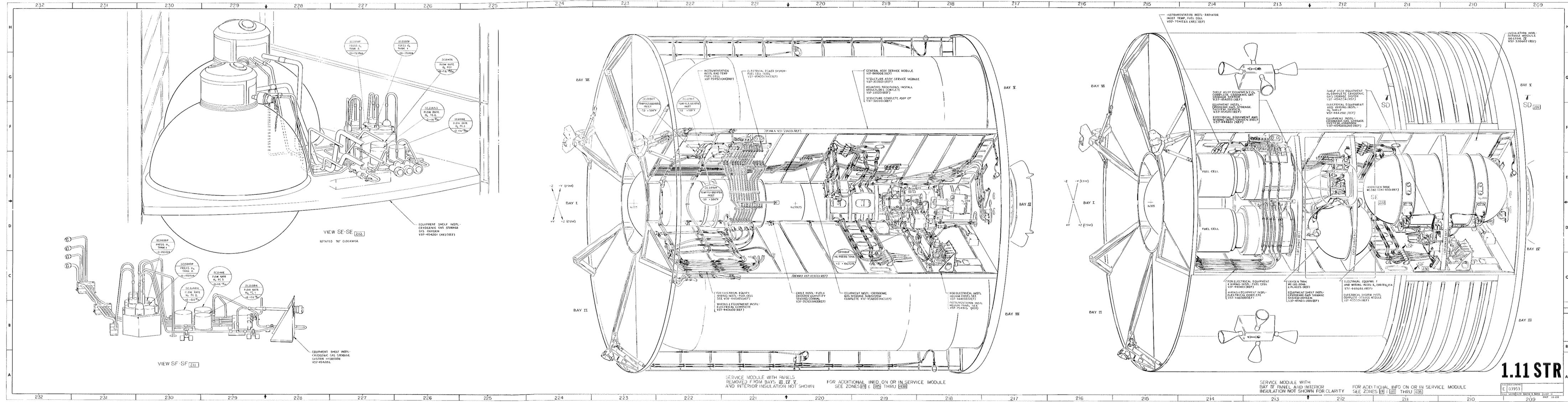






1.9 STR

SIZE	E
FIGURE NO.	03953
SCALE	NONE
PAGE	11-13
SHEET	9



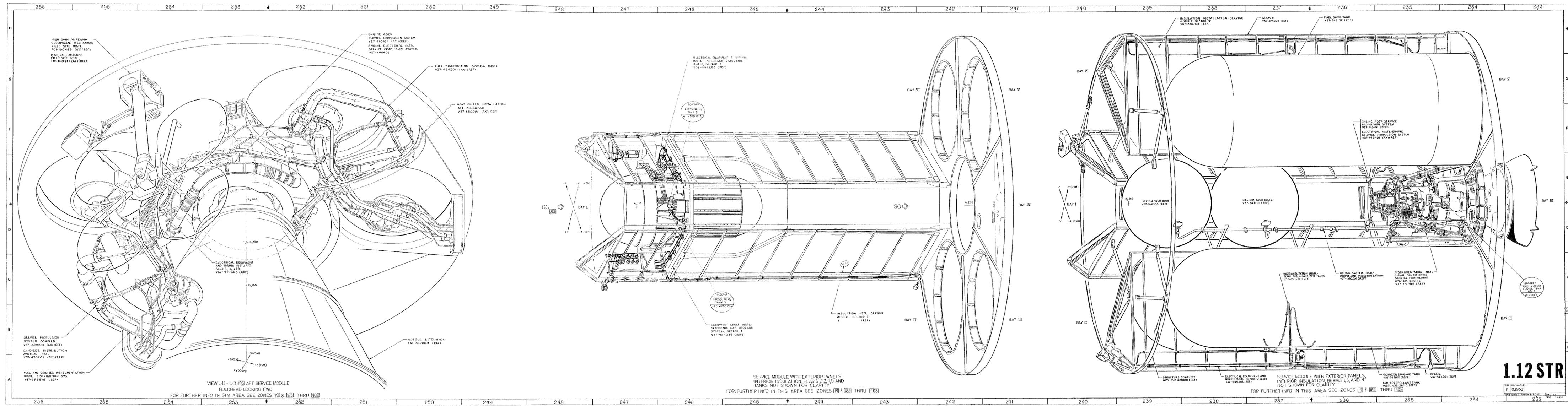
VIEW SE-SE (212)
ROTATED 90° CLOCKWISE

VIEW SF-SF (211)

SERVICE MODULE WITH PANELS REMOVED FROM BAYS III, IV, V, AND INTERIOR INSULATION NOT SHOWN
FOR ADDITIONAL INFO ON OR IN SERVICE MODULE SEE ZONES (9) & (10) THRU (10)

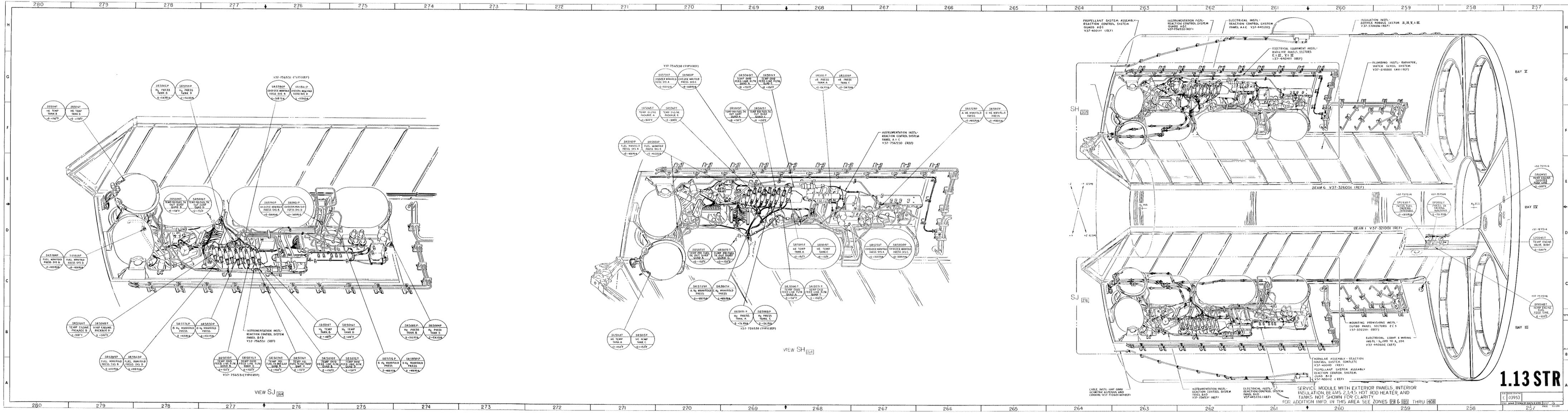
SERVICE MODULE WITH BAY IV PANEL AND INTERIOR INSULATION NOT SHOWN FOR CLARITY
FOR ADDITIONAL INFO ON OR IN SERVICE MODULE SEE ZONES (9) & (10) THRU (10)

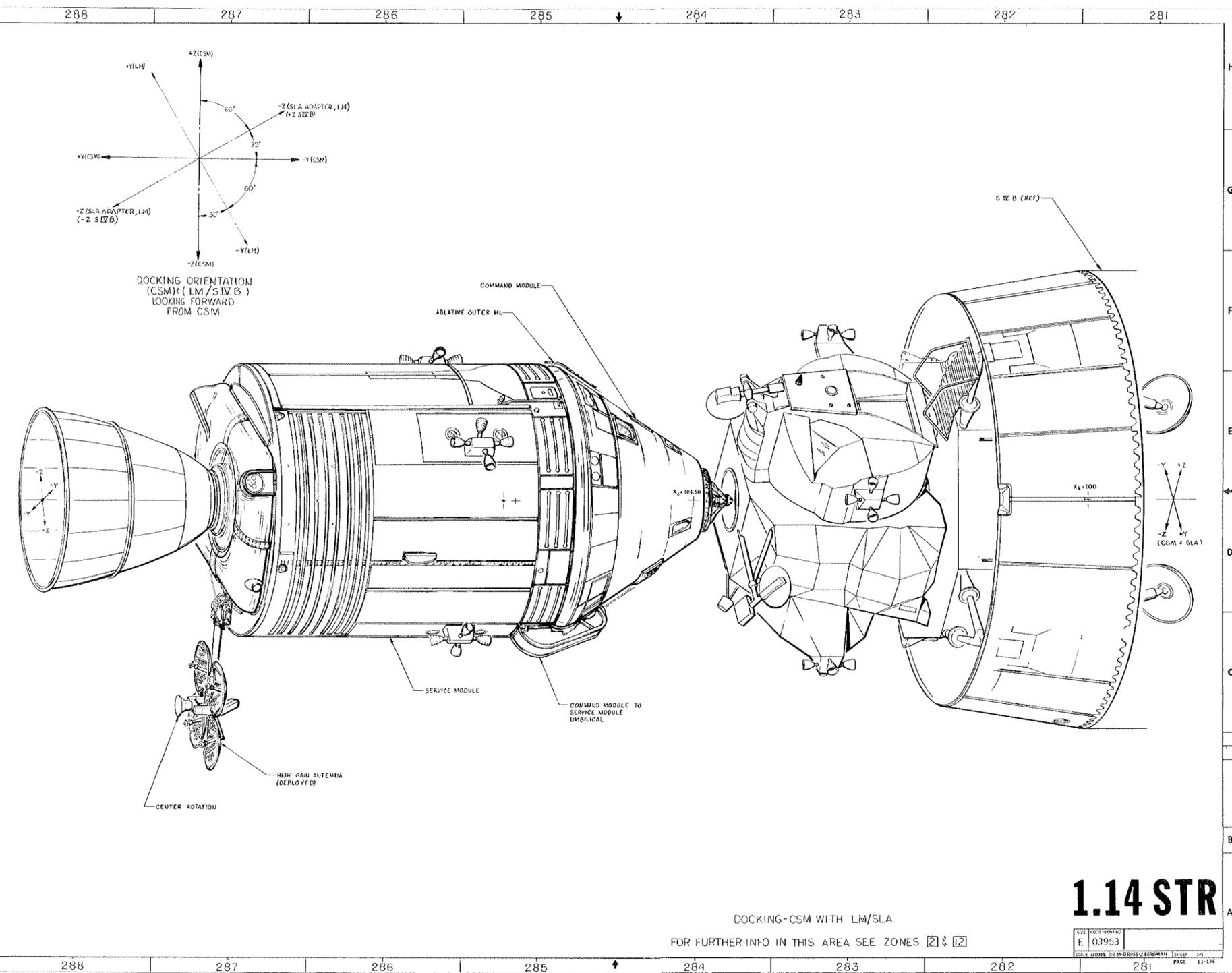
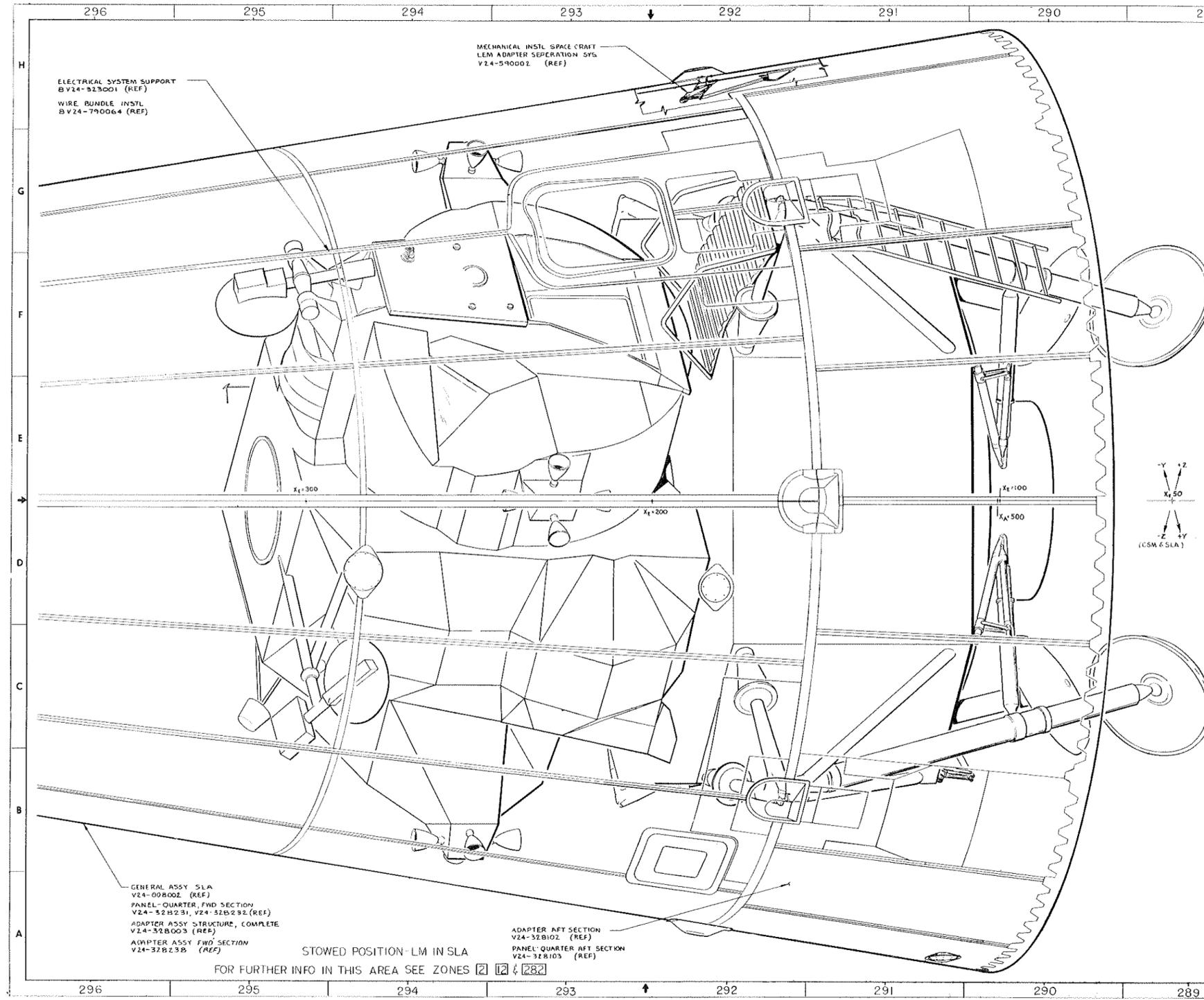
1.11 STR
E 03953
Doc. 1484 BY SAHA & BATES
PAGE 13-138



1.12 STR

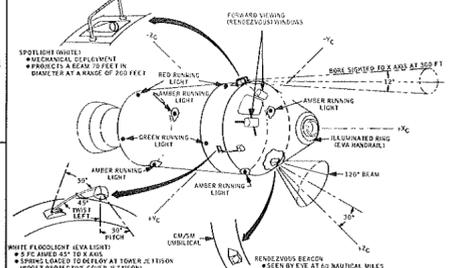
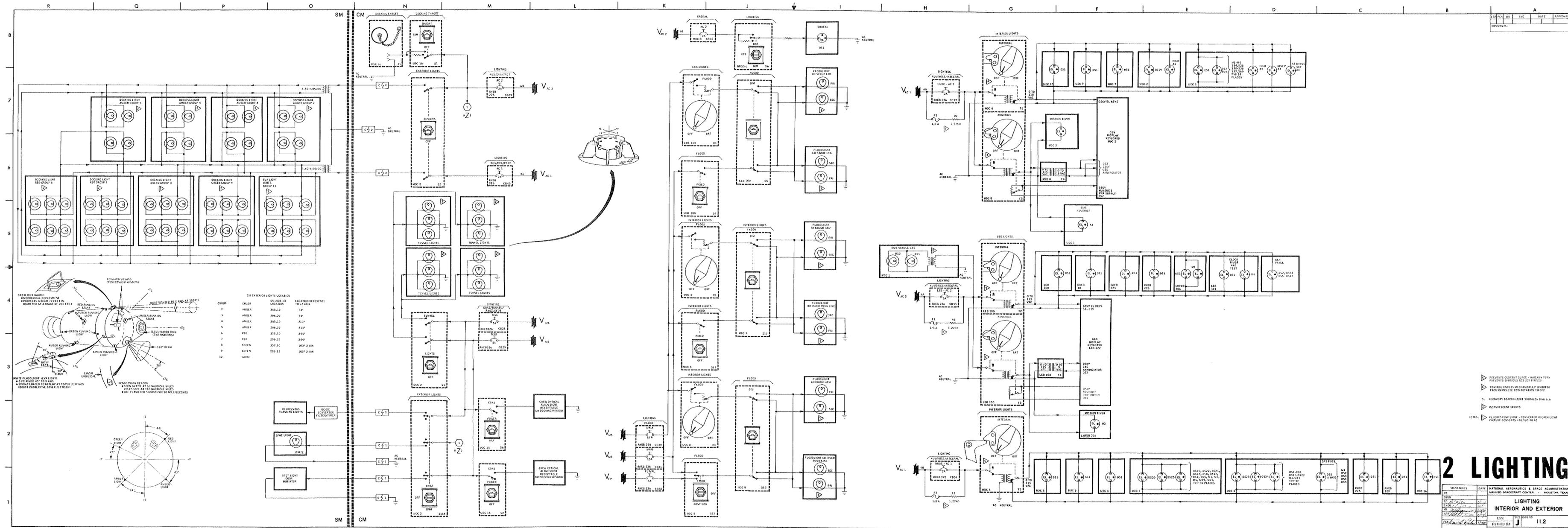
FILE: 03953
 E 03953
 11-11K





STOWED POSITION - LM IN SLA
 FOR FURTHER INFO IN THIS AREA SEE ZONES 2, 2, 282

DOCKING- CSM WITH LM/SLA
 FOR FURTHER INFO IN THIS AREA SEE ZONES 2, 2

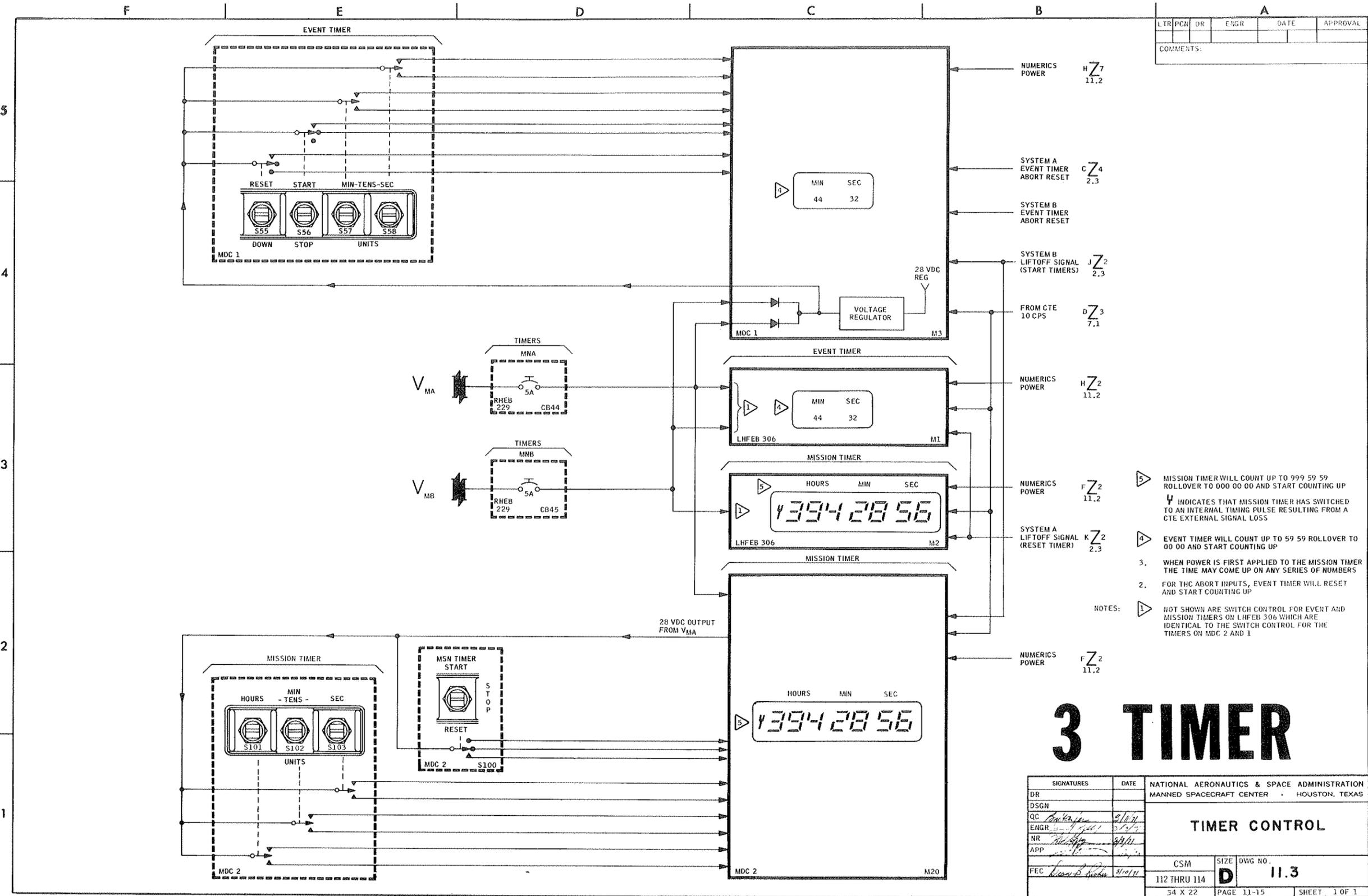


GROUP	COLOR	SW NO.	LOCATION	LOCATION REFERENCE
1	AMBER	358.10	64°	
2	AMBER	358.10	313°	
3	AMBER	358.10	91°	
4	RED	358.10	244°	
5	RED	358.10	244°	
6	GREEN	358.10	103° 3 MIN	
7	GREEN	358.10	103° 3 MIN	
8	WHITE	206.22		
9	WHITE	206.22		

- ▷ PREVENTS CURRENT SURGE - WHICH IN TURN PREVENTS SPARKING REL. ICE FUSION
- ▷ CONTROL KNOB IS MECHANICALLY INHIBITED FROM COMPLETE CCW ROTATION TO OFF
- 3. RECOVERY BEACON LIGHT SHOWN ON DNO 6.6
- ▷ INCANDESCENT LIGHTS
- NOTES: ▷ FLOODLIGHT LIGHT - COVERED IN EACH LIGHT FIXTURE COVERS - 28 VDC 100A

2 LIGHTING

DESIGNER	DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION
CHECKED		MANAGED SPACECRAFT CENTER - HOUSTON, TEXAS
LIGHTING		
INTERIOR AND EXTERIOR		
C53	SIZE 18x24	11.2
112 BHSU 114		
V.P. 24	PAGE 11-2	SHEET 1 OF 1



LTR	PCN	DR	ENGR	DATE	APPROVAL

COMMENTS:

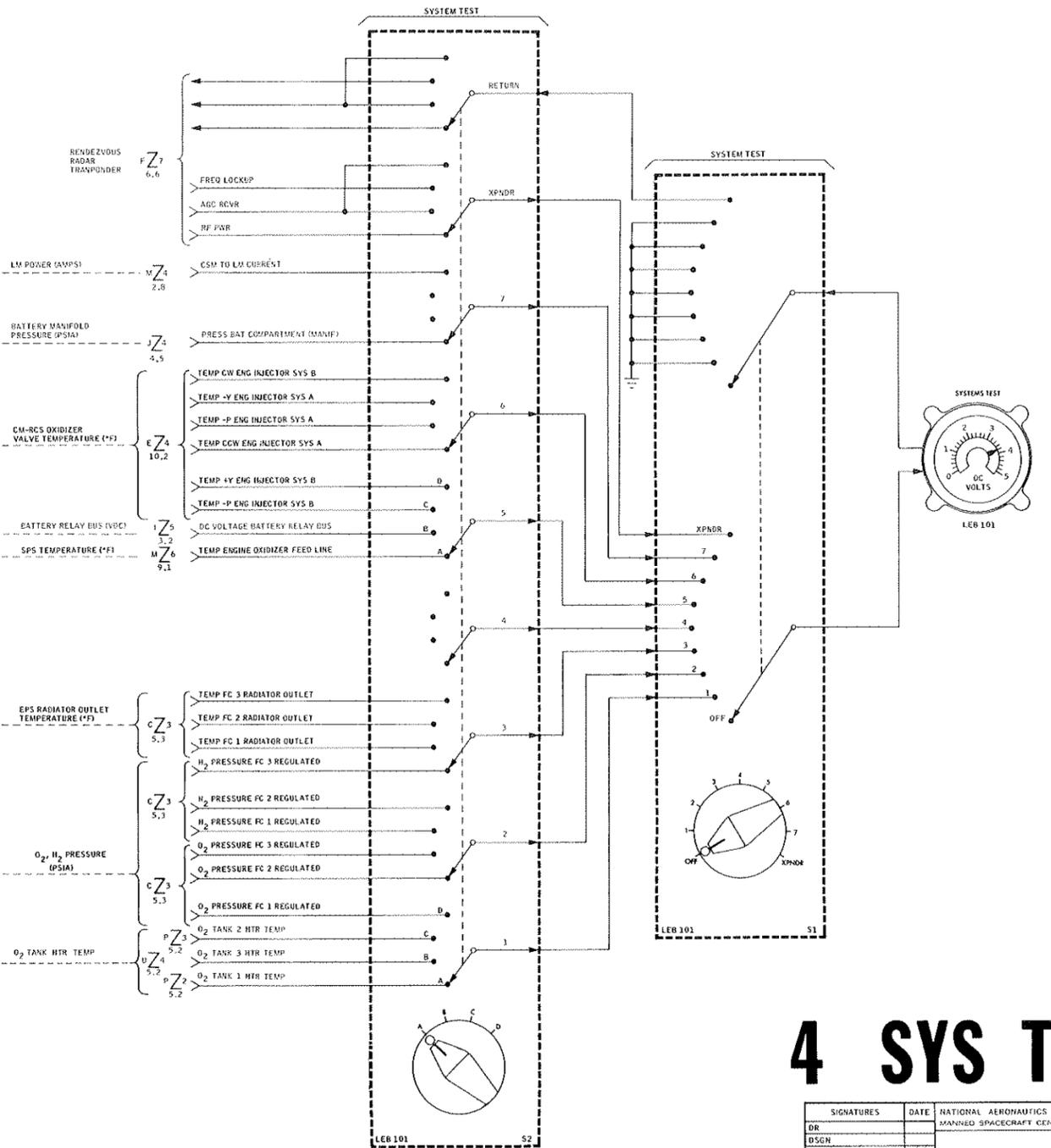
- NOTES:
- NOT SHOWN ARE SWITCH CONTROL FOR EVENT AND MISSION TIMERS ON LHFEB 306 WHICH ARE IDENTICAL TO THE SWITCH CONTROL FOR THE TIMERS ON MDC 2 AND 1
 - FOR THE ABORT INPUTS, EVENT TIMER WILL RESET AND START COUNTING UP
 - WHEN POWER IS FIRST APPLIED TO THE MISSION TIMER THE TIME MAY COME UP ON ANY SERIES OF NUMBERS
 - EVENT TIMER WILL COUNT UP TO 59 59 ROLLOVER TO 00 00 AND START COUNTING UP
 - MISSION TIMER WILL COUNT UP TO 999 59 59 ROLLOVER TO 000 00 00 AND START COUNTING UP
 V INDICATES THAT MISSION TIMER HAS SWITCHED TO AN INTERNAL TIMING PULSE RESULTING FROM A CTE EXTERNAL SIGNAL LOSS

3 TIMER

SIGNATURES		DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER HOUSTON, TEXAS	
DR			TIMER CONTROL	
DSGN				
QC				
ENGR				
APP				
FEC			CSM	SIZE DWG NO. 112 THRU 114 D 11.3
			34 X 22	PAGE 11-15 SHEET 1 OF 1

DATE	APPROVAL
COMMENTS	

SYSTEMS TEST METER DISPLAY (VOLTS)																										
0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0	
0.0	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.6	6.0	6.4	6.8	7.2	7.6	8.0	8.4	8.8	9.2	9.6	10.0	
0.0	0.8	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	8.0	8.8	9.6	10.4	11.2	12.0	12.8	13.6	14.4	15.2	16.0	16.8	17.6	18.4	19.2	20.0	
-50	-46	-42	-38	-34	-30	-26	-22	-18	-14	-10	-6	-4	0	+4	+10	+14	+18	+22	+26	+30	+34	+38	+42	+46	+50	
0	1.8	3.6	5.4	7.2	9.0	10.8	12.6	14.4	16.2	18.0	19.8	21.6	23.4	25.2	27.0	28.8	30.6	32.4	34.2	36.0	37.8	39.6	41.4	43.2	45.0	
0	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168	176	184	192	200	
-50	-36	-22	-8	+6	+20	+34	+48	+62	+76	+90	+104	+118	+132	+146	+160	+174	+188	+202	+216	+230	+244	+258	+272	+286	+300	
0	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75	
-300	-254	-228	-192	-156	-120	-84	-48	-12	24	60	96	132	168	204	240	276	312	348	384	420	456	492	528	564	600	
0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0	
SYSTEMS TEST METER DISPLAY (VOLTS)																										



4 SYS TEST

SIGNATURES		DATE	NATIONAL AERONAUTICS & SPACE ADMINISTRATION MANNED SPACECRAFT CENTER - HOUSTON, TEXAS	
DR				
DSGN				
QC				
ENGR				
NR				
APP				
FEC				
			CSM	SIZE DWG NO
			112 THRU 114	J 11.4
			44 x 29.75	PAGE 11-16 SHEET 1 OF 1

12 LUNAR ORBIT
EXPERIMENTS